PEDAGOGY IN SCHOOL



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Pedagogy for Maladjusted Learners

Hema Ganapathi

Introduction

Adjustment is a necessary condition in order to live peacefully in this world. Adjustment starts right from the birth and continues till death, and adjustment related issues arise at home, school, college, workplace and many other places. Adjustment is the process of arriving at a balanced state between the need of an individual and his/her satisfaction of that need. 'Adjustment' can be defined as a process of altering one's behavior to reach at the harmonious relationship with the environment. This is typically a response to a situation brought about by some type of change that has been taken place in an individual. The stress of this change impels him/her to reach a new type of balance or homeostasis between the individual (both inwardly and outwardly) and his/her environment. Maladjustment is the inability of an individual, family, group, community or society to be in synchronous with other individual, family, group, community or society. Maladjustment is the common term used to describe an inability to maintain a stable relationship or adjust to changing environments. Some individuals are incapable of maintaining a steady relationship and suffer from maladjustment.

Concept and Characteristics of Maladjustment

The struggle between the needs of the individual and external forces is a continuous struggle since the beginning of the humanity. Maladjusted children are ineffective in their approach and behaviour in their immediate environment of home, school or other social settings. Depending upon the temperament and personal experiences, the emotional and behavioural difficulties of the maladjusted children may be manifested in extremely diversified manners ranging from the polarized conditions of being intensely introvert to extremely extrovert behaviours. The manifestation of adjustment problems may include withdrawal,

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Recent Trends In Education

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Chapter - 1

Application of Android Apps for Teachers and Students in the Modern Digital Era

R. Rajkumar and Dr. G. Hema

Abstract

The inspiration of technology upon education has been huge over the past few decades. There was a time when education was associated with money, but the things have been transformed now. Great education for students is no more a dream. There are millions of applications available at the play store, choosing the right one can change the way a student looks at the process of teaching and learning. Educational Apps are making things easier for students to understand.In this chapter, we discus some important educational apps for utilizing students and teachers for teaching and learning process.

Keywords: education apps, presentation app, formative assessment app. android apps for creating portfolios

Introduction

Across the globe, education is experiencing a much-needed interruption. New-age learners from the millennial and post-millennial generations are challenging the education ecosystem to pave the way for new ways of learning. Showing from an early age to technology and operational social resources, they are always on the viewpoint for ways to use technology to shake up straight structures and it is no different when it comes to education (Kulmeet Bawa, 2018).

The Indian education system is under pressure to adapt to a rapidly changing world. To keep pace with a worldwide paradigm shift brought about by digitization, our education system must accept digital resources and methodologies to improve availability, quality and scale. Technology and tools can guide in the much-needed service of our educational system, to make it more relevant in a digital world. The grouping of easily available high superiority digital devices and continuous connectivity is changing the face of learning.

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Resources Use Efficiency in Agriculture

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Chapter

LDH Ternary Nanocomposites: g-C_3N_4 Intercalated ZnO\Mg-Al for Superior Photocatalytic Activity towards Dye Degradation

Kandasamy Bhuvaneswari, Thangavelu Pazhanivel, Govindasamy Palanisamy and Ganapathi Bharathi

Abstract

Photocatalytic dye degradation has received more attention as an affordable and effective way to treat the dye polluted water. In the present chapter, we are going to discuss; (i) the preparation and photophysical characterization of g-C_3N_4 intercalated ZnO\Mg-Al LDH, a novel ternary nanocomposite, and (ii) its visible light photocatalytic degradation activity against the methylene blue dye. LDHs are 2D materials composed of "brucite-like" cationic layers where an inclusion of trivalent cations presents an overall positive charge to the nanosheets. g-C_3N_4 is one of the organic semiconductor photocatalyst which active for several types of reactions such as CO_2 reduction, water splitting, and degradation because of its stable, non-toxic, and earth-abundant nature. Mainly, the development of numerous 2D g-C_3N_4 nanosheets has been extensively used in the field of photocatalyst. By the combination heterojunction with 2D/2D interface can effectively improve the photocatalytic activity. The nitrogen-rich g-C_3N_4 intercalated ZnO\Mg-Al LDH ternary nanocomposite formation could follow the direct dye degradation process and results enhance the visible light absorption. The enhanced photocatalytic activity is mainly due to the improved charge separation rate and high number of photogenerated electrons. The large number of photogenerated electrons and high charge separation efficiency are effectively influence the dye degradation efficiency.

Keywords: layered double hydroxides, graphitic carbon nitride, photocatalytic activity, methylene-blue, ternary nanocomposites, visible light, dye degradation

1. Introduction

1.1 Water pollution

The industrial revolution could not avoid its effects on increasing environmental pollution, which pose a life threat to living beings. On the other hand, the increase of population rises the corresponding needs, which in turn result in the increased release of pollutants. The toxic substances from farmhouses, municipalities,

pesticides, and factories are the major sources of water pollution. Organic dyes are one of the major groups of pollutants which are released from textile industrial wastewater. The dye effluent contaminates the surface and groundwater, thereby, making it unfit for drinking and other daily usages. Polluted drinking water can cause serious cariogenic effects on human and other living beings.

The effective handling of increasing environmental pollution is a major challenge for the sustainable progress of modern civilization. With a lack of waste management measures, there is an urgent need in finding efficient ways to treat and decompose the pollutants. Water is a "universal solvent," it can dissolve more substances than any other liquid on earth. It is because of this substantial property, water dissolves most of the pollutants and thus be polluted easily. Quality drinking water is a fundamental right to every human being and most of the countries do not provide drinking water in the WHO standards. Water pollution not only affects the human being, but also every living organism, as there is nothing without water.

Organic dyes used in many industries such as textiles, furniture, chemical, paint, food, and cosmetic industries are the major water pollutants. The organic dyes possess color owing to the following reasons; (i) the dye molecules absorb light in the visible region of the electromagnetic spectrum (400–700 nm), (ii) they have a conjugated structure, i.e. a structure with alternating single and double bonds, (iii) the molecule dye have at least one color bearing chromophore group, and (iv) exhibit resonance of electrons, which is a stabilizing force in organic compounds [1]. The removal of dye molecules is a challenging process because of the enormous variety of functional groups in dissimilar dyes and their different properties. Many techniques like electrochemical coagulation, reverse osmosis, nano-filtration, photocatalytic degradation, adsorption using activated materials etc., are used for the removal of dye from wastewater. Among the various types of approaches adsorption and photocatalytic degradation of chemically stable organic pollutants occupy a prominent place, due to some of the obvious advantages such as cost-effectiveness, simplicity of operation besides great efficiency.

1.2 Photocatalysis

Photocatalysis is a process, which accelerates a photoreaction in the presence of a photocatalyst. Photocatalysis, as a fresh, cheap, environmentally friendly "green" process, offers great potential for environmental protection and energy exchange. The organic pollutants can be effectively decomposed by the semiconductor-based photocatalysts under light irradiation with the photon energies equal or higher to the bandgaps of the photocatalysts. In recent years, the photocatalytic reaction has received increasing attention for environmental applications such as air purification, hazardous material remediation, water disinfection, and water purification. The versatility of the photocatalytic process, for example, photocatalytic degradation of dyes and photoelectrocatalytic reduction of CO_2 into hydrocarbon compounds in aqueous semiconductor suspensions, greatly attracted the scientists to work in the field of photocatalysis. The pioneering work of photo-electrochemical water splitting on TiO_2 electrode reported by Fujishima and Honda in 1972, has been the initiative in the field of photocatalysis. In this way, the semiconductor based photocatalysis has grown as an ideal green chemistry tool in dealing with the globally concerned energy shortage and environmental pollution issues. In general, a photocatalytic reaction consists of three simple steps; (i) The semiconductor photocatalysts absorb incident photons whose energy ($h\nu$) is equal to or more than its bandgap (E_g), resulting in the generation of electron-hole pairs, (ii) The photogenerated charge electrons and holes are separated and transferred to the surface of photocatalysts, and (iii) The photogenerated electrons and holes

contribute in catalytic reactions by forming superoxide and hydroxide radicals which react with dye molecules [2].

The detailed photocatalytic mechanism was shown in **Figure 1**. Several efforts have been conveyed through a variety of materials and methods and it is true, that each report put forward some scientific development to its ancestors. The photodegradation is one of the cost-effective and easy-to-implement methods, and the materials studied include TiO_2, SnO_2, ZnO, CuO, and WO_3 along with their heterostructures and organic/inorganic composites [3–7].

The photocatalytic decomposition of pollutants in the real-time application for water sanitization requires the use of non-toxic, cheap as well as reproducible resources. The conventionally used wide bandgap (SCs) with limited light responding range, which can only absorb UV light (λ <380 nm), seriously confines the photocatalytic efficiencies. Therefore, it has become a significant problem to develop the photocatalytic SCs with a visible light response for practical applications. Besides, another major task in photocatalysis is the increase in the charge separation efficiency of the photocatalyst and the corresponding photocatalytic efficiency. The separation of the electron–hole pairs can increase the efficiency of photocatalysts. Transition metal oxides (TiO_2, ZnO_2, SnO_2, etc.) have lower photocatalytic efficiency since its wide bandgap and high recombination rate of photogenerated electron-hole pairs. To overcome this difficulty, the development of hetero-nanostructures could offer an enhancement in the photocatalytic efficiency and can act as a better photocatalyst which can degrade various kinds of persistent organic pollutants.

Among the numerous photocatalytic materials, ZnO occupied the reasonable research area owing to its whole beneficial characteristics over other materials [8, 9]. Even though, when it comes to commercial developments, the robustness of ZnO needs further developments [10]. Such as, the trapping state (including interstitial and missing atoms/vacancy defect) bolstered loss of excitons, which is basic in oxide-based semiconductors, should be tended to appropriately [11]. One plausibility of accomplishing this is, utilize a better surfactant/capping molecule to passivate the surface traps, which overwhelmingly trigger the charge carrier recombination. On the other hand, such passivation has the opportunity to acting as a barrier for hinders the association between the dye pollutant and active material, which will likewise bring low efficiencies. The development of a ZnO based hybrid photocatalyst comprising of a composite material with suitable band structure would be a better choice towards the concealment of charge carrier recombination and consequent improvement in the photocatalytic dye degradation process [12, 13].

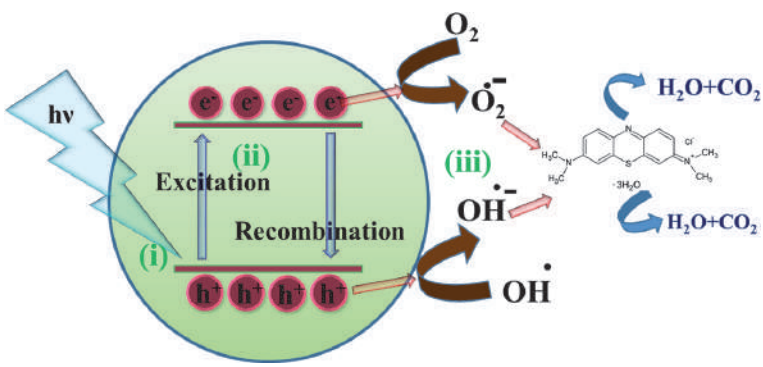


Figure 1.
Schematic illustration of photocatalytic dye degradation.

1.3 Graphitic carbon nitride (g-C_3N_4)

Graphitic carbon nitride (g-C_3N_4), is a two-dimensional metal-free conjugated crystalline sheet material with a bandgap energy of 2.7 eV, which has concerned exceptional research enthusiasm because of its environmental friendly nature, attractive electronic structure, low-cost excellent thermal and chemical stabilities [14–18]. The conduction and valence band boundaries of g-C_3N_4, exist at −1.12 and + 1.6 eV, making it active under visible light as an efficient photocatalyst [19–22]. Even though, its implication has drawbacks such as faster recombination of the electron-hole pairs, and agglomeration in most solvents caused by the strong van der Waals attractions between sp^2 carbon atoms [23]. 2D g-C_3N_4, nanosheets have much attention because of their enlarged specific surface area, improved electron–phonon interaction, and enhanced electron mobility along the in-plane direction [24]. Although some developments have been attained, the light-harvesting ability and quantum efficiency of these modified g-C_3N_4 systems are still poor.

For these reasons, various protocols such as surface modification, doping with metal or nonmetal elements and co-polymerization have been actively employed to enhance the photocatalytic performance of g-C_3N_4. It has high nitrogen content compared to other N-carbon materials, which is capable of creating more active reaction sites that would increase the electron donor/acceptor characteristics. Even after several decades and extensive investigations on several materials, a robust combination of materials and method is still required to vanish away the environment threatening organic pollutants.

1.4 Layered double hydroxides

Layered double hydroxides (LDH), a new class of lamellar metal hydroxide materials, consist of positively-charged hydrotalcite-like layers with carbonate ions and water molecules in the interlayer galleries [25–27]. Due to the two dimensional (2D) layered structure, LDH has a high explicit surface area, which can help quick ion transfer [26, 28–30]. Dvininov et al. prepared the SnO_2/Mg-Al LDH coupling through the thermal treatment, which demonstrated good photocatalytic activity for methylene blue degradation [31]. It was made conceivable by the oxygen reduction and progressive creation of hydroxyl radicals, which are accountable for the degradation. Seftel et al. synthesized Ti incorporated Mg-Al LDH solid which shows better photocatalytic activity due to the isolation of small TiO_2 nanoparticles on the LDH surface [32]. Kingshuk Dutta et al. prepared ZnO\Zn-Al LDH nanostructure by hydrothermal method using Al substrate as a template for developing different compositions and morphologies and the author demonstrated the degradation of Congo red dye [33]. Therefore, the LDH is a better candidate to be hybridized with ZnO which will enhance the catalytic activity of photocatalysts.

In any case, to build up a superior photocatalyst, hybridizing the LDH with a material having high conductivity and surface area is one of the hopeful approaches, which can further improve the charge transport proficiency of LDH-composite. Xiaoya Yuan et al. prepared the g-C_3N_4\Zn-Al LDH composites through a simple in situ crystallization technique and the as-prepared composite exhibited improved photodecolorization of MB.

In the present work, we have prepared a ternary nanocomposite of g-C_3N_4 intercalated ZnO\Mg-Al LDH through a hydrothermal technique and studied its photocatalytic activity against the MB dye degradation. The ZnO is attached on the surface also interlayers of the LDHs, and ZnO\Mg-Al LDH are distributed over the surface of g-C_3N_4 nanosheets. The nitrogen-rich ternary composite formation

resulted in the enhancement of visible light absorption and improved charge separation to result in the enhanced photocatalytic degradation activity towards the MB dye.

2. Experimental section

2.1 Preparation of g-C_3N_4 nanosheets

The g-C_3N_4 was prepared by a thermal condensation method using melamine as a precursor. 5 g of melamine was kept in an alumina crucible and thermally treated at 550°C for 3 h in a furnace. The obtained agglomerate residues are ground into fine powder and subjected to hydrochloric acid treatment for 12 h to obtain the g-C_3N_4 nanosheets. The suspension was centrifuged to separate the residual of g-C_3N_4 nanosheets. The obtained precipitate product was heated at 60°C for overnight to attain the light yellow colored powder of g-C_3N_4 nanosheets.

2.2 Preparation of Mg-Al LDH

In a typical synthesis procedure, Mg-Al LDH was prepared by a facile hydrothermal method. Firstly, 0.05 M of aluminum nitrate and 0.03 M of magnesium chloride were dissolved into 20 ml DDW separately under vigorous magnetic stirring for 10 min. Subsequently, 0.04 M of urea were dissolved into the 10 ml DDW and stirred for 30 min. After that, the precursor and urea solutions were mixed and 0.2 M of NaOH was added to the above solution mixture until the pH of the suspension was reached 12. The entire solution was transferred into a 100 ml Teflon lined stainless-steel autoclave, followed by heating in an oven under 180°C for 24 h. After the reaction was complete, the autoclave was cooled to room temperature. Finally, the sample was centrifuged and washed with DDW water and dried at 80°C for overnight to obtain the final product.

2.3 Preparation of ZnO nanoparticles

ZnO nanoparticles were prepared by the hydrothermal method. In this process, 0.2 M of $ZnCl_2$ were dissolved in 100 ml of DDW, and 0.2 M of NaOH were dissolved in 20 ml of DDW separately under constant stirring. After 10 min stirring the above-mentioned solutions were mixed together, and transferred into a 100 ml Teflon liner stainless-steel autoclave, followed by heating in an oven under 180°C

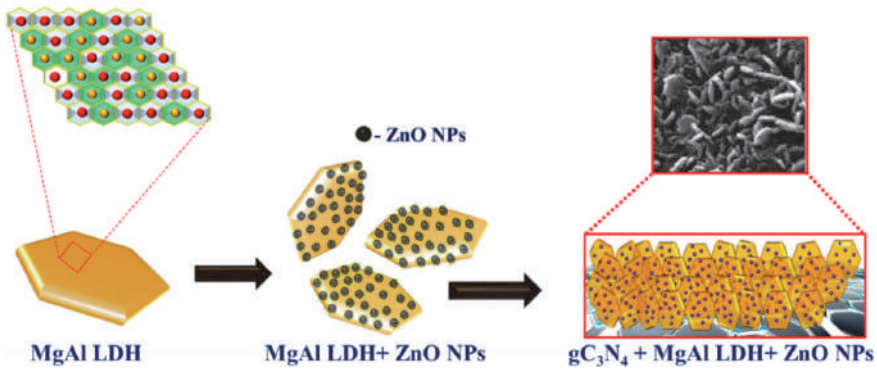


Figure 2.
Pictorial representation for the formation of g-C_3N_4\ZnO\Mg-Al LDH 2D/2D LDH tertiary nano-composite [34].

for 24 h. Later, the autoclave was cooled down naturally. Finally, the obtained solution was centrifuged and washed with DDW water and dried at 80°C for overnight to obtain the final product.

2.4 Preparation of 2D\2D hybrid

A certain amount of g-C_3N_4 was dispersed into 20 ml of DDW and ultrasonicated for 30 min. Subsequently, the ZnO\Mg-Al precursor solution was prepared and mixed with ultrasonicated g-C_3N_4 nanosheets. Again, the mixture was ultrasonicated for 30 min in a beaker to form a homogeneous suspension. After that, the reaction mixture was transferred into a 100 ml Teflon liner stainless-steel autoclave, followed by heating in an oven under 180°C for 24 h. After that, the autoclave was cooled down naturally to ambient temperature. Finally, the sample was centrifuged and washed with DDW water and dried at 80°C for overnight to obtain the final product. **Figure 2** shows the formation of g-C_3N_4\ZnO\Mg-Al LDH 2D\2D hybrid.

3. Characterization details

The photocatalytic activities mostly depend on the material nature, specific surface area, and light energy utilization ratio [35] etc., and for these reasons the crystallinity, functional group, surface area morphology and photophysical properties of the as-prepared samples were systematically investigated by various analytical techniques.

i. Structural investigation

ii. Morphology analysis

iii. Elemental analysis

iv. Photophysical investigation

v. Surface area investigation

3.1 Structural investigation

The crystalline phases have a significant influence on the photocatalytic activities [36]. So the phase purity and crystallite size of the synthesized samples were evaluated by X-ray diffractometer using Riguku MiniFlux-II diffractometer using Cu Kα radiation (λ = 1.540 46 Å). The crystalline nature of the prepared samples were investigated through XRD analysis and **Figure 3** displays the XRD pattern of Mg-Al LDH, gC_3N_4, ZnO and g-C_3N_4\ZnO\Mg-Al LDH ternary nanocomposite.

The XRD pattern of the Mg-Al LDH and g-C_3N_4, sample is in good agreement with the JCPDS card no: 35-0965 [37] and 87-1526 [38], respectively. The diffraction peaks indexed to (003), (006), (012), (015), (018), and (110) are the plane reflections of a typical hydrotalcite-like phase screening, sharp and symmetric basal (00 l) reflection of LDH. The XRD pattern of ternary nanocomposite consists of g-C_3N_4, ZnO and Mg-Al LDH diffraction peaks indicate the formation of the composite.

3.2 Morphological analysis

3.2.1 FE-SEM analysis

The surface morphology of the prepared samples was investigated by using FESEM and HRTEM analyses, respectively. The FE-SEM images were obtained by using Zeiss SUPRA-25 and the particle size and morphology of the prepared samples were analyzed by using HR-TEM – Jeol/JEM 2100, with LaB6 source.

Figure 4 shows the FESEM images of (a) Mg-Al LDH, (b) g-C_3N_4, (c) ZnO and (d) gC_3N_4\ZnO\Mg-Al LDH ternary nanocomposite samples. The Mg-Al LDH consists of plenty of two-dimensionally structured hexagonal LDHs matrix with a layer by layer assembly. The size of the hexagonal nanoflakes is approximately 200 nm, which indicate the successful exfoliation of a 2D layer.

3.2.2 HRTEM analysis

Furthermore, the hexagonal formed hydrotalcite-like particles were seen from the HRTEM analysis (**Figure 4d** and **e**) and it concurs well with the morphology

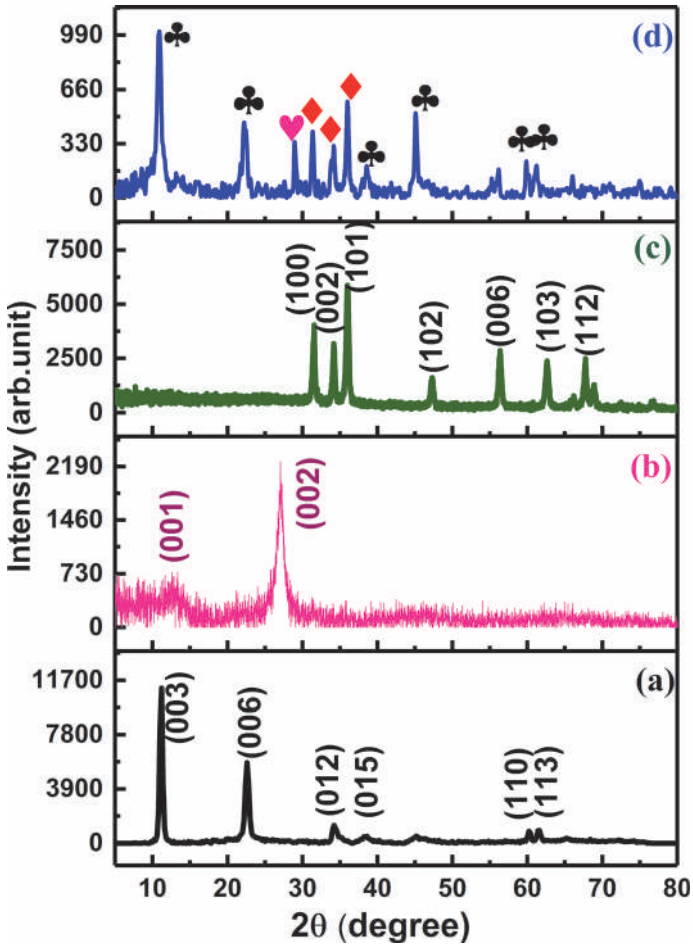


Figure 3.
XRD pattern of (a) Mg-Al LDH, (b) gC_3N_4, (c) ZnO and (d) g-C_3N_4\ZnO\Mg-Al LDH ternary nanocomposite [34].

acquired from FE-SEM investigation. Some dull spots showed up on the outside of the LDH, demonstrating that the ZnO nanoparticles are well attached on the LDH surfaces. Some dark spots appeared on the surface of the LDH, indicating that the ZnO nanoparticles are well attached to the surface of the as-prepared LDH. The 2D\2D ternary nanocomposites assembly was successfully obtained, and by arresting the ZnO\Mg-Al LDH sheets with g-C_3N_4 sheets, the formation of the 2D\2D ternary nanocomposite was possible. Surprisingly, after the formation of the ternary nanocomposite, the LDH loose its horizontal stacking arrangements and started aligning vertically on the surface of the g-C_3N_4 nanosheets. These types of arrangements provide a more active surface for the prepared photocatalysts.

3.3 Chemical analysis

The surface chemical composition of the prepared samples was confirmed by the FTIR, EDAX, Elemental mapping, and XPS analyses.

3.3.1 FTIR analysis

The vibrational bands of the prepared samples were analyzed by FTIR analysis (using a Bruker model Tensor 27 instrument) and the results are shown in **Figure 5a**. All the spectra, exhibit a strong band at 3700 to 3000 cm^{-1} which could be ascribed to the vibration of surface adsorbed water molecules and in the case of LDH plates, it is due to the formation of interlayer water molecules. Furthermore, several bands were observed in the 1200–1650 cm^{-1} region, which is assigned to the characteristic stretching modes of C—N heterocycles [39]. The absorption bands at 1620 cm^{-1} are associated with the C═O of the carboxylate groups. The occurrence of the feeble band at 1631 and 1643 cm^{-1} can be ascribed to the bending frequency and O—H asymmetric stretching vibration of the water molecules, respectively [40, 41]. The characteristic absorption band of ZnO samples was observed at 595 cm^{-1}, which is related to the metal-oxygen stretching vibration. The absorption

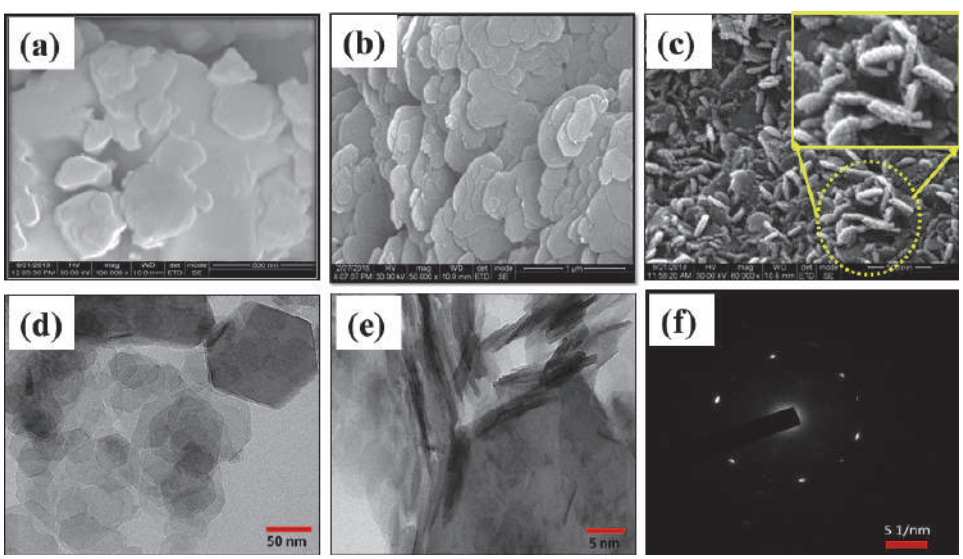


Figure 4.
Morphology analysis: FE-SEM images of (a) Mg-Al LDH, (b) g-C_3N_4, (c) g-C_3N_4\ZnO\Mg-Al LDH ternary nanocomposite and HRTEM images of (d) Mg-Al LDH, (e) g-C_3N_4\ZnO\Mg-Al LDH ternary nanocomposite, (f) SAED pattern of ternary nanocomposite [34].

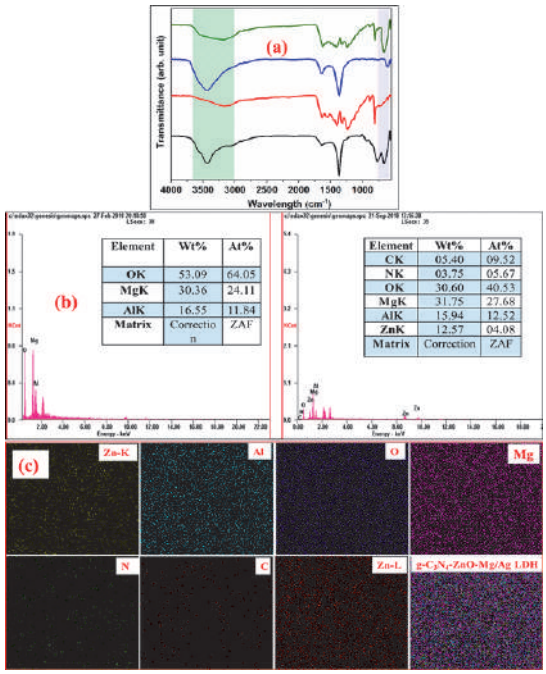


Figure 5.
(a) FTIR spectra for as prepared samples (b) EDX spectra of MgAl LDH and g-C_3N_4\ZnO\Mg-Al LDH ternary nanocomposite and (c) mapping analysis of g-C_3N_4\ZnO\Mg-Al LDH ternary nanocomposite [34].

bands at 653 cm^{-1} could be owed to the M—O—M lattice vibrations of the hexagonal sheets [42]. The successful intercalation of g-C_3N_4 and ZnO with Mg-Al LDH were observed from the presence of their corresponding bonds, in the FTIR results.

3.3.2 EDX analysis

Figure 5b shows the observed elemental composition of the ternary nanocomposite by EDX analysis (carried out using a JEOL Model JED 2300). From the EDX results, it could be able to observe the high percentages of O, Mg and Al elements, present in the as-prepared samples and no other impurities were observed. The elemental mapping of Mg-Al LDH and g-C_3N_4\ZnO\Mg-Al LDH ternary nanocomposite were presented in **Figure 5c**, which indicates the even distribution of the observed elements across the sample.

3.3.3 XPS analysis

XPS analysis was used to investigate the surface chemical composition of the prepared ternary nanocomposite and the obtained results were shown in **Figure 6**. The survey spectra show that the prepared sample is contain Mg, Al, Zn, O, C and N elements which creating peaks corresponding to Mg 1s, Al 2p, Zn 2p, O 1s, C 1s, and N 1s positions, respectively (**Figure 6A**). The high-resolution spectra of individual elements are presented in **Figure 6B**. The Mg^{2+} species are observed by the presence of Mg 2p, Mg 2s, Mg KLL, and Mg 1s state corresponding to the binding energies of 52.8, 90.8, 306.8, 351.8 and 1302.8 eV, respectively [43]. The high-resolution spectra of Mg 1s are fitted with three segments associating to the binding energies of 1307, 1308 and 1308.8 eV, which are ascribed to Mg, Mg-CO_3 and MgO [44, 45]. The Al attributed to the two states such as Al 2p and Al 1s and the characteristic

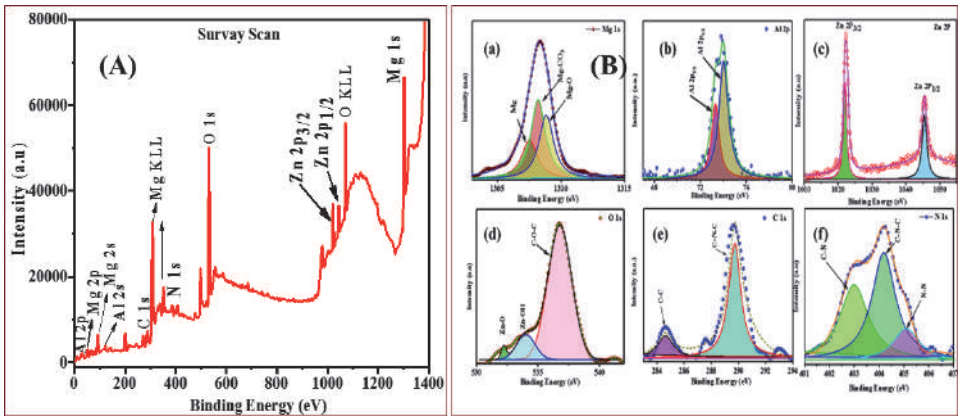


Figure 6.
XPS spectra of C_3N_4\ZnO\Mg-Al LDH ternary nanocomposite: (A) survey spectra and (B) high resolution XPS spectra of (a) Mg 1s (b) Al 2p (c) Zn 2p (d) O 1s (e) C 1s (f)N 1s [34].

peak were observed at 76.8 and 120.8 eV. The occurrence of Zn is seen from the two Zn 2p states as Zn $2P_{3\2}$ and Zn $2P_{1\2}$ corresponding to 1020.8 and 1043.8 eV respectively. It additionally uncovers that the Zn is available just in 2^+ oxidation state which affirms the conceivable bonding between Zn and O [10]. The oxygen O 1s is deconvoluted into three peaks corresponding to the O^{2-} at 532.2 eV, OH^- species at 533 eV and C—O—O at 536 eV, respectively [46]. In over-all, the inferior binding vitality of O 1s peaks emerges from the bond between O^{2-} and Zn^{2+} metal ions. The C 1s spectra can be deconvoluted into dual contributions such as 284.4 and 289 eV, assigned to the occurrence of sp^2 hybridized carbon atoms and C═*N*—C bonding [47], respectively. The N 1s spectra can be tailored into three basic peaks with the binding energies of 402, 404.1 and 405 eV, which are attributable to the binding of C—N, C—N—C, and N—N respectively [20]. Henceforth, the above observations affirm the formation of g-C_3N_4\ZnO\Mg-Al LDH ternary nanocomposite and the XPS results are in good agreement with FTIR, EDX and mapping analyses.

3.4 Photophysical investigation

3.4.1 UV-Vis absorption spectra

Optical properties possess a prominent role in the photocatalytic materials and therefore the photophysical properties of the prepared materials were investigated by UV-Vis and PL analyses. The optical absorption analysis was done using a SHIMADZU 3600 UV-Vis-NIR spectrophotometer and Emission spectrum of the as-prepared samples was recorded by using Horiba Jobin Yvon Spectro Fluromax 4. **Figure 7A** shows the UV-Vis. absorption spectra of the prepared samples. The absorption maxima were observed in the range between 320 and 450 nm. And the absorption of ternary nanocomposite was extended to the visible region and show an obvious red shift compared with the other samples, which may because of the interaction between the ZnO, LDH, and g-C_3N_4. The 2D\2D formation demonstrates a reality that the as-prepared ternary nanocomposite noticeable light vitality which can thusly create more charge transporters offered to contribution in the photocatalytic efficiency. Tauc's plot was used to determine the energy bandgap of the samples and the obtained values are 2.6, 3.5, 2.57 and 2.81 eV for LDH, ZnO,

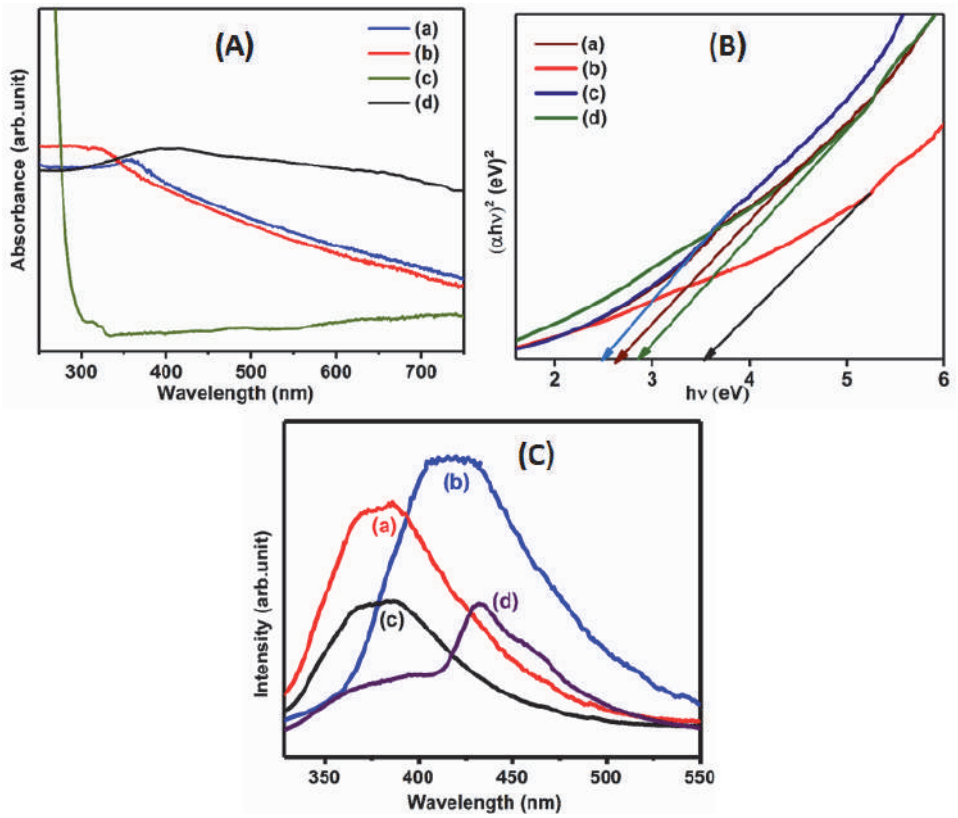


Figure 7.
(A) UV-Vis absorption spectra (B) Tauc's plots and (C) PL spectra of the prepared samples ((a) Mg-Al LDH and (b) ZnO (c) g-C_3N_4 (d) g-C_3N_4\ZnO\Mg-Al LDH ternary nanocomposite) [34].

g-C_3N_4, g-C_3N_4\ZnO\Mg-Al LDH ternary nanocomposite, respectively. The UV-Vis absorption results show the considerable enhancement in the visible light absorption and it is because of this reason, an enhancement in the photocatalytic performance of the as-prepared photocatalyst is observed (discussed in the latter part).

3.4.2 PL spectra

The emission spectrum is produced because of recombination of the charge carriers and it provides hints about the proficiency of charge carrier transformation, trapping, and separation of the photo generated electrons-holes pairs. The strong PL emission profile usually indicates the quick recombination of electron-hole pairs which provides low photocatalytic activity.

Figure 7C shows the PL emission spectra of (a) MgAl LDH, (b) g-C_3N_4, (c) ZnO and (d) g-C_3N_4\ZnO\Mg-Al LDH ternary nanocomposite, which were recorded using 320 nm as excitation wavelength. The LDH and ZnO nanoparticles exhibit a strong PL emission in the range from 350 to 450 nm. The pure g-C_3N_4 shows a strong emission about ~420 nm, which can be attributed to the fast electron-hole recombination process. It can be seen that, after the formation of ternary nanocomposite the emission was intensity was decreased which may due to the delocalization of electrons. In general, a decrease in the recombination rate gives rise to a low PL intensity, which results in the maximum photocatalytic activity.

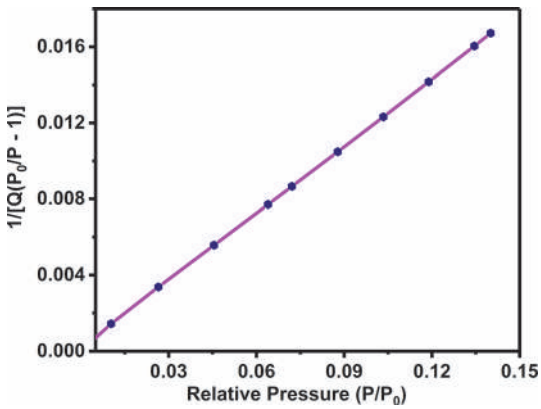


Figure 8.
BET surface area analysis of g-C_3N_4\ZnO\Mg-Al LDH ternary nanocomposite [34].

3.5 Surface area investigation

The specific surface area of the photocatalyst was determined by Brunauer-Emmett-Teller (BET) analysis through N_2 adsorption/desorption measurements at 25°C (**Figure 8**). The measured surface area of the ternary nanocomposite was ~37 $m^2\ g^{-1}$. The high surface area support more active species and reactants to be absorbed on its surface, which might proficiently help the kinetics of photo catalytic reaction.

4. Photocatalytic activity

4.1 Dye removal procedure

The photocatalytic activity of the as-prepared samples was investigated under UV-Vis light irradiation. The aqueous MB solution (20 mg L^{-1}) was prepared and kept in dark for 60 min to attain equilibrium. Later, 10 mg of the as-prepared photocatalyst was added to 10 ml MB solution and it was placed in a water jacketed photocatalytic reactor for the photocatalytic degradation process. A 250 W Hg lamp was used as the illumination source to excite the photocatalysts. In the whole reaction, the photocatalytic container was maintained at room temperature by circulating water. At 15 min time interval, 3 ml of solution was taken and centrifuged to remove the photocatalyst particles. The supernatant was examined by a Shimadzu UV3000 UV-Vis spectrophotometer and the dye absorption band maximum was observed at ~664 nm. The percentage of degradation was calculated using the Beer-Lambert relation [48]:

$$A(\lambda) = \log\left(I(\lambda)/I_0(\lambda)\right) = -\varepsilon l[BM] \quad (1)$$

where
A – absorbance at a given wavelength λ,
I_0 (λ) – incident light intensity,
I (λ) – light intensity transmitted through the MB solution,
ε – Molar attenuation coefficient of MB.
l – Path length of the beam of light.

The degradation efficiency was calculated by

$$\text{Degradation } (\%) = (C_0 - C)\backslash C_0 * 100 \quad (2)$$

where,

C_0 is the initial dye concentration and
C is the dye concentration at time t from the start of the photocatalytic reaction.

For the reusability purpose, the as-prepared photocatalyst collected after the photocatalytic reaction by centrifuging, washed with DDW and then dried at 60°C.

4.2 Radical trapping experiment

To elucidate the reaction mechanism of the photocatalytic MB dye degradation, the radical trapping investigation was performed. In the scavenging activity, h^+, OH and O_2^- radicals are trapped by EDTA, 2-propanol and benzoquinone, respectively. The trapping experiments were carried out with the accumulation of different scavengers into the catalytic reaction. The reaction samples were taken from the photocatalytic reactor to record their UV-Vis absorption spectra.

4.3 Reaction mechanism of dye degradation

The photocatalytic activities of the Mg-Al LDH, g-C_3N_4, and g-C_3N_4\ZnO\Mg-Al LDH ternary nanocomposite were assessed under UV-Vis light illumination. In this work, MB dye was utilized as an objective contamination so as to decide the photocatalytic action of the impetuses under obvious light illumination. The MB dye solutions were prepared and the photocatalytic reactions were performed by adding the as-prepared samples to the MB dye solutions. The pure MB dye fragment shows a strong visible light absorption around 664 nm. The MB dye with prepared photocatalyst is subjecting under the visible light irradiation, corresponding absorption peak intensity was decreased, and the decreasing MB dye intensity is attributed to the degradation of MB dye through the photocatalytic activity. When increases the irradiation time, absorption intensity of MB dye molecules was decreased (i.e.) once increase the irradiation/reaction time, the large number of dye molecules can be degraded. In this process, a photocatalyst is irradiated by light with energy equal to or higher than the bandgap energy of the photocatalyst. This results in the excitation of an electron (e^-) from the valence band to the conduction band, leaving a hole (h^+) in the valence band. Before the recombination takes place, the photogenerated electrons (e^-) and holes (h^+) should be transferred to the surface of the photocatalyst in order to take part in the redox reactions with the adsorbed species. The redox reactions of electrons (e^-) and holes (h^+) with adsorbed oxygen and water molecules lead to the formation of superoxide radical anion ($^{\bullet}O_2^-$) and hydroxyl radical ($^{\bullet}OH$), respectively.

Among all the as-prepared photocatalyst samples, g-C_3N_4\ZnO\Mg-Al LDH ternary nanocomposite sample exhibit better photocatalytic activity. This could be attributed to a large number of electrons and holes generated by the as-prepared photocatalyst system, caused by the favorable visible light absorption. On the other hand, ZnO, a wide bandgap material, provides intermediate states to delay the electron–hole recombination, which could also contribute to the high photocatalytic activity. The morphological arrangements of the nanocomposite and its resultant electronic structure, (i.e.) the even distribution of ZnO intercalated LDH over the surface of g-C_3N_4 [49], collectively contribute to the effective separation of the photogenerated charge carriers. The observed photocatalytic degradation efficiencies of the as-prepared photocatalysts are 32%, 30%, 49% and 96.5% for ZnO, LDH, g-C_3N_4, and g-C_3N_4\ZnO\Mg-Al LDH ternary nanocomposite, respectively.

It has to be noted that the photocatalytic efficiency reported in the present study, betters our previous research work, in which ZnS QDs-LDH [49] exhibited a photocatalytic degradation efficiency of 95%. The enhanced photocatalytic efficiency is originated from the photocatalytic activity of N-rich g-C_3N_4, (i.e.,) the improved photocatalytic mechanism could be ascribed to the synergetic effect of graphitic N rich surface which offers more reactive sites for photocatalytic reaction. This in turn increases the utilization of the photo-separated charges towards the radical formation and corresponding degradation. Parallelly, the N-carbon acted as a co-catalyst to improve surface reaction kinetics and the nitrogen species directly contributed to the outstanding photocatalytic activity under visible light irradiation. Especially the nitrogen rich surface can achieve essential optical absorbance under visible light due to the mixing of O 2p states with p states. And also the nitrogen rich surface 2D/2D offers more active surface for the e^- transfer. The reaction kinetics of the MB dye degradation of the prepared photocatalysts is investigated by fitting the pseudo-first-order kinetic curve [50].

The plots of ln (C_0\C) against illumination time are appeared in **Figure 9**. From the kinetic graph, the ternary nanocomposite fits well and the outcome is in concurrence with the pseudo-first-order model. The impact of different scavengers on the photodegradation of MB dye solution was studied in order to recognize the role of receptive oxidative species in the photodegradation process. The role of H^+, OH and O_2 radicals were done individually, utilizing EDTA, 2-propanol, and BQ respectively. During the addition of EDTA and BQ, there were conspicuous variations in the photocatalytic process, which shows that H^+ and O_2 radicals are influences in MB dye degradation. But after the addition of 2-Proponal (scavenger for the OH radical), the degradation of MB is highly suppressed than other reactions, indicating the major of *OH in MB dye degradation. From this result, it is clear that the photocatalytic degradation process is led by the contribution of hydroxyl radical (*OH). After the addition of the as-prepared photocatalyst into the reaction and irradiating with visible light, the electrons were photoexcited from the valence band (VB) to the conduction band (CB). Once electrons are excited, the hole act as an oxidizing agent and oxidize the aquatic or the dye directly to form *OH radicals.

These OH reactive species are responsible for the efficient degradation of organic pollutants in water. The following equation represent the possible photocatalytic reaction mechanism of MB dye degradation under visible light irradiation.

$$\begin{aligned}
&g - C_3N_4/ZnO/MgAl(LDH) + h\nu \rightarrow g - C_3N_4/MgAlLDH\left(h^+ + e^-\right)ZnO\\
&g - C_3N_4/MgAl(LDH) + \left(h^+\right) \rightarrow (e^-)(free - electrons)\\
&e^- + O_2 \rightarrow O_2^{\bullet}\\
&h^+ + OH^- \rightarrow OH\\
&h^+ + H_2O \rightarrow OH + H^+\\
&O_2^{\bullet} + MB \rightarrow CO_2 + H_2O\left(By - product\right)\\
&OH^{\bullet} + MB \rightarrow CO_2 + H_2O\left(By - product\right)\\
&h^+ + MB \rightarrow CO_2 + H_2O\left(By - product\right)
\end{aligned} \tag{3}$$

The **Figure 10** shows the schematic illustration of possible photocatalytic degradation of MB dye under visible light irradiation. The reusability of the prepared photocatalyst was studied by performing continual tests under same reaction conditions (shown in **Figure 11b**). The fresh MB solution was utilized for resulting cycles. Subsequently in each cycle, the prepared catalyst was isolated from the photocatalytic reactor through centrifugation. After 4 cycles, the degradation ability of the prepared catalyst was slightly reduced and it might be because of the loss

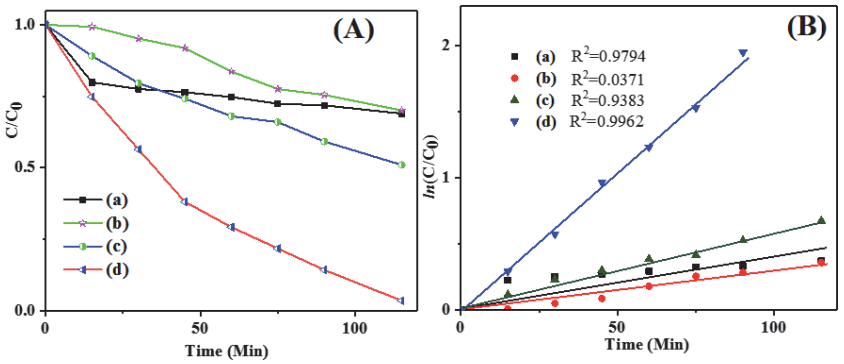


Figure 9.
(A) Photocatalytic degradation and (B) pseudo-first-order kinetics for the degradation of MB over (a) ZnO (b) LDH(c) g-C_3N_4 (d) g-C_3N_4\ZnO\Mg-Al LDH ternary nanocomposite [34].

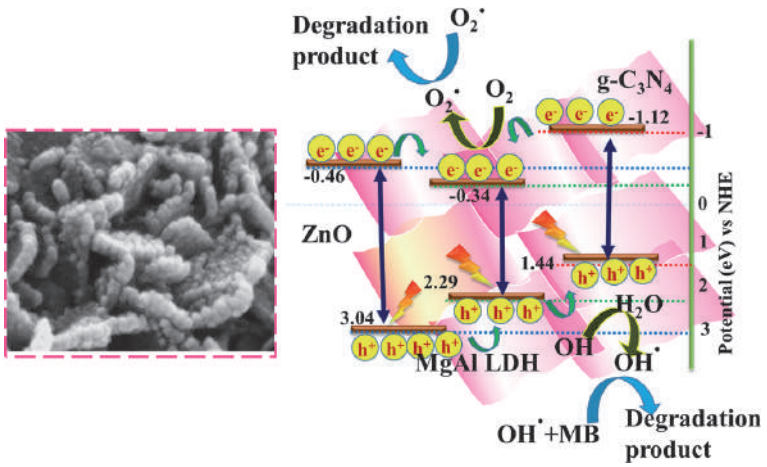


Figure 10.
Schematic illustration of proposed photocatalytic reaction mechanism.

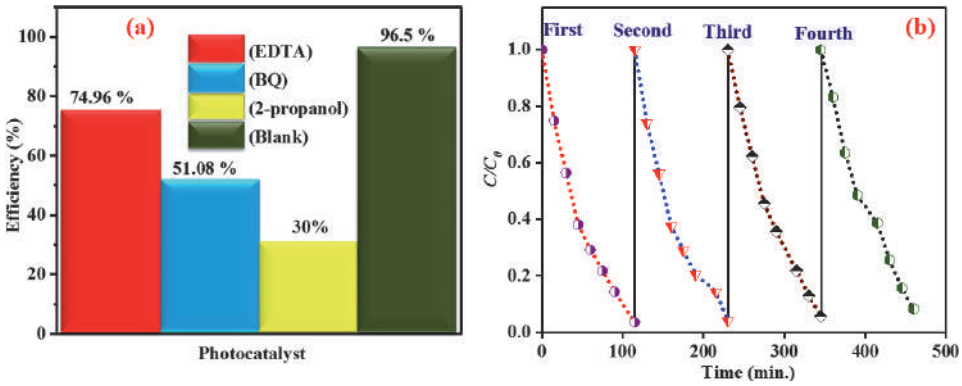


Figure 11.
(a) Radical trapping experiments of active species over g-C_3N_4\ZnO\Mg-Al LDH ternary nanocomposite and (b) reusability of g-C_3N_4\ZnO\Mg-Al LDH ternary nanocomposite in the photodegradation of MB [34].

of catalyst during the recycling process. The photocatalytic dye degradation activity of the prepared sample was compared to the previously reported nanomaterials, which is given in **Table 1**.

S. No	Catalyst	Dosage of dye (mg)	Dye	Light source	Catalyst efficiency (%)	Reaction time (min)	References
1.	PANI-ZnO	100	MB	250 W	98.3	180	[51]
2.	Nitrogen doped dual phase titanate	10	MB	450 W	~97	310	[52]
3.	Zirconia	50	MB	500 W	~78	300	[53]
4.	CA-CNT/TiO_2-NH_2	2 cm × 13 cm (CNT)	MB	40 W	80	300	[54]
5.	TiO_2	100	MB	6 W	97	180	[55]
6.	g-C_3N_4\ZnO\Mg-Al LDH	10	MB	250 W	96.5	120	Present work

Table 1.
Comparison table of MB dye degradation using different photocatalyst with degradation (%) of previously reported nanomaterials.

Form the experimental results, it was confirmed that the as-prepared ternary nanocomposite exhibits remarkable photocatalytic activity and reusability under visible light to photo-degrade MB dye.

5. Conclusion

In summary, the hydrothermally prepared 2D\2D ternary nanocomposite was used as an efficient photocatalyst for the photodegradation of MB dye. The nitrogen-rich 2D\2D (g-C_3N_4 and Mg-Al LDH) surface significantly enhanced the photocatalytic efficiency under the visible light irradiation due to the improved photo active surfaces. Especially, in ternary nanocomposite Mg-Al LDH 2D nanoplates are vertically well aligned on the surface of the g-C_3N_4 2D nanosheets. This 2D/2D arrangement results effectively enhances the photocatlytic activity due to the efficient separation of photo-induced charge carriers and transfer by the incorporation of ZnO into LDH brucite layers. In addition, the g-C_3N_4 surface contributed to the efficient charge injection in the photocatalytic reaction. The novel g-C_3N_4\ZnO\Mg-Al LDH ternary nanocomposite can be used as a proficient material for the photocatalytic degradation of MB dyes under visible light irradiation.

6. Future aspects/prospective

1. The as prepared ternary nanocomposite show large specific surface area and efficiently active in the visible light region so this material can used as a good photocatalytic for other organic dye degradation

2. The LDH have large number of interlayer galleries which can capable to adsorb the pollutants such as heavy metals synthetic or organic dyes.

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6 Pelargonidin, a Dietary Anthocyanidin in the Prevention of Colorectal Cancer and Its Chemoprotective Mechanisms

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Abstract

Diseases of bowl wall mucosa stemming from sudden mutation lead to the development of colorectal cancer (CRC) cells by the transformation of normal epithelial cells into neoplastic lesions. CRC is considered to be a global burden; hence, its incidence rate is expeditiously increased up to ten-fold higher, worldwide. The epidemiological report pinpointed CRC as the utmost third common malignancy in men and second in women. Because of greater efficacy, the synthetic drugs are unsatisfactory due to higher toxic effects to the normal cells, and a chance of developing multidrug resistance by tumor cells. Therefore, dietary flavonoids with potent anticarcinogenic effects have been focused on recent investigations. Pelargonidin (PD), a bioactive molecule classified under anthocyanidin is present in red and pink pigmented berries. PD efficiently modulates intercellular antioxidant status, thereby reducing oxidative DNA damage, cellular proliferation, differentiation, apoptosis, angiogenesis, and reverse drug resistance of metastatic cells, and potentially induces cell cycle arrest, thereby interfering in colorectal carcinogenesis. PD scavenges and normalizes the intracellular reactive oxygen species (ROS), which results in gene mutation and induction of colon carcinogenesis. Therefore, the proliferation of tumor cells would be affected or blocked potentially due to disturbance in cell cycle protein by these ROS. Considering the wide pharmacological benefits of PD, this chapter deliberately reviews the cumulative research data from in vitro human colon cancer cell line studies on chemoprotective property of PD against CRC, and also summarizes the underlying mechanism in experimental models.

Keywords

Colorectal cancer (CRC) · Pelargonidin · Antioxidant · Apoptosis · Chemoprevention

6.1 Introduction

Flavonoids are low-molecular-weight large group bioactive polyphenols with a basic benzo-γ-pyrone as a backbone structure, and are widespread in a variety of plants. These bioactive compounds potentially induce apoptosis and modulate tumor cell proliferation, angiogenesis, and differentiation, thereby directly interfering at each step of carcinogenesis (Ramos 2007). A number of research studies evidenced that

secondary metabolites include flavonoids which are phenolic in nature and possess several pharmacological activities based on its unique chemical structure (Mahomoodally et al. 2005). Basically, the degree of chemical reactions such as hydroxylation, substitutions, polymerization, and conjugations determines its specific chemical properties. More interestingly, the antioxidant, metal chelating, and free radical scavenging efficiency of flavonoids were enumerated by the number of hydroxyl groups present in the flavonoids. Chelating property of flavonoids primarily prevents damage of biomolecule by stress-induced intracellular free radicals. Previous studies had evidence that flavonoids possess a chemoprotective effect against various degenerative and infectious diseases like cancer and cardiovascular diseases. Pelargonidin (PD), a bioactive molecule classified under anthocyanidin, is present in red and pink pigmented berries. This phytochemical efficiently modulates intercellular antioxidant status, thereby reducing oxidative DNA damage, cellular proliferation, differentiation, apoptosis, angiogenesis, and reverse drug resistance of metastatic cells, and potentially induces cell cycle arrest, thereby interfering in colorectal carcinogenesis. PD scavenges and normalizes the intracellular reactive oxygen species (ROS), which results in gene mutation and induction of colon carcinogenesis. Therefore, this chapter aims to provide a cumulative research data from in vitro human colon cancer cell line studies on chemoprotective property of PD against CRC, and also focuses to summarize the underlying mechanism in experimental models.

6.2 Colorectal Cancer (CRC): A General Overview

Rapid growth and progressive spreading through adjoining tissues lead to metastasis, and the formation of secondary tumors at different sites is the basic nature of the tumor cells (Tanaka 2009). Successive angiogenesis and uncontrolled proliferation of stem cells are the two important hallmarks of carcinogenesis (Neergheen et al. 2010). Colorectal cancer can be mentioned as a mucosal disease. Bowel wall mucosal lining is found to be the basal origin of colon cancer. This bowel wall anatomically consists of different layers, such as mucosa, submucosa, the serosa, and the muscularis propria. In particular, single-layered columnar epithelial goblet cells of bowel wall were termed as mucosa, which produces mucus, and identified as the primary site of colon cancer induction due to genetic mutations. The mutated cells in this region usually proliferate very rapidly and spread into the lumen. Further progression takes place at microvilli, where the crypts of Lieberkuhn were reprocessed. The strongest layer stand under mucosa is submucosa, and it is considered as an important region for carcinogenesis, and hence this layer includes vascular blood vessels and terminal and lymphatics nerve fibers by the way the tumor cells invade the circulatory system and spread throughout the body.

6.2.1 Colorectal Cancer Epidemiology

Worldwide, third most frequently recorded cancer in men and the second common cancer in women was statically reported as CRC (Ferlay et al. 2015). The incidence

rate increased up to ten-fold higher worldwide with a steep increase in notable countries, such as Australia, New Zealand, the Czech Republic, Slovakia, Kuwait, Israel, and low middle-income countries. Increased risk factors including an unbalanced diet, increased body weight, alcohol, and habitual tobacco consumption are the major reasons behind the sudden increase in the prevalence of CRC in Asian and Eastern European countries (Torre et al. 2015). Moreover, poor diagnosis at initial stage of CRC would lead to metastasis, and cordial epidemiological report had stated that it would be the universal burden which would record more new colon cancer cases approximately 2.2 million peoples and mortality may reach up to 1.1 million by the year of 2030 (Arnold et al. 2017; Ouakrim et al. 2015). Even though the mortality rates throughout the world have been declining in a huge amount in a number of countries, mortality still occurs in few countries like Romania, South America, Russia, and Brazil (Torre et al. 2015).

6.2.2 Etiology of Colorectal Cancer

The major lifestyle-related risk factors include lack of physical activity, over bodyweight, red meat and canned food intake in large amounts, habitual smoking, consumption of alcohol, and a diet lacking in vegetables and fruits. Previous family or individual history of colon polyps, and individual history of type 2 diabetes, bowel disease due to chronic inflammation, or genetic diseases such as Lynch syndrome or familial adenomatous polyposis has been proved as an important risk factor for CRC. The precise causes of colorectal cancer seem to be unknown. However, few studies state the etiology of developing colorectal cancer. The prevalence of CRC has been gradually increasing in urbanized countries, and also the rate of incidence in economically transitioning countries has been raised due to Western lifestyle culture. High fat, high calories diet, processed meats, and low fiber intake are strongly associated with the development of colorectal cancer. It has been proved that the chemical carcinogen produced while the meat was overcooked at a very high temperature, which includes frying, boiling, and grilling, is prone to cause colon cancer (Gingras and Béliveau 2011). Sedentary lifestyle and obesity play a major part in the development and progression of the number of cancer including CRC were evident by epidemiological reports. Lack of physical activity and increased body weight are the two important modifiable and inter-relatable risk factors that account third of CRC. The physical activity, which stimulates the movement of colon and the passage of waste through the colon activity, is associated with a decreased risk of CRC (Lee et al. 2007). Epidemiological evidence indicates that increased consumption of red meat such as beef, pork, and lamb are prone to cause colorectal cancer in both men and women. Stastical data had shown substantial proportion, ranging from 30% to 70%, of all colorectal cancer cases are attributable to diet with red and processed meat intakes, which is implicated as important dietary risk factors. Red meat, processed meat, and meat derived heterocyclic amines (HCAs), polycyclic aromatic hydrocarbons (PAHs), nitrites, and nitrates are the known animal mutagenic compounds formed when muscle meat is cooked using high temperature. Nitrites are

harmful and are more susceptible to develop cancer at proximal colon, whereas HCAs and PHAs cause cancer in the region of the distal colon and rectum. Greater red meat and processed meat intakes were more consistently associated with colorectal carcinoma (Miller et al. 2013).

6.2.3 Pathogenesis of Colorectal Cancer

In accordance to etiology of CRC, chronic inflammation and sudden mutation resulted in the formation of polyps on distinct sites of colon and rectum, and epithelial lining is the primary characteristic of colorectal cancer development, and these polyps can be nonneoplastic or neoplastic. The microenvironment of cancer cells and epigenetic changes along with genetic mutations play a key role in multistep carcinogenesis. These epigenetic mechanisms mostly programmed in most of the cancer cells in the process of DNA methylation along with alterations in histone proteins (Bardhan and Liu 2013). The CRC development in most of the cases would be a subsequential modulation in signaling pathways as a result of respective oncogenes activation and also inactivation of tumor suppressor genes. In addition, chromosomal gains or losses are termed as chromosomal instability (CIN), and sudden insertion/deletion in the specific DNA sequence would be the reason for microsatellite instability (MSI) (Jass 2007). Most often, etiology of distal colon cancer development and progression was mainly due to CIN, which accounts for about 60–70% of total CRC cases. However, most common proximal colon cancer was observed in MSI cases. Mutations in adenomatous polyposis coli (APC) were induced by dysplastic aberrant crypt foci, where it pawed away in the transformation of polyps to cancer by activation Wnt pathway. Such mutations in APC or genes involved in Wnt signaling pathways such as KRAS or TP53 would help in the progression of dACF to tumor cells (Nosho et al. 2008). Also, epigenetic alterations in the promoter region of the respective gene including DNA methylation and histone modifications is the key factor in cancer cells epigenetic inheritance DNA methylation involves the enzymatic addition of a methyl group to the 5′-position of cytosine by DNA methyltransferases (DNMTs) to form 5-methylcytosine. The DNMTs work on specific CG dinucleotide sequences, known as CpGs. More than 70% of the cytosine (C) bases in the context of CpG dinucleotides are supposed to undergo methylation. The biallelic promoter CpG island methylation of the mismatch repair gene MLH1 is characterized to be the primary epigenetic mechanism leading to the development of sporadic colorectal cancer associated with MSI-H (Bardhan and Liu 2013). Histone deacetyl transferases (HDACs) are the most widely characterized proteins among the histone modification enzymes that play predominant roles in the development of CRC. The high HDAC expression has been shown to be associated with reduced survival in CRC patients (Ashktorab et al. 2009).

Intracellular oxidative stress is mainly because of the imbalanced state of unstable highly reactive free radicals and the intermediate metabolites. These free radicals were commonly called reactive oxygen species (ROS), and also the inbuilt cellular mechanism to neutralize and protect cells from such ROS is termed as

antioxidants. ROS rapidly attacks the bricks of the cellular components such as all the important biomolecules that cause serious damage and defect to the whole organism (Ďuračková 2010). Intensive studies on oxidative stress mechanism during the last 20 years by a number of researchers have unmasked its key role in chronic inflammation; thereby, it has a significant role in the progression of several inflammation-related disease conditions, including cancer, cardiovascular, diabetes, pulmonary, and neurological diseases. When cells encounter a sudden attack by oxidative stress, it triggers several subsequent inflammation-related molecular pathways, such as NF-κB, HIF-1α, AP-1, PPAR-γ, p53, β-catenin/Wnt, and Nrf2 (Reuter et al. 2010). Widely occuring procarcinogens, the toxin from environmental pollution, and intracellular phagocytosis by chemo drugs generate an enormous amount of ROS as the metabolic intermediates (Klaunig et al. 2011). Oxidative stress has been found to take part in the aging process, and also it has a major impact on the prevalence of cancer in old age. More interestingly, any serious damage to the genomic DNA or mitochondrial DNA due to ROS will imitate carcinogenesis in most cases. Further, such a process may vary based on the type of tissue or triggered/suppressed transcription of certain gene or modulation in the signaling pathway or some mutational errors in replication, which would significantly result in genetic instability. It has also been studied that a notable amount of intracellular ROS was generated in tumor cells which leads to a specific microenvironment that maintains constant oxidative stress in tumor cells which favors cancer progression. Human cancer is a major activator of antioxidant defense mechanisms. With respect to its apoptosis-inducing capacity, molecules that promote ROS production may be novel therapeutics, proposed to selectively target cancer cells by elevating ROS levels beyond a tolerable threshold to induce mitochondrial outer membrane permeabilization (MOMP) and cell death (Graham et al. 2010).

Most of the common physical work and intermediates of cellular metabolism results in the inevitable production of oxidants and free radicals. At the same time, an inbuilt protective mechanism for the human body is antioxidants and that will be different for each cell type and tissues, and its mode of action might vary as a synergistic effect or even antagonistic effect based on the site of action. The cellular antioxidant defense system includes natural enzymatic antioxidant, namely catalase (CAT) which hydrolyzes H_2O_2, superoxide neutralizing enzyme superoxide dismutase (SOD), glutathione-dependent catalytic enzymes glutathione peroxidase (GPx), glutathione reductase (GR), and glutathione-S-transferase (GST), and nonenzymatic antioxidants such as retinol (Vit A), ascorbic acid (Vit C), and tocopherol (Vit E) which includes vitamin A, vitamin C, vitamin E, polyphenols, pigmented carotenoids, and other natural by-products as antioxidants, paying attention great interest in recent decades. Antioxidants at very low concentrations have a higher efficacy to prevent any oxidative damage to cells when compared to antioxidants that donate an electron to stabilize free radicals and thereby inhibit its detrimental effects. SOD is an endogenous antioxidant that involves catalysis dismutation reaction, thereby producing hydrogen peroxide (H_2O_2) from most of the superoxides (O_2^-). Further, CAT catalyzes H_2O_2, the end product of SOD, and splits them into oxygen and water. On the other hand, glutathione-dependent enzyme glutathione peroxidase

(GPx) significantly neutralizes the transition metals, and with the help of GSH as cofactor, it also catalyzes H_2O_2 in the aqueous phase of the cell membrane (Valadez-Vega et al. 2013). GR catalyzes the reduction of oxidized glutathione and thereby maintains the cellular GSH level, thus altering the GSH/GSSH ratio. Further, GSH and intracellular electrophile conjugation were facilitated by glutathione-S-transferase (GST), also called Phase II detoxifying enzymes. The conjugation of GSH to electrophilic compounds is catalyzed by Phase II detoxifying enzymes called glutathione-S-transferase (GST). GSH has been considered as an important natural intracellular antioxidant and has a major role in neutralization and detoxification of ROS such as peroxides, which is produced as a result of increased LPO. It also takes a role in conjugation and excretion of toxic molecules, and thereby it maintains the normal cell structure and function (Dickinson and Forman 2002).

Human beings are constantly bombarded by ROS by means of exogenous factors, such as tobacco, smoking, chemicals, ultraviolet (UV) rays, and many other agents. It also includes drugs or medicines which are used for medical practice. The aerobic cellular metabolism generates highly reactive free radicals in terms of oxidants, which cause serious damage to different types of cells and tissues due to normal physiological conditions. The protection mechanism against infection involves NADPH enzyme activity found in neutrophils and macrophages, and also the electron transfer system of mitochondria or microsomes and peroxisomes takes a vital role in the production of ROS endogenously (Noda and Wakasugi 2001). ROS are not only prone to cause cancer but also many other human diseases (Hippeli et al. 1999). The necrotic lesion was formed by the peroxidation of the biological membrane by highly reactive oxygen with lipids (Halliwell 1994). These ROS in higher amounts alter the biomolecules, such as proteins, lipids, lipoproteins, and deoxyribonucleic acid (DNA). The active oxygen species also induce gene mutation, which results in the development of cancer; on the other hand, it also modulates signal transduction and either triggers/suppresses transcription factors which are also a mechanism of induction of carcinogenesis (Floyd et al. 1986). Tumor suppressor genes p53 and gene involved in cell cycle regulation are highly susceptible to mutations as a result of DNA damage in the presence of ROS. Also the product of LOP, malondialdehyde, potentially induces mutation. Many researchers have pointed out the necessity of enzymatic and nonenzymatic antioxidants to maintain the natural oxidative homeostasis of the organism especially in tumor therapy. Endogenous enzymatic antioxidants, such as SOD, CAT, GPx, GR, and GSt, play a vital role in chelating superoxides and peroxides. Therefore, tumor therapy is basically based on oxidative stress and antioxidant homeostasis (Čipak gašparović et al. 2010).

Plant products are widely used in the present world as medicines, due to the fact that they are very effective therapeutically. Moreover, they are relatively more safe when compared to any synthetic drugs (Singh and Tripathi 2018; Datir 2018; Akhtar and Swamy 2018). Natural products, mainly plant metabolites, exert superior antitumor properties by reducing the action of reactive oxygen species and protecting the critical constituents of cells, that is, macromolecules like nucleic acids and proteins from oxidative damages (Ravichandra et al. 2018). As a result, plant-derived metabolites have attracted researchers in the field of natural medicines to design effective chemodrugs for

treating cancers. Thus, plant-derived compounds are well recognized as anticancer agents, and some of them are being used in the present market for treating various cancer types (Akhtar and Swamy 2018). Drug molecules like camptothecin, vincristine, and vinblastine are some of the examples of chemodrugs derived from plant sources. However, these drugs pose a challenge of toxicity and cause side effects. Hence, a continuous search is in progress to innovate novel drug molecules against cancers. In this regard, different plant species are being explored to isolate new phytochemicals and to evaluate their bioactivities. Likewise, plant molecules are also evaluated for their antiproliferative potentials. Pelargonidin, an anthocyanidin, is among them, and the details of it are given in the following section. Also, the role of a phytochemical against different CRC cells is discussed, emphasizing on its mechanisms of actions.

6.3 Pelargonidin: An Anthocyanidin

The chemical structure of anthocyanins consists of flavylium cation, which is linked to hydroxyl (–OH) and/or methoxyl ($–OCH_3$) groups along with one or more sugar molecules. Anthocyanins without sugars are known as anthocyanidins. Six major anthocyanidins which are abundant in fruits and vegetables are pelargonidin, malvidin, delphinidin, cyanidin, peonidin, and petunidin. They differ by position and number of –OH and $–OCH_3$ group present in it. Based on the position of the functional group, either hydroxyl, methyl, sugar moiety, or several other functional substituents, about 500 and more anthocyanins have been identified and are classified under 31 anthocyanidins. Cited previous literature stated that 31 anthocyanidins account for cyanidin (30%), delphinidin (22%), and pelargonidin (18%). Also, other methylated derivatives of anthocyanidins account for 20% of all anthocyanins. Consequently, about 90% of all the anthocyanins are cyanidin, delphinidin, pelargonidin, and its derivatives (methylated). Naturally, these anthocyanidins are present in the form of glycosides with the respective sugar moiety at 3-position on the C-ring or the 5-position on the A-ring to the aglycone chromophores. Basically, pelargonidin can be chemically structured as 1-benzopyrylium, 3,5,7-trihydroxy-2-(4-hydroxyphenyl), chloride, n anthocyanidin cation that is flavylium substituted by a hydroxy group at positions 3′, 5′, 7′, and 4′ (Barnes et al. 2011).

6.3.1 Natural Occurrence of Pelargonidin

Anthocyanins are one among the subgroup of water-soluble flavonoids found widespread in the plant kingdom, and their specific compounds are responsible for floral pigmentation and other parts of plants. The color of the pigments may vary from vibrant red, purple, to blue pigments, and this is because of its conjugated structure that draws light at 500 nm (Wang et al. 2012). In particular, widespread and usually found anthocyanins are the 3-*O*-glycosides or 3,5-di-*O*-glycosides of delphinidin, cyanidin, petunidin, peonidin, malvidin, and pelargonidin. Anthocyanins are important polyphenolic components of fruits, especially berries. Bioactive component

pelargonidin is rich in berries, such as strawberry, blackberry, black currant, elderberry, sour cherry, and pomegranate. Consumption of anthocyanin and polyphenol-rich juice enhanced antioxidant status, reduced oxidative DNA damage, and stimulated immune cell functions (Ferretti et al. 2010).

6.3.2 Pharmacological Activities of Pelargonidin

Flavonoids most prevalently found in floral, fruit, and vegetable have been reported as pelargonidin and consuming them as fresh or processed food has a major impact in prevention and control of devastating chronic human diseases, such as inflammatory diseases, cancer, and cardiovascular diseases, where it directly acts as potent antioxidant, plays significant role in detoxification, induces apoptosis, fights against inflammation, etc. (Nikkhah et al. 2008). The antioxidant property of pelargonidin (anthocyanidin) was due to scavenging efficacy of ONOO− function group, and it was evidently first reported by Tsuda et al. (2003) (anthocyanidin). The mechanism behind its antioxidant activity was due to the conversion of pelargonidin to p-hydroxybenzoic and further formation of 4-hydroxy-3-nitrobenzoic acid by the catalytic conversion with ONOO− present in its structure. In vitro studies on anthocyanin had significantly downregulated the signaling pathways including NF-κB and MAPK pathways, resulting in the reduced proinflammatory cytokine expression and inhibiting inflammation (Wang et al. 1999; Pergola et al. 2006). In addition, extensive study on literature of anthocyanidin unraveled its anti-inflammatory mechanism, where significant downregulation of certain vital inflammatory markers at both transcription and translational levels in some cell line models such as downregulation of cyclooxygenase-2 (COX-2) expression in stimulated macrophage (RAW 264 cells) with lipopolysaccharide (LPS) and another case potential inhibition was observed against the transcription and expression of inducible nitric oxide (iNOS) murine macrophages (J774) activated with LPS (Hou et al. 2005; Hämäläinen et al. 2007). Isolated leucopelargonidin-3-*O*-alpha-L rhamnoside from the bark of *Ficus benghalensis*, oral administration at a dose of 100 mg/kg, showed a significant decrease in glucose level with a rise in serum insulin level of diabetic dogs induced by alloxan at a time period of 2 h. The findings state that leucopelargonidin-3-*O*-alpha-L rhamnoside stimulates insulin secretion (Augusti et al. 1994). Also, few studies have reported the estrogenic property of anthocyanidins, including pelargonidin, delphinidin, and cyanidin. These anthocyanidins were categorized as nongenotoxic, and it efficiently modulates DNA damage caused by oxidative stress and 4-nitroquinoline 1-oxide by its estrogenic activity. Therefore, the stated study has substantial evidence for the chemopreventive effects of anthocyanins against carcinogenesis on HL-60 cells (Abraham et al. 2007). A recent study on *F. benghalensis* root extract showed an antimicrobial activity when compared to the standard drug. Also, two important flavonoid compounds such as leucopelargonidin 3-*O*-alpha-L rhamnoside and 5, 3′-dimethyl ether of leucocyanidin 3-*O*-alpha-D galactosyl cellobioside were isolated from the bark of *F. benghalensis*, which inhibits the Gram-negative bacteria and also the fungal species (Aswar et al. 2008).

6.3.3 Bioavailability

Till now, very few numbers of literature are available to understand bioavailability including absorption/excretion of anthocyanins in humans, still, we found some of the contradictory conclusions. Previous studies have shown that wine from graphs rich in pelargonidin, it may or may not contain alcohol do not block the anthocyanin's absorption (Bub et al. 2001; Frank et al. 2003). Later, few other studies by Wu et al., (2006) also stated the similar pattern of specific anthocyanin pelargonidin-3-*O*-glucoside absorption form strawberries and blackberries (Wu et al. 2006). Felgines et al. (2007) stated that pelargonidin-3-*O*-glucoside present in strawberry was metabolically converted into respective pelargonidin glucuronides and pelargonidin sulfate and got excreted in the urine along with a very minute concentration of pelargonidin glucoside and pelargonidin alone a trace of pelargonidin as parent glucoside and its aglycone. More than 80% of urinary excreted pelargonidin accounts as pelargonidin glucuronides (Felgines et al. 2005). Bioactive compound like Cyanidin-3-*O*-glucoside, 3DA or 3 deoxy derivative, pelargonidin-3-*O*-glucoside, which is present in blackberry was reported as much as less than ten times its bioavailability with the corresponding 0.16% of intake and it is excreted as glucurono, sulfo and methylated metabolites which account for about 13% (Felgines et al. 2005). Pelargonidin glucuronides along with pelargonidin-3-*O*-glucoside are the two forms of anthocyanidins from strawberries found in the blood stream, and it undergoes a metabolic modification before being excreted in the urine along with trace quantities (1–3%) of pelargonidin and pelargonidin-*O*-sulfate, whereas the remaining quantity of pelargonidin was detected in plasma. In human beings on ingestion with strawberries pelargonidin-3-*O*-glucoside, it was metabolically converted to pelargonidin-*O*-glucuronide, which is present predominantly in both plasma and urine rather than the parent glucoside. The Cmax of this metabolite was found to be 274 ± 24 nmol/l after 1.1 ± 0.4 h. The major anthocyanin in strawberries, pelargonidin-*O*-glucuronide, was excreted after its metabolic process within the period of 24 h after its intake (Mullen et al. 2008).

6.4 Anticancer Mechanisms of Pelargonidin

6.4.1 Anticancer Activity Via Inducing Apoptosis

Pelargonidin, an anthocyanin found widespread in most of the berries including blackberry, raspberry, strawberry, and pomegranate, were studied in human colon adenocarcinoma cells (HT-29) (Felgines et al. 2007; Beekwilder et al. 2005). The primary anticancer effect of pelargonidin was screened with well-defined in vitro MTT assay on HT-29 cells. Followed by treatment with a determined concentration of pelargonidin (GI_{50}) against HT-29, induction of apoptosis in cancer cells had been reported. Also, the same study had stated the activation of caspase-dependent apoptotic pathway along with the fragmentation of genomic DNA. Additionally, the microscopical observation of treated cancer cells was found to be pictured with

distinct morphology, including floating cells, cellular shrinkage, and membrane blebbing, which are the hallmark features of apoptosis. A similar pattern of cell morphology in another study was reported as characteristic features of apoptotic induction in cancer cells (Sivalokanathan et al. 2006). HT-29 cell architecture had been pictured with high alterations such as round-up of cancer cells with distorted patterns (Karthi et al. 2016). AO and EtBr (AO/EtBr) fluorescent screening had further pictured the intensive morphology of apoptosis-induced HT-29 cancer cells after pelargonidin treatment in a dose-dependent manner. Basically, AO dye stains both live cells with the rigid cell membrane and permeable dead cells, whereas EtBr stains only apoptotic cells with no cell membrane integrity (Raju et al. 2004). Pelargonidin supplement had reported the notable percentage of both early and late apoptotic colon cancer cells with morphological alterations during apoptosis such as cell shrinkage along with chromatin condensation.

The development and maintenance of a living organism have to be brought by the standard and controlled the homeostatic balance of both cell proliferation and cell death. Numerous physiological functions and pathological processes were based on the key role played by the apoptosis of individual cells. Modulation in the expression pattern of certain antiapoptotic proteins (Bcl-XL, Bcl-2, and A1) was notably unregulated by the specific transcription factor of NF-κB, and that was a key role in the inflammation process. Also, the unique transcription factors of this Bax family along with the contribution of NF-κB induce apoptosis. Apoptotic induction by the pelargonidin in HT-29 cells was illustrated with DNA fragmentation protocol, which has been considered as exemplary biochemical features of apoptosis. The ladder pattern after pelargonidin treatment was evident as a result of oligonucleosomal fragmentation of chromosomal DNA at the early apoptotic stage. The previous research study had stated that pelargonidin with short incubation time brings about early apoptosis and longer exposure of pelargonidin was reported to increase the volume of nuclear fragmentation which evidences the basal mechanism of anticancer effect of the pelargonidin, and also it may act through the apoptotic signaling. Bcl-2 family are known cytoplasmic proteins that regulate apoptosis, in particular sub-group of pro-apoptotic proteins Bax, significantly promotes cell death where other members of the Bcl-2 possess anti-apoptotic activity namely, Bcl-x Land Bcl-w, those includes four regions of similarity with Bcl-2. In this review, it is significant to pinpoint that pelargonidin alters the expression level of Bcl-2 family proteins in cancer cells and thereby induces apoptosis. Consciously, the expression of these particular proteins after pelargonidin treatment was deliberated with the immunoblot analysis, and the study has reported that the expression level of Bax was found to be markedly increased dose dependently in HT-29. At the same time, pelargonidin modulations in BH3 interacting-domain (BID) death were also upregulated. As per the study by Karthi et al., (2016), this treatment also down-regulates the expression of antiapoptosis protein Bcl-2 and Bcl-xL Briefly, this review conveys that pelargonidin specifically promotes the translocation of mitochondrial Bax to the cytosol and triggers the signaling pathway for apoptosis in colon cancer cells.

6.4.2 Pelargonidin and Mitochondrial Pathway

The apoptotic proteins from the mitochondria due to its permeabilization make the cancer cells to induce apoptosis by three major toxic proteins: direct caspase activators, indirect caspase activators, and caspase-independent proapoptotic factors. Initially, the apoptosome was formed by conjugation of cytochrome c with apoptosis-protease activating factor pro-caspase-9, thereby caspase-9 gets activated. Subsequently, this initiator caspase-9 activates downstream caspases 3, 6, and 7, which were denoted as effectors, thereby it activates the last step of the pathway to induce apoptosis (Pradelli et al. 2010). Tumor suppressor p53 induces autophagy and/or apoptosis through its cytosolic and nuclear effects in response to DNA damage and other stresses. Oxidative stress, i.e., increased production of reactive oxygen species (ROS), can also induce apoptosis and autophagy (Fimia and Piacentini 2010). As in the case of pelargonidin treatment against colon cancer cells, Bcl-2 family members that come under proapoptotic activity significantly activate mitochondrial-mediated intrinsic apoptosis, where pelargonidin potentially induces the loss of mitochondrial membrane potential, which in turn activates caspase-9 cascade. Briefly, the cascade was initiated with the release of cytochrome C followed by activation of caspase 3 and caspase 7, where the program cell death was initiated with sequential degradation of cellular functional proteins (Karthi et al. 2016; Adams 2003). On the other hand, this review also explores the upregulation of apoptotic proteins on pelargonidin exposure such as PARP and P53. Based on the previous literature and the various study reports, the current review has summarized the activation of the intrinsic apoptotic mechanism of pelargonidin against colon cancer cells.

6.4.3 Pelargonidin Affects Cell Cycle Regulators

Tumor cell possesses unique characteristic futures by modulating the regulation of the cell cycle in cancer cells. This chapter also concentrates on elaborating on the mechanism of cell cycle arrest induced by pelargonidin in colon cancer cells. Basically, the transition between cell cycle phases is tightly regulated by cyclin-dependent kinases (Cdk). The role of Cdks is to control cell cycle progression by phosphorylation of protein substrates on serine and threonine amino acids. The protein substrates have specific roles that contribute to the cellular events that occur during the cell cycle. For example, Lamin B protein is phosphorylated by Cdk1 during mitosis, which causes nuclear envelope break down. The correct timing of cell cycle phase changes is regulated by specific cyclin-dependent protein kinase complexes. Cyclin-dependent kinases are composed of two proteins: a catalytic subunit known as Cdk and a regulatory protein subunit known as cyclin. The cyclin proteins do not have enzymatic activity; however, they bind and activate the catalytic 6 subunits. At least 25 catalytic Cdks have been described, and each binds to at least one of a large family of cyclin binding partners, creating many possibilities for Cdk cyclin protein pairings (Bruyère and Meijer 2013). The timing of the synthesis of specific cyclins is carefully regulated, which ensures that certain Cdk-cyclin

complexes trigger different stages of the cell cycle. For example, the Cdk4/cyclin D complex functions early in the G1 phase of the cell cycle in response to growth factors, whereas the Cdk1/cyclin B complex enables cells to enter mitosis. There are several biochemical steps required to activate Cdks in addition to cyclin synthesis, thus ensuring cell cycle fidelity. The cell is blocked in the G2 phase of the cell cycle if Cdk1 remains phosphorylated on tyrosine 15, which holds the enzyme in an inactive state regardless of cyclin B1 levels. Eukaryotic cells (including human cells) have a second biochemical system that can regulate CDK activity if the cell has damaged DNA. Another protein kinase, Chk1 (Checkpoint kinase 1), can prevent the activation of Cdk1 by phosphorylating and promoting the degradation of Cdc25 phosphatases. Without Cdc25 phosphatases, cells cannot dephosphorylate tyrosine 15 of the catalytic subunit of Cdk1, thus remain blocked in interphase, usually the G2 phase. Overall, a series of protein phosphorylation and protein synthesis pathways converge to regulate cyclin-dependent protein kinases. It appears that the complexity of these steps provides cells with opportunities to ensure that their genomes are accurately copied and distributed to daughter cells while avoiding genome change (Smith et al. 2007). This part of the chapter specifically focused to reveal the cell cycle arrest and checkpoint adaptation due to induced DNA damage and interface with the cancer cells to enter mitosis. Cells with damaged DNA initiate a biochemical pathway called the "DNA damage checkpoint," which causes a delay in the cell cycle during S phase or G2 phase to allow repair. It is believed that the role of DNA damage checkpoints is to prevent damaged DNA from being transmitted to daughter cells. Cells with damaged DNA initiate a biochemical pathway called the "DNA damage checkpoint," which causes a delay in the cell cycle during S phase or G2 phase to allow repair. Thus, the review study has strongly deliberated the role of pelargonidin-induced DNA damage, and its role in cell cycle checkpoints is to prevent damaged DNA from being transmitted to daughter cells. The DNA damage checkpoint is composed of several overlapping checkpoint systems. S-phase checkpoint provides continuous monitoring of the DNA during DNA replication to ensure that blocked replication complexes or damaged DNA were repaired before replication. The successful completion of DNA replication is assessed in the G2 checkpoint. The G2 checkpoint enables cells to detect unreplicated DNA or DNA that may have been damaged by a variety of means such as genotoxic agents. The cell will delay its progression through the cell cycle at the G2 phase until errors are corrected (Palou et al. 2010). The previous study of our laboratory had strongly pinpointed that the G2/M phase arrest of colon cancer cells was significantly induced by pelargonidin treatment in a dose-dependent manner and take part in a potential role of regulating the expression of subsequential cell cycle regulatory proteins (Karthi et al. 2016). Also, pelargonidin has a minimal effect to inhibit the cells at the G1-S phase of the cell cycle in cancer cells and is mainly due to transition-related CDKs, and their expressions were highly modulated by pelargonidin with inhibiting the function of mutated P53 in colon cancer cells. Thus, the literature study on anthocyanidin, pelargonidin the drug of interest, has high efficacy and efficiency to modulate the expression of functional protein in inhibition of CRC, and thereby it possesses a significant anticancer activity which was summarized in this chapter.

6.5 Conclusions

This comprehensive review about the anticarcinogenic effect of pelargonidin concludes that most of the commercial synthetic and isolated compounds used to treat cancer not only kill cancer cells, but are also proven to be highly cytotoxic to normal cells and would cause a severe adverse effect after therapy. Whereas, pelargonidin being pinpoint and speculate that naturally occurring dietary flavonoid acts as an anticancer therapeutic agent, which inhibits colon carcinogenesis by activating the immune system and by regulating the hyperproliferation, inflammation, angiogenesis, and mitochondrial-mediated apoptosis. In particular, this chapter signifies the importance of pelargonidin in the treatment of colon cancer. Briefly, the review study states that pelargonidin can affect the basic cell functions associated with cancer development. Also, it induces significant cell cycle arrest and apoptosis in cancer cells; thereby, pelargonidin would control the formation and progression of tumors. The previous literature evidence that any alteration in the inhibition of proteins involved in the cell cycle would potentially reflect in inhibition of cell proliferation and block carcinogenesis in tumor cells. Thus, this chapter highlights the pharmacological potential of pelargonidin, and it may be very useful in the prevention of oxidative stress-induced diseases and takes part in vanquishing colon carcinogenesis. Further, a detailed study on pelargonidin would effectively promote the development of new antitumor drugs and regimens for human colorectal carcinoma.

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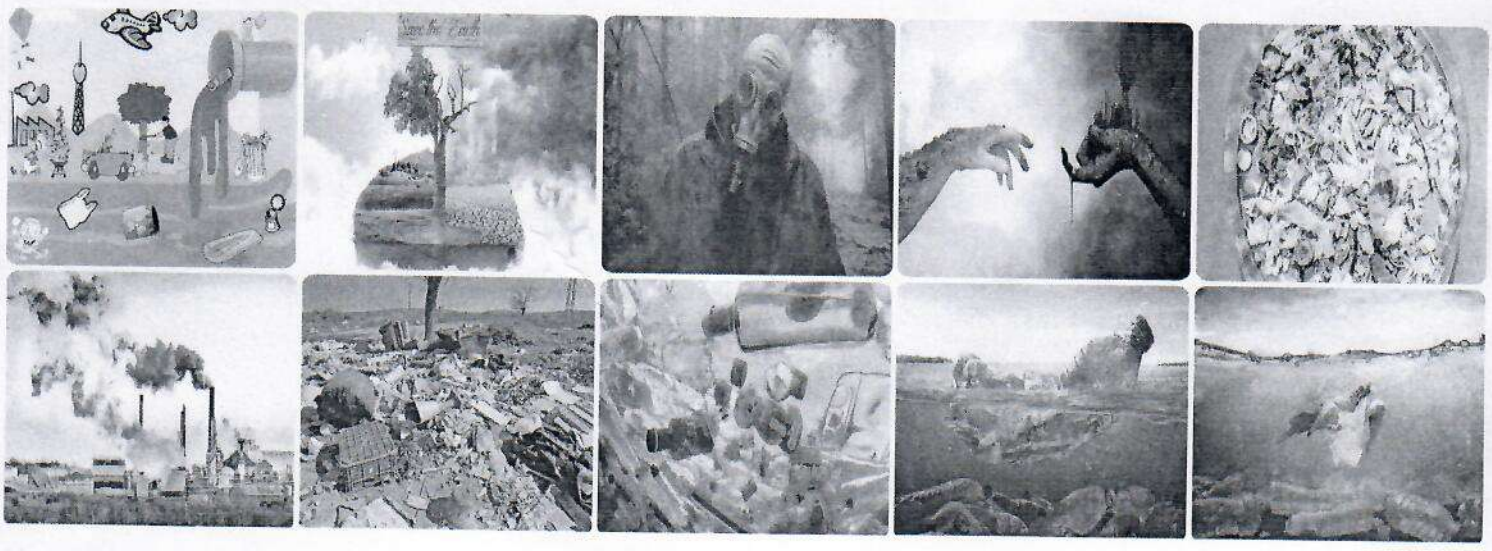
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Isolation and identification of metal tolerant fungi from Bauxite mines, Kolli hills, Eastern Ghats, Tamil Nadu.

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Abstract

Bauxite mining industry is producing harmful heavy metals which can affects human health. High concentration of heavy metals in the soil generally induces morphological and physiological changes in the microbial communities and them evolves to tolerate the metal stress. In this present study, heavy metal polluted soil sample was collected from Kolli Hills, Eastern Ghats, Tamil Nadu. The sample was serially diluted and plated on Sabouraud dextrose Agar media. The initial screening of fungal population results show, 18 fungal strains were isolated from metal polluted soil samples. Among them, *Aspergillus* and *Penicillum* species was found to be more dominant fungi followed by other species. In addition, Metal Tolerant index of these fungal isolates were determined and result noted *Aspergillus* sp. exhibit better growth rate against Zinc and chromium metals. Based on this study we suggest the use of *Aspergillus* sp. for remediation purpose. This work is funded by SERB, New Delhi under Startup grant for Young Scientists (SR/YS/LS-25/2013).

Keywords: Bauxite mines, Metal tolerant Index, Fungus

Introduction

Human beings are facing a major environmental problem in the form of increasing pollution day by day. The misuse of natural resources resulting in environmental

Identification of Bioactive Compounds by Using Gc-Ms and FTIR Analysis in *Dryopteris hirtipes*

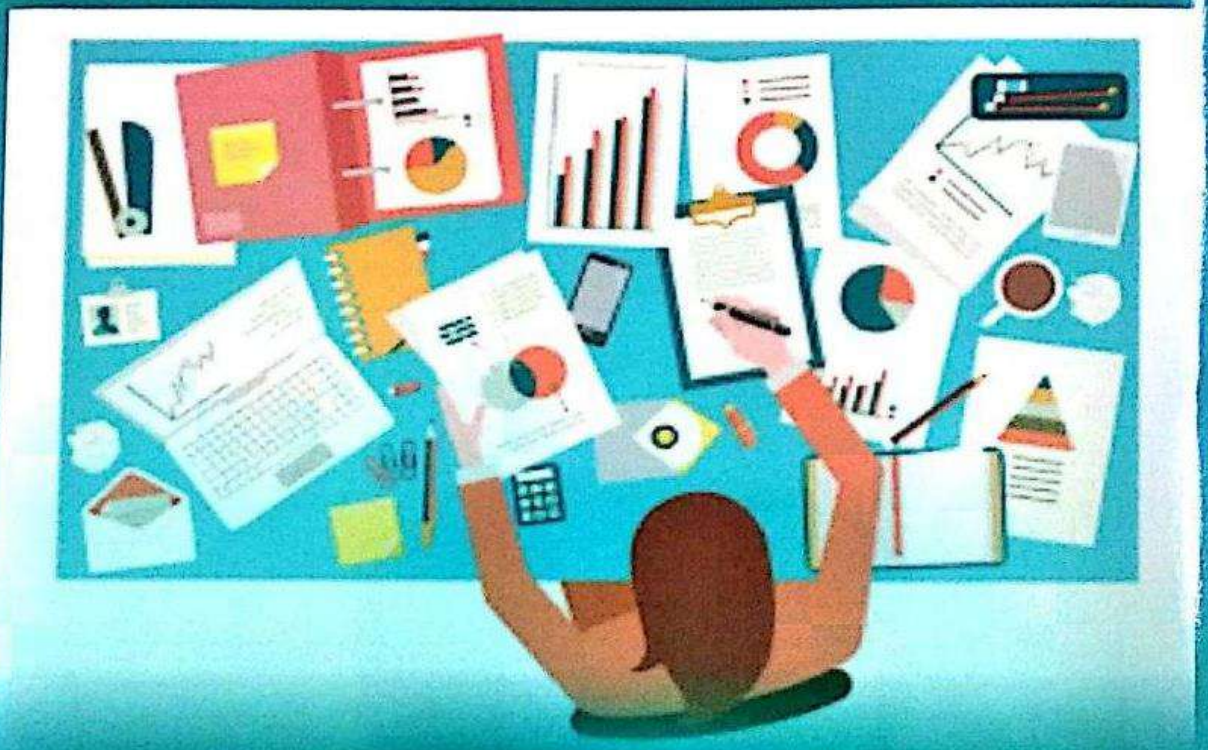
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Abstract

Dryopteris hirtipes belonging to the family Dryopteridaceae in Pteridophytes. Pteridophytes are mainly the ferns variety have been used by different tribal communities and they used as food and medicines. The tribal community have been using rhizome, stem, fronds and spores for the treatment of various ailments. Now a days ,to treat various diseases in humans, modern techniques were used to isolate the secondary metabolites from Rhizome, fronds and stem .In the present study was carried out to investigate the bioactive compounds present in D.hirtipes leaf powder and done with different solvents in Soxhlet apparatus . The methanolic extract of *Dryopteris hirtipes* reveals to identify 7 major bioactive compounds in GC-MS such as Stigmast-5-en-3-ol(56.65%),Phytol(5.39%),Lanost -8-en-3-ol(3 β)(3.18%),Neophytadiene (2.68%),Tri-o-trimethylsilyl N-heptaflurobutryl derivative of terbutaline(2.19%),1H-Imidazole 2-methanol(1.28%),8A-(2,4-Dimethyl-1-nitrilo-pent-2-yl) dioxy) tocopherone(1.0%) and low concentrations of compounds like Hexadecanoic acid(0.6%),Elephantoin(0.05%). In FTIR analysis, showed the presence of C-OH alcohol and phenol, C=C-H-Alkene groups, C=O Carbonyl groups, NH_2-C=O aromatic compounds. The detailed investigation done with

Emerging Trends in Bibliometrics, Scientometrics and Altmetrics



Editors
P. Senthilkumaran
P. Balasubramanian
A. P. Shanmugam

About the Books

This book examined bibliometric investigations to identify the patterns of publication, authorship, citations and secondary journal coverage in the hope that such regularities can give an insight into the dynamics of the area under consideration. This consequently leads to a better organization of literature. Bibliometric investigation includes statistics, operations research, bibliometric distribution and laws, citation analysis, circulation theory, information theory and theoretical aspects of information retrieval, explicitly presented in this book.

Scientometrics is the field of study which concerns itself with measuring and analyzing scientific literature. Scientometrics is a sub-field of bibliometrics. Major research issues include the measurement of the impact of research papers and academic journals, the understanding of scientific citations, and the use of such measurements in policy and management contexts. In practice there is a significant overlap between Scientometrics and other scientific fields such as information systems, information science, science of science policy, sociology of science..

The quality of research output is totally dependent on the information used and produced as a result of research. Scientific output in the form of publications can be measured by using bibliometric /scientometric techniques such as number of publications based on author, institution, country, year, type, subject and citation etc. This book presents bibliometrics, Scientometrics and Altmetrics studies collected chapters from the different authors and edited this book.

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Chapter 12

Human DNA Research Output During 2009 to 2018: A Scientometric Study

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Abstract

The study evaluates Scientometrics Study Human DNA Research Output during 2009 to 2018. The data were downloaded from the web of science database which maintained by Thomson Reuters. The total number of records was 1915. Data is analyzed Microsoft excel sheet and His cite software. The use of a statistical tool such as study, Relative growth rate, Times series analysis, Degree of collaboration, Arithmetic mean and exponential growth rate.

Keywords: Scientometrics, Web of science, DNA, Relative growth rate, Authors productivity

Introduction

Bibliometric is a set of methods used to study or measure texts and information. Citation analysis and content analysis are commonly used bibliometrics methods. While bibliometrics methods are most often used in the field of library and information science, bibliometrics have wide applications in other areas. In fact, many research fields use bibliometrics methods to explore the impact of their field, the impact of a set of researchers, or the impact of a particular paper. Bibliometrics are now used in quantitative research assessment exercises of academic output which is starting to threaten practice based research.

Scientometric

Scientometrics is a branch of the science 'Science of Science'.

Haitun treats 'Scientometrics', as scientific disciplines, which performs reproducible measurements of scientific activity and reveal its objective quantitative regularities. According to him, Scientometrics methods include statistical and thesaurus methods, and indicators as to the number of citations, term etc. There are two aspects within science of science, viz., the analytical aspect which deals with the general laws of the development of science as a knowledge system and a specific social institution; and the normative aspect that deals with the development of practical recommendations for raising research efficiency. Scientometrics are used to measure scientific activities, mainly by producing statistics on scientific publications indexed in databases. They are flexible tools used to study the sociological phenomena associated with scientific communities, to conduct scientific/strategic, technical, technological or competitive monitoring, to design and manage research programs and to evaluate research. They are extremely valuable methods for evaluating research output, positioning studies and conducting foresight studies in science and technology scientific fields. Scientometric indicators give policymaker's objective, reproducible and therefore verifiable information that goes beyond the anecdotal.

Human DNA

The human genome is the complete set of nucleic acid sequences for humans, encoded as DNA within the 23 chromosome pairs in cell nuclei and in a small DNA molecule found within individual mitochondria. These are usually treated separately as the nuclear genome, and the mitochondrial genome. Human genomes include both protein-coding DNA genes and noncoding DNA. DNA content while there are significant differences among the genomes of human individuals (on the order of 0.1%), these are considerably smaller than the differences between humans and their closest living relatives, the chimpanzees (approximately 4%) and bonobos.

Review of Literature

Lee, T. S., et.al. (2018) human space exploration (HSE) is an interdisciplinary field composed of a range of subjects that have developed dramatically over the last few decades. This paper investigates the intellectual structure of HSE research with a focus on human. A Bibliometric approach with quantitative analytical techniques is applied to study the development and growth of the research. This study retrieves 1921 papers on HSE related to human factors from the year 1990 to the year 2016 from Web of Science and constructs a critical citation network composed of 336 papers. Edge-between ness-based clustering is used to classify the citation

network into twelve distinct research clusters based on four research themes:"biological risks from space radiation," "health and performance during long-duration "program and in-situ resources for HSE missions," and "habitat and life support systems in the space environment." These research themes are also similar to the classification results of a co-occurrence analysis on keywords for a total of 1921 papers. Papers with high centrality scores are identified as important papers in terms of knowledge flow. Moreover, the intermediary role of papers in exchanging knowledge between HSE sub-areas is identified using brokerage analysis.

Balasubramani, C., Gopalakrishnan, S., & Gnanasekaran, D. (2014) in their paper identify the growth of research output on Genetic Engineering. For this study, the data were downloaded from the multi discipline citation database 'Scopus' and there were 165984 records contributed worldwide over a period of 40 years from 1974-2013. Among them, 59877 (36.07%) publications were contributed by USA and it holds first place. India holds 8th place with 5354 (3.23%) publications. Bibliometric techniques such as year wise distribution, bibliographic form of the records, area and sub filed of research, source titles and research organizations were studied.

Mukherjee, B. (2013) explored bibliometric characteristics including authorship pattern, citations received and relative performance of Prof. Lalji Singh an eminent Indian scientist in the field of genome analysis, DNA finger printing, etc..The study is based on the publication data indexed in Web of Science and Scopus. Results show that 222 unique articles have been indexed in the two databases with an average of 7-8 articles per year. Of the 222 articles only 18 articles appeared in Indian journals. Most of the articles were published when he served at Centre for Cellular and Molecular Biology, Hyderabad during 1987-2011. Authorship pattern of Prof. Singh indicates that he is serving as a leader of his research term and K Thangaraj is the fellow scientist with whom he wrote most. Almost all his articles appear in high-impact journals. The h-index of Prof. Singh is 30 in both the databases. He has received fellowships of all major national science academies as also third world academy.

Wonkam, A., Kenfack, M. A., Muna, W. F. (2011) describe the profile of human genetic studies that used Cameroonian DNA samples, with specific focus on i) the research centers that were involved, ii) authorship, iii) population studied, iv) research topics and v) ethics disclosure, with the aim of raising ethical issues that emerged from these studies. Bibliometric Studies; we conducted a PubMed based systematic review of all the studies on human genetics that used Cameroonian DNA

samples from 1989 to 2009.Fifty articles were identified, involving predominantly research centers from Europe (64%) and America (32%). Only 7 (14%) Cameroonian institutions and 14 (28%) Cameroonian authors were associated with these publications.

Objective

- To know the year wise distribution of contribution.
- To know the authorship pattern wise of contribution.
- To know the document type wise distribution.
- To know the language wise distribution.
- To find out the institution wise contribution.
- To find out the country wise distribution.
- To find out the word wise distribution.
- To find out the degree of collaboration.
- To analysis of the relative growth rate and doubling time.
- To find out the arithmetic mean.

Methodology

The data for the study were retrieved from wed of science database for the. which is the scientific and indexing services maintained by Thomas Reuters. The human DNA research output was analyzed. it can see that nearly 1915 Bibliographic records & the contribution in human DNA. Records during the period 2009 -2018, for the study bibliographic details such as author wise, document type, collaboration, ect, was analysis & information visualization. The collected data were analyzed with hiscite software.

Statistical tools applied

statistical tools and techniques to serve the fundamental purpose of the descriptive and differential analysis; The following techniques were used in the study.

- Percentage
- Relative growth rate and doubling time
- Degree of collaboration

- Cumulative
- Exponential growth rate
- Growth of literature-time series analysis
- Arithmetic mean

Data Analysis and Interpretation Analysis

A Scientometrics study on human DNA during the year 2009-2018. For this study 1915 contribution of records were selected for the analysis. This chapter aims to analyse and interpretation of the data collected for the identified period. In this study 1915 records were retrieved from web of science bibliographical database. Then the data was analyzed by the help of hist cite.

Table 1: Year Wise Publication

S.NO	Publication Year	Records	Percentage
1	2009	168	8.8
4	2010	175	9.1
5	2011	172	9
3	2012	192	10
6	2013	188	9.8
2	2014	214	11.2
7	2015	208	10.9
8	2016	192	10
9	2017	205	10.7
10	2018	201	10.5
	Total	**1915**	**100**

Table 1: shows that year wise distribution of the publication on human DNA output during the year 2009 to 2018 (10 year) a total of publication 1915 were published. The highest number 214(11.2) articles were published in the year 2014 followed by 208(10.9) articles were published in the year 2015 followed by 205(10.7) articles were published in the year 2017 followed by 201(10.5) articles were published in the year 2018 the lowest number of articles 168(8.8) were published in the year 2009.

Table :2 Language wise publication

S.No	Language	Records	Percentage
1	English	1892	98.8
2	French	7	0.4
3	Japanese	3	0.2
4	Polish	3	0.2
5	Russian	3	0.2
6	Chinese	2	0.1
7	German	2	0.1
8	Hungarian	1	0.1
9	Spanish	1	0.1
10	Turkish	1	0.1
	Total	**1915**	**100**

Table 2: Explain that the language wise distribution of publication on human DNA the highest distribution English for 1892(98.5) and followed by 7(0.4) French and lowest distribution for Hungarian, Spanish, Turkish, 1(0.1%).The highest number of distribution English 1892(98.5).

Table 3: Document wise distribution

S.no	Document Type	Records	Percentage
1	Article	1588	82.9
2	Review	134	7
3	Article; Proceedings Paper	26	1.4
4	Review; Book Chapter	11	0.6
5	Editorial Material	23	1.2
6	Article; Book Chapter	7	0.4
7	Letter	5	0.3
8	Article; Data Paper	1	0.1
9	News Item	4	0.2
10	Correction	7	0.4
11	Meeting Abstract	108	5.6
12	Book Review	1	0.1
	Total	**1915**	**100**

Table 3: provides the publication on document types. it is clearly noticed from the table that the major source of publication in human DNA comes in the form the articles with 1915 records, contributing to (82.4%) of the total publications, followed by Review 134 (7.0%) and 108(5.6) with Meeting Abstract, and very low contributing was Article; Data Paper, meeting Abstract-item1(0.1).

Table 4: Degree of collaboration

S.NO	Year	single author	multi author	Total author	DC
1	2009	11	157	168	0.93
2	2010	11	164	175	0.94
3	2011	7	165	172	0.96
4	2012	14	178	192	0.93
5	2013	7	181	188	0.96
6	2014	11	203	214	0.95
7	2015	11	197	208	0.95
8	2016	12	180	192	0.94
9	2017	7	198	205	0.97
10	2018	8	193	201	0.96
	Total	**99**	**1816**	**1915**	

Table 4: Shows that indicate degree of collaboration single author contributions 99 out of 1915 and rate of 1816 for multiple authors' contributions. The degree of collaboration range started from 0.93 to 0.96 overall degree of collaboration range is 9.4.

Table: 5 Year wise Authorship pattern

Year	Single Author	Double Author	Three Author	Four Author	Five Author	More than 5 Authors	Total
2009	11	11	24	18	22	82	168
2010	11	13	23	27	28	73	175
2011	7	22	23	23	25	72	172
2012	14	17	11	24	23	103	192
2013	7	24	28	26	21	82	188
2014	11	21	28	21	31	102	214

2015	11	20	32	23	29	93	208
2016	12	17	18	23	22	100	192
2017	7	24	33	26	19	96	205
2018	8	19	34	20	21	99	201
Total	**99**	**188**	**254**	**231**	**241**	**902**	**1915**

Table 5: examine that the year wise authorship pattern. Among this authorship pattern, highest number of papers were published in the year of 2014 the records of 214.authors participate in the year, followed the year of 2015 the records the records of 208.The lowest author produced in the year of 2009 the record of 168. The maximum number of authors was in the year 2014.

Table 6: country wise distribution

S.No	Country	Records	percentage	TLCS	TGCS
1	USA	817	42.7	1068	18924
2	Peoples R China	166	8.7	175	2938
3	UK	148	7.7	108	2871
4	Germany	134	7	163	3230
5	Japan	121	6.3	161	1701
6	India	94	4.9	169	1087
7	France	81	4.2	53	1443
8	Italy	79	4.1	35	1724
9	Canada	72	3.8	68	1553
10	Australia	63	3.3	55	3561

Table 6 : shows that the total number of Indian publication in human DNA involved in during the period 2009 t0 2018, the top place of USA was published 817(42.7) contribution of publication in first rank and followed by the second rank of Peoples R china contribution 166(8.7) records. Among the different countries analysis shows UK, Germany,japan are in the middle, and the bottom of Australia 63(3.3).

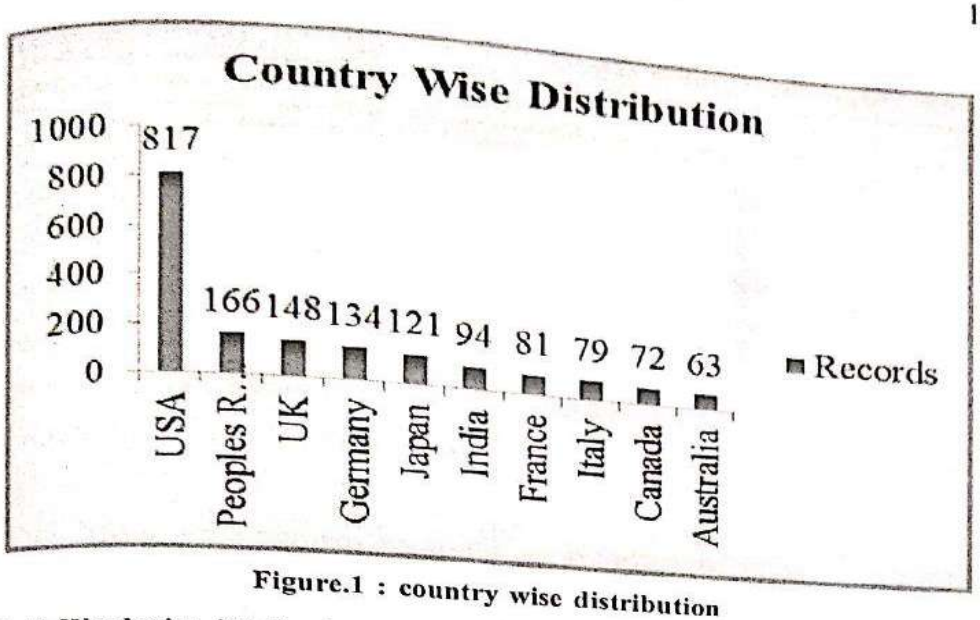


Figure.1 : country wise distribution

Table 7: Word wise distribution

S.NO	Word	Records	Percentage
1	DNA	796	56.3
2	HUMAN	680	48.1
3	POLYMERASE	210	14.8
4	CANCER	91	6.4
5	ANALYSIS	89	6.3
6	DETECTION	80	5.7
7	USING	78	5.5
8	REPAIR	74	5.2
9	BASED	70	4.9
10	CELLS	63	4.5

Table 7: presents the top ten keywords used by the researchers in their publication, it is clearly seen from the table that the word "Human DNA" has been used in 796(56.3%) records by the researchers, followed by the maximum number of word used "Human" in 680(48.1%) records, "Polymerase" in 210(14.8%) records, "Chicer" in 91(6.4) records, "Analysis "in 89(6.3%) records, "Detection" in 80(5.7%) records, "Using" in 78(5.5) records, "Repair" in 74(5.2) records, "Based" in 70(4.9%) records, "Cells"63(4.5%) records.

Table 8: Exponential growth rate

S.NO	Publication Year	Records	Exponential growth rate
1	2009	168	Nil
2	2014	214	1.27
3	2012	192	0.89
4	2010	175	0.91
5	2011	172	0.98
6	2013	188	1.09
7	2015	208	1.1
8	2016	192	0.92
9	2017	205	1.06
10	2018	201	0.98
	Total	**1915**	**9.2**

Table 8: shows that Exponential Growth Rate of publication in human DNA during the period of 2009 to 2018 (10 years).The highest growth rate 1.27 was found during 2014 with 214 publications. Followed by the year 1.10 with 208 publications. The lowest growth rate 0.89 with 192 in the year 2012.it is also found that the Exponential Growth Rate was found to be 9.2 and average growth rate has positive value showing the increasing trend in the human DNA research.

Table 9: Relative Growth Rate

Year	No.of contri-bution	cumula-tive contri-bution	W1	W2	R(a) W2-W1	Mean R(a) 1-2	Doub-ling Time DT(a)	M DT(a) 1-2
2009	168	168	NIL	5.12	Nil	0.92	Nil	0.53
2010	175	343	5.17	5.84	0.67		1.03	
2011	172	515	5.15	6.24	1.09		0.64	
2012	192	707	5.26	6.55	1.29	2	0.54	0.35
2013	188	895	5.24	6.8	1.56		0.44	
2014	214	1109	5.36	7.01	1.65		0.42	
2015	208	1317	5.34	7.18	1.84		0.38	
2016	192	1509	5.23	7.32	2.09		0.33	

2017	205	1714	5.32	7.45	2.13	
2018	201	1915	5.3	7.56	2.26	0.33
Total	**1915**					0.31
					2.92	

R(1-2)=W2-W1/T2-T1

R(1-2)= mean relative growth rate over the specified period interval

W1=log W1 (natural log of initial number of publication)

W2=log W2 (natural log of initial number of publication)

T2-T1=the unit difference between the initial time and final time

R(a)=relative growth rate per unit publication per unit of time (year)

DT(a)=0.693/R(a).

Table 9:Explained the relative growth rate of total contribution published had gradually increased. The growth rate in 0.67 in 2010, Which is increased up to 2.26 in 2018 at the same time doubling time decreased from 1.03 to 0.31 2009 to 2018.

Table 10: Institutions wise distribution

S.No	Institution	Records	Percentage
1	Vanderbilt University	51	3.6
2	Johns Hopkins University	25	1.8
3	Ohio State University	22	1.6
4	University Oxford	22	1.6
5	University Cambridge	21	1.5
6	Russian Academy Science	20	1.4
7	Penn State University	18	1.3
8	University Texas Med Branch	18	1.3
9	University Arkansas Med Science	17	1.2
10	Integral University	16	1.1

Table 10: shows that the institution wise distribution of publication on human DNA. The highest distribution from the Vanderbilt University 51(3.6%) followed 25(1.8) Johns Hopkins University, lowest distribution from integral university 16(1.1).

Table 11: Single author Vs multiple author

S.NO	Authors	Records	Percentage
1	single authors	99	5.17
2	multiple authors	1816	94.83
	total	1915	100

Table 11: examine the single author Vs multiple author contributions. In this table give the single author contribution is 99(5.17%) out of 1915.And the multiple author contribution is 1816 (94.83%) out of 1915 records. The highest number of contribution was published by multiple authors.

Table 12: Arithmetic mean

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total A.M	
Total no of publication	168	214	192	175	172	188	208	192	205	201	1915	191.5

A.M= 1915/10=191.5

Table 12 : Shows that the arithmetic means of the human DNA research according to the year of (2009to2018). The arithmetic mean value is 1991.5 to the all years.

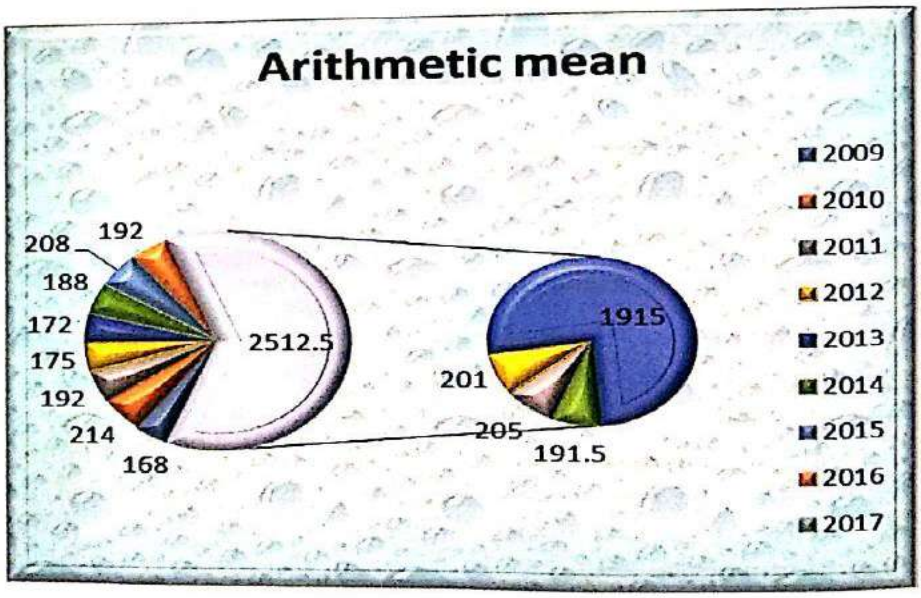


Figure. 2 Arithmetic mean

Findings and Conclusion

- To find out the 1915 records in the year wise authorship pattern. The highest number of 214(11.2%) records were published in the year of 2014.
- To find out the country wise distribution, the total number of Indian publication in human DNA involved in during the period 2009 to 2018 the highest number 817(42.7%) records by research.
- To find out the overall degree of collaboration single author contribution 99 out of 1915 and rate of 1816 for multiple authors' contribution. The degree of collaboration range started from 0.93 to 0.96 overall degree of collaboration range is 9.46.
- To identify the relative growth rate of total contribution published had gradually increased. The growth rate in 2.26 in 2018
- To review the distribution of publication on human DNA by document types, it is clearly noticed from the table that the major source of publication in human DNA comes in the form of articles with 1588 records.
- To identify the table institution wise distribution of publication on human DNA the highest distribution institute for unknown 50 (3.6%)
- To measure the total number of Indian publication in human DNA involved in during the period 2009 to 2018.
- To analysis the clearly seen from the table that the word "DNA" has been used in 796(56.3%) records by the researchers,
- To find out the language wise distribution of publication on human DNA the highest number of distribution English for 1892(98.8%)
- To measure the highest growth rate was found during 2014 with 214 publications.
- To calculate the Arithmetic mean of the human DNA research according to the year of (2009 -2018).

Conclusion

The research has Scientometrics studies are orderly used to assess in which scientific and systematic research distribution to energetic information should be used to the principle makers and genius. in this study has demonstrated to be useful tools in the assessment of research publications

of scientist in information and communication, distribution and productivity of authorship pattern, arithmetic mean have been calculation, should be data analyzed. This study have been highlighted for Scientometrics analysis to measure various reviews such as growth of articles, authorship pattern, institution of distribution and country wise distribution of articles in which can be used to observation has analysis of the word wise contribution of articles. The study will be helpful to the library professional and many data collection implement, out of the physics and the research has identify of authors and including to procure core subject in the area.

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IMPACT OF GOODS AND SERVICES TAX (GST) ON COVID 19 – CSR PERSPECTIVE

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Abstract

Corporate Social Responsibility (CSR) as a tool to sort out these problems up to some level because business is running in the society, by exploiting the different resources. In the trusteeship Mahatma Gandhi has also defined business is the piece of society so it has to fulfill the social responsibilities. Social Responsibility is a requirement to the planet & people living inside and outside the business organizations. Any business is having number of contacts in the society such as owners, employees, customers, government, suppliers, environment etc., Besides human life which is most important, COVID 19 has a worst impact on the economic activity, driving important part of the industry to a standstill. Due to various measures taken by the Government to avoid spread of the virus, multiple areas such as supply chain, employee well being and mobility, working capital and other financial commitments and challenges around cyber safety measures and privacy due to working from home are some of the instant challenges being faced by the business. In addition various financial regulatory and tax observance is another area which gets impacted. Hence it is concluded that sustainability and to carry on in this mechanistic world, the organizations need to reveal a strong relationship with the society.

Keywords: Society, Economic Activity, Working Capital, Supply Chain.

Introduction

CSR is a corporate entity's way of giving back to the society from which it draws all its resources, personnel, and business for the betterment of its stakeholders and society we live in. At the corporate level, CSR is generally considered as a strategic initiative that contributes to the organization's brand and positive impact. **The CSR Expenditure of a Company Can be Claimed as a Business Expenditure** Explanation 2 to Section 37 of Income Tax Act introduced via Finance Act, 2014 provides that any expenditure incurred by an assesses on the activities relating to corporate social responsibility referred to in Section 135 of the Companies Act, 2013 shall not be deemed to be an expenditure incurred by the assesses for the purposes of the business or profession. Thus, cannot be claimed as business expenditure.

Recently, the Ministry of Corporate Affairs, in order to encourage the companies to help the society to recover from the COVID-19 pandemic, has declared that all expenditure/grants given by companies towards the fight against COVID-19 pandemic would also be counted towards CSR Activities.

Review of Literature

Shah, Bhaskar (2010) discussed that there is a broad relationship between the organization and society. Organization has its existence only with the society. Organization used the resources of the society. In reverse, the organization provides services to the society. Hartman (2011) analyzed the importance of CSR in food sector, particularly those companies which have high brand image CSR is an important part of these companies but

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SME's are less capable in discharging their obligation towards society. The economic Times (2012), news highlighted the views of a CSR award function organized by industry body. It should make mandatory for all the companies to spend a percentage of its profit on corporate social responsibility. **Bibhu Parshed (2012)**, suggested that profit earning is a natural fact of companies but CSR is beyond the natural and statutory obligation of the companies.

Objectives

1. To develop an understanding of concept of CSR and GST.
2. To analyze the development of CSR in India and its changing trends on GST.
3. To understand the policies governing CSR on GST during COVID19.

Methodology

The study used a conceptual research design because it assessed the nature of prevailing conditions.

GST Perspective

Section 16(1) of CGST Act, 2017 states the eligibility and conditions for taking input tax credit, accordingly, every registered person shall, subject to such conditions and restrictions as may be prescribed, is entitled to take credit of input tax levied on any supply of goods or services or both to him which are used or intended to be used **in the course or furtherance of his business.**

The term *"in the course or furtherance of his business"* is not defined under GST Law. However, the term *"Business"* is defined under Section 2(17) of the CGST Act which includes any trade, commerce, manufacture, profession, vocation, adventure or wager etc. whether or not undertaken for a pecuniary benefit. The business also includes any activity or transaction which is incidental or ancillary to the aforementioned listed activities. ***Thus, we can infer that the term "in the course of furtherance of business" means any supplies made in connection with the business.***

Implication of GST on CSR activities

1. Input tax credit for expenditure for performing CSR activities

Section 16 of the CGST Act enables a registered person to take credit of input tax charged on supply of goods or services to him, if the said goods or services are used or intended to be used in the course or furtherance of business, along with certain conditions.

It is imperative to understand whether the activities performed for CSR are in the course or for the furtherance of business as it is one of the main conditions to avail input tax credit.

The term "business" is defined under section 2(17) of the CGST Act, to include:

- Any trade, commerce, manufacture or any other similar activity, whether or not it is for a pecuniary benefit.
- Also, any activity or transaction which is ancillary or incidental to the above-mentioned activities would be included,
- The activities above would be called a business activity irrespective of the volume, frequency, continuity, or regularity.

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CSR activities are said to be carried out mandatorily for the above-mentioned specific class of companies under Companies Act, 2013, they are required for conducting the business in compliance with the law. Hence it can be said that they are incidental to the main business activities.

2. **Supply of own goods**

A transaction should fall in the "scope of supply" as provided for in section 7 of the CGST Act to attract GST. As per the said section "supply" includes:

- Supply of goods or services such as sale, barter, transfer, disposal, etc. made for a consideration by a person in the course or furtherance of business;
- Activities specified in Schedule I, made without a consideration.
- Since it is clear that there is no consideration received from CSR activities performed by the registered person, it is important to examine Schedule I of the CGST Act, which mentions the activities that would be treated as supply even if made without a consideration.

3. **Supply of services for CSR on GST**

As discussed above, Schedule I of the CGST Act is required to be analyzed to decide whether the provision of service qualifying as a CSR activity would be a supply attracting GST. Hence any services provided by a company without any consideration for CSR activities would not be a supply, thereby not attracting GST. On the contrary, CSR activities done through outside agencies to undertake specific projects for consideration may get covered under the scope of supply and would be liable for GST.

CSR activities

Every company, under Section 135(5) of the Companies Act, is required to comply with the CSR requirements. Every company with any one of the following during the immediately preceding financial year is required to meet Corporate Social Responsibility requirements under the Act:

1. A net worth of Rs 500 crore or more
2. A turnover of Rs 1,000 crore or more
3. A net profit of Rs 5 crore or more

In every financial year, a company is required to spend at least 2% of the average net profits made during the immediately preceding three fiscal years by following its Corporate Social Responsibility Policy.

Expenditure covered under Corporate Social Responsibility activities are

1. Providing education
2. Promoting gender equality
3. Projects related to rural development
4. Contribution to PM Cares Fund
5. Contribution towards the protection of the environment
6. Promotion of healthcare, preventive healthcare and sanitation activities related to COVID-19
7. Events related to disaster management including relief activities

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Availability of ITC on CSR activities

A) No ITC available on CSR activities

For understanding the availability of ITC on CSR activities, let us first understand some of the crucial definitions under GST.

1. **Supply:** Supply is a taxable event under GST. The liability to pay tax under GST arises at the time of the supply of goods or services. Supply includes: Sale, Transfer, Exchange, Barter, License, Rental, Lease, and Disposal Any person who engages himself in any of the above activities is covered under the definition of supply under GST. Further taxable supply means a supply of goods or services or both which are subject to tax under the GST Act.
2. **Goods:** Goods means all kinds of movable property. It includes actionable claim, growing crops, grass and, things attached to or forming part of the land. However, it does not include money and securities.
3. **Services:** Services include any activity other than goods, money and securities. It consists of all the activities related to the use of money or conversion of money from one form to another. Separate consideration is charged for this.
4. **Business:** Business means any activity carried out by a person including trade, commerce, manufacture, profession, vocation, adventure or wager whether or not it is carried out for a monetary benefit.

Input tax credit provisions

Section 17(2) of the CGST Act has a point. The taxes paid on inputs can be claimed as ITC only if the outputs are taxable supplies. Also, as per section 17(5)– Block Credit, ITC is not available for goods lost, stolen, destroyed, written off or disposed of by way of gift or free samples. In the case of Corporate Social Responsibility activities, a company is providing outputs/output services free of cost. Thus, by taking into consideration the definition of taxable supplies and provisions of section 17(2), input credit cannot be availed on CSR activities.

B) ITC is available on CSR activities

ITC is available on CSR activities because they are incurred in the course or furtherance of business. CSR activities have a high impact on the image of the company and are also mandatory as per the provisions of the Companies Act, 2013. It enhances the reputation of the company and thus creates the goodwill of the company. Therefore, it can be ascertained that Corporate Social Responsibility activities are incurred in the course or furtherance of business. So, ITC can be claimed for such events.

Overall GST Collection during COVID 19



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Conclusion

Since there is no specific provision that denies input tax credit on CSR activities, a stand can be taken to reward the input tax credit. However, the shortfall in CSR expenditure arising due to an ailment of ITC should be compensated by contributing in addition towards CSR activities, so that the minimum contribution requirement is satisfied. Professional guidance can be sought in this regard, before taking a stand, as it may be litigated by the department. In these times of crisis, it is necessary that all those who are contributing to the well- being of others, be confident and motivated to keep doing the same. Recently, the Ministry of Corporate Affairs, in order to encourage the companies to help the society to recover from the COVID-19 pandemic, has declared that all expenditure/grants given by companies towards the fight against COVID-19 pandemic would also be counted towards CSR Activities.

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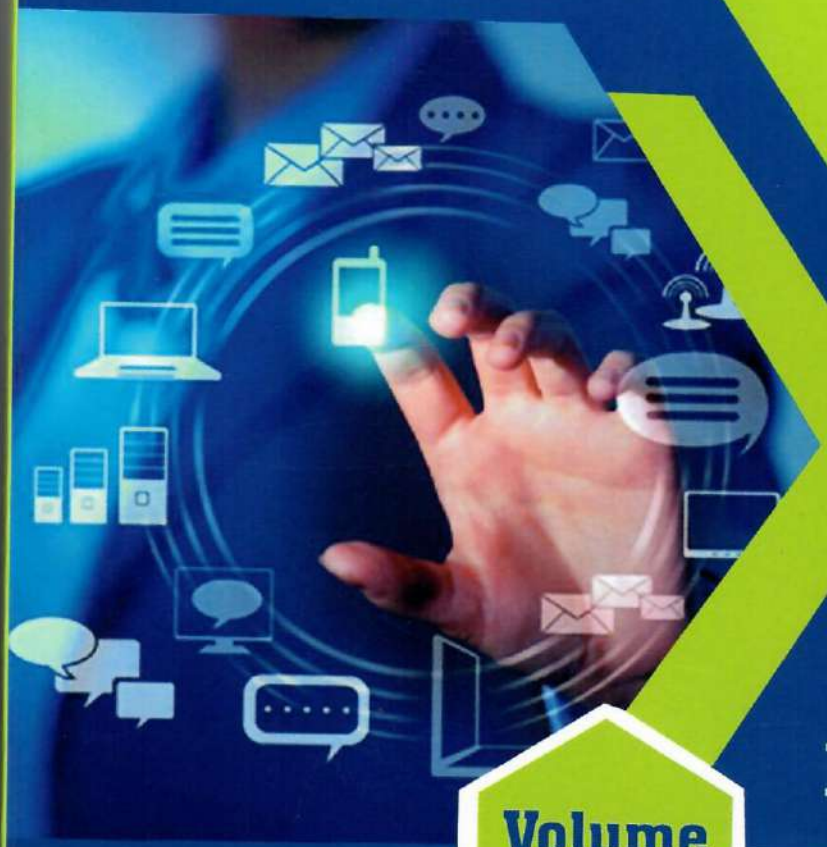
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CORPORATESOCIAL RESPONSIBILITY DURING COVID-19 – AN OVERVIEW

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Abstract

Corporate Social Responsibility (CSR) is becoming an more and more important activity to businesses nationally and internationally. India is becoming one of the fastest growing economies in the world. Every companies are having the composed of earnings and wealth boosting by doing business. The toxic virus the covid-19 gives serious damage to both human as well as entrepreneurs. In order to protect people from corona virus Indian Government announce lock down for all types of businesses. Business in general can offer solutions for people breathing below the poverty line as they try to recover financially and mentally. However, covid-19 crisis is going to have a devastating impact on their business. The Coronavirus outbreak caught the world by surprise, spreading like wildfire and causing fatal illness to many. The ongoing pandemic and its consequences have led to stark worldwide socioeconomic disturbance, tentative most sporting activities. Surviving with the virus and its terrible consequences essential to twitch together all continent which determinations by individuals, organizations and governments. Businesses have entered on things to upkeephack it with the pandemic in various ways, as associated with the concept of corporate social responsibility (CSR). This paper highlights the CSR during the period of covid -19.

Keywords: *Corporate social responsibility, Coronavirus, socio-economic activities.*

Introduction

The coronavirus outbreak, which started in China in December 2019, was diffusion rapidly worldwide and was stated pandemic by the World Health Organization (WHO) in March of 2020. As of 15 April 2020, around 2 million cases have been reported resulting in more than 100000 deaths. The outbreak of the Corona virus caused global socioeconomic disruption including the shutdown of factories and businesses, uncertain transportation, deferment of events, travel limits, social distancing and lockdown Business. Organizations and businesses have embarked on an effort to support fighting the pandemic in various ways, providing products, manufacturing capabilities and logistic support, community services and funding volunteering programs. This article provides an interim review of the various corporate social responsibility (CSR) practices in the fight against the corona virus pandemic. This leads to better understanding on which CSR best practices in terms of the business and society, as well as portion recommendations for further research examining various aspects of CSR at times of crisis and in the aftermath of new normal.

The Concept Overview

The term "corporate social responsibility" came in to common use in the late 1960s and early 1970s after many multinational corporations formed. CSR is titled to aid an organization's mission as well as a guide to what the company stands for and will uphold to its stakeholders. Corporate social responsibility is also called corporate conscience, corporate citizenship, social performance, or sustainable responsible business. Corporate Social Responsibility (CSR) is becoming an increasingly important activity to businesses nationally and

internationally. As globalization accelerates and large corporations serve as global providers, these corporations have progressively recognized the benefits of providing CSR programs in their various locations. CSR activities are now being undertaken throughout the globe. A more common approach of CSR is philanthropy. This includes monetary donations and aid given to local organizations and impoverished communities in developing countries. Some organizations do not like this approach as it does not help build on the skills of the local people, whereas community-based development generally leads to more sustainable development. A business needs a healthy, educated workforce, sustainable resources and adept government to compete effectively. For society to thrive, profitable and competitive businesses must be developed and supported to create income, wealth, tax revenues, and opportunities for philanthropy. Many companies use the strategy of benchmarking to compete within their respective industries in CSR policy, implementation, and effectiveness. Benchmarking involves reviewing competitor CSR initiatives, as well as measuring and evaluating the impact that those policies have on society and the environment, and how customers perceive competitor CSR strategy. A concept describing the communication of social and environmental effects of a company's economic actions to particular interest groups within society and to society at large is thus an important element of Corporate Social Responsibilities in India.

Importance of Corporate Social Responsibilities

Effective Leadership

How a company perceives its societal responsibility depends on various factors such as the markets in which it operates, its business line and its size. In recent years CSR has become a fundamental business practice and has gained much attention from the management of large international companies. They understand that a strong CSR program is an essential element in achieving good business practices and effective leadership.

Economic, Social and Environmental sector

Companies have explored that their impact on the economic, social and environmental sector directly affects their relationships with investors, employees and customers. Whilst so far Corporate Social Responsibility was mainly promoted by a number of large or multinational companies, it is now also becoming important to small national companies.

Prime Goal of a Company

As companies face themselves in the context of globalization, they are increasingly aware that Corporate Social Responsibility can be of direct economic value. Although the prime goal of a company is to generate profits, companies can at the same time contribute to social and environmental objectives by integrating corporate social responsibility as a strategic investment in to their business strategy.

An Intrinsic Part of Business Plans

In **India** there are an existent but small number of companies which practice CSR. This engagement of the Indian economy concentrates mainly on a few old family owned companies, and corporate giants such as the Tata and Birla group companies which have led the way in making corporate social responsibility of an intrinsic part their business plans. These companies have been deeply involved with social development initiatives in the communities surrounding their facilities. So, the corporate social responsibilities play a vital role in Indian companies.

The Key Drivers for CSR

The rationale for CSR has been articulated in a number of ways. In essence it is about building sustainable businesses, which need healthy economies, markets and communities.

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Enlightened self-interest

Creating a synergy of ethics, a cohesive society and a sustainable global economy where markets, labour and communities are able to function well together.

Social investment

Contributing to physical infrastructure and social capital is increasingly seen as a necessary part of doing business.

Transparency and trust

Business has low ratings of trust in public perception. There is increasing expectation that companies will be more open, more accountable and be prepared to report publicly on their performance in social and environmental areas.

Increased public expectations of business

Globally companies are expected to do more than merely provide jobs and contribute to the economy through taxes and employment.

How to achieve your Corporate Social Responsibility Goals

- Support some of our programs and social service initiatives.
- Adopt a child, family, school, or a village to meet you social responsibility.
- Corporate can sponsor a vocation training program through our 'Sponsor a Skill' drive.
- Buy greeting cards from our partner NGOs.
- We help the corporate meet their Corporate Social Responsibility targets through NGOs with expertise in the respective field.
- Corporate have Social Responsibility (CSR) targets to help improve community living.
- With Corporate Social Responsibility in India having acquired a new dimension in the recent years, more and more companies are increasingly realizing that it is a good business investment, which brings manifold benefits to the company. Thus, all CSR activities are being designed in alignment with the corporate business strategies.
- In India, though the corporate understand their accountability towards the society and are willing to take initiatives for the betterment, it becomes difficult for them to reach the grass root level. We thus join hands with the corporate to help them advance their welfare initiatives to the needy families and save on their time and human resources.
- A number of companies with good social and environmental records indicate that CSR activities can result in a better performance and can generate more profits and growth. Researches hast shown that company CSR programs influence to an extensive degree consumer purchasing decisions, with many investors and employees also being swayed in their choice of companies.
- A major challenge for companies today is attracting and retaining skilled workers. There is not only an image gain for the companies using CSR, but it is also important for the employees. Within the company, socially responsible practices primarily involve employees and relate to issues such as investing in human capital, health and safety and managing change.
- The major impact of these economic reforms has been the increased presence of multinational corporations in the country and transformation of Indian businesses into large global enterprises. In this scenario, there is an increased focus on the social role of these private enterprises by both the proponents and opponents of liberalization in India.

Challenges for CSR Vs Covid 19

Corporate Social Responsibility is provided as a background to the follow-on overview of business-related activities within the CSR domain. In recent years, the pursuance of CSR has

gained wide recognition as a good practice that can lead to improved corporate image and financial performance. The concept is not new and is based on the belief that the companies have some responsibilities to society beyond that of making profits for the shareholders.

Moral Responsibilities

The premise of CSR is that corporations have that go beyond simply making profit for their owners and shareholders. Being socially responsible means going beyond legal and economic obligations to do the right things by acting in ways that benefit society and relationships with stakeholders. The voluntary actions that business can take, over and above compliance with minimum legal requirements, to address both its own competitive interests and the interests of wider society.

Functioning Free Society

Insofar as the business system as it exists today can only survive in an effectively functioning free society, the corporate social responsibility movement represents a broad concern with business's role in supporting and improving that social order. By the instrumental perspective, CSR means that corporations are expected to achieve profits and financial stability, a concept rooted in the assumption that the role of corporation is wealth creation for the benefit of society at large.

Economic Responsibility

The salience of the financial aspect of CSR is reflected in the work of Carroll, who asserted that the social responsibility of business encompasses the economic, legal, ethical, and discretionary expectations that society has of organizations at a given point of time,and went on to portray those aspects as four layers of the pyramid of CSR. By the pyramid metaphor, Carroll suggests that each CSR element is a prerequisite for the one built upon it. Accordingly, the economic responsibility of the firm, which forms the first layer, is necessary because without it, the firm would not survive as an entity that contributes to society.

Financial Performance and Sustainability

Benefits and Costs of CSR There is debate on the question of how CSR affects corporate financial and economic performance. With so many factors affecting profits, this led to the notion that a firms socially responsible conduct would advance its competitive advantage and result in better financial performance and sustainability. Consequently, CSR developed to be an element of business strategy, aiming to develop a competitive advantage. In other words, those corporations engaged in CSR will, with all things being equal, be more financially successful.

Lead to Costly Lawsuits

Several companies with reputations for good CSR have much larger profits than those that have poor reputations. Companies considered being highly socially responsible by their societal view. Although companies can benefit from CSR, there are often upfront costs before getting a payback on the investment. There are also costs for the lack of CSR to a business. CSR has been in the news constantly for the past several years. Being socially irresponsible has negative consequences, as it gives the company a negative reputation that leads to more difficulty in attracting customers, investors, and employees, and it can lead to costly lawsuits. Money can be made again, but a negative reputation can take years to improve, and a good reputation may be lost forever.

Multiple Constituencies

The stakeholder theory of the firm is strongly related to the practical application of CSR. It asserts that multiple constituencies - stakeholders, should be considered when managing a firm, and not just shareholders. Multiple constituencies could be considered including employees, customers, suppliers, investors, communities and others. The organization can affect stakeholders negatively as well as positively. Stakeholders can be harmed by the firms" actions

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helped to achieve their goals. Conversely, stakeholders can act in ways that either firm achieve its goals. Firms therefore institute stakeholder management to address the needs and expectations of their stakeholders to avoid negative and induce positive outcomes for themselves.

CSR Goals

almost every major corporation has explicitly adopted nonfinancial CSR goals as mission, and diversity has become particularly important because of its benefits to and society. Major corporations issued a statement saying that they are share a commitment to all of our stakeholders. Members embraced a model of capitalism account the interest of all corporate stakeholders—and therefor renounced the shareholders should always come first.

Related CSR

Dimensions

provides an overview of CSR activities, in relation to the situation caused by the outbreak, examined through the prism of various stakeholder groups. Pressure to profits in an uncertain business environment is driving executives to seek competitive

Dimensions

are the most valuable organizational resource, and how the firm treats its is related to its performance. Corporate social responsibility toward employees may multiple aspects such as job security, fair remuneration and compensation, health and working conditions, organizational justice, avoid discrimination-diversity and labour relations and collective bargaining, flexible work arrangements, training and and more. Some of these aspects are more significant in relation to the situation coronavirus outbreak. An overview of some of these aspects, with some example that followed this practice.

Dimensions

Corporate social responsibility toward customers may include multiple aspects product quality, safety and environment friendly, fair price, quality of service product life cycle, honest and truthful advertising, and more. This perception is also with the marketing concept of customer perceived value (CPV) which explains why will prefer one product over the other, and includes, among others, the elements of benefits, service benefits, monetary costs and time and energy cost. Some of these more significant in relation to the situation caused by the coronavirus outbreak. For online services, deferred payments due to financial difficulties, home delivery are the more important issues in this context. An overview of some of these aspects, with example companies that followed this practice, More specific examples on creating value through deals, discounts and freebies, relate to the coronavirus outbreak are

Dimensions

Corporate social responsibility toward communities may include multiple such as charitable giving to the community, in-kind giving of a firms products and that are in need, or the use of facilities or managerial expertise, helping those in need, Some of these aspects are more significant in relation to the situation caused by the outbreak. For example, medical and food products are highly important in this An overview of some of these aspects, with some example companies that followed this

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Environment Dimensions

Environment Including sustainability in managing the business is being socially responsible. Today, the world is confronting a colossal unmet need unlike anything in the past, as the warming of or our planet is causing dramatic changes to the climate to the point of being called a crisis. A recent World Economic Forum report says that two-thirds of the world population could be living in water-stressed countries by 2025 if current consumption patterns continue. With the pandemic, the environment is the "big winner" of the new situation that was imposed due to the coronavirus outbreak. Satellite picture and data, as well as other environment monitoring facilities, reveal significant decrease in air pollution and CO2, during the pandemic spread by the new coronavirus. This is the result of halting major activities worldwide including industry and transportation. Of course, this has nothing to do with CSR but rather an outcome of the situation. Thus, no specific CSR efforts have been directed to the environment.

Companies Dimensions

Companies Leveraging Manufacturing Capability for CSR Brands that have offered production lines, production capabilities and material resources, to produce and assemble the items needed to treat and contain the coronavirus. Such items include medical equipment such as sanitizers, masks and ventilators. As those are not their typical product, companies are retooling to produce, and switch output the newly needed products. Other companies offering to lend floor space, machinery, staff and production expertise. Companies Leveraging Increase in Production for CSR Companies who regularly produce products that are needed in fighting the coronavirus, such as sanitizers, masks and ventilators; are now facing a sharp increase in demand. Thus, those companies are called upon to ramp up production of their own products, while changing production portfolios. Such change calls for high level of flexibility in production arrangements and sharpens the firm capability to do so in the future when conditions in the external environment are changing. Companies Leveraging Research and Development for CSR Fighting the coronavirus pandemic requires fast development of medical products including diagnostics and treatment capabilities as well as vaccines. This requires investing extreme efforts in research and development mainly from companies in the medical and healthcare industry. Large corporations as well as small start-up firms, are rising to the challenge.

Conclusion

India is becoming one of the fastest growing economies in the world. With a soaring growth rate, India is inviting more international investors to its markets. But is this rise in economic growth solely based on successful business operations. As far as the upliftment of communities, generation of employment opportunities and economic growth is concerned, the government alone cannot attain success. It is also the responsibility of business organizations to take up social and environmental causes and make a difference to communities. The coronavirus pandemic has been a formative event impacting our life and way of thinking. Organizations and businesses contributed efforts and resources to cope with the consequences of the pandemic, following the notion of their social responsibility within society. The impact of the various CSR practices will be examined in the future. The sheer scale of CSR, in the face of a major worldwide crisis, provides an opportunity to sharpen our understanding and insights on the best ways that firms should plan and practice their social responsibility. The coronavirus pandemic, although we would have been better off without it, provided an opportunity for deep examination of social responsibility practices. While CSR strategy and programme planning is vital, implementation still needs continuous monitoring, improvement and vigilance on the impacts on beneficiaries.

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EFFECT OF SUNLIGHT PHOTODEGRADATION ON WICKING BEHAVIOR OF DYED MULBERRY AND TASAR SILK FABRICS

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Introduction

A fibre is to be considering for its possible use as a textile fibre, it must possess certain physical and chemical properties. Fabrics made from different fibres have naturally different properties and hence are suite for different purpose (1). Silk is a beautiful luxury fibre which is strong elastic and lustrous (2). Silk is the splendid gift of nature to mankind is an inimitable natural fibre (3). The word silk often refers to mulberry silk, which is the symbol of luster, smoothness and elegance. A wide range of fabrics mostly used for dress materials are produced in the mulberry variety (4). Mulberry silk is the finest and strongest fibre. There are two types of mulberry silk bivoltine and multivoltines. Mulberry silk comes from the silk-worm, Bombxymori L. which solely feeds on the leaves of mulberry plant. These silk-worms are completely domesticated and reared indoors (5).

Tasar culture is regarded as the most important types of non-mulberry sericulture. The size of the tasar cocoon is much bigger than that of mulberry cocoon, but the filaments in tasar cocoon are coarser than filaments in mulberry cocoon (6). Tasar silk is copperish colour; coarse silk used for dress materials, furnishing and interiors. It is less luster that mulberry silk, but has its own feel and appeal (7). Silk is an excellent dye absorbent and this makes it possible to make infinite shades, designs and finishes (8). The coloration of this royal fibre is also an art form. Acid dyes are commercially applied mainly on natural protein, synthetic polyamide and a small extent to acrylic and blends of these materials. Acid dyes are so called because they are applied in presence of organic and inorganic acid dye bath solutions (9).

A STUDY ON THE PHYSICAL PROPERTIES OF COTTON/POLYESTER CORE SPUN YARNS

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PhD scholar,
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INTRODUCTION

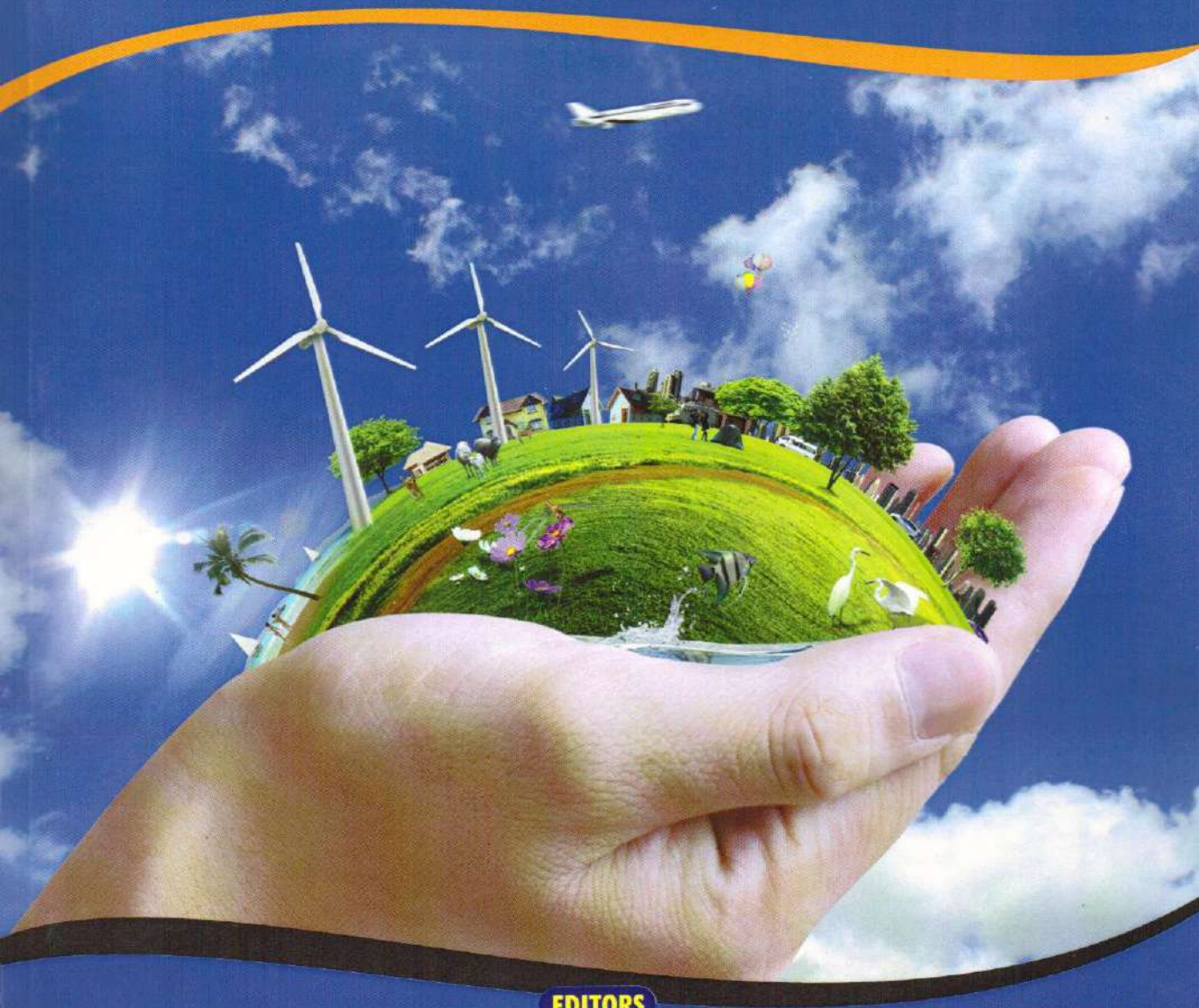
Cotton fibers are natural, soft, cool, breathable and absorbent fibers can hold 24-27 times their own weight. They are strong, dye absorbent and can stand up against abrasion wear and high temperature. Since cotton wrinkles, mixing it with polyester improves strength and handling properties[1].

Polyester was the second synthetic fiber developed in 1942 and widely used for the balancing properties of great versatility, less expensive, low production cost compared with nylon[2]. Polyester shows high strength, abrasion resistance, heat set properties in the performance point of view. When compared with nylon, polyester exhibits good resilience and high modulus which means it is springy and can recover well from strain. Polyester conducts moisture away from skin and dries faster than nylon. Polyester core spun yarns are produced to improve high strength and shrink proof qualities of yarn[3].

In the finishing process polyester fabric undergoes preshrunk, thus polyester clothing resists shrinking and will not stretch out of shape. The fabric is easily dyeable and is not damaged by mildew. Filling pillows, quilting, outerwear, and sleeping bags are made up of textured polyester fibers because of the effective, non-allergenic insulating properties[4].

In recent years, an important development of core-spun yarn is the use of viscose, viscose and linen or cotton and viscose blended polyester core yarn, as well as cotton and silk or cotton and wool blended coated core yarn, these products are very popular[5]. Recently, cotton wrapped staple core and filament core yarns reportedly much improved core-coverage, strip resistance, hand and bulk have been developed. These yarns exhibit 95% core coverage and an excellent strip resistance which are the essential parameters of

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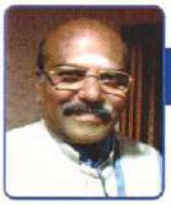
Dr. P. Senthilkumar & Dr. P. Jayanthi

Air Pollution: Sources, pollutant types, impact of air pollutants on human health, plants and materials and control measures. Water Pollution: Types, sources and impacts of water pollution - Drinking and wastewater treatment. Soil Pollution: Physico-chemical and biological properties of soil (texture, structure, inorganic and organic components) - Analysis of soil quality - Soil Pollution control.

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Dr. R. Mallika

Solid Waste: types, sources, Collection, transportation and disposal method.–Hazardous waste: Types, characteristics, health impacts and treatment - Plastic and e-waste management.



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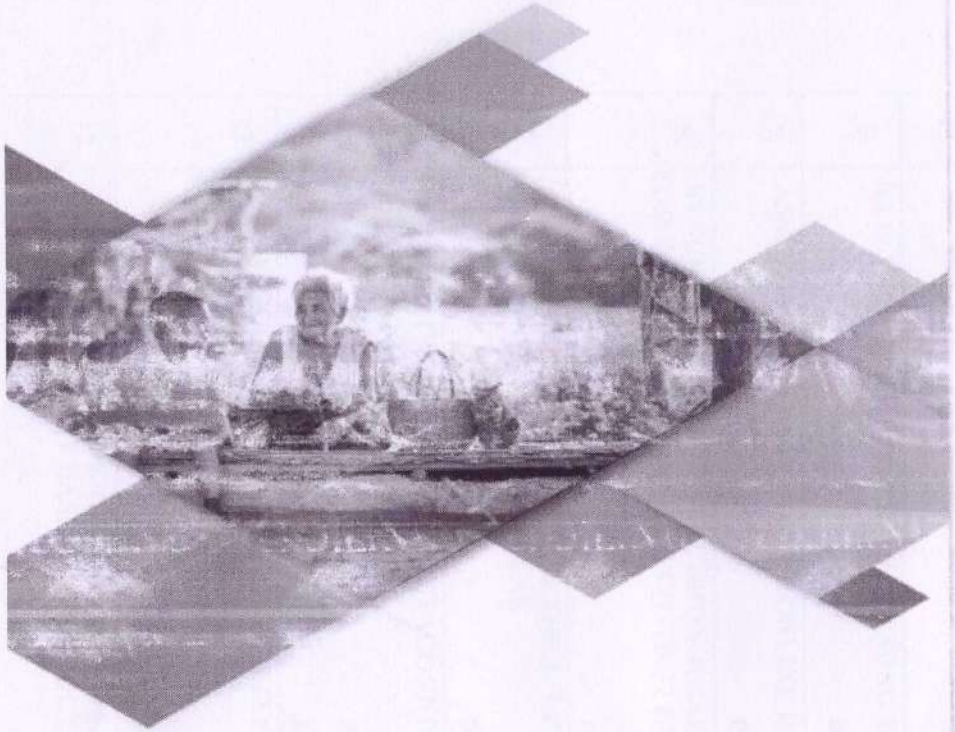
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DIGITAL LEARNING AND ITS CHALLENGES – A SOCIOLOGICAL ANALYSIS

[1]Dr.P.Sethurajakumar

The 21st century has brought out lot of structural changes in our society. The changing processes had been started since the era of French revolution as well as the industrial revolution. These remarkable changes have led to create a lot of innovations and inventions which brought the human society as advanced one. With the help of mechanization and industrial erections lot of employment opportunities had been emerged and it led to establish a new social order which brings gender equality, eradication of blind rules and monarchy, establishment of new cultural, social and educational system. Especially in the education field it was gradually developed, the gender parity had eliminated and more educational institutions were built to bring knowledge to the community people by the governments as well as the religious institutions.

During the ancient days the education system had been considered as a valuable one. In the ancient period the mode of education was totally different from today's formal setup. Learning good things from the parents, earning the experiences from the society through interaction and used to follow the cultural and traditional etiquettes were being considered as better education. Also it was done through the ways of observation, interaction, participation and parental socialization. From the ancient period and up to till today, the education is one of the best tool to create the self-awareness, self-realization, self-improvement and learning the societal norms and values. Education is an ever ending process. Compare with ancient system, today the educational system is directly handling the students through the teachers.

Direct teaching is one of the best methods that bring out the talents of the students as well as reduce the knowledge gap between one to another. Through class room teaching the teachers are taking care of students regarding their academic issues, personal issues, psychological issues and also their familial issues. The teachers are being considered as the second parents of the students in the direct teaching methods. The teachers can able to find the students weakness and strengths through their regular observation in the class room environment. The direct teaching methods also find out the best students from the difficult place. Former President Dr.Abdul Kalam quoted that "Some of the brightest minds of the country can be found in the last benches of the class room". These greatest findings can be done by the teachers only through their direct teaching methods.

Shifting education through digital platform

In the early 20th century, expanding the classroom and educating more children became a national and economic priority in many countries. Governments began to publicly fund education,

[1] Dr.P.Sethurajakumar, Assistant Professor, Department of Sociology, Periyar University, Salem-11

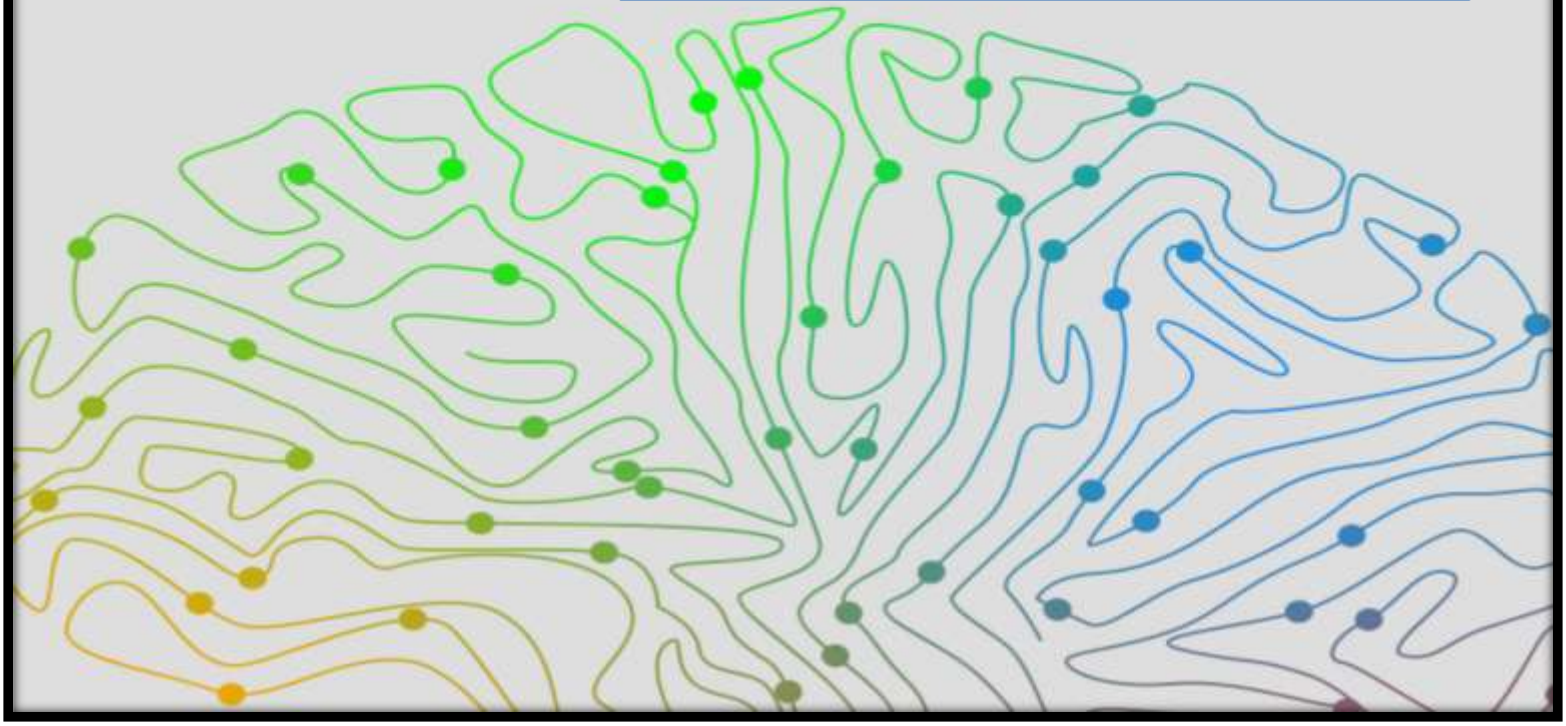
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EMOTIONAL INTELLIGENCE Vs CAREER MATURITY: SALIENT PREDICTORS OF EMPLOYABILITY OF MILLENNIAL COHORTS IN COLLEGE

D.Bhuvaneswari[1], Dr.P.Thirumoorthi[2]

ABSTRACT

The millennials are the generations who are the stepping inside the workforce and partly some are still yet to step inside the workforce, but whereas, the effects they will have on firms are stillunidentified.The study's aim is to analyze the emotional intelligence and career maturity l evels of millennials who are pursuing their graduation in college. The study comprises of all the undergraduate and post graduate students, who were selected randomly from selected colleges in Salem district. The sample size taken for the study is 170.The five dimensions that were measured in Emotional intelligence are relating well to others, emotional mentoring, managing emotions, self-awareness, and self-motivation. In this study, statistical techniques like percentage analysis, t-test, ANOVA, and Correlation were used. The outcomes imply that the proposed curriculum that is been inculcated to student, needs development in areas like communication skill, soft-skill development. The researcher suggests that high the level of emotional intelligence and maturity towards job the more it may contributes to employability.

KEYWORDS: Career maturity (CM); Curriculum; Emotional Intelligence (EI); Employability; Millennial Cohorts; Salem District; Soft-skill; Workforce;

Biovalorisation of Wastes to Renewable Chemicals and Biofuels

Edited by
Navanietha Krishnaraj Rathinam
Rajesh K. Sani



ELSEVIER

CHAPTER

10

Microbial leaching of heavy metals from e-waste: opportunities and challenges

V. Gopikrishnan[1], *A. Vignesh*[1], *M. Radhakrishnan*[1], *Jerrine Joseph*[1], *T. Shanmugasundaram*[2], *Mukesh Doble*[3], *R. Balagurunathan*[4]

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1. Introduction

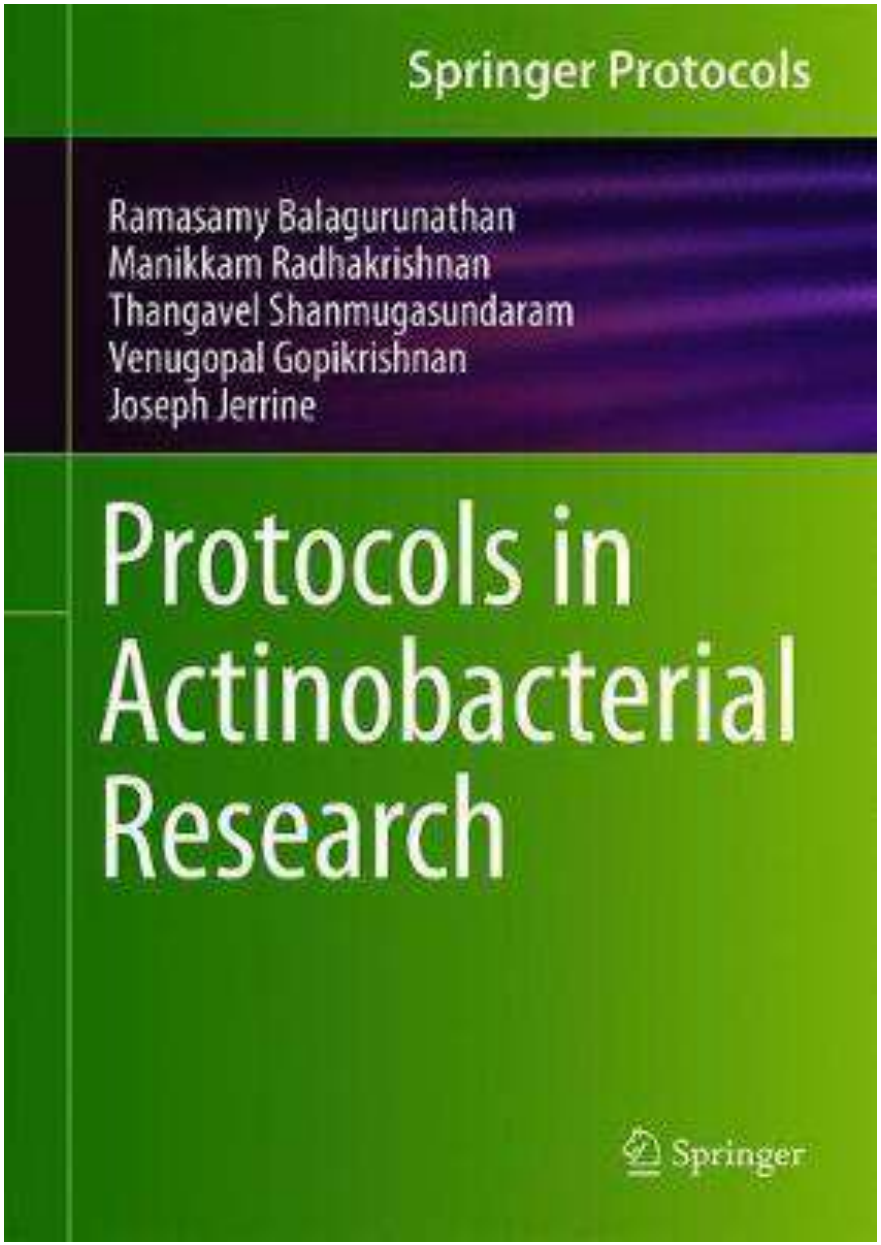
Rapid urbanization, industrialization, and population growth have resulted in an increased demand of electronic and electrical gadgets. With fast technologic advancement and development, with the demand of people in parallel, industries are now manufacturing novel, superior, and smart electronic and electrical equipment (EEEs) at an alarming rate. More and more production, usage, and discarding of EEE products resulting in the generation of a huge amount of waste electronic and electrical equipment (WEEEs) (Tansel, 2017). The electronic waste (e-waste) normally consists of small and large equipment such as light emitting diode lamps, cell phones, smart mobile phones, superior televisions, refrigerators, printers, driers, temperature exchangers, as well as advanced computing devices (Bhattacharya and Khare, 2016). Due to the fast advancement in technology and tremendous market growth, most of these electronic and electric material have a very short life span, which results in the fastest accumulation in e-waste (Dave et al., 2017).

E-waste contains both hazardous and nonhazardous substances in its components. Globally, the annual e-waste generation is estimated as 20–50 million tons. The presence of organic toxic and hazardous substances in e-waste separates it from normal municipal waste. These hazardous substances like plastic, lead, mercury, cadmium, arsenic, etc., pose health hazards to humans when treated in uncontrolled condition via air, water, and soil.

The presence of these pollutants in the atmosphere creates various kinds of diseases. The people engaged in the recycling and recovery from the e-waste are severely affected with chronic and acute diseases like cancer. The infrastructure to deal with abundant e-waste in developing countries is insufficient in terms of technology, and more than 90% e-waste is treated with rudimentary and primitive techniques adopted by informal agencies. To prevent humans and the environment from contamination of these pollutants, it is desirable to study the characteristics of various hazardous materials in e-waste, so people are made aware about ill effects of e-waste treated in uncontrolled conditions (Vats and Singh, 2014). Various hydrometallurgical (the leaching of metals with acids or bases) and pyrometallurgical (the leaching of metals using thermal treatment) approaches have been reported for efficient metal recovery from WEEE; still a decisive assessment of conventional approaches has not been sufficiently explicated. Bioleaching is a low-cost, green technology for leaching metals from a variety of minerals and waste materials (Zeng et al., 2016). Bioleaching has several advantages compared to conventional hydrometallurgy or pyrometallurgy that require a large amount of chemicals with the production of high levels of environmental pollution (Zeng et al., 2013). Currently, a significant portion of many minerals/ores are processed at industrial scale using bioleaching (Walting, 2015). For example, approximately 20%–25% of the world's total copper (Cu) is produced using bioleaching (Brierley, 2008). A number of successful commercial bioleaching operations exist worldwide, and a Cu

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Social Media: Changing Landscape in Language Interaction

S.Nandha Kumar, Jenitha Judson and Ardra G Mani

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March 9, 2020

SOCIAL MEDIA: CHANGING LANDSCAPE IN LANGUAGE INTERACTION

Dr.S.Nandakumar[1]
Ms.J.R.Jenitha[2]
Ms.Ardra[3]

Abstract:

Social media is one of the 'digital world' platforms in 20th century's new Information Communication Technologies for people's comfort social life Communication. Social Media like *Facebook*, Whatsapp, Twitter, Instagram, and other web media are used predominantly for social communication purposes. In communication process, interactivity is one of the most significant elements which plays a major role in forging relationships between social media users. Despite many research studies have done in communication aspects and still exists various areas that are unexplored. It is observed that social media users use texting, rich media content, updating status etc. The present research is undertaken to identify the changes in texting pattern among users and the impact of languages by adopting quantitative research approaches through questionnaires among respondents in Periyar University, Salem.

Key Words: *Communication, Language, Social media, Users, interactivity,*

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Social media create opportunities to learn and practice languages through social interaction

Dr. S. Nandakumar
Ms. JR. Jenitha
Ms.Ardra

INTRODUCTION

In the Modern digital world, the Information Communication Technologies including social media is connected with people's everyday life. This hyper media particularly in educational community helps different forms to communicate in various ways such as social networks like *Facebook*, *Whatsapp, Instagram, Twitter*, *Wikipedia, Snapchat*. Such applications like *Facebook, Twitter, YouTube, and WhatsApp* have massively increased social interaction. Behind the reason the human's longing were discovered and unlimited connection and exchange of information with the same interests. Social media applications permit to use across the world to connect and express themselves in global level.

1.1 ROLE OF LANGUAGE

During last two centuries between eighteenth and twentieth century, English language has spread rapidly at global level. The Internet has introduced as a new medium of communication in mid of twentieth century and made available to the society some language researchers assumed that English language has developed new and standard of varieties in English spelling, pronunciation, vocabularies, and grammar under the influence of the Internet. These changes were considered as a new branch of linguistics called *Internet Linguistics (*David Crystal (2001, 2005, and 2011)

1.2 ENGLISH AS A GLOBAL LANGUAGE

In the twentieth century English as a National language and it is becoming the Global language. In globally, the communication between academics, professionals, commercial and diplomatic made possibly as English. Also the introduction of Macaulay's British educational system English became an academic language in India which creates international relations to

remain competitive global job market in science, and technology. The IT industries have adopted English as its mother-tongue, and this position gives English became common language in the Internet and Social media as a powerful and inexpensive way of market business.

1.3 INTERNET LINGUISTICS

The common features of Late Modern English in recent linguistic phenomena that concurred with the development of the Internet. Today Internet Linguistics is widely discusses in research papers. Due to the development of Digital technology, the Digital world (internet, websites and social media) have influenced by attacking the language and made changes very effectively.

1.3.1 TEXTESE (TEXT)

The changes in languages came from the texting pattern to frame all these changes. That result affected the communication in a new changes or genre of English that has been increasingly used in day-to-day. Crystal (2008) used the term ‘textese’ in his research article "Digital Small Talk and the new textese" Textese is the most recent distinguishable linguistic phenomenon. It is commonly typed faster and less carefully than other forms of writing.

1.3.2 LANGUAGE USE IN SOCIAL MEDIA COMMUNICATION

The social media has a significant influence on the communication. The social media platforms on our language has accomplished to modify new vocabulary, increase the number of communication with immediately create a social relationship and leave us feeling an established accountability to remain connected with the world at huge.

1.3.3 NEW VOCABULARY

Social media alters the usage of languages and it introduces new practice, with the need for rapid and brief language communications in online. The full verb phrases have become common acronyms and Phrases such as “How are you?” or “Happy Birthday” are quickly changed to “HW U?” or “HBD” that are now used in everyday settings and not just online. Sometimes when we use language and words together, can make some funny phrases like “LOL” it means “laugh out loud”. These acronyms steal up the everyday life of the people.

1.5 NEW STYLE TEXTING

1.5.1 ACRONYMS

The acronyms used an abbreviation form and the initial letters pronounced as a word, now everyday replacements came to whole sentences like **LOL** (laugh out loud), **OMG** (Oh my God), **TTYL** (talk to you later) are just a few that establish how social media change the things up by decreasing the need to write lengthier phrases and lessens space.

1.5.2 IMOJIES AND STICKERS

The Emojis are used for representing visual communication. The facial expressions such as smiley, sad, laugh; cry, happy and love all emotions were convey the users better expressions on the content than the texting and the Stickers. Some stickers have text on them, so this is get two in one benefits and used to carry the user's feeling or to express the proposal tone without actually having to write it.

1.5.3 IMAGE TYPE: GIF (Graphics Interchange Format)

The GIF (Graphics interchange Format) most commonly refers to a short, animated picture without sound and simply your team of communication in online texting. GIF contains within the single file a set of images that are presented in a specified order (https://whatis.techtarget.com).

1.6 Evolution Of English In The Internet Age

In the second half of the twentieth century, English was cultured on a great rule to non-native English speakers under different tags, such a English as a foreign language (EFL), English as a second language (ESL), and recently English as a lingua franca (ELF) (Thornbury, 2006). The Greater variations and new language diversities arisen progressively distance themselves from either American or British English.

REVIEW OF LITERATURE

2.1. Social media overview and usage

Impact of social media in English language learning: Utilizing SWOT Analysis (Lino S. Cabrera, 2018) The study focuses on social media uses about Source of information, language text and Vocabulary, Acquaintance to communication, connection and interaction, Weaknesses and prevalent information, simple language and ungrammatical language text, Absence of real language interaction, typing skills and amount of knowledge in contemporary social media be used by the education.

2.2. Social media impacts on modern English Language

People look as to always be in a flash to permit messages through sometimes without the apprehensions of using proper English. Basically, a language change is no exclusion to the language used on social media. One of the most important effects of social media on spoken and written English is the assumption of terminology (Dalzell & Victor 2017). Hoffmann and Bublitz (2017) clarify this state by filling out that social media communication is disturbed with being pragmatic and that the maximum significances are accessibility and common clarity.

2.2 Positive impacts

Conferring to Asad et al (2012) students' academic learning results might growth when their social learning consequences were sharp. Students are though, powerful to use social media for academic purpose and this grants an opportunity to involve them to learn in a relaxed way by seeking, exploring and testing ideas with other students surrounded by their own social network.(Gremu & Halse, 2012). Teenagers and young adults have particularly involved these sites as a way to associate with their nobles, share information, reinvent their behaviours, and shows their social lives(Boyd 2007).

2.3 Negative Impacts

Bunce (2010) chat room communication was a smaller amount effective for language learning than face-to-face oral communication as "slow typing can significantly hamper language production, intercession, group effort, and hence observing". "An important individual of online chat rooms is that they are fundamentally graphic. Chat conversations display structures of both written and spoken language" (Freiermuth, 2002).

2.4 Effects of *Facebook* use on students' English language skills

Facebook offers the interaction chances to its users, it is the example of the social-interactions method to language attainment encouraged by Lantolf (2000). *Facebook* can offer language beginners with new forecasts of real time cultural and linguistic exchange (Harrison& Thomas, 2009). Also, from an environmental perspective, which opinions context as essential to language teaching (van Lier, 2004), According to Gibson (1979), suggest the use of affordances, clear as objects, places, events or things, by students, with his teachers' help to exploit language learning.

2.5 Writing Speaking Skills in Social Media

Anika Belal (2017) Social networking sites have a fundamental role in establishment a connection between the people, which permit them to interconnect on a common medium. Digital networking sites can be an unlimited way to stay in trace with a huge people. Communication is quickly changing; the educators and the students connect through social networking sites.

RESEARCH METHODOLOGY

3.1 RESEARCH DESIGN

The present descriptive study analyse the respondents (University department students) characteristics and behaviours how when why occurred. According to Caeple research design was used to collect the data from the respondents.

3.2 OBJECTIVES

1. To identify the role of social media in English language development at university.
2. To analyse the opinions of university teachers on the subject of social media in vocabulary development of English language.
3. To analyse the communication text methods among Students.
4. To make implementable proposals for incorporating social media in vocabulary development of English language at university level.

3.3 SURVEY

A survey was conducted among Periyar University students of postgraduate, undergraduate, M. Phil and PhD students. Using a structured questionnaire was used for total sample of 130, age group between 18 and 30.

3.4 HYPOTHESIS

H1: Social media is a platform for learning more Stuff.

H2: The Morden English language affects the Brand of Standard English.

H3: Students interested to learn Short term texts and Stickers rather than large Sentence.

H4: The development English Language improving day by day in Different ways.

3.5 THEORETICAL FRAMEWORK

Albet Bandura defines Social Learning Theory (1977). The study focuses on the theory revealed that individuals learn and replicate their behaviours. In social learning system obtain different pattern of behaviour through straight involvement or by detecting others behaviour. According to Bandura people can signify external impacts representatively and such representation to lead their movements. During the time of learning people not only perform or response, they also perceive the different impacts associated their various actions on the root of informative comment and they progress thought or suggestion about the kind of actions which most likely to be successful.

3.6 LIMITATION OF RESEARCH:

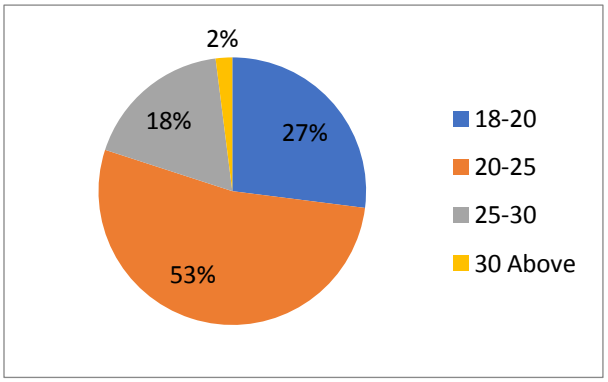
The present research was conducted among the students studying various departments in Periyar University who uses free wi-fi internet connections offered by the University management.

DATA ANALYSIS

A survey was conducted among the Post Graduate, Under Graduate, M. Phil and PhD Students of the Periyar University in Salem. Students under the age group of 18 to 30 were significantly identified as using Social Media for their academic purposes. Thus these students were chosen for the study.

Fig.1 Social Media Users

Up to One hours	Up to Three hours	Up to Five hours	Up to Eight hours	Up to 12 hours
13%	22%	14%	38%	13%

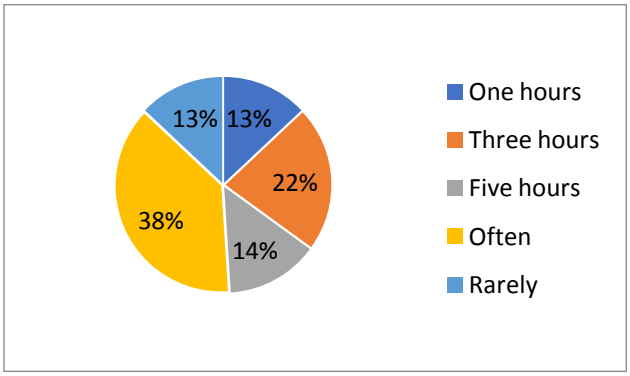


Social Media Users

Age group 20-25 have 53% of them using Social media regularly. Followed by 18-20 have 27% and 25-30 have 18% and age group of Above 30 have 2%of them using Social media very rarely.

Fig.2 Time spent with Social Media (Per Day)

18-20	20-25	25-30	30 Above
27%	53%	18%	2%

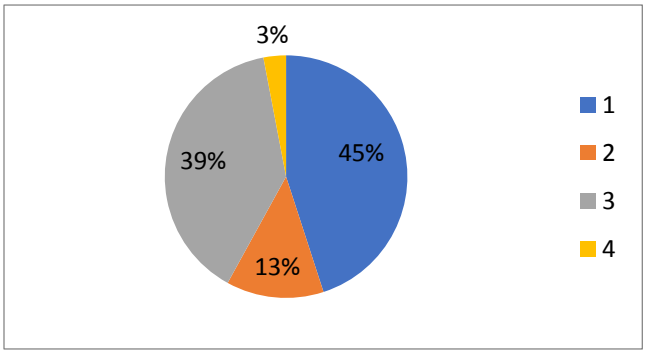


Spending time in Social Media (Per Day)

38% of the student spends most of the time with social media. 22% of them use three hours and14% of them using Five hours, finally 13% of them using social media very rarely.

Fig.3 Use English Language in Social Media

Only Chats	Only Post	Chats &Post	Do not use
45%	13%	39%	3%



Use English Language in Social Media

The Finding Shows 49% Students using English language only chat conversation, 13% of Student use only for posting Something, 39% students use english language for both chat and post, 3% student do not use english language in social media.

Fig.4 The Questions divided into five sections based on English language development in Social Media.

1. New Vocabulary
2. Following Grammar
3. Listening and Speaking
4. Reading and Writing
5. Language learning

Table. 1

VOCABULARY	Yes	No	Sometimes
Interested to learn new vocabulary	78%	16%	6%
Forced to use and Share	12%	80%	8%
Improve my vocabulary	58%	12%	30%
Use Abbreviation	86%	10%	4%
Update internet Slang	68%	20%	12%
Emojis and Stickers	88%	2%	10%
Use vocabulary to others	63%	25%	12%

Table. 2

GRAMMAR	Yes	No	Sometimes
Improve my Grammar	48%	36%	16%
Using Grammar rules	56%	19%	25%
Check Sentence structure	45%	38%	17%
Learn Worst grammar	35%	42%	23%

Table. 3

READING &WRITING	Yes	No	Sometimes
Understand authentic text	32%	48%	20%
Randomly text	76%	16%	8%
Avoid long Sentence	53%	38%	9%
Use Short Form	62%	22%	18%
Use American & British English	28%	60%	12%

Table.4

LISTENING & SPEAKING	Yes	No	Sometimes
Improve Listen & Speak	32%	48%	20%
Improve Pronunciation	22%	62%	16%
To improve Speaking skills	12%	68%	20%
Faced insults	43%	27%	30%

Table.5

LANGUAGE LEARNING	Yes	No	Sometimes
New words learn from different people	68%	20%	12%
Avoid Spelling mistakes	68%	16%	16%
Good platform	82%	-	18%
Not boring	64%	21%	15%
Improved Language Skills	47%	32%	21%

FINDINGS AND CONCLUSION

1. New Vocabulary, most of the students interested to learn new words from new people through chats in social media. This is a good chance to develop new words and learn internet Slangs.

2. Following Grammar Rule, Number of Students followed Grammar rules while texting to others. This is the chance to improve grammar and some students do not follow the grammar rules for their texts.

3. Listening and Speaking is the most important thing in language learning, the way of words pronunciation and use British English and American English and improved Speaking skills through the Social media and some people felt get insulted by others because of poor English.

4. Reading and Writing in Social media is best opportunity to share their thoughts to others, and tend to read and understand authentic text. Some students felts Random texts like English mixed with other language (e.g,Tanglish) and use Emojis and Stickers. Which is make the Conversation more Interest and fun.

5. Language learning, In the Academic Structure language learning is difficult and bored one but taking social media is a good opportunity to language learning. It is the chances to interact with known person through chats and know about their colloquial slang and social media trending words. But some students thought is social media is not a good platform for language learning. The modern English affects the stranded and structured English.

CONCLUSION

A supremacy that can also control the linguistic developments between its users. Additionally, deceptively, these trends, at minimum in terms of language, seem like developing and propagation of English. The language that helps as a construction between people of unlike origins when they effort to start meaningful communications among the digital world. Social media have many features that make it so tempting to indusial, that ability to find amuse, collect information and even search for education are what permits social media to be so projecting in contemporary times.

In general use of English are changeable and the development of the language itself and its prevalent effect may apply on other languages. The worldwide use of English indicates the arrival of new words, slang and abbreviation usage. But the apprehension is more about the rate that dialect, advance words and acronyms are presenting to the language. This introduction amount has increased significantly because of the comfort that statistics is able spread over the social media. And as a outcome, developments and language chances tend to be obtain stronger positions in language wilder. However, it is undisputable that the use social media in our globalized world will establish another fascinating period in the use of language.

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important parameters is sufficient amount of water is distributed for crop growth with periodic. Smart systems were developed for plant growth improvement and scheduling system but the sufficient amount of water is that the major challenges. Water is employed for irrigation system for agriculture in various levels of plant growth the effective cultivation to regulate over what proportion water system. The proposed system concentrate on decision-making system of water system and avoid water losses. In this paper, presents the work on effective irrigation system has been developed by soft computing technique. The quantity of water is estimated by fuzzy logic control using Matlab and it's integrated with hardware using Matlab Arduino support system.

PP-26

Popularity of information and communication technologies (ICT) tools in disseminating technology among banana farmers in Tamil Nadu

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Media communication is playing a very prominent role for creating awareness on scientific information and technology to farming community. Majority of the banana farmers are exposed to the electronic media such as television, radio and print media such newspapers and magazines for acquiring agricultural information. Among the mass media, print and electronic media are found to be the most suitable for farming community as well as development of agricultural technologies. The present study was carried out to assess the satisfaction level of media communication in dissemination of cultivation technology among the banana farmers in five selected blocks, namely Thottiyam, Lalgudi, Andanallur, Mannachanallur and Tiruverambur in Tiruchirappalli district of Tamil Nadu. Quantitative survey method was used for selecting samples and 750 questionnaires were administered. The majority of the respondents were satisfied with the information on banana cultivation disseminated through media such as television (96.6%), newspapers (96%), telephone / mobile phones (90.7%), radio (88.5%), new media (88%), magazines (85%) and other media (*i.e* exhibition/ extension/ technical folders/ handout/ notice *etc.* to provide technological information on agriculture with special reference to banana cultivation) (84%). It is concluded that respondent's maximum usage is television medium than the other media. Among the 13 technologies of ICAR-NRCB disseminated by mass media for providing information on banana cultivation through ICT, the majority of the respondents were highly satisfied with application of biocontrol agents (plant protection system), followed by the soil testing (soil management), sucker selection (selection of planting materials) and "Banana Shakti"- a micronutrient mixture (nutrient management).

PP-40

Constraints of banana growers in accessing farm information in Tiruchirappalli district

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The growth of ICT in developing countries like India offers new technologies where new opportunities for accessing information are rated as poor. Without a strong willingness for technology transfer at knowledge production and receiver ends, it is impossible to assimilate, adopt, and generate new technology. This study was carried out to assess the satisfaction level of media communication in dissemination of cultivation technology among the banana farmers in five selected blocks, namely Thottiayam, Lalgudi, Andanallur, Mannachanallur and Tiruverambur in Tiruchirappalli district of Tamil Nadu. Quantitative Survey method was used for selecting samples and 750 questionnaires were distributed (@150 / each block). The study also attempted to identify the media communication barriers between media and target audience. It was found that barriers existed in communicating agricultural programmes and banana related messages from the media and the majority of respondents felt a lack of effective and objective message delivery as a top barrier. Other top-listed barriers to effective communication by the media included a lack of programmer's understanding and education among the media, lack of time and money for agents to address the issues, and lack of access to up-to-date media contacts for technology transfer from both the recipients and the donor. The major constraints are associated with the defects in extension organization, insufficient incentives to extension professionals, inadequate funds and resources, and absence of in-service training facilities.

PP-41

Innovative techniques adopted in banana fruit production

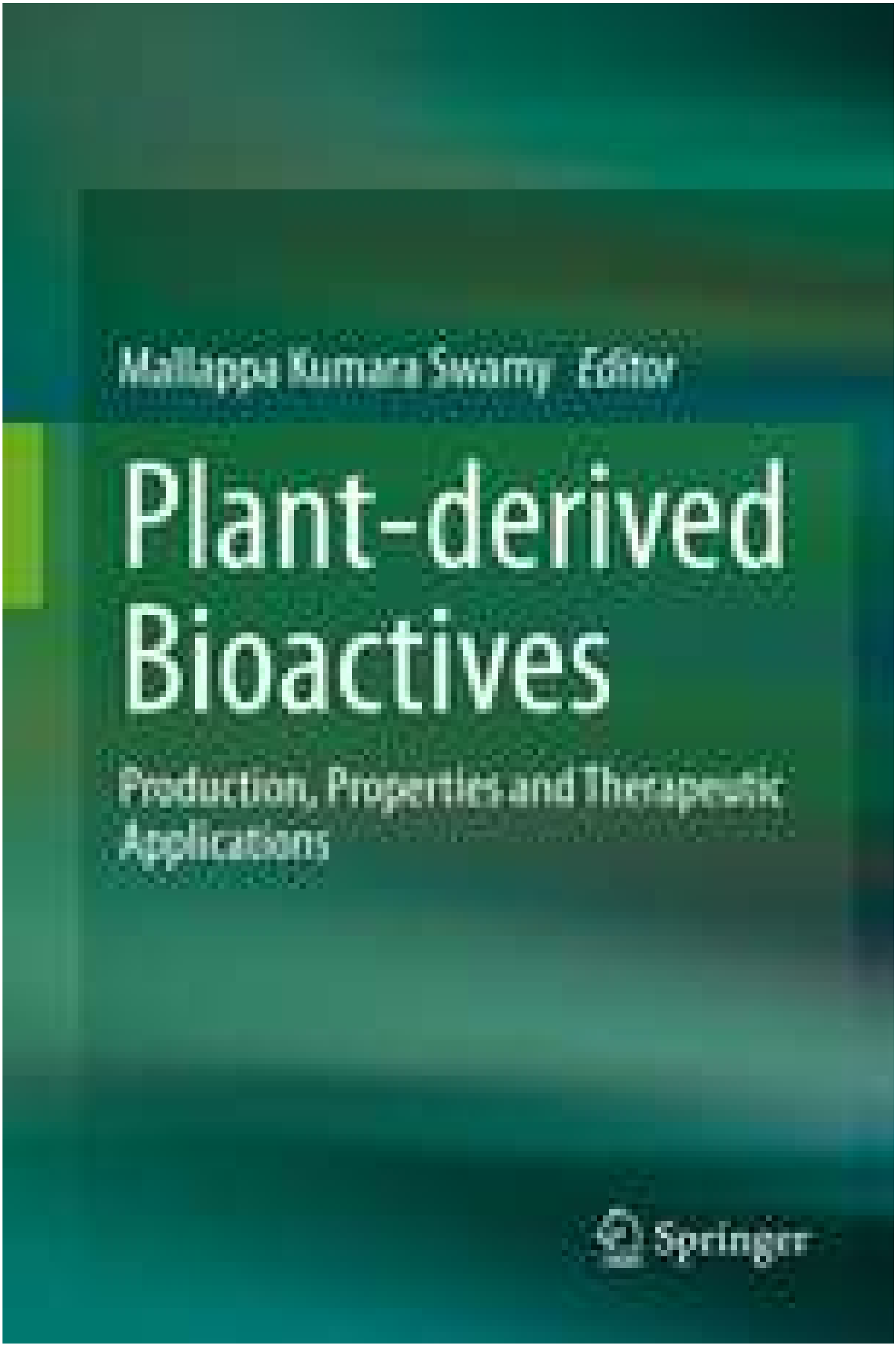
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Banana (*Musa* spp.) is the most important tropical fruit crop in the world as well as in India. It is one of the earliest fruit crops grown by mankind at the dawn of civilization which has great socio-economic significance interwoven with the cultural heritage of India. Banana crop has nutritional, medicinal and industrial values and it has been linked with man as food and has religious purposes. It is also a valuable earner of export income. As it acquires a prominent position in national and global markets, it is necessary to innovate and implement new scientific techniques in its production process. As a result, many new techniques, viz. seed priming, micropropagation, macro propagation, high density planting, micro irrigation, fertigation, bio-fertilizer, matt management, mulching, bunch spray and bunch feeding, bunch covering, bell injection, cone feeding, retaining finger in the last hand, improvement at molecular level and mutation breeding have been developed. Many of these have shown positive effect on increasing the yield and quality of the banana fruits.

There are many research institutions working on developing new and effective techniques in banana production.


Mallappa Kumara Swamy Editor
Plant-derived Bioactives
Production, Properties and Therapeutic Applications
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Orientin: A C-Glycosyl Flavonoid that Mitigates Colorectal Cancer

1

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Abstract

Colorectal cancer (CRC) is one of the most frequent malignancies, causing human deaths in large numbers around the world. It can be prevented by using chemotherapeutic drugs; however, the available drugs have shown systemic toxicity and drug resistance, which makes the treatment a challenging issue. The use of flavonoid-rich sources may effectively reduce the risk of colorectal cancer. Orientin, a C-glycosyl flavonoid exists in diverse medicinal flora, such as *Aspalathus linearis*, *Ocimum tenuiflorum*, *Passiflora*, and *Phyllostachys* species, and it has been shown to have beneficiary effects in treating cancers, cardiovascular diseases, and neurodegenerative disorders. Recent preclinical validation studies on orientin have evidently shown its anti-carcinogenic effect against human colorectal adenocarcinoma cells and carcinogen-induced CRC albino Wistar rat models. Orientin reinstates the antioxidants to put forth their scavenging mechanism and limits the activation of phase 1 enzymes. Orientin induces mitochondrial intrinsic apoptosis in CRC cells, and thereby actively interrupt cell proliferation and inflammatory signaling pathways without disturbing the normal tissue. Research reports have reported the attenuating effects of orientin on aberrant crypt foci progression in cancer-bearing animal, and it results in a significant suppression of pre-neoplasia to malignant neoplasia transformation. Orientin also suppresses NF-κB and the associated inflammatory cytokines, and thereby ameliorates inducible nitric oxide synthase and cyclooxygenase-2 expression in 1,2-dimethylhydrazine rat models. Thus, this chapter emphasizes the therapeutic effects of flavonoids with a special focus on orientin against CRC. Also, it summarizes our understandings about the molecular mechanisms behind orientin-mediated cancer prevention.

Keywords

Colorectal cancer · Orientin · Chemoprevention · Apoptosis · Cell proliferation

1.1 Introduction

Chemoprevention involves the inhibition or delay in the development of neoplasia by interrupting the instigation of neoplasia as well as transformation before malignancy. Colorectal cancer is probably a preventable cancer. The chemoprevention of colorectal cancer (CRC) has been the spotlight of research for three decades, which intends to thwart or delay the commencement of cancer through the deterioration or anticipation of colonic adenomas (Ricciardiello et al. 2016). Chemotherapy is highly recommended for colorectal cancer patients as palliative and adjuvant chemotherapy. It also depends on the tumor staging of CRC. Adjuvant chemotherapy is optional for patients under the stage III and in some cases for stage II patients with a chance of recurrence after the surgery. Palliative chemotherapy is optional for the stage IV patients, when the cancerous cells spread from the colon to other organs and tissues that are even far apart. 5-Fluorouracil, irinotecan, capecitabine, oxaliplatin, tipiracil, and trifluridine are some of the common chemotherapeutic agents that are used against CRC (Idrees and Tejani 2019; Akhtar and Swamy 2018).

A huge number of chemopreventive agents demonstrated promising results in preclinical models; however clinical trials have succumbed to contradictory outcomes. The detrimental effects of some of the clinically proven antitumor compounds boost up death cases and accentuate a vital need for novel and nontoxic chemopreventive agents (Youns and Hegazy 2017; Bhatia and Nair 2018; Roy et al. 2018). Many known natural compounds are notorious to exert significant inhibitory action against aberrant signaling pathways involved in carcinogenesis. Furthermore, the natural compounds can be obtainable readily. They are cost-effective and harmless with both protective and health-giving potential against cancers (Arivalagan et al. 2015; Bhatia and Nair 2018). The compounds of natural origin, such as dietary agents, have been of immense interest due to the development of novel and innovative therapeutic agents for cancer (Karthi et al. 2016; Tuorkey 2016; Roy et al. 2018). In this regard, medicinal plants have an immense potential of providing natural agents, i.e., secondary metabolites that are effective in treating several types of cancers. Among plant-derived metabolites, flavonoids are found to have several medicinal importance (Chang et al. 2018; Anwar et al. 2019; Jain et al. 2019). Flavonoids like umbelliferone, luteolin, orientin, and eriodictyol have been shown to have considerable antiproliferative activities against cancerous cells. Reports have shown the attenuating effects of orientin on aberrant crypt foci (ACF) progression in cancer-bearing animal, and it results in a significant suppression of preneoplasia to malignant neoplasia transformation (Muthu et al. 2016; Mariyappan et al. 2017; Thangaraj et al. 2018). Orientin has also been shown to suppress NF-κB (nuclear factor kappa-light-chain-enhancer of activated B cells) and the associated inflammatory cytokines and thereby ameliorates inducible nitric oxide synthase and cyclooxygenase-2 expression in 1,2-dimethylhydrazine rat models (Hamiza et al. 2012a, b; Thangaraj et al. 2018). Thus, this chapter emphasizes the therapeutic effects of flavonoids with a special focus on orientin against CRC. Also, it summarizes our understandings about the molecular mechanisms behind orientin-mediated cancer prevention.

1.2 Flavonoid's Role in Cancer Prevention

Flavonoids possess the potential of regulating multiple carcinogenic processes, such as apoptosis, angiogenesis, tumor differentiation, and cell proliferation. The flavonoid-induced alterations in kinase activity have a strong relationship with apoptosis, tumor cell proliferation, and invasion. Some of the dietary flavonoids have displayed in vivo antitumor activity and repress inflammation, proliferation, vascularization, and metastasis (Kumar and Pandey 2013; Panche et al. 2016; Tungmunnithum et al. 2018). Epidemiological studies on colon cancer proposed that some flavonoids that prevent colon cancer may enhance therapeutic efficiency by regulating colon tumor cell proliferation and survival signaling pathways (Zamora-Ros et al. 2015; Thangaraj et al. 2018). Flavonoids block several steps in carcinogenesis, namely tumor cell transformation, invasion, and metastasis (Chahar et al. 2011). A positive correlation exists between a flavonoid-rich diet and lowers the risks of colon cancer. Several flavonoids, such as umbelliferone, luteolin, and eriodictyol have been shown to exhibit superior inhibitory activities against colorectal cancer cells (Manju and Nalini 2010; Muthu et al. 2016; Mariyappan et al. 2017). Naturally available flavonoids most commonly exist as O- or C-glycosides. C-Glycosylflavones are the major class of flavonoids, which imparts the dark-yellow color to flowers of Leguminosae family members. C-Glycosides are well known for their diverse pharmacological potentials, including antioxidant, antiinflammatory, antimicrobial, and antitumor activities.

1.3 About Orientin

1.3.1 Chemistry

The IUPAC name of orientin is 2-(3,4-dihydroxyphenyl)-5,7-dihydroxy-8-[(2S,3R,4R,5S,6R)-3,4,5-trihydroxy-6-(hydroxymethyl)oxan-2-yl]chromen-4-one. Orientin is a water-soluble C-glycosyl flavonoid with the molecular formula $C_{21}H_{20}O_{11}$, and its molecular weight is 448.38 g/mol. In general, C-glycosyl flavonoids possess C_6–C_3–C_6 flavone skeleton, in which two aromatic rings are attached by three carbons cyclized with oxygen, having one to several glucoside units. Orientin has a 15-carbon skeleton, consisting of two phenyl rings (A and B); in specific O-phenolic hydroxyl group at 3′ of B ring and a heterocyclic ring exemption of a C-glycosides linked to glucose of the A ring (An et al. 2015). It comprises phenol groups alongside one ketone group and two ether groups. It is the 8-C glucoside of luteolin, substituted by a β-D-glucopyranosyl moiety at position 8.

1.3.2 Natural Occurrence

Several medicinal plants are the source of orientin. Some of the most widely explored medicinal plants for orientin include *Ocimum sanctum* (holy basil) (Devi

et al. 2004), *Aspalathus linearis* (rooibos tea) (Koeppen et al. 1962), *Phyllostachys nigra* (bamboo leaves), *Passiflora edulis* (passion flowers, juice and peel of passion fruit), *Trollius chinensis* Bunge (Golden Queen), *Linum usitatissimum* (flax) (Dubois and Mabry 1971), *Jatropha gossypifolia* (bellyache bush), *Commelina communis* (dayflower) (Shibano et al. 2008), *Euterpe oleracea* Mart. (acai palm) (Gallori et al. 2004), *Ascarina lucida* (Soltis and Bohm 1982), *Roscoea capitata*, *Celtis africana* (white stinkwood) (Perveen et al. 2011), *Croton zambesicus* (lavender croton) leaves (Wagner et al. 1970), *Cajanus cajan* (pigeon pea) leaves (Pal et al. 2011), *Thlaspi arvense* (field penny-cress) (Pang et al. 2013), *Fagopyrum esculentum* (buckwheat) (Krahl et al. 2008), *Trigonella foenum-graecum* L. (fenugreek) oils (He et al. 2014), *Clinacanthus nutans* (Sabah snake grass) leaves (Chelyn et al. 2014), and *Polygonum orientale* L. (Li et al. 2017a).

1.3.3 Pharmacological Properties

Orientin has been testified to possess numerous medicinal properties, such as anti-aging, antiviral, antibacterial, antiinflammation, cardioprotective, antinociceptive, radioprotective, and neuroprotective effects. Orientin inhibits esophageal cancer (EC-109) cell development in a time-dependent and dose-dependent way. It has been found to downregulate the anti-apoptotic B-cell lymphoma 2 (Bcl-2) expression and induce early apoptosis in EC-109 cells. Orientin was found to have higher antitumorigenic effect, when compared to vitexin (an apigenin flavone glycoside). The researchers have doubted on the associated OH-groups at the 3′- and 4′-position of the B ring in orientin for the increased effect. Due to the presence of a single OH-group at the 4′-position of the B ring in vitexin, its was believed to be less effective (An et al. 2015). Orientin inhibited the multiplication of HeLa (cervical cancer) cells in a concentration-dependent way and stimulated apoptosis. It reduced anti-apoptotic Bcl-2 and enhanced pro-apoptotic Bax (bcl-2-like protein 4) protein levels in HeLa cells. Also, it instigated the proteolytic stimulation of protease enzymes, i.e., caspases (Guo et al. 2014). Orientin induces apoptosis and inhibited the proliferation of breast cancer (MCF-7) cells in a time- and dose-dependent way (Czemplik et al. 2016). However, so far, none of the information validates the influence of orientin against CRC. Further, the precise molecular mechanisms of action of cell inhibitory activities induced by orientin still remain unclear.

1.4 Experimental Colorectal Carcinogenesis

1.4.1 HT29 (Human Colorectal Adenocarcinoma) Cell Line

HT29 is a human colon adenocarcinoma with epithelial morphology. This cell line was firstly obtained from a Caucasian woman (aged 44 years) suffering from a cancer of the colon (Fogh and Trempe 1975). HT29 cells contain unique features, such as microvilli, microfilaments, lipid droplets, smooth and rough endoplasmic

reticulum with free ribosomes, large vacuolated mitochondria with dark granules, and few primary and many secondary lysosomes (Martínez-Maqueda et al. 2015). These cells consume high levels of glucose, and hence in vitro growth of these cells needs a medium containing elevated levels of glucose. They propagate as a multilayer of nonpolarized cells under standard conditions. After the treatment with inducers, these cells can be modulated to express various paths of absorptive cell differentiation, such as cell flattening, apical surfaces with brush border development, and formation of tight junctions among the adjoining cells. These intestinal cells are pluripotent and widely used to study cell differentiation mechanisms (Martínez-Maqueda et al. 2015). The p53 (a cellular tumor protein) antigen is overproduced in these cells. HT29 secretes pro-inflammatory cytokines, namely, tumor necrosis factor-α (TNF α) and interleukins (IL-1β and IL-6); chemokines (e.g., interferon-γ and IL-8); transforming growth factors (TGF-α and TGF-β); pro-angiogenic factors like vascular endothelial growth factor (VEGF) and IL-15; and immune-modulatory cytokines, such as granulocyte-macrophage colony-stimulating factor (GM-CSF), granulocyte colony-stimulating factor (GCSF), and IL-3 (Desai et al. 2013).

Orientin expressively inhibits the cell survival of HT29 in a concentration-dependent way. Further, microscopic interpretations suggested the cell shrinking from its polyhedral origin, membrane blebbing, round off, and cells in detached forms (Karthi et al. 2016). The oxidative stress-induced intracellular ROS (reactive oxygen species) generation in tumor cells serves to be one of the possible therapeutic strategies for combating CRC. Excessive generation of ROS may severely damage the genome and proteins, resulting to promote apoptosis (Han et al. 2013). Orientin triggers dose-dependent intracellular ROS generation extensively.

1.4.2 Chemically Induced Animal Models

Chemical carcinogens are extensively used to induce colonic epithelial lesions similar to human CRC. They include aromatic amines, 1,2-dimethylhydrazine (DMH), heterocyclic amines, azoxymethane (AOM), and alkylnitrosamide compounds. These carcinogens can be readily verified for their therapeutic effects in model animals of diverse genetic conditions, and the human CRC pathogenesis can be initiated successfully (De Robertis et al. 2011). The anticancer efficacy of chemopreventive agents is generally tested against carcinogen-induced preclinical models. The rodents (rat/mouse) are commonly established animal models of colon carcinogenesis. This is because their physiology is similar to humans. Also the cancer formation is rapid and reproducible and there is a possibility of studying adenoma-carcinoma sequences (Muthu et al. 2016).

1.4.2.1 DMH-Induced Experimental Colon Carcinogenesis

The procarcinogen 1,2-dimethylhydrazine dihydrochloride (DMH) was extensively used to stimulate colon tumors in rodents. It mimics human colon carcinoma in epithelial origin, morphology, anatomy, histology and tumor characteristics, thereby

acting as an ultimate experimental model for chemoprevention studies (Manju and Nalini 2005; Nirmala and Ramanathan 2011; Muthu and Vaiyapuri 2013). DMH induced the transformation of pre-neoplastic aberrant crypt foci into adenomas and adenocarcinomas. DMH and its inter-metabolites (AOM and MAM) are a set of man-made composites with the general structure of cycasin (Liu et al. 2015). DMH uptake is threefold higher in the colorectal cells in contrast to the enterocytes. The cancer-causing effect of DMH occurs with a single dosage of injection or by giving a series of injections after every week. DMH injected at a dose between 10 and 20 mg/kg body weight (BW) produces adenomas and adenocarcinomas of the colon in rodents. After the administration, the malignant lesion is formed from the non-dysplastic mucosa, and later it completely develops within 4 to 30 weeks. About 80% of the treated mice can develop adenocarcinomas even when a lesser dose of drugs are administered (Machado et al. 2016). Injecting a small dosage (10 mg/kg) of dimethylhydrazine will lead to colorectal cancer development in rats with a latency duration of 1–2 years (Banerjee and Quirke 1998). The preneoplastic lesions namely the aberrant crypt foci (ACF) are the earliest marker of future neoplastic development that appears after exposing DMH for 14 days (Kilari et al. 2016).

1.4.2.2 Metabolism of DMH

DMH undergoes dehydrogenation in the liver and is metabolically activated to azoxymethane (AOM) and methylazoxymethanol (MAM) (Manju and Nalini 2010). Generally, DMH do not act as carcinogenic agent. However, it is metabolically activated (including N-oxidation and hydroxylation) into DNA reactive metabolites and exhibits its tumorigenic potential (Qi et al. 2015). The highly unstable MAM with a half-life of 12 h is metabolized further to form an active electrophilic methyldiazonium glucuronide by NAD + -dependent dehydrogenase. The methyldiazonium ion which has the capability to alkylate macromolecules excretes via bile and blood to reach the colonic lumen.

Cytochrome P450 enzymes are involved in the bioactivation of procarcinogens as they interfere with the polar functional groups via hydrolysis and redox mechanisms. The phase 2 enzymes, such as glutathione S-transferase (GST), N-acetyltransferase (NAT), DT-diaphorase (DTD), UDP-glucuronosyltransferase (UGT), and sulfotransferase (SULT), detoxify upon conjugation (Beyerle et al. 2015). Cytochrome P450-dependent monooxygenases (phase 1 enzymes) carry out a reaction to introduce –OH groups to produce methyldiazonium ions, which are highly reactive in nature, and this in turn alkylates DNA bases. The strong nucleophilic methyldiazonium ions interact with nucleotide bases to yield adducts. Both N^7-methylguanine and O^6-methylguanine induce the genetic mutations and tumor formation (Megaraj et al. 2014). O^6-Methylguanine induces GC to AT transitions and k-ras protooncogene mutations in DMH-induced colorectal carcinogenesis. Phase 2 enzymes, such as GST and DTD, are known to detoxify the electrophilic intermediate compounds (Giftson et al. 2010).

1.5 Orientin Against Colon Cancer in Different Ways

1.5.1 Body Weight, Growth Rate, and Polyp's Incidence

Body weight and growth rate typically controls the carcinogenicity rate in carcinogen-induced investigational animals (Manju and Nalini 2005). Loss in body weight in addition to growth rate in DMH alone induced rats could be because of increased cancer burden, lack of appetite followed by the higher incidence of polyps driven cachexia and anorexia (Vinothkumar et al. 2014a). Orientin increases the body weight despite the transformation induced by DMH, owing to their capability to reinstate the metabolic deregulation. The plant metabolites have been proven to gain body weight by restraining the cancer-causing agent-induced tumorigenicity and diminishing the incidence of polyps (Selvam et al. 2009).

1.5.2 Lipid Peroxidation and Antioxidant Status

Antioxidant and lipid peroxidation levels are anticipated to be the notorious markers for ascertaining the peril of oxidative damage-induced tumorigenesis (Thangaraj et al. 2018; Muthu and Vaiyapuri 2013). The significant increase in circulatory thiobarbituric acid reaction substances (TBARS) by the high ROS production and membrane crumbling leads to the transformation of epithelial cells (Perše 2013). Tumors acquire favorable conditions and proliferate rapidly in DMH-exposed rats where the lipid peroxidation is decreased (Giftson et al. 2010; Ghadi et al. 2009; Vinothkumar et al. 2014b). The decreased TBARS in colon tissues might be because of the concomitant resistance and reduced vulnerability of tumor cells to the ROS scavenging action (Muthu and Vaiyapuri 2013). Antioxidants defend cells from the oxidative damages via free radical scavenging activities. The antioxidants, such as CAT and SOD, primarily scavenge the reactive oxygen species; GPx detoxifies H_2O_2 and by this means counteracts reactive oxygen species. GSH and the dependent enzymes closely associate with innate defense (Siddique et al. 2017). The increased consumption of tissue antioxidants during DMH metabolite detoxification in tumor cells leads to their decreased level in DMH-alone-exposed rats. Orientin restores the antioxidant levels to put forth their scavenging action. The free -OH groups present in orientin make it an efficient antioxidative agent against ROS prompted by DMH and thereby exhibit their inhibitory prospective against colorectal carcinogenesis.

1.5.3 Xenobiotic Metabolizing Enzymes

DMH upon dehydrogenation in the liver forms azoxymethane (AOM) and methylazoxymethanol (MAM) intermediates (Manju and Nalini 2010). Phase 1 and phase 2 enzymes introduce polar or reactive groups into xenobiotics or carcinogens. Phase 1 enzymes stimulate the procarcinogens by introducing polar active groups, while the phase 2 enzymes detoxify after conjugating with the carcinogens (Padmavathi

et al. 2006; Beyerle et al. 2015). Cytochrome P450 enzymes effectively convert lipophilic xenobiotics into more hydrophilic carcinogenic compounds (Sangeetha et al. 2012). The increased level of liver microsomal drug-metabolizing enzyme and intestinal epithelial cell phase 1 enzymes, i.e., CYP2E1, CYP450, and cytochrome b, exhibit DMH-induced carcinogenicity. The genotoxic intermediates produced by phase 1 enzymes covalently attach to form DNA adducts (Balaji et al. 2014). Similar to many flavonoids, orientin administration activates cytochrome P450 enzymes owing to the existence of –OH groups (Sangeetha et al. 2012). The phase 2 enzymes, comprising GST and DT-diaphorase, aid in the introduction of a polar or reactive group to xenobiotic compounds. DT-diaphorase, a widely distributed flavoprotein in animal tissues, detoxifies the quinone and its derivatives to protect against neoplasia (Mohan et al. 2006). Glutathione-S-transferase (GST) interrupts initiation of carcinogenesis by detoxifying hydroquinones and neutralizing electrophilic intermediates (Balaji et al. 2014). The increased level of phase 2 enzymes aids protection against carcinogens. The decreased phase 2 enzyme levels in the hepatic and colonic regions might be because of utilizing more detoxifying enzymes for counteracting DMH-induced malignant tumor formation. Orientin increased the level of phase 2 enzymes and detoxifies the carcinogens. Orientin diminishes active DMH metabolite formation and excretes carcinogen from the colonic lumen.

1.5.4 ACF Formation

Aberrant crypt foci are surrogate precursor lesions of colon cancer distinguished from the usual crypts based on their size, shape, thickness, and the pattern of staining (Bird and Good 2000; Rodrigues et al. 2002). The aberrant crypt with high multiplication rate, i.e., >4 crypts/focus, and their number are the indication of colorectal cancer incidence (Aranganathan and Nalini 2009). The carcinogen-induced rats show higher incidences of ACF and cancer frequency (Baskar et al. 2011). The bioactive compounds inhibiting ACF would also promote the antitumorigenicity (Sengottuvelan et al. 2006; Muthu and Vaiyapuri 2013). ACF shows the initiation of colorectal cancer formation and their increased numbers and multiplicity of crypt suggest the advancement and progress of cancer. Orientin inhibits the ACF progression and suppresses the transformation to malignant neoplasia. The protective activity is ascribed to the antioxidative efficiency of orientin and the metabolic activation of xenobiotic enzymes. The capability of orientin to reinstate DMH-stimulated histological changes authenticates its anticancer and antiinflammatory potentials.

1.5.5 Tumor Marker Levels

An early identification and lessening of precancerous lesions can be made possible by the quantification of serum markers, which may curtail the incidences and death rate of CRC. The assessment of tumor marker levels in serum acts as the prominent

markers owing to their ease of handling and economical. The Serological cancer markers (CEA and CA 19–9) are synthesized and liberated into the interstitial fluid and then enters lymph to enter circulation (Narimatsu et al. 2010). Cells holding a higher metastatic potential express these intracellular adhesive proteins on their surface. CEA, the glycosylated immunoglobulin, is the most often characterized tumor-associated antigen and widely existing biomarker for CRC patients. CEA is found in high levels during the malignant and metastatic stages compared to benign conditions (Shitrit et al. 2005). CEA levels in the columnar epithelial cells and goblet cells vary with tumor staging (Flamen et al. 2001). The elevated levels of CEA found in DMH-stimulated experimental animals are most probably linked with tumor size, stage, multiplication, and tumor site. Orientin is reported to moderate CEA levels via reducing the rate of tumor development. CA 19–9 is one of more familiar cancer markers for diagnosing CRC. The increased level of this glycolipid is highly correlated with increased CRC mortality cases. The increased CA 19–9 levels is highly related to perineural and lymphatic invasions, leading to metastatic tumors (Fernandez-Fernandez et al. 1995). The decline in the levels of CA 19–9 after injecting orientin hypothesizes the antitumor action, similar to that of umbelliferone (Muthu and Vaiyapuri 2013). Moreover, orientin treatment for the whole period revealed a strong influence of its cancer preventive potential in DMH-prompted colorectal cancer-possessing experimental animals.

1.5.6 Mast Cell Infiltration

Infiltration of mast cells acts as the finest marker for beginning of inflammatory process. The innate cells of the immune system alter the progression of adenomas into carcinoma initiation by eliciting inflammatory reactions (Khan et al. 2013). Mast cell infiltration is apparently observed in the submucosal layer of DMH-treated animals, which aggravates constant inflammation in the tumor microenvironment. Orientin reduced mast cell infiltration to indicate that it has a potential antiinflammatory activity and also anti-angiogenic potential. The reported antiinflammatory effect of orientin was similar to carvacrol and umbelliferone (Muthu and Vaiyapuri 2013; Arivalagan et al. 2015).

1.5.7 Tumor Cell Proliferation

The reliability of intestinal mucosa is maintained by the crucial mechanism of cell proliferation. The deregulation of cancer cell multiplication recurrently effects in hypergenesis and oncogenesis (Lee and Yun 2010). The nucleolus-associated chromosomal regions (nucleolar organizer regions) are positioned on the acrocentric chromosomes short arm. NORs containing the acidic proteins are silver-stained (AgNORs), and they serve as the investigative or predictive marker of cell multiplication/proliferation (Gundog et al. 2015). In cancerous cells, the cell proliferation is positively linked to AgNORs/nucleus (Sengottuvelan et al. 2006). The total number

of AgNORs/nucleus determines cancer succession and the developmental phases. The black dots visualized are utilized as prognostic indicators for cell spread/propagation (Arivalagan et al. 2015). The aggregated numbers of AgNORs/nucleus in the colonic epithelium were found to be higher in DMH-treated experimental animals (Sengottuvelan et al. 2006; Muthu et al. 2016). Orientin decreases the number of AgNORs/nucleus owing to its role in preventing the proliferation of cancer cells. Umbelliferone was earlier reported to decrease the number of AgNORs/nucleus in enterocytes (Muthu et al. 2016; Mariyappan et al. 2017).

Proliferating cell nuclear antigen (PCNA), a non-histone nuclear acidic protein (of 36 KDa), is presumed as an intermediate biomarker of cell proliferation (Aranganathan and Nalini 2013). The expression of PCNA was high in the nuclei of multiplying cells in the growth (G1) phase and early synthetic (S) phase of cell cycle. PCNA monomers enclose the DNA strand like a ring and hold DNA polymerase δ (DNA Pol δ) to the template strand as a clamp to cause hyperproliferation (Mohania et al. 2014). Another proliferating antigen, Ki67 expresses only during G1, S, and G2 phases, but not in the G0 phase. The augmented nuclear expression of PCNA and Ki67 in DMH-induced rats indicates a high proliferation of colonic epithelial cells (Sekar et al. 2016). The suppression of cell proliferation represents one of the protecting actions against DMH-treated colon cancer. Orientin was shown to decrease the expressions of PCNA, Ki67, and their labeling indices. Orientin inhibits cell proliferation by its anti-apoptotic activities (Karthikkumar et al. 2015).

1.5.8 NF-κB and Inflammatory Cytokine Expression

Tumors develop and promote the inflammatory signals in and around the microenvironment. NF-κB activation allows translocation of NF-κB dimer to initiate the transcription of pro-inflammatory cytokines and the downstream target genes (Umesalma and Sudhandiran 2010). The degree of inflammations in DMH-treated animals was apparent by increased NF-κB expression. Orientin reduced the expression of NF-κB owing to its antiinflammatory potentials against DMH-treated inflammations. The inflammatory cytokines (IL-6 and TNF-α) are produced in the tumor microenvironment, which regulates proliferation and apoptosis. The increased TNF-α level during chronic inflammation upholds tumor propagation and metastatic behavior (Colussi et al. 2013). IL-6 is mostly formed by macrophages and monocytes, following the activation of NF-κB. IL-6 plays a huge role during the acute inflammation, tumor cell multiplication, and apoptotic mediated cell death (Dai et al. 2014). TNF-α and IL-6 inhibition serve one of the effective approaches in the treatment of CRC. The elevated production of cytokines during DMH-induced inflammatory response gets downregulated because of the inhibitory potential of orientin (Nash and Ward 2014).

1.5.9 Pro-Inflammatory Enzymes

Inducible nitric oxide synthase (iNOS), the pro-inflammatory mediator, synthesizes nitric oxide (NO), which arbitrates inflammation and persuades tumorigenesis. The carcinogen-induced tumor-bearing rats increased iNOS expression, thereby promoting the invasiveness and metastatic potential (Muthu et al. 2016). iNOS overexpression in colonic cells associates with CRC pathogenesis, where it restrains apoptosis via nitrosylation of caspases. NO impedes DNA repair mechanisms and leads to cytokine post-translational modifications which further influence the commencement and progression of CRC (Narayanan et al. 2003). Orientin distinctly improves the expression of iNOS in DMH-induced rats.

Cyclooxygenase enzymes (COX-2) catalyze prostaglandin synthesis from arachidonic acid, which gets induced at the inflammatory phase and overexpressed in colonic adenocarcinoma (Hamiza et al. 2012a, b). The inflammatory chemokines, cytokines, and tumor promoters induce COX-2 activation (Peng et al. 2013). COX-2 enzymes express higher in cancerous cells via the activation of NF-κB mediated inflammatory cytokine pathway. The increase in COX-2 expression in DMH induced rats was due to its anti-apoptotic effect on colon cancerous cells (Srimuangwong et al. 2012). Orientin distinctly decreased COX-2 expression and corroborates their inhibitory action against inflammation-linked colon tumorigenesis. Orientin suppress the overexpression of inflammatory cytokines due to DMH treatment, thereby validating their antiinflammatory and antiproliferative effects.

1.5.10 Cell Cycle Arrest

The cell cycle dysregulation and avoidance of apoptotic mediated cell death are the familiar events in CRC development (Wu et al. 2018). Arresting of cell cycle at a particular checkpoint and apoptotic induction are the most commonly used mechanisms in the chemoprotection of tumors (Song et al. 2017). The cell cycle checkpoints reinforce the differentiating cells from DNA damages and control the genomic integrity. Orientin stimulated cell cycle arrest at G0/G1 phase in a concentration-dependent way. The stimulated cyclin-dependent serine/threonine kinases and their regulatory cyclin subunits regulate cell cycle progression. These cyclin/CDK complexes act as a biomarker for tumor cell multiplication and targets for anticancer drug development (Peyressatre et al. 2015). Among the different cyclin/CDK complexes, cyclin D and cyclin E along with CDK2 and CDK4 control mitotic division and advance the cell cycle through G1 phase. Orientin noticeably reduced the expression of cyclin D1, cyclin E, and the cyclin-dependent kinases, CDK2 and CDK4. Pelargonidin also showed the reduced expression of CDKs and cyclins in colorectal cancer cell line, HT29 (Karthi et al. 2016). Orientin elevates $p21^{WAF1/CIP1}$, the chief inhibitor of cyclin D/CDK complex. $p21^{WAF1/CIP1}$ mediates G0/G1 phase arrest in HT29 cells (Kan et al. 2013). CDK4 activated phosphorylation of Rb trigger the disruption of tumor suppressors which further discharges E2F and

initiates G1 to S phase transition (Asghar et al. 2015). Orientin reduces the expression of pRb and thereby inhibits G1 to S phase transition.

1.5.11 Apoptosis

Apoptosis is a complex sequence, which regulates cell proliferation and protects cells from being malignant by getting rid of immortal or repaired cells. Multiple signals trigger the loss of mitochondrial membrane potential with the successive release of cytochrome C from cytosol in carcinogen-induced cancer cells (Lemieszek et al. 2016). Apoptosis is conceivably the powerful defense mechanism of many chemotherapeutic agents toward CRC. The evolutionarily conserved members of Bcl-2 protein family such as Bcl-2 and Bax regulate apoptosis. The pro-apoptotic Bax confines to mitochondria and triggered cytochrome C release leading to caspase-mediated cell death. The prosurvival Bcl-2 binds along with Bax to avert its oligomerization and thwarts mitochondrial membrane depolarization and thereby cytochrome C release (Ding et al. 2010; Tanwar et al. 2010). Orientin decreased the level of anti apoptotic Bcl-2 and Bcl-XL with the increased pro apoptotic Bax and Bid levels which obviously demonstrated the immense potential of Orientin in regulation of Bcl-2 family proteins and apoptotic induction in colon tumor cells. Orientin activates mitochondria-mediated apoptosis in DMH-induced CRC-bearing rats by the simultaneous increase of cytosolic cytochrome C with a decrease in Bcl-2/Bax ratio. Orientin increases caspase 3 and caspase 9 expression in tumor-bearing rats. Caspases are the aspartate-specific cysteine proteases that play a decisive role in apoptotic process. The binding of cytosolic cytochrome C with Apaf-1 activates caspase 9, the initiator caspase, and in turn activates the caspase 3, the downstream effector which leads to intrinsic apoptosis (Sengottuvelan et al. 2009). Orientin activates mitochondria-mediated intrinsic apoptosis in DMH-induced CRC-bearing rats.

Orientin induces Smac/DIABLO release in HT29 cells, along with cytochrome C, thereby neutralizing inhibitor of apoptosis proteins (IAPs) (Srinivasula et al. 2000; Endo et al. 2009; Abdel-Magid 2017). The cytochrome C associates with apoptotic protease-activating factors (Apaf-1) and procaspase 9 to form apoptosome and commence the activation of caspase cascade. The binding of Apaf-1 triggers a conformational change in procaspase 9 to caspase 9 (Omer et al. 2017). Orientin increases caspases (caspase 9 and caspase 3) and cleavage of poly(ADP-ribose) polymerases. Orientin induces apoptosis primarily in the intrinsic pathway (Jiang et al. 2017; Li et al. 2017b). Orientin decreased the expression of inhibitor of apoptosis protein family members, XIAP and Survivin, in HT29 cells due to the release of cytochrome C and the depolarization of mitochondrial membrane potential (Abdel-Magid 2017). Orientin increased expression of tumor suppressor p53 and induced overexpression of $p21^{WAF1/CIP1}$. The increased level of γ-H2AX in Orientin treated tumor cells serves as a hallmark of DNA damages which confirms the DNA damage induced in HT29 cells.

1.6 Conclusions

Colorectal cancer is one of the most diagnosed cancers, which can be protected or prevented with the chemotherapeutic agents; however, the available drugs have shown systemic toxicity and drug resistance which makes the treatment a challenging issue. A positive correlation exists between flavonoid-rich sources and lowers the risk of colorectal cancer. The above discussed contents explored the effect of dietary flavonoid, orientin, and validated its anti-carcinogenic effect in human colorectal adenocarcinoma HT29 cells and DMH-induced colorectal cancer-bearing Wistar rats. Orientin induces mitochondria-mediated intrinsic apoptosis in colorectal cancer cells and arrests tumor growth by interrupting cell proliferation and inflammatory signaling pathways. Orientin exerts a regulatory effect on major signaling pathways linked with colon cancer progression, namely PTEN/PI3/Akt and Wnt/β-catenin pathways. Overall, this chapter suggests that orientin can be a novel chemotherapeutic agent for controlling CRC.

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Plant Flavonoids Against Colorectal Cancer and Mechanisms of Action

2

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Abstract

Worldwide colorectal cancer (CRC) was considered to be a primary health disease that leads to high morbidity and mortality in both developed and developing countries, which can be controlled with novel chemopreventive agents. In the past few decades, chemoprevention of several cancers by the use of natural flavonoids has become an attractive strategy. Bioactive polyphenols with a low molecular weight in the dietary supplements determine the fate of a cell by interacting at the molecular and cellular level. In the past few decades, several preclinical/clinical studies perceptibly figured the chemopreventive and cytotoxic effect of bioactive flavonoids on cancers. Flavonoids have been frequently considered as enzyme inhibitors and ligands of receptors involved in the signal transduction. There has been increasing interest in unrevealing the beneficial and chemoprotective potential of flavonoids that had encouraged in novel drug discovery for CRC. An elaborated molecular mechanism of phytocompounds against cancer treatment overlies with direct interactions between various types of genes and enzymes. It is well known that anticancer efficacy would include apoptosis, antiproliferation, antioxidation, cell cycle arrest, and reversal of multidrug resistance mechanism. This chapter highlights the cumulative research findings of plant-derived bioactive flavonoids against CRC treatment and provides novel insights into its molecular regulation and mechanism with protein interaction in anticancer drug discovery.

Keywords

Flavonoids · Anticancer · Colorectal cancer · Drug discovery · Bioactive compounds

2.1 Introduction

Bowel cancer has been diagnosed as the third most prevalent cancer worldwide. It is reported globally with a very high rate of prevalence and mortality in both sexes. Study literature pinpoints westernized life anticipation, unbalanced diet, uncooked food, processed and canned meats, change in environmental conditions due to urbanization, and synthetic mutagens due to pollution were thought to be a serious etiology of colorectal cancer (CRC). The key factors behind CRC etiology were denoted as oxidative stress caused by the generation of non-neutralizable reactive oxygen species (ROS) and free radicals, which can directly interact with the bio-molecules of living cells and induce spontaneous mutations in bowel cells that leads to colon cancer (Mariyappan et al. 2017). Subsequent accumulation of sequential genetic mutation in a colonic gene, in particular, oncogenes and tumor suppressor genes resulted in the stepwise progression of colon cancer that starts from bowl inflammation followed by the formation of adenomatous polyposis coli and finally leads to colorectal carcinogenesis (Fearon and Vogelstein 1990). Further, intensive

study reports on colorectal cancer in rodent models have stated that microflora of animal guts have a major contribution to the development of colon cancer (Manju and Nalini 2005). Environmental pollutants, chemical toxicants in food, and modernized dietary food style have a direct impact on the microenvironment of gut microbes. Such uncomfortable gut environment resulted in improper metabolism and development of resistance against deadly pathogens and procarcinogens along with unbalanced homeostasis of increased immune response that had extensively known to regulate T cell development and Th17 responses that were denoted as key factors for colon cancer development (Kamada et al. 2013). As per the previous reseach study, various epidemiological case studies had evidently proved that daily diet accounts a dominant role in etiology of CRC; in particular, processed meat and red meat consumption had evidently increased the risk of colon carcinogenesis, whereas consumption of fiber-rich food like fruits, vegetables, and whole grains had highly decreased the colon cancer risk (McGirr et al. 2017). As a highlight of this chapter, consumption of a variety of green leaves, vegetables, and fruits with high fiber contents also includes a variety of naturally occurring bioactive molecules scientifically termed as dietary flavonoids that possess a strong chemoprotective effect against colon cancer and also have inverse action on colon carcinogenesis mechanism (Chang et al. 2018). For decades, scientists have been working with the isolation and characterization of a number of naturally occurring flavonoids and elucidated its pharmacological properties on various study models. Therefore, this chapter particularly provides a brief review of a few such flavonoids along with its biological properties and protective mechanism of action against colorectal cancer.

2.2 Bacterial Enzymes and Colon Cancer

The human digestive tract inhabits approximately about 400 species of bacteria, and it is a complex ecosystem of multiple microorganisms. The literature review provides evidence that invasion of pathogenic bacteria into the intestine was prevented by the presence of anaerobic gut bacteria which in turn reduce the threatened occurrence of CRC, and it is because of bacterial conversion of short-chain fatty acids by dietary fiber (Abeni et al. 2013). Consumption of high-fat and imbalanced diet alters the protective metabolism of intestinal microflora by increased bacterial enzyme activity, which resulted in a decreased host immune responses (Asha and Gayathri 2012). One of the best examples is β-glucuronidase, a common gut bacterial enzyme that produces the toxic metabolites with carcinogenic effect, which has a significant role in the progression of the tumor at secondary sites like large intestine, colon, etc. (Beaud et al. 2005). 1,2-Dimethylhydrazine (DMH) is an alkylating agent which stimulates the formation of methyl adducts with DNA bases that leads to point mutation. It has been well studied that β-glucuronidase enzymes catalysis the conversion of procarcinogen form of DMH into various metabolic intermediates which has a higher efficacy to interact with colon epithelium and act as potent carcinogens (Reddy et al. 1974). The accumulation of aglycones is due to the catalytic activity of β-glucosidase which synergistically hydrolyzes cellulose to lignocellulose

(Sohail et al. 2009; Jeng et al. 2011). On the other hand, the permeability of the colon mucosal membrane was highly altered by the enzymatic catalysis of intestinal mucin by gut bacterial mucinase enzyme (Robertson et al. 1940). Along with other bacterial enzymes, nitroreductase also has a unique task in colon cancer development by producing amines in the colon tissues by catalytic conversion of procarcinogens such like nitropyrenes, dinitrotoluene, and nitrobenzenes (Facchini and Griffiths 1981).

2.3 Reactive Oxygen Species (ROS) and Cancer

Mitochondrial oxidative phosphorylation generates a large amount of ROS by impaired transfer of electrons between complexes I and III of the mitochondrial respiratory chain (MRC). ROS is a collective term that refers to highly reactive oxygen molecules that can be listed as hydroxyl radical (OH−) ions, hydrogen peroxide (H_2O_2), and superoxide anion (O_2-) (Fulda et al. 2010). Naturally occurring antioxidant enzymes such as superoxide dismutase enzymes and catalase serve as defense system by catalytically naturalizing the generated reactive pro-oxidants. ROS may have beneficial effects on regulation of cell proliferation and gene expression, and increased ROS production results in oxidative stress-induced damage to proteins, lipids, and DNA, which has implications in diseases including diabetes, Parkinson's disease, and cancer (Gogvadze et al. 2009). Studies of aging mechanism had revealed the role of oxidative stress in higher probability of risk for cancer development in old age. Generated reactive species or free radicals actively damage genomic or mitochondrial DNA that leads to sudden mutation implicated in the earlier stage of cancer development. Due to mutational genetic instability in DNA causes the modulations in the signal transduction or even induce error in replication would efficiently reflects in induction or repression of specific transcription of the genes related to carcinogenesis. The recent investigation also described that the increased level of intracellular ROS in cancer cells possess a constant and chronic oxidative stress, and thereby it provides a favorable microenvironment for tumor progression. Further, the p53 tumor suppressor was found to be mutated and accounts for up to approximately 50% of all human cancers and is a major activator of antioxidant defense mechanisms. With respect to its apoptosis-inducing capacity, molecules that promote ROS production may be novel therapeutics, proposed to selectively target cancer cells by elevating ROS levels beyond a tolerable threshold to induce mitochondrial outer membrane permeabilization (MOMP) and cell death (Graham et al. 2010).

2.4 Flavonoid

From the ancient years, our folk medicine has been made of different and variety of naturally occurring plant products which later we call as nutraceuticals. Flavonoids are polyphenols produced as secondary byproducts of plants, which were

considered as main constituents of nutraceuticals. Hence, these flavonoids possess numerous pharmacological properties, and these polyphenols were consumed for hundreds of years as diet in form of fruits and vegetables; therefore these polyphenols were called as dietary flavonoids (Li et al. 2018). Chemically these flavonoids were characterized to have basic hydroxylated phenyl moieties with a number of phenolic rings and electron donation functional groups (Manach et al. 2004). Basically, these flavonoids are classified as polyphenols that are responsible for pigmentation in plants. Such polyphenols have a significant physiological function in plants to perform maturation of seeds, actively encounters biotic and abiotic stress of plants, maintains homeostasis of heat, freezing tolerance, act as a defense mechanism against pathogens and takes part in plants detoxification mechanism (Mierziak et al. 2014). Out of thousands of identified flavonoids, diphenyl propane skeleton (C6–C3–C6) with two phenyl ring and one heterocyclic ring form the basic structure of all the flavonoids (Kawser Hossain et al. 2016). Briefly, flavonoids are low molecular weight large group bioactive polyphenols with a basic structure of benzo-γ-pyrone and are widely found in a variety of plants. These flavonoids contain the number of hydroxyl group along with the catechol group at 3- and 5-positions at flavon ring that attributes its radical scavenging effect and antioxidant properties. Based on the structures, these flavonoids were classified into six major subclasses that can be listed as flavones, flavanones, flavanols, flavonols, isoflavones, and anthocyanins/anthocyanidins (Fig. 2.1). A large number of plant-derived bioactive polyphenols have been studied and evidently proved as efficient anti-carcinogenic agents. These flavonoids potentially block cancer development by interfering at multi-stages of carcinogenesis either at initiation, development, or progression of tumors; thereby these molecules have a significant inhibitory effect on proliferation and differentiation of cells and block angiogenesis and metastasis along with a decrease in tumor mass by induction of programmed cell death (Ramos 2007). Earlier research studies evidence that secondary metabolites include flavonoids which are phenolic in nature that possess several pharmacological activities which are structure-dependent (Mahomoodally et al. 2005). The specified quantity of hydroxylation, conjugations with other substitutional functional groups, and polymerization basically determines the structure and chemical nature of the flavonoids. It is well known that flavonoids were rich in hydroxyl groups and functionally act as scavengers to neutralize the free radicals and act as an antioxidant. It also has the capability to chelate metal ions. Previous studies evidenced that these flavonoids possess a chemoprotective effect against various degenerative and infectious diseases like cancer and cardiovascular diseases.

2.5 Functional Flavonoids as Antioxidants

Brief reviews from vast literature denoted that variety of flavonoids act as an antioxidant; in particular, it possesses reducing power to scavenge highly reactive radicals that are generated during human metabolic functions (Brunetti et al. 2013). Previous research investigations on antioxidant activity of these polyphenolic

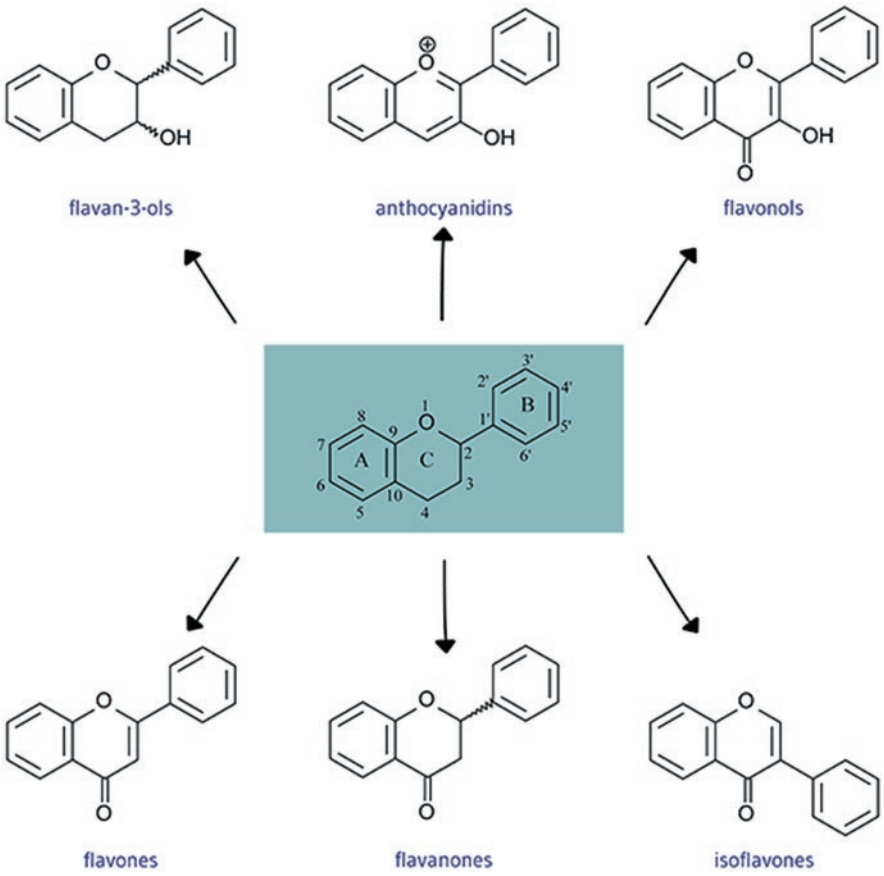


Fig. 2.1 Basic structure of flavonoids

compounds have shown that flavonoids efficiently inhibit specific enzymes like xanthine oxidase and protein kinase C which produce active superoxide radicals (Hanasaki et al. 1994). Also, these bioactive compounds inhibit a wide range of enzymes like cyclooxygenase, lipoxygenase, microsomal monooxygenase, etc. that involves in lipid peroxidation metabolism. An extensive report on the relation between the structure of free radicals and the respective flavonoids had revealed the radical scavenging mechanism and demonstrated its antioxidant potentials (Rice-Evans et al. 1996). Numerous in vivo study models pictured that dietary flavonoids readily scavenge free radicals in the stomach, and thereby they reduce ROS and act as primary antioxidant defense system (Papas 1998). Green medicines always get more attention toward researchers and are an important tool to prevent, reverse, or delay the carcinogenesis. Therefore, prevention could be a possible option for expensive treatments for existing disease. There have been many more compounds that are in a trial which have been declared as prospect chemopreventive agents. It

is well known that these bioactive compounds were commonly present in many food products, commercially available beverages, and many other dietary components. Consumption of these compounds directly or indirectly acts as inhibitory agents on cancer cell proliferation, and thereby these plant flavonoids in foods serve as preventive shield against human carcinogenesis implicated in the prevention of human carcinogenesis possibly through their inhibitory activities of cell proliferation or survival. Decades of research were interested to fix on the natural compounds that include any plant byproduct substances to unmask their anti-carcinogenic effect by tuning the level of intracellular lipid peroxidation and modulate the status of antioxidant that would be used as chemopreventive medicine in the treatment of colorectal cancer. The following are a short brief of few bioactive compounds which were recently studied for their anticancer activity against colorectal cancer.

2.5.1 Eriodictyol

Number of bioactive compounds that are in a trial which have been declared as prospect chemopreventive agents; one of the novel flavonoids recently studied was eriodictyol which comes under flavanone and has been proved to possess antioxidant effect by reducing the level of lipid peroxidation and oxidative stress. The flavonoid rich in citrus and lemons with chemical structure 5,7,3′,4′-tetrahydroxyflavanone was called eriodictyol, and it is naturally occurring in citrus fruits in glycoside form. Eriodictyol was previously considered as vitamin P that was found to be essential in normal small blood vessels (Horowitz 1958). Eriodictyol is an isomer of kaempferol and has been isolated from yerba santa (*Eriodictyon californicum*). Other major sources of eriodictyol were identified as citrus fruits including lemon, lime, and sour orange and green leaves like peppermint. A number of studies had reported few pharmacological properties such as antioxidant, anti-inflammatory, and anticancer activities. Hence the structural chemistry of eriodictyol consists of free electron-donating hydroxyl moieties, which would impact on potent free radicals' scavenging activities which in turn reduces the oxidative stress. Previous experiments on supplementation of eriodictyol to rodent model bearing DMH-induced colon cancer had reported with a significant anti-carcinogenic efficacy against colon cancer models (Fig. 2.2). The study had described that eriodictyol primarily alters antioxidant status, gut microbial enzyme activity, and lipid oxidation status in cancer-bearing rats. Prolonged treatment with this flavonoid had intensively reduced pre-neoplastic lesions along with the decrease in aberrant crypt numbers that was reported. β-Glucuronidase suppressor would effectively reduce ACF formation that was early reported in past decades (Takada et al. 1982). Cordially another study also evidently pointed out that chronic treatment of eriodictyol had highly influenced the reduction of β-glucuronidase activity in DMH-induced colon cancer rat models. It is likely to be believed that oxidative stress and lipid peroxidation induce cancer cell initiation and proliferation (Peluso et al. 2011). In connection, extensive study with eriodictyol supplementation to colon cancer-bearing rats showed a notable decrease in lipid peroxidation and pro-oxidant status; thereby colon cancer

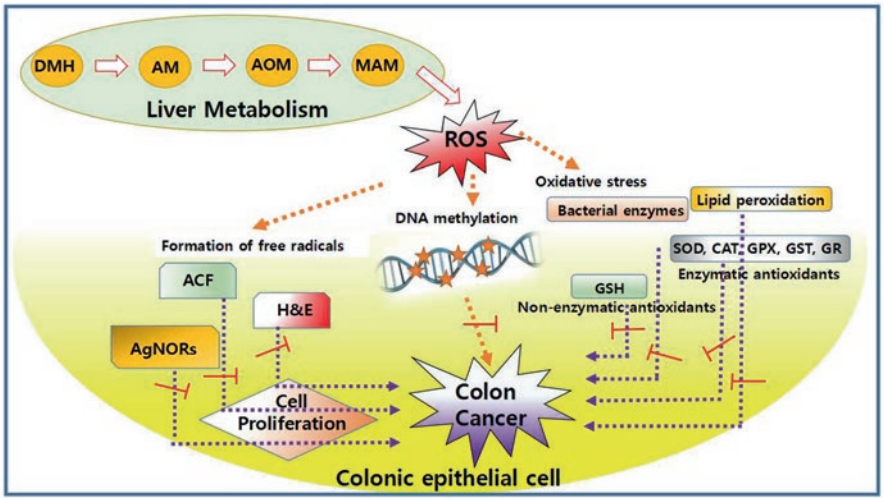


Fig. 2.2 Graphical representation of eriodictyol's protective mechanism against DMH-induced colorectal cancer models

progression and severity were highly reduced (Mariyappan et al. 2017). Highlights of eriodictyol on gut enzyme activity were reported as considerable inhibition of sulfo-conjugations; thereby nitroreductase sulfatase enzyme activities were thought to be decreased, and on the other hand it is well studied that high number of cancer was reported on increased activity of gut sulfatase and nitroreductase enzymes. As a pictorial proof, eriodictyol's anti-carcinogenic effect was reported with the histological examination on eriodictyol-supplemented rat models, and the study had pictured the architecture of the colon cancer cells after treatment, and the abnormal changes were highly reduced with decreased dysplastic cells in the colon tissue of flavonoid-treated rats. As a whole, this review about eriodictyol had briefly elaborated the mechanism of antioxidant potential and anti-carcinogenic effect against cancer models.

2.5.2 Umbelliferone

Umbelliferone had been a known and well-studied coumarin, a flavonoid with benzopyrone in nature, and was widely spread in common plants and herbs like parsley sanicle, fennel, celery, giant hogweed, cumin, and asafoetida (Mazimba 2017). This particular bioactive coumarin compound was reported to possess an effective antioxidant role; hence it has been derived from plant polyphenols and consumed as diet in form of fruits and vegetables from ancient days (Hoult and Payá 1996). Here we concise a summarized view on antioxidant potential and anti-carcinogenic effect of pharmacologically active 7-hydroxycoumarin, i.e., umbelliferone. A recent research was highly considered that the use of potentially active

phyto-flavonoids is a novel and efficient method to treat and eliminate colon cancer as illustrated in (Muthu et al. 2016). These bioactive compounds that include umbelliferone have been found to modulate the various signaling pathways; thereby it considerably inhibits the pathogenesis of colorectal cancer, and it is designated as a novel anticancer agent. One of the previous studies in our team had efficiently proved that umbelliferone had stiffly and strongly inhibited CRC in DMH-induced colon cancer rat models (Muthu et al. 2016). It is well studied that DMH induction in rats generates a large amount of ROS and causes genetic mutation in colon genes which would be resulted in an initial increase in aberrant crypt formation and later the pathogenesis that lead to colon epithelial carcinoma (Sengottuvelan et al. 2006). Earlier study on rats had reported that intraperitoneal administration of umbelliferone to CRC-bearing rats significantly inhibited and reduced the formation of a specified number of the aberrant crypt in colon epithelial at an early stage of colon cancer. It is to be highlighted that the study also confirmed with the histological pictures of reduced ACF in umbelliferone-treated CRC rat models. Further, the same study had stated that umbelliferone has efficacy to arrest cancer cell proliferation and the AgNOR quantification with image tools that had indexed the reduced cell activation in umbelliferone-treated to CRC-bearing rats (Sirri et al. 1995). Subsequently, mast cells provide a considerable microenvironment for cancer cells to proliferate and survive by means of increased angiogenesis (Oldford and Marshall 2015).

Further reports from previous literature had stated that umbelliferone-treated to CRC-bearing rats have a significant decrease in a number of mast cells, and it clearly indexed the anti-inflammatory effect of umbelliferone in carcinogenesis models. Extensive study reports of primary inflammatory markers like tumor necrosis factor-alpha (TNF-α), interleukin-1, *cyclooxygenase* (*COX*), and iNOS that were known to be activated by ROS on CRC models had indicated that umbelliferone significantly had changed the microenvironment of tumor cells by downregulating the expression of intestinal inflammatory marker in cancer-bearing rats (Takahashi et al. 2015). Thereby it has been evidently shown that umbelliferone modulates NF-kB signaling pathway.

Also, umbelliferone had been reported to induce apoptosis and DNA fragmentation by activation of Bax-dependent caspase pathway of apoptosis in CRC rats (Fig. 2.3). As a whole, this brief review about umbelliferone against CRC has clearly pictured the potential use of this particular flavonoid to eliminate colon cancer. Further intensive preclinical and clinical studies on cancer models would be helpful to unravel its complete mechanism of action and would be made commercially available for cancer patients.

2.5.3 Luteolin

Luteolin was classified under flavones of flavonoids based on its chemical structure. Chemically its architecture is of 3′,4′,5,7-tetrahydroxyflavone and was found widespread in most of the plants. Luteolin structure is composed of A and B, two benzene ring, one C ring with oxygen, and a double bond at 2–3 along with readily

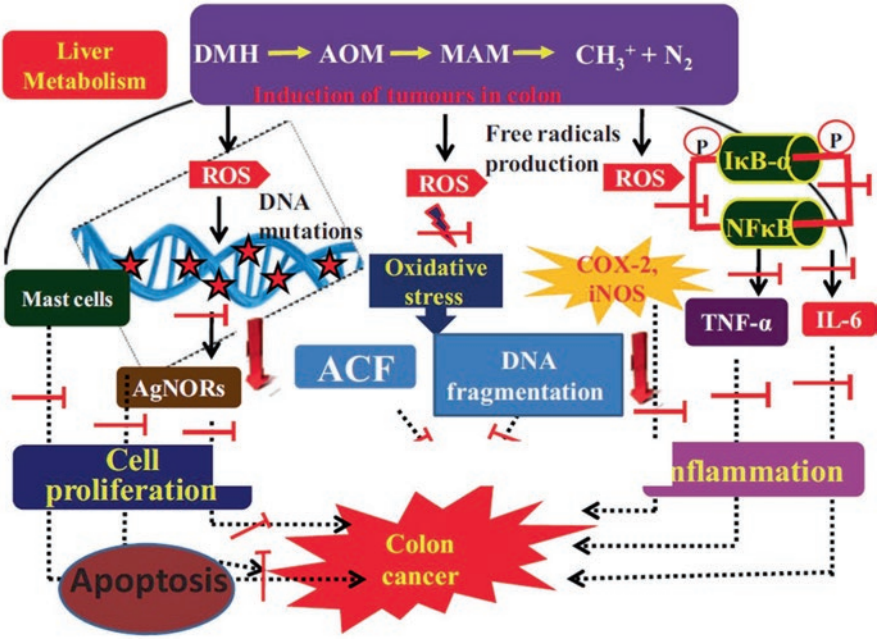


Fig. 2.3 Schematic representation of umbelliferone against DMH-induced colon cancer

reducing several hydroxyl groups at 5-, 7-, 3′-, and 4′-positions as shown in (Ross and Kasum 2002). Abundant and naturally occurring sources of luteolin supplementation that were available such as parsley, onion leaves, broccoli, celery, cabbages, chrysanthemum flowers, carrots, peppers, and peanuts were listed (Pandurangan and Esa 2014). Hence it consists of a large number of reducing groups, and it can readily donate an electron to free radicals and scavenge generated ROS. Further literature studies have cumulatively accounted pharmacological properties such like cardio-protective (Madhesh and Vaiyapuri 2013), antioxidant (Ashokkumar and Sudhandiran 2008), anticancer (Manju and Nalini 2005) (Manju), and anti-inflammatory activities (Nishitani et al. 2013). Previous investigations had stated that luteolin possesses significant antiproliferative effect against various cancers that include breast, liver, prostate, esophageal, and lung cancers; thereby it plays a key role as strong chemoprotective agent (Pandurangan and Esa 2014). Any abnormal increase in neoplastic cells due to the absence of apoptosis leads to tumor mass progression with increased cell differentiates, angiogenesis, oxidative stress due to over metabolic process and resulted with metastasis of cancer. Overproduction of ROS due to increased metabolism is not only the factor for cancer progression; lack of sufficient antioxidant defense to scavenge the radicals generated by cancer cell plays a vital role in carcinogenesis (Cheng et al. 2012). Therefore normal cells require endogenous and supplemented antioxidants to fight against the oxidative stress generated by cancer cells. Hence, luteolin possesses more electron donor

functional groups, and it serves as a rapid antioxidant to scavenge the unstable reactive free radicals to protect the cells from intracellular ROS lesions. In particular, luteolin induces cell cycle arrest and programmed cell death; thereby it efficiently blocks the invasion of cancer cells. Earlier research studies on cancer therapy had explained about the apoptosis mechanism and it was initiated by death receptors and sub-sequential activation of mitochondrial-dependent caspase pathway (Ma et al. 2018). Large number of bioactive compound has a potential chemoprotective effect to induce programmed cell death in cancer cells that were evaluated by a number of investigators in past decades, and also the previous study reports the anticancer efficacy of luteolin against human colon cancer cells that were sequenced by induced cell cycle arrest and followed with activation of caspase-dependent intrinsic apoptotic pathway (Pandurangan and Esa 2014). Pathogenesis of colon cancer in DMH rats involves lipid peroxidation to form active malondialdehyde, conjugated dienes, and lipid hydroperoxides, which causes considerable damage in cells. In our previous study using DMH-induced rate models, we had evidently pictured and elaborated mechanism of action on how the target flavonoid luteolin had significantly reduced the tumor cell number mediated by a decrease in lipid peroxidation and inversely increased endogenous enzyme-dependent antioxidant mechanism. For the past decades level of glycoprotein in serum was considered as one of the hallmark markers to assess cancer, hence this glycoprotein plays a key role in cell-cell recognition, cellular adhesion, binding, and cellular transport, during rapid proliferation and differentiation of cancer cells the level of this specific protein would be elevated and its server as valuable marker carcinogenic process. Luteolin-administered DMH rats found to have a lower level of these glycoproteins were reported (Pandurangan et al. 2012). Earlier literature reports on luteolin had stated to induce cell shrinkage followed by chromatin condensation and finally leads to DNA fragmentation, which was said to be the hallmark of apoptosis in colon cancer cells. Activation of effector caspases and Bax/Bcl2 ratio critically determine the fate of the cancer cell to induce apoptosis. This was followed by the successive release of mitochondrial cytochrome C conform the activation of mitochondrial-dependent intrinsic apoptosis and this hypothesis was tested with various cancer cell against luteolin treatment was reported (Attoub et al. 2011; Pandurangan and Ganapsam 2013). Use of such naturally occurring phytocompounds in the prevention of colon cancer was expected to be safe and avoid the adverse effect of anticancer drugs like synthetic chemotherapeutic compounds. This chapter also summarizes the ample of research evidence from the past study reports to show the chemopreventive potential of bioactive flavonoids in the prevention of colon carcinoma.

2.6 Conclusions

Consumption of dietary flavonoids in a consistent manner and an adequate amount has been proven to be a significant nutritional therapy to prevent and lower the risk of colorectal cancer, which could be implicated to enhance for cancer treatments. This chapter insensitively discussed about the flavonoids as chemopreventive drugs

to treat cancer, and also elaborated the primary mechanisms of action of such bioactive flavonoids on chemically/carcinogen-induced oxidative stress. Efficacy of flavonoids to reduce the oxidative stress by scavenging ROS is considered as a principal factor to act as antioxidant and anti-inflammatory properties. Hence, colon cancer is a chronic disease, and its progression was brought by continuous bowel inflammation caused by oxidative stress and various other factors. Supplementation of flavonoids potentially prevents the inflammation, thus controlling colon cancer progression and invasion. Further, it modulate the expression of oncogenic and apoptotic proteins in cancer models, thereby activating Bax/Bcl2-mediated mitochondrial apoptotic pathway. A number of recent studies also have pinpointed the synergetic effects of flavonoids along with other anticancer drugs. Hence, the present review concludes that flavonoids have a significant anticancer potential against colon cancer, and it can be used as drug/supplements to prevent inflammation, and it helps to eradicate cancer diseases. However, the prospective cohort preclinical and clinical studies on flavonoids would help to better understand other mechanisms of dietary flavonoids for improved implication in the treatment of a number of cancer diseases.

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6 Pelargonidin, a Dietary Anthocyanidin in the Prevention of Colorectal Cancer and Its Chemoprotective Mechanisms

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Abstract

Diseases of bowl wall mucosa stemming from sudden mutation lead to the development of colorectal cancer (CRC) cells by the transformation of normal epithelial cells into neoplastic lesions. CRC is considered to be a global burden; hence, its incidence rate is expeditiously increased up to ten-fold higher, worldwide. The epidemiological report pinpointed CRC as the utmost third common malignancy in men and second in women. Because of greater efficacy, the synthetic drugs are unsatisfactory due to higher toxic effects to the normal cells, and a chance of developing multidrug resistance by tumor cells. Therefore, dietary flavonoids with potent anticarcinogenic effects have been focused on recent investigations. Pelargonidin (PD), a bioactive molecule classified under anthocyanidin is present in red and pink pigmented berries. PD efficiently modulates intercellular antioxidant status, thereby reducing oxidative DNA damage, cellular proliferation, differentiation, apoptosis, angiogenesis, and reverse drug resistance of metastatic cells, and potentially induces cell cycle arrest, thereby interfering in colorectal carcinogenesis. PD scavenges and normalizes the intracellular reactive oxygen species (ROS), which results in gene mutation and induction of colon carcinogenesis. Therefore, the proliferation of tumor cells would be affected or blocked potentially due to disturbance in cell cycle protein by these ROS. Considering the wide pharmacological benefits of PD, this chapter deliberately reviews the cumulative research data from in vitro human colon cancer cell line studies on chemoprotective property of PD against CRC, and also summarizes the underlying mechanism in experimental models.

Keywords

Colorectal cancer (CRC) · Pelargonidin · Antioxidant · Apoptosis · Chemoprevention

6.1 Introduction

Flavonoids are low-molecular-weight large group bioactive polyphenols with a basic benzo-γ-pyrone as a backbone structure, and are widespread in a variety of plants. These bioactive compounds potentially induce apoptosis and modulate tumor cell proliferation, angiogenesis, and differentiation, thereby directly interfering at each step of carcinogenesis (Ramos 2007). A number of research studies evidenced that

secondary metabolites include flavonoids which are phenolic in nature and possess several pharmacological activities based on its unique chemical structure (Mahomoodally et al. 2005). Basically, the degree of chemical reactions such as hydroxylation, substitutions, polymerization, and conjugations determines its specific chemical properties. More interestingly, the antioxidant, metal chelating, and free radical scavenging efficiency of flavonoids were enumerated by the number of hydroxyl groups present in the flavonoids. Chelating property of flavonoids primarily prevents damage of biomolecule by stress-induced intracellular free radicals. Previous studies had evidence that flavonoids possess a chemoprotective effect against various degenerative and infectious diseases like cancer and cardiovascular diseases. Pelargonidin (PD), a bioactive molecule classified under anthocyanidin, is present in red and pink pigmented berries. This phytochemical efficiently modulates intercellular antioxidant status, thereby reducing oxidative DNA damage, cellular proliferation, differentiation, apoptosis, angiogenesis, and reverse drug resistance of metastatic cells, and potentially induces cell cycle arrest, thereby interfering in colorectal carcinogenesis. PD scavenges and normalizes the intracellular reactive oxygen species (ROS), which results in gene mutation and induction of colon carcinogenesis. Therefore, this chapter aims to provide a cumulative research data from in vitro human colon cancer cell line studies on chemoprotective property of PD against CRC, and also focuses to summarize the underlying mechanism in experimental models.

6.2 Colorectal Cancer (CRC): A General Overview

Rapid growth and progressive spreading through adjoining tissues lead to metastasis, and the formation of secondary tumors at different sites is the basic nature of the tumor cells (Tanaka 2009). Successive angiogenesis and uncontrolled proliferation of stem cells are the two important hallmarks of carcinogenesis (Neergheen et al. 2010). Colorectal cancer can be mentioned as a mucosal disease. Bowel wall mucosal lining is found to be the basal origin of colon cancer. This bowel wall anatomically consists of different layers, such as mucosa, submucosa, the serosa, and the muscularis propria. In particular, single-layered columnar epithelial goblet cells of bowel wall were termed as mucosa, which produces mucus, and identified as the primary site of colon cancer induction due to genetic mutations. The mutated cells in this region usually proliferate very rapidly and spread into the lumen. Further progression takes place at microvilli, where the crypts of Lieberkuhn were reprocessed. The strongest layer stand under mucosa is submucosa, and it is considered as an important region for carcinogenesis, and hence this layer includes vascular blood vessels and terminal and lymphatics nerve fibers by the way the tumor cells invade the circulatory system and spread throughout the body.

6.2.1 Colorectal Cancer Epidemiology

Worldwide, third most frequently recorded cancer in men and the second common cancer in women was statically reported as CRC (Ferlay et al. 2015). The incidence

rate increased up to ten-fold higher worldwide with a steep increase in notable countries, such as Australia, New Zealand, the Czech Republic, Slovakia, Kuwait, Israel, and low middle-income countries. Increased risk factors including an unbalanced diet, increased body weight, alcohol, and habitual tobacco consumption are the major reasons behind the sudden increase in the prevalence of CRC in Asian and Eastern European countries (Torre et al. 2015). Moreover, poor diagnosis at initial stage of CRC would lead to metastasis, and cordial epidemiological report had stated that it would be the universal burden which would record more new colon cancer cases approximately 2.2 million peoples and mortality may reach up to 1.1 million by the year of 2030 (Arnold et al. 2017; Ouakrim et al. 2015). Even though the mortality rates throughout the world have been declining in a huge amount in a number of countries, mortality still occurs in few countries like Romania, South America, Russia, and Brazil (Torre et al. 2015).

6.2.2 Etiology of Colorectal Cancer

The major lifestyle-related risk factors include lack of physical activity, over bodyweight, red meat and canned food intake in large amounts, habitual smoking, consumption of alcohol, and a diet lacking in vegetables and fruits. Previous family or individual history of colon polyps, and individual history of type 2 diabetes, bowel disease due to chronic inflammation, or genetic diseases such as Lynch syndrome or familial adenomatous polyposis has been proved as an important risk factor for CRC. The precise causes of colorectal cancer seem to be unknown. However, few studies state the etiology of developing colorectal cancer. The prevalence of CRC has been gradually increasing in urbanized countries, and also the rate of incidence in economically transitioning countries has been raised due to Western lifestyle culture. High fat, high calories diet, processed meats, and low fiber intake are strongly associated with the development of colorectal cancer. It has been proved that the chemical carcinogen produced while the meat was overcooked at a very high temperature, which includes frying, boiling, and grilling, is prone to cause colon cancer (Gingras and Béliveau 2011). Sedentary lifestyle and obesity play a major part in the development and progression of the number of cancer including CRC were evident by epidemiological reports. Lack of physical activity and increased body weight are the two important modifiable and inter-relatable risk factors that account third of CRC. The physical activity, which stimulates the movement of colon and the passage of waste through the colon activity, is associated with a decreased risk of CRC (Lee et al. 2007). Epidemiological evidence indicates that increased consumption of red meat such as beef, pork, and lamb are prone to cause colorectal cancer in both men and women. Stastical data had shown substantial proportion, ranging from 30% to 70%, of all colorectal cancer cases are attributable to diet with red and processed meat intakes, which is implicated as important dietary risk factors. Red meat, processed meat, and meat derived heterocyclic amines (HCAs), polycyclic aromatic hydrocarbons (PAHs), nitrites, and nitrates are the known animal mutagenic compounds formed when muscle meat is cooked using high temperature. Nitrites are

harmful and are more susceptible to develop cancer at proximal colon, whereas HCAs and PHAs cause cancer in the region of the distal colon and rectum. Greater red meat and processed meat intakes were more consistently associated with colorectal carcinoma (Miller et al. 2013).

6.2.3 Pathogenesis of Colorectal Cancer

In accordance to etiology of CRC, chronic inflammation and sudden mutation resulted in the formation of polyps on distinct sites of colon and rectum, and epithelial lining is the primary characteristic of colorectal cancer development, and these polyps can be nonneoplastic or neoplastic. The microenvironment of cancer cells and epigenetic changes along with genetic mutations play a key role in multistep carcinogenesis. These epigenetic mechanisms mostly programmed in most of the cancer cells in the process of DNA methylation along with alterations in histone proteins (Bardhan and Liu 2013). The CRC development in most of the cases would be a subsequential modulation in signaling pathways as a result of respective oncogenes activation and also inactivation of tumor suppressor genes. In addition, chromosomal gains or losses are termed as chromosomal instability (CIN), and sudden insertion/deletion in the specific DNA sequence would be the reason for microsatellite instability (MSI) (Jass 2007). Most often, etiology of distal colon cancer development and progression was mainly due to CIN, which accounts for about 60–70% of total CRC cases. However, most common proximal colon cancer was observed in MSI cases. Mutations in adenomatous polyposis coli (APC) were induced by dysplastic aberrant crypt foci, where it pawed away in the transformation of polyps to cancer by activation Wnt pathway. Such mutations in APC or genes involved in Wnt signaling pathways such as KRAS or TP53 would help in the progression of dACF to tumor cells (Nosho et al. 2008). Also, epigenetic alterations in the promoter region of the respective gene including DNA methylation and histone modifications is the key factor in cancer cells epigenetic inheritance DNA methylation involves the enzymatic addition of a methyl group to the 5′-position of cytosine by DNA methyltransferases (DNMTs) to form 5-methylcytosine. The DNMTs work on specific CG dinucleotide sequences, known as CpGs. More than 70% of the cytosine (C) bases in the context of CpG dinucleotides are supposed to undergo methylation. The biallelic promoter CpG island methylation of the mismatch repair gene MLH1 is characterized to be the primary epigenetic mechanism leading to the development of sporadic colorectal cancer associated with MSI-H (Bardhan and Liu 2013). Histone deacetyl transferases (HDACs) are the most widely characterized proteins among the histone modification enzymes that play predominant roles in the development of CRC. The high HDAC expression has been shown to be associated with reduced survival in CRC patients (Ashktorab et al. 2009).

Intracellular oxidative stress is mainly because of the imbalanced state of unstable highly reactive free radicals and the intermediate metabolites. These free radicals were commonly called reactive oxygen species (ROS), and also the inbuilt cellular mechanism to neutralize and protect cells from such ROS is termed as

antioxidants. ROS rapidly attacks the bricks of the cellular components such as all the important biomolecules that cause serious damage and defect to the whole organism (Ďuračková 2010). Intensive studies on oxidative stress mechanism during the last 20 years by a number of researchers have unmasked its key role in chronic inflammation; thereby, it has a significant role in the progression of several inflammation-related disease conditions, including cancer, cardiovascular, diabetes, pulmonary, and neurological diseases. When cells encounter a sudden attack by oxidative stress, it triggers several subsequent inflammation-related molecular pathways, such as NF-κB, HIF-1α, AP-1, PPAR-γ, p53, β-catenin/Wnt, and Nrf2 (Reuter et al. 2010). Widely occuring procarcinogens, the toxin from environmental pollution, and intracellular phagocytosis by chemo drugs generate an enormous amount of ROS as the metabolic intermediates (Klaunig et al. 2011). Oxidative stress has been found to take part in the aging process, and also it has a major impact on the prevalence of cancer in old age. More interestingly, any serious damage to the genomic DNA or mitochondrial DNA due to ROS will imitate carcinogenesis in most cases. Further, such a process may vary based on the type of tissue or triggered/suppressed transcription of certain gene or modulation in the signaling pathway or some mutational errors in replication, which would significantly result in genetic instability. It has also been studied that a notable amount of intracellular ROS was generated in tumor cells which leads to a specific microenvironment that maintains constant oxidative stress in tumor cells which favors cancer progression. Human cancer is a major activator of antioxidant defense mechanisms. With respect to its apoptosis-inducing capacity, molecules that promote ROS production may be novel therapeutics, proposed to selectively target cancer cells by elevating ROS levels beyond a tolerable threshold to induce mitochondrial outer membrane permeabilization (MOMP) and cell death (Graham et al. 2010).

Most of the common physical work and intermediates of cellular metabolism results in the inevitable production of oxidants and free radicals. At the same time, an inbuilt protective mechanism for the human body is antioxidants and that will be different for each cell type and tissues, and its mode of action might vary as a synergistic effect or even antagonistic effect based on the site of action. The cellular antioxidant defense system includes natural enzymatic antioxidant, namely catalase (CAT) which hydrolyzes H_2O_2, superoxide neutralizing enzyme superoxide dismutase (SOD), glutathione-dependent catalytic enzymes glutathione peroxidase (GPx), glutathione reductase (GR), and glutathione-S-transferase (GST), and nonenzymatic antioxidants such as retinol (Vit A), ascorbic acid (Vit C), and tocopherol (Vit E) which includes vitamin A, vitamin C, vitamin E, polyphenols, pigmented carotenoids, and other natural by-products as antioxidants, paying attention great interest in recent decades. Antioxidants at very low concentrations have a higher efficacy to prevent any oxidative damage to cells when compared to antioxidants that donate an electron to stabilize free radicals and thereby inhibit its detrimental effects. SOD is an endogenous antioxidant that involves catalysis dismutation reaction, thereby producing hydrogen peroxide (H_2O_2) from most of the superoxides (O_2^-). Further, CAT catalyzes H_2O_2, the end product of SOD, and splits them into oxygen and water. On the other hand, glutathione-dependent enzyme glutathione peroxidase

(GPx) significantly neutralizes the transition metals, and with the help of GSH as cofactor, it also catalyzes H_2O_2 in the aqueous phase of the cell membrane (Valadez-Vega et al. 2013). GR catalyzes the reduction of oxidized glutathione and thereby maintains the cellular GSH level, thus altering the GSH/GSSH ratio. Further, GSH and intracellular electrophile conjugation were facilitated by glutathione-S-transferase (GST), also called Phase II detoxifying enzymes. The conjugation of GSH to electrophilic compounds is catalyzed by Phase II detoxifying enzymes called glutathione-S-transferase (GST). GSH has been considered as an important natural intracellular antioxidant and has a major role in neutralization and detoxification of ROS such as peroxides, which is produced as a result of increased LPO. It also takes a role in conjugation and excretion of toxic molecules, and thereby it maintains the normal cell structure and function (Dickinson and Forman 2002).

Human beings are constantly bombarded by ROS by means of exogenous factors, such as tobacco, smoking, chemicals, ultraviolet (UV) rays, and many other agents. It also includes drugs or medicines which are used for medical practice. The aerobic cellular metabolism generates highly reactive free radicals in terms of oxidants, which cause serious damage to different types of cells and tissues due to normal physiological conditions. The protection mechanism against infection involves NADPH enzyme activity found in neutrophils and macrophages, and also the electron transfer system of mitochondria or microsomes and peroxisomes takes a vital role in the production of ROS endogenously (Noda and Wakasugi 2001). ROS are not only prone to cause cancer but also many other human diseases (Hippeli et al. 1999). The necrotic lesion was formed by the peroxidation of the biological membrane by highly reactive oxygen with lipids (Halliwell 1994). These ROS in higher amounts alter the biomolecules, such as proteins, lipids, lipoproteins, and deoxyribonucleic acid (DNA). The active oxygen species also induce gene mutation, which results in the development of cancer; on the other hand, it also modulates signal transduction and either triggers/suppresses transcription factors which are also a mechanism of induction of carcinogenesis (Floyd et al. 1986). Tumor suppressor genes p53 and gene involved in cell cycle regulation are highly susceptible to mutations as a result of DNA damage in the presence of ROS. Also the product of LOP, malondialdehyde, potentially induces mutation. Many researchers have pointed out the necessity of enzymatic and nonenzymatic antioxidants to maintain the natural oxidative homeostasis of the organism especially in tumor therapy. Endogenous enzymatic antioxidants, such as SOD, CAT, GPx, GR, and GSt, play a vital role in chelating superoxides and peroxides. Therefore, tumor therapy is basically based on oxidative stress and antioxidant homeostasis (Čipak gašparović et al. 2010).

Plant products are widely used in the present world as medicines, due to the fact that they are very effective therapeutically. Moreover, they are relatively more safe when compared to any synthetic drugs (Singh and Tripathi 2018; Datir 2018; Akhtar and Swamy 2018). Natural products, mainly plant metabolites, exert superior antitumor properties by reducing the action of reactive oxygen species and protecting the critical constituents of cells, that is, macromolecules like nucleic acids and proteins from oxidative damages (Ravichandra et al. 2018). As a result, plant-derived metabolites have attracted researchers in the field of natural medicines to design effective chemodrugs for

treating cancers. Thus, plant-derived compounds are well recognized as anticancer agents, and some of them are being used in the present market for treating various cancer types (Akhtar and Swamy 2018). Drug molecules like camptothecin, vincristine, and vinblastine are some of the examples of chemodrugs derived from plant sources. However, these drugs pose a challenge of toxicity and cause side effects. Hence, a continuous search is in progress to innovate novel drug molecules against cancers. In this regard, different plant species are being explored to isolate new phytochemicals and to evaluate their bioactivities. Likewise, plant molecules are also evaluated for their antiproliferative potentials. Pelargonidin, an anthocyanidin, is among them, and the details of it are given in the following section. Also, the role of a phytochemical against different CRC cells is discussed, emphasizing on its mechanisms of actions.

6.3 Pelargonidin: An Anthocyanidin

The chemical structure of anthocyanins consists of flavylium cation, which is linked to hydroxyl (–OH) and/or methoxyl ($–OCH_3$) groups along with one or more sugar molecules. Anthocyanins without sugars are known as anthocyanidins. Six major anthocyanidins which are abundant in fruits and vegetables are pelargonidin, malvidin, delphinidin, cyanidin, peonidin, and petunidin. They differ by position and number of –OH and $–OCH_3$ group present in it. Based on the position of the functional group, either hydroxyl, methyl, sugar moiety, or several other functional substituents, about 500 and more anthocyanins have been identified and are classified under 31 anthocyanidins. Cited previous literature stated that 31 anthocyanidins account for cyanidin (30%), delphinidin (22%), and pelargonidin (18%). Also, other methylated derivatives of anthocyanidins account for 20% of all anthocyanins. Consequently, about 90% of all the anthocyanins are cyanidin, delphinidin, pelargonidin, and its derivatives (methylated). Naturally, these anthocyanidins are present in the form of glycosides with the respective sugar moiety at 3-position on the C-ring or the 5-position on the A-ring to the aglycone chromophores. Basically, pelargonidin can be chemically structured as 1-benzopyrylium, 3,5,7-trihydroxy-2-(4-hydroxyphenyl), chloride, n anthocyanidin cation that is flavylium substituted by a hydroxy group at positions 3′, 5′, 7′, and 4′ (Barnes et al. 2011).

6.3.1 Natural Occurrence of Pelargonidin

Anthocyanins are one among the subgroup of water-soluble flavonoids found widespread in the plant kingdom, and their specific compounds are responsible for floral pigmentation and other parts of plants. The color of the pigments may vary from vibrant red, purple, to blue pigments, and this is because of its conjugated structure that draws light at 500 nm (Wang et al. 2012). In particular, widespread and usually found anthocyanins are the 3-*O*-glycosides or 3,5-di-*O*-glycosides of delphinidin, cyanidin, petunidin, peonidin, malvidin, and pelargonidin. Anthocyanins are important polyphenolic components of fruits, especially berries. Bioactive component

pelargonidin is rich in berries, such as strawberry, blackberry, black currant, elderberry, sour cherry, and pomegranate. Consumption of anthocyanin and polyphenol-rich juice enhanced antioxidant status, reduced oxidative DNA damage, and stimulated immune cell functions (Ferretti et al. 2010).

6.3.2 Pharmacological Activities of Pelargonidin

Flavonoids most prevalently found in floral, fruit, and vegetable have been reported as pelargonidin and consuming them as fresh or processed food has a major impact in prevention and control of devastating chronic human diseases, such as inflammatory diseases, cancer, and cardiovascular diseases, where it directly acts as potent antioxidant, plays significant role in detoxification, induces apoptosis, fights against inflammation, etc. (Nikkhah et al. 2008). The antioxidant property of pelargonidin (anthocyanidin) was due to scavenging efficacy of ONOO− function group, and it was evidently first reported by Tsuda et al. (2003) (anthocyanidin). The mechanism behind its antioxidant activity was due to the conversion of pelargonidin to p-hydroxybenzoic and further formation of 4-hydroxy-3-nitrobenzoic acid by the catalytic conversion with ONOO− present in its structure. In vitro studies on anthocyanin had significantly downregulated the signaling pathways including NF-κB and MAPK pathways, resulting in the reduced proinflammatory cytokine expression and inhibiting inflammation (Wang et al. 1999; Pergola et al. 2006). In addition, extensive study on literature of anthocyanidin unraveled its anti-inflammatory mechanism, where significant downregulation of certain vital inflammatory markers at both transcription and translational levels in some cell line models such as downregulation of cyclooxygenase-2 (COX-2) expression in stimulated macrophage (RAW 264 cells) with lipopolysaccharide (LPS) and another case potential inhibition was observed against the transcription and expression of inducible nitric oxide (iNOS) murine macrophages (J774) activated with LPS (Hou et al. 2005; Hämäläinen et al. 2007). Isolated leucopelargonidin-3-*O*-alpha-L rhamnoside from the bark of *Ficus benghalensis*, oral administration at a dose of 100 mg/kg, showed a significant decrease in glucose level with a rise in serum insulin level of diabetic dogs induced by alloxan at a time period of 2 h. The findings state that leucopelargonidin-3-*O*-alpha-L rhamnoside stimulates insulin secretion (Augusti et al. 1994). Also, few studies have reported the estrogenic property of anthocyanidins, including pelargonidin, delphinidin, and cyanidin. These anthocyanidins were categorized as nongenotoxic, and it efficiently modulates DNA damage caused by oxidative stress and 4-nitroquinoline 1-oxide by its estrogenic activity. Therefore, the stated study has substantial evidence for the chemopreventive effects of anthocyanins against carcinogenesis on HL-60 cells (Abraham et al. 2007). A recent study on *F. benghalensis* root extract showed an antimicrobial activity when compared to the standard drug. Also, two important flavonoid compounds such as leucopelargonidin 3-*O*-alpha-L rhamnoside and 5, 3′-dimethyl ether of leucocyanidin 3-*O*-alpha-D galactosyl cellobioside were isolated from the bark of *F. benghalensis*, which inhibits the Gram-negative bacteria and also the fungal species (Aswar et al. 2008).

6.3.3 Bioavailability

Till now, very few numbers of literature are available to understand bioavailability including absorption/excretion of anthocyanins in humans, still, we found some of the contradictory conclusions. Previous studies have shown that wine from graphs rich in pelargonidin, it may or may not contain alcohol do not block the anthocyanin's absorption (Bub et al. 2001; Frank et al. 2003). Later, few other studies by Wu et al., (2006) also stated the similar pattern of specific anthocyanin pelargonidin-3-*O*-glucoside absorption form strawberries and blackberries (Wu et al. 2006). Felgines et al. (2007) stated that pelargonidin-3-*O*-glucoside present in strawberry was metabolically converted into respective pelargonidin glucuronides and pelargonidin sulfate and got excreted in the urine along with a very minute concentration of pelargonidin glucoside and pelargonidin alone a trace of pelargonidin as parent glucoside and its aglycone. More than 80% of urinary excreted pelargonidin accounts as pelargonidin glucuronides (Felgines et al. 2005). Bioactive compound like Cyanidin-3-*O*-glucoside, 3DA or 3 deoxy derivative, pelargonidin-3-*O*-glucoside, which is present in blackberry was reported as much as less than ten times its bioavailability with the corresponding 0.16% of intake and it is excreted as glucurono, sulfo and methylated metabolites which account for about 13% (Felgines et al. 2005). Pelargonidin glucuronides along with pelargonidin-3-*O*-glucoside are the two forms of anthocyanidins from strawberries found in the blood stream, and it undergoes a metabolic modification before being excreted in the urine along with trace quantities (1–3%) of pelargonidin and pelargonidin-*O*-sulfate, whereas the remaining quantity of pelargonidin was detected in plasma. In human beings on ingestion with strawberries pelargonidin-3-*O*-glucoside, it was metabolically converted to pelargonidin-*O*-glucuronide, which is present predominantly in both plasma and urine rather than the parent glucoside. The Cmax of this metabolite was found to be 274 ± 24 nmol/l after 1.1 ± 0.4 h. The major anthocyanin in strawberries, pelargonidin-*O*-glucuronide, was excreted after its metabolic process within the period of 24 h after its intake (Mullen et al. 2008).

6.4 Anticancer Mechanisms of Pelargonidin

6.4.1 Anticancer Activity Via Inducing Apoptosis

Pelargonidin, an anthocyanin found widespread in most of the berries including blackberry, raspberry, strawberry, and pomegranate, were studied in human colon adenocarcinoma cells (HT-29) (Felgines et al. 2007; Beekwilder et al. 2005). The primary anticancer effect of pelargonidin was screened with well-defined in vitro MTT assay on HT-29 cells. Followed by treatment with a determined concentration of pelargonidin (GI_{50}) against HT-29, induction of apoptosis in cancer cells had been reported. Also, the same study had stated the activation of caspase-dependent apoptotic pathway along with the fragmentation of genomic DNA. Additionally, the microscopical observation of treated cancer cells was found to be pictured with

distinct morphology, including floating cells, cellular shrinkage, and membrane blebbing, which are the hallmark features of apoptosis. A similar pattern of cell morphology in another study was reported as characteristic features of apoptotic induction in cancer cells (Sivalokanathan et al. 2006). HT-29 cell architecture had been pictured with high alterations such as round-up of cancer cells with distorted patterns (Karthi et al. 2016). AO and EtBr (AO/EtBr) fluorescent screening had further pictured the intensive morphology of apoptosis-induced HT-29 cancer cells after pelargonidin treatment in a dose-dependent manner. Basically, AO dye stains both live cells with the rigid cell membrane and permeable dead cells, whereas EtBr stains only apoptotic cells with no cell membrane integrity (Raju et al. 2004). Pelargonidin supplement had reported the notable percentage of both early and late apoptotic colon cancer cells with morphological alterations during apoptosis such as cell shrinkage along with chromatin condensation.

The development and maintenance of a living organism have to be brought by the standard and controlled the homeostatic balance of both cell proliferation and cell death. Numerous physiological functions and pathological processes were based on the key role played by the apoptosis of individual cells. Modulation in the expression pattern of certain antiapoptotic proteins (Bcl-XL, Bcl-2, and A1) was notably unregulated by the specific transcription factor of NF-κB, and that was a key role in the inflammation process. Also, the unique transcription factors of this Bax family along with the contribution of NF-κB induce apoptosis. Apoptotic induction by the pelargonidin in HT-29 cells was illustrated with DNA fragmentation protocol, which has been considered as exemplary biochemical features of apoptosis. The ladder pattern after pelargonidin treatment was evident as a result of oligonucleosomal fragmentation of chromosomal DNA at the early apoptotic stage. The previous research study had stated that pelargonidin with short incubation time brings about early apoptosis and longer exposure of pelargonidin was reported to increase the volume of nuclear fragmentation which evidences the basal mechanism of anticancer effect of the pelargonidin, and also it may act through the apoptotic signaling. Bcl-2 family are known cytoplasmic proteins that regulate apoptosis, in particular sub-group of pro-apoptotic proteins Bax, significantly promotes cell death where other members of the Bcl-2 possess anti-apoptotic activity namely, Bcl-x Land Bcl-w, those includes four regions of similarity with Bcl-2. In this review, it is significant to pinpoint that pelargonidin alters the expression level of Bcl-2 family proteins in cancer cells and thereby induces apoptosis. Consciously, the expression of these particular proteins after pelargonidin treatment was deliberated with the immunoblot analysis, and the study has reported that the expression level of Bax was found to be markedly increased dose dependently in HT-29. At the same time, pelargonidin modulations in BH3 interacting-domain (BID) death were also upregulated. As per the study by Karthi et al., (2016), this treatment also down-regulates the expression of antiapoptosis protein Bcl-2 and Bcl-xL Briefly, this review conveys that pelargonidin specifically promotes the translocation of mitochondrial Bax to the cytosol and triggers the signaling pathway for apoptosis in colon cancer cells.

6.4.2 Pelargonidin and Mitochondrial Pathway

The apoptotic proteins from the mitochondria due to its permeabilization make the cancer cells to induce apoptosis by three major toxic proteins: direct caspase activators, indirect caspase activators, and caspase-independent proapoptotic factors. Initially, the apoptosome was formed by conjugation of cytochrome c with apoptosis-protease activating factor pro-caspase-9, thereby caspase-9 gets activated. Subsequently, this initiator caspase-9 activates downstream caspases 3, 6, and 7, which were denoted as effectors, thereby it activates the last step of the pathway to induce apoptosis (Pradelli et al. 2010). Tumor suppressor p53 induces autophagy and/or apoptosis through its cytosolic and nuclear effects in response to DNA damage and other stresses. Oxidative stress, i.e., increased production of reactive oxygen species (ROS), can also induce apoptosis and autophagy (Fimia and Piacentini 2010). As in the case of pelargonidin treatment against colon cancer cells, Bcl-2 family members that come under proapoptotic activity significantly activate mitochondrial-mediated intrinsic apoptosis, where pelargonidin potentially induces the loss of mitochondrial membrane potential, which in turn activates caspase-9 cascade. Briefly, the cascade was initiated with the release of cytochrome C followed by activation of caspase 3 and caspase 7, where the program cell death was initiated with sequential degradation of cellular functional proteins (Karthi et al. 2016; Adams 2003). On the other hand, this review also explores the upregulation of apoptotic proteins on pelargonidin exposure such as PARP and P53. Based on the previous literature and the various study reports, the current review has summarized the activation of the intrinsic apoptotic mechanism of pelargonidin against colon cancer cells.

6.4.3 Pelargonidin Affects Cell Cycle Regulators

Tumor cell possesses unique characteristic futures by modulating the regulation of the cell cycle in cancer cells. This chapter also concentrates on elaborating on the mechanism of cell cycle arrest induced by pelargonidin in colon cancer cells. Basically, the transition between cell cycle phases is tightly regulated by cyclin-dependent kinases (Cdk). The role of Cdks is to control cell cycle progression by phosphorylation of protein substrates on serine and threonine amino acids. The protein substrates have specific roles that contribute to the cellular events that occur during the cell cycle. For example, Lamin B protein is phosphorylated by Cdk1 during mitosis, which causes nuclear envelope break down. The correct timing of cell cycle phase changes is regulated by specific cyclin-dependent protein kinase complexes. Cyclin-dependent kinases are composed of two proteins: a catalytic subunit known as Cdk and a regulatory protein subunit known as cyclin. The cyclin proteins do not have enzymatic activity; however, they bind and activate the catalytic 6 subunits. At least 25 catalytic Cdks have been described, and each binds to at least one of a large family of cyclin binding partners, creating many possibilities for Cdk cyclin protein pairings (Bruyère and Meijer 2013). The timing of the synthesis of specific cyclins is carefully regulated, which ensures that certain Cdk-cyclin

complexes trigger different stages of the cell cycle. For example, the Cdk4/cyclin D complex functions early in the G1 phase of the cell cycle in response to growth factors, whereas the Cdk1/cyclin B complex enables cells to enter mitosis. There are several biochemical steps required to activate Cdks in addition to cyclin synthesis, thus ensuring cell cycle fidelity. The cell is blocked in the G2 phase of the cell cycle if Cdk1 remains phosphorylated on tyrosine 15, which holds the enzyme in an inactive state regardless of cyclin B1 levels. Eukaryotic cells (including human cells) have a second biochemical system that can regulate CDK activity if the cell has damaged DNA. Another protein kinase, Chk1 (Checkpoint kinase 1), can prevent the activation of Cdk1 by phosphorylating and promoting the degradation of Cdc25 phosphatases. Without Cdc25 phosphatases, cells cannot dephosphorylate tyrosine 15 of the catalytic subunit of Cdk1, thus remain blocked in interphase, usually the G2 phase. Overall, a series of protein phosphorylation and protein synthesis pathways converge to regulate cyclin-dependent protein kinases. It appears that the complexity of these steps provides cells with opportunities to ensure that their genomes are accurately copied and distributed to daughter cells while avoiding genome change (Smith et al. 2007). This part of the chapter specifically focused to reveal the cell cycle arrest and checkpoint adaptation due to induced DNA damage and interface with the cancer cells to enter mitosis. Cells with damaged DNA initiate a biochemical pathway called the "DNA damage checkpoint," which causes a delay in the cell cycle during S phase or G2 phase to allow repair. It is believed that the role of DNA damage checkpoints is to prevent damaged DNA from being transmitted to daughter cells. Cells with damaged DNA initiate a biochemical pathway called the "DNA damage checkpoint," which causes a delay in the cell cycle during S phase or G2 phase to allow repair. Thus, the review study has strongly deliberated the role of pelargonidin-induced DNA damage, and its role in cell cycle checkpoints is to prevent damaged DNA from being transmitted to daughter cells. The DNA damage checkpoint is composed of several overlapping checkpoint systems. S-phase checkpoint provides continuous monitoring of the DNA during DNA replication to ensure that blocked replication complexes or damaged DNA were repaired before replication. The successful completion of DNA replication is assessed in the G2 checkpoint. The G2 checkpoint enables cells to detect unreplicated DNA or DNA that may have been damaged by a variety of means such as genotoxic agents. The cell will delay its progression through the cell cycle at the G2 phase until errors are corrected (Palou et al. 2010). The previous study of our laboratory had strongly pinpointed that the G2/M phase arrest of colon cancer cells was significantly induced by pelargonidin treatment in a dose-dependent manner and take part in a potential role of regulating the expression of subsequential cell cycle regulatory proteins (Karthi et al. 2016). Also, pelargonidin has a minimal effect to inhibit the cells at the G1-S phase of the cell cycle in cancer cells and is mainly due to transition-related CDKs, and their expressions were highly modulated by pelargonidin with inhibiting the function of mutated P53 in colon cancer cells. Thus, the literature study on anthocyanidin, pelargonidin the drug of interest, has high efficacy and efficiency to modulate the expression of functional protein in inhibition of CRC, and thereby it possesses a significant anticancer activity which was summarized in this chapter.

6.5 Conclusions

This comprehensive review about the anticarcinogenic effect of pelargonidin concludes that most of the commercial synthetic and isolated compounds used to treat cancer not only kill cancer cells, but are also proven to be highly cytotoxic to normal cells and would cause a severe adverse effect after therapy. Whereas, pelargonidin being pinpoint and speculate that naturally occurring dietary flavonoid acts as an anticancer therapeutic agent, which inhibits colon carcinogenesis by activating the immune system and by regulating the hyperproliferation, inflammation, angiogenesis, and mitochondrial-mediated apoptosis. In particular, this chapter signifies the importance of pelargonidin in the treatment of colon cancer. Briefly, the review study states that pelargonidin can affect the basic cell functions associated with cancer development. Also, it induces significant cell cycle arrest and apoptosis in cancer cells; thereby, pelargonidin would control the formation and progression of tumors. The previous literature evidence that any alteration in the inhibition of proteins involved in the cell cycle would potentially reflect in inhibition of cell proliferation and block carcinogenesis in tumor cells. Thus, this chapter highlights the pharmacological potential of pelargonidin, and it may be very useful in the prevention of oxidative stress-induced diseases and takes part in vanquishing colon carcinogenesis. Further, a detailed study on pelargonidin would effectively promote the development of new antitumor drugs and regimens for human colorectal carcinoma.

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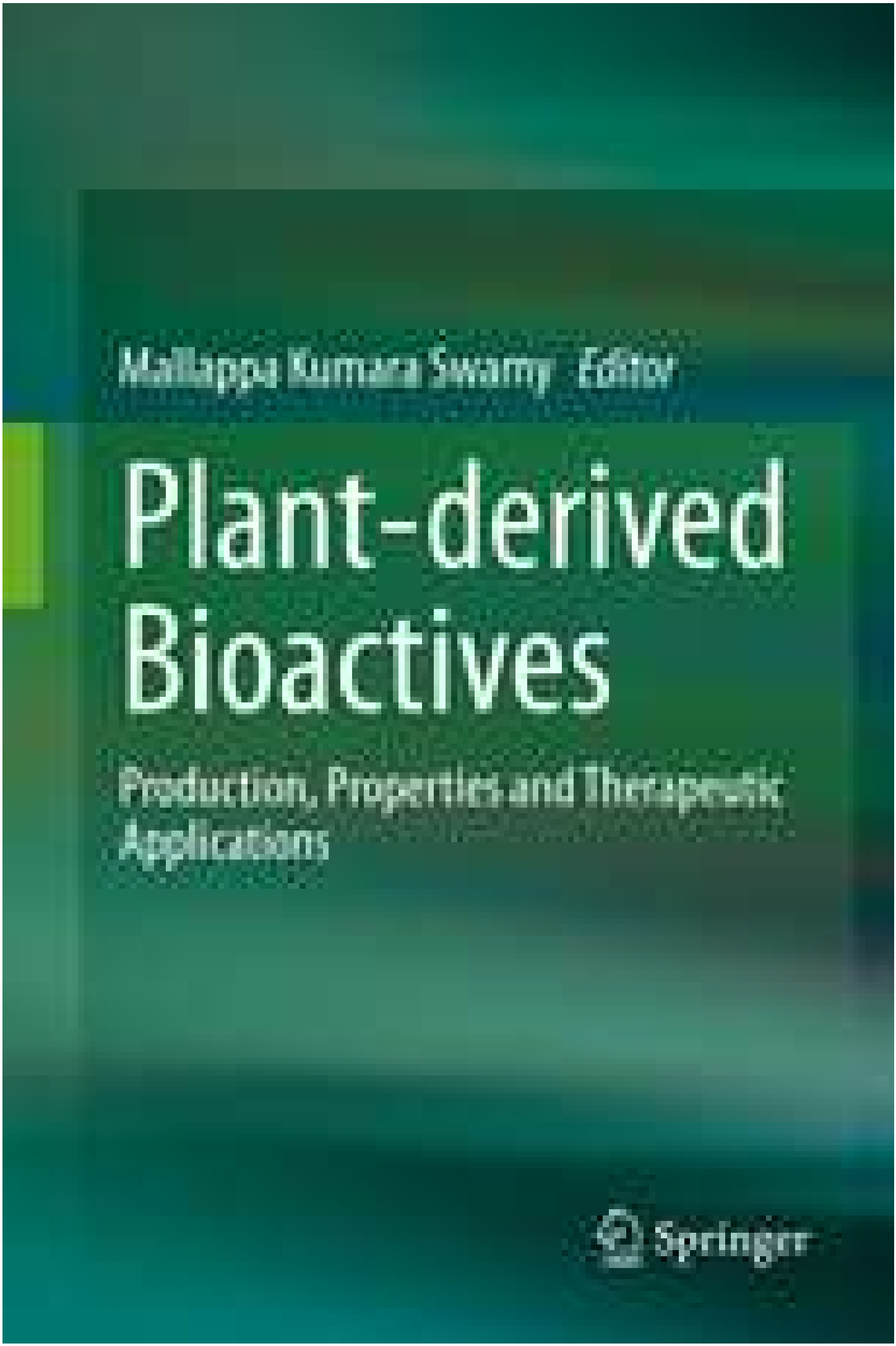
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About this book

Introduction

Plants produce a vast number of bioactive compounds with different chemical scaffolds, which modulate a diverse range of molecular targets and are used as drugs for treating numerous diseases. Most present-day medicines are derived either from plant compounds or their derivatives, and plant compounds continue to offer limitless reserves for the discovery of new medicines. While different classes of plant compounds, like phenolics, flavonoids, saponins and alkaloids, and their potential pharmacological applications are currently being explored, their curative mechanisms are yet to be understood in detail.

This book is divided into 2 volumes and offers detailed information on plant-derived bioactive compounds, including recent research findings. Volume 1, *"Plant-derived Bioactives: Chemistry and Mode of Action"* discusses the chemistry of highly valued plant bioactive compounds and their mode of actions at the molecular level. Volume 2, *"Plant-derived Bioactives: Production, Properties and Therapeutic Applications"* explores the sources, biosynthesis, production, biological properties and therapeutic applications of plant bioactives.

Given their scope, these books are valuable resources for members of the scientific community wishing to further explore various medicinal plants and the therapeutic applications of their bioactive compounds. They appeal to scholars, teachers and scientists involved in plant product research, and facilitate the development of new drugs.

Keywords

Bioactivities Herbal medicine Medicinal plants Natural products Therapeutics

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Plant Flavonoids Against Colorectal Cancer and Mechanisms of Action

2

Srivalli Thimmarayan, Mahalakshmi Manickam, Manjulatha Mekapogu, Bala Murali Krishna Vasamsetti, Mallappa Kumara Swamy, Karthi Natesan, and Manju Vaiyapuri

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Abstract

Worldwide colorectal cancer (CRC) was considered to be a primary health disease that leads to high morbidity and mortality in both developed and developing countries, which can be controlled with novel chemopreventive agents. In the past few decades, chemoprevention of several cancers by the use of natural flavonoids has become an attractive strategy. Bioactive polyphenols with a low molecular weight in the dietary supplements determine the fate of a cell by interacting at the molecular and cellular level. In the past few decades, several preclinical/clinical studies perceptibly figured the chemopreventive and cytotoxic effect of bioactive flavonoids on cancers. Flavonoids have been frequently considered as enzyme inhibitors and ligands of receptors involved in the signal transduction. There has been increasing interest in unrevealing the beneficial and chemoprotective potential of flavonoids that had encouraged in novel drug discovery for CRC. An elaborated molecular mechanism of phytocompounds against cancer treatment overlies with direct interactions between various types of genes and enzymes. It is well known that anticancer efficacy would include apoptosis, antiproliferation, antioxidation, cell cycle arrest, and reversal of multidrug resistance mechanism. This chapter highlights the cumulative research findings of plant-derived bioactive flavonoids against CRC treatment and provides novel insights into its molecular regulation and mechanism with protein interaction in anticancer drug discovery.

Keywords

Flavonoids · Anticancer · Colorectal cancer · Drug discovery · Bioactive compounds

2.1 Introduction

Bowel cancer has been diagnosed as the third most prevalent cancer worldwide. It is reported globally with a very high rate of prevalence and mortality in both sexes. Study literature pinpoints westernized life anticipation, unbalanced diet, uncooked food, processed and canned meats, change in environmental conditions due to urbanization, and synthetic mutagens due to pollution were thought to be a serious etiology of colorectal cancer (CRC). The key factors behind CRC etiology were denoted as oxidative stress caused by the generation of non-neutralizable reactive oxygen species (ROS) and free radicals, which can directly interact with the bio-molecules of living cells and induce spontaneous mutations in bowel cells that leads to colon cancer (Mariyappan et al. 2017). Subsequent accumulation of sequential genetic mutation in a colonic gene, in particular, oncogenes and tumor suppressor genes resulted in the stepwise progression of colon cancer that starts from bowl inflammation followed by the formation of adenomatous polyposis coli and finally leads to colorectal carcinogenesis (Fearon and Vogelstein 1990). Further, intensive

study reports on colorectal cancer in rodent models have stated that microflora of animal guts have a major contribution to the development of colon cancer (Manju and Nalini 2005). Environmental pollutants, chemical toxicants in food, and modernized dietary food style have a direct impact on the microenvironment of gut microbes. Such uncomfortable gut environment resulted in improper metabolism and development of resistance against deadly pathogens and procarcinogens along with unbalanced homeostasis of increased immune response that had extensively known to regulate T cell development and Th17 responses that were denoted as key factors for colon cancer development (Kamada et al. 2013). As per the previous reseach study, various epidemiological case studies had evidently proved that daily diet accounts a dominant role in etiology of CRC; in particular, processed meat and red meat consumption had evidently increased the risk of colon carcinogenesis, whereas consumption of fiber-rich food like fruits, vegetables, and whole grains had highly decreased the colon cancer risk (McGirr et al. 2017). As a highlight of this chapter, consumption of a variety of green leaves, vegetables, and fruits with high fiber contents also includes a variety of naturally occurring bioactive molecules scientifically termed as dietary flavonoids that possess a strong chemoprotective effect against colon cancer and also have inverse action on colon carcinogenesis mechanism (Chang et al. 2018). For decades, scientists have been working with the isolation and characterization of a number of naturally occurring flavonoids and elucidated its pharmacological properties on various study models. Therefore, this chapter particularly provides a brief review of a few such flavonoids along with its biological properties and protective mechanism of action against colorectal cancer.

2.2 Bacterial Enzymes and Colon Cancer

The human digestive tract inhabits approximately about 400 species of bacteria, and it is a complex ecosystem of multiple microorganisms. The literature review provides evidence that invasion of pathogenic bacteria into the intestine was prevented by the presence of anaerobic gut bacteria which in turn reduce the threatened occurrence of CRC, and it is because of bacterial conversion of short-chain fatty acids by dietary fiber (Abeni et al. 2013). Consumption of high-fat and imbalanced diet alters the protective metabolism of intestinal microflora by increased bacterial enzyme activity, which resulted in a decreased host immune responses (Asha and Gayathri 2012). One of the best examples is β-glucuronidase, a common gut bacterial enzyme that produces the toxic metabolites with carcinogenic effect, which has a significant role in the progression of the tumor at secondary sites like large intestine, colon, etc. (Beaud et al. 2005). 1,2-Dimethylhydrazine (DMH) is an alkylating agent which stimulates the formation of methyl adducts with DNA bases that leads to point mutation. It has been well studied that β-glucuronidase enzymes catalysis the conversion of procarcinogen form of DMH into various metabolic intermediates which has a higher efficacy to interact with colon epithelium and act as potent carcinogens (Reddy et al. 1974). The accumulation of aglycones is due to the catalytic activity of β-glucosidase which synergistically hydrolyzes cellulose to lignocellulose

(Sohail et al. 2009; Jeng et al. 2011). On the other hand, the permeability of the colon mucosal membrane was highly altered by the enzymatic catalysis of intestinal mucin by gut bacterial mucinase enzyme (Robertson et al. 1940). Along with other bacterial enzymes, nitroreductase also has a unique task in colon cancer development by producing amines in the colon tissues by catalytic conversion of procarcinogens such like nitropyrenes, dinitrotoluene, and nitrobenzenes (Facchini and Griffiths 1981).

2.3 Reactive Oxygen Species (ROS) and Cancer

Mitochondrial oxidative phosphorylation generates a large amount of ROS by impaired transfer of electrons between complexes I and III of the mitochondrial respiratory chain (MRC). ROS is a collective term that refers to highly reactive oxygen molecules that can be listed as hydroxyl radical (OH−) ions, hydrogen peroxide (H_2O_2), and superoxide anion (O_2-) (Fulda et al. 2010). Naturally occurring antioxidant enzymes such as superoxide dismutase enzymes and catalase serve as defense system by catalytically naturalizing the generated reactive pro-oxidants. ROS may have beneficial effects on regulation of cell proliferation and gene expression, and increased ROS production results in oxidative stress-induced damage to proteins, lipids, and DNA, which has implications in diseases including diabetes, Parkinson's disease, and cancer (Gogvadze et al. 2009). Studies of aging mechanism had revealed the role of oxidative stress in higher probability of risk for cancer development in old age. Generated reactive species or free radicals actively damage genomic or mitochondrial DNA that leads to sudden mutation implicated in the earlier stage of cancer development. Due to mutational genetic instability in DNA causes the modulations in the signal transduction or even induce error in replication would efficiently reflects in induction or repression of specific transcription of the genes related to carcinogenesis. The recent investigation also described that the increased level of intracellular ROS in cancer cells possess a constant and chronic oxidative stress, and thereby it provides a favorable microenvironment for tumor progression. Further, the p53 tumor suppressor was found to be mutated and accounts for up to approximately 50% of all human cancers and is a major activator of antioxidant defense mechanisms. With respect to its apoptosis-inducing capacity, molecules that promote ROS production may be novel therapeutics, proposed to selectively target cancer cells by elevating ROS levels beyond a tolerable threshold to induce mitochondrial outer membrane permeabilization (MOMP) and cell death (Graham et al. 2010).

2.4 Flavonoid

From the ancient years, our folk medicine has been made of different and variety of naturally occurring plant products which later we call as nutraceuticals. Flavonoids are polyphenols produced as secondary byproducts of plants, which were

considered as main constituents of nutraceuticals. Hence, these flavonoids possess numerous pharmacological properties, and these polyphenols were consumed for hundreds of years as diet in form of fruits and vegetables; therefore these polyphenols were called as dietary flavonoids (Li et al. 2018). Chemically these flavonoids were characterized to have basic hydroxylated phenyl moieties with a number of phenolic rings and electron donation functional groups (Manach et al. 2004). Basically, these flavonoids are classified as polyphenols that are responsible for pigmentation in plants. Such polyphenols have a significant physiological function in plants to perform maturation of seeds, actively encounters biotic and abiotic stress of plants, maintains homeostasis of heat, freezing tolerance, act as a defense mechanism against pathogens and takes part in plants detoxification mechanism (Mierziak et al. 2014). Out of thousands of identified flavonoids, diphenyl propane skeleton (C6–C3–C6) with two phenyl ring and one heterocyclic ring form the basic structure of all the flavonoids (Kawser Hossain et al. 2016). Briefly, flavonoids are low molecular weight large group bioactive polyphenols with a basic structure of benzo-γ-pyrone and are widely found in a variety of plants. These flavonoids contain the number of hydroxyl group along with the catechol group at 3- and 5-positions at flavon ring that attributes its radical scavenging effect and antioxidant properties. Based on the structures, these flavonoids were classified into six major subclasses that can be listed as flavones, flavanones, flavanols, flavonols, isoflavones, and anthocyanins/anthocyanidins (Fig. 2.1). A large number of plant-derived bioactive polyphenols have been studied and evidently proved as efficient anti-carcinogenic agents. These flavonoids potentially block cancer development by interfering at multi-stages of carcinogenesis either at initiation, development, or progression of tumors; thereby these molecules have a significant inhibitory effect on proliferation and differentiation of cells and block angiogenesis and metastasis along with a decrease in tumor mass by induction of programmed cell death (Ramos 2007). Earlier research studies evidence that secondary metabolites include flavonoids which are phenolic in nature that possess several pharmacological activities which are structure-dependent (Mahomoodally et al. 2005). The specified quantity of hydroxylation, conjugations with other substitutional functional groups, and polymerization basically determines the structure and chemical nature of the flavonoids. It is well known that flavonoids were rich in hydroxyl groups and functionally act as scavengers to neutralize the free radicals and act as an antioxidant. It also has the capability to chelate metal ions. Previous studies evidenced that these flavonoids possess a chemoprotective effect against various degenerative and infectious diseases like cancer and cardiovascular diseases.

2.5 Functional Flavonoids as Antioxidants

Brief reviews from vast literature denoted that variety of flavonoids act as an antioxidant; in particular, it possesses reducing power to scavenge highly reactive radicals that are generated during human metabolic functions (Brunetti et al. 2013). Previous research investigations on antioxidant activity of these polyphenolic

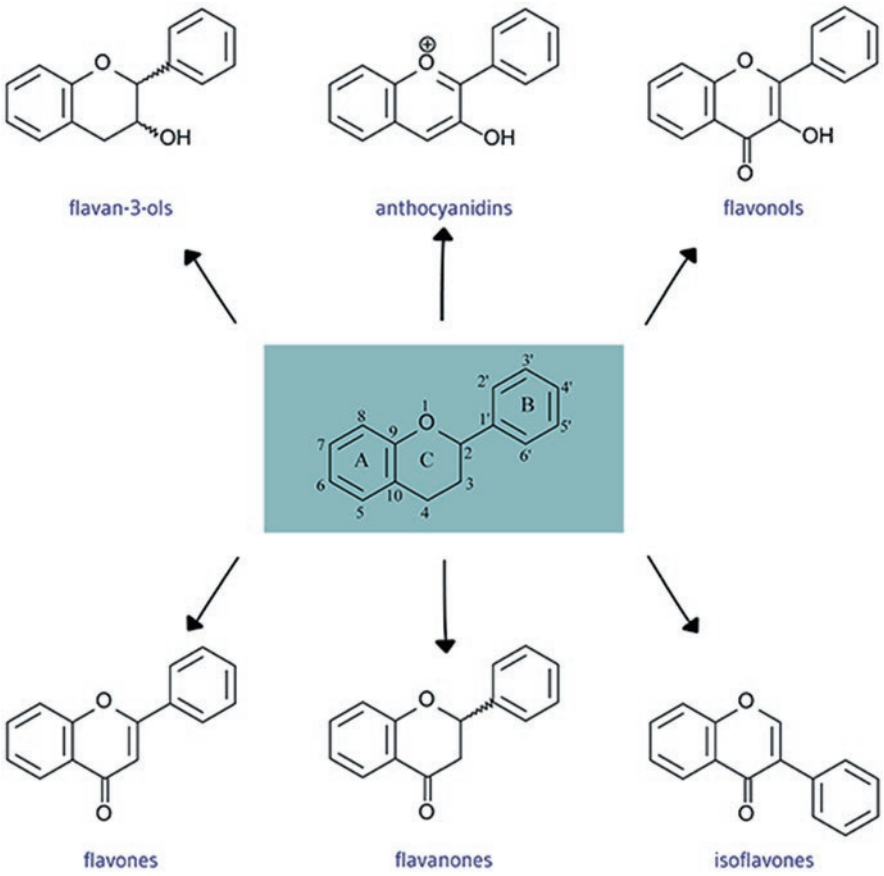


Fig. 2.1 Basic structure of flavonoids

compounds have shown that flavonoids efficiently inhibit specific enzymes like xanthine oxidase and protein kinase C which produce active superoxide radicals (Hanasaki et al. 1994). Also, these bioactive compounds inhibit a wide range of enzymes like cyclooxygenase, lipoxygenase, microsomal monooxygenase, etc. that involves in lipid peroxidation metabolism. An extensive report on the relation between the structure of free radicals and the respective flavonoids had revealed the radical scavenging mechanism and demonstrated its antioxidant potentials (Rice-Evans et al. 1996). Numerous in vivo study models pictured that dietary flavonoids readily scavenge free radicals in the stomach, and thereby they reduce ROS and act as primary antioxidant defense system (Papas 1998). Green medicines always get more attention toward researchers and are an important tool to prevent, reverse, or delay the carcinogenesis. Therefore, prevention could be a possible option for expensive treatments for existing disease. There have been many more compounds that are in a trial which have been declared as prospect chemopreventive agents. It

is well known that these bioactive compounds were commonly present in many food products, commercially available beverages, and many other dietary components. Consumption of these compounds directly or indirectly acts as inhibitory agents on cancer cell proliferation, and thereby these plant flavonoids in foods serve as preventive shield against human carcinogenesis implicated in the prevention of human carcinogenesis possibly through their inhibitory activities of cell proliferation or survival. Decades of research were interested to fix on the natural compounds that include any plant byproduct substances to unmask their anti-carcinogenic effect by tuning the level of intracellular lipid peroxidation and modulate the status of antioxidant that would be used as chemopreventive medicine in the treatment of colorectal cancer. The following are a short brief of few bioactive compounds which were recently studied for their anticancer activity against colorectal cancer.

2.5.1 Eriodictyol

Number of bioactive compounds that are in a trial which have been declared as prospect chemopreventive agents; one of the novel flavonoids recently studied was eriodictyol which comes under flavanone and has been proved to possess antioxidant effect by reducing the level of lipid peroxidation and oxidative stress. The flavonoid rich in citrus and lemons with chemical structure 5,7,3′,4′-tetrahydroxyflavanone was called eriodictyol, and it is naturally occurring in citrus fruits in glycoside form. Eriodictyol was previously considered as vitamin P that was found to be essential in normal small blood vessels (Horowitz 1958). Eriodictyol is an isomer of kaempferol and has been isolated from yerba santa (*Eriodictyon californicum*). Other major sources of eriodictyol were identified as citrus fruits including lemon, lime, and sour orange and green leaves like peppermint. A number of studies had reported few pharmacological properties such as antioxidant, anti-inflammatory, and anticancer activities. Hence the structural chemistry of eriodictyol consists of free electron-donating hydroxyl moieties, which would impact on potent free radicals' scavenging activities which in turn reduces the oxidative stress. Previous experiments on supplementation of eriodictyol to rodent model bearing DMH-induced colon cancer had reported with a significant anti-carcinogenic efficacy against colon cancer models (Fig. 2.2). The study had described that eriodictyol primarily alters antioxidant status, gut microbial enzyme activity, and lipid oxidation status in cancer-bearing rats. Prolonged treatment with this flavonoid had intensively reduced pre-neoplastic lesions along with the decrease in aberrant crypt numbers that was reported. β-Glucuronidase suppressor would effectively reduce ACF formation that was early reported in past decades (Takada et al. 1982). Cordially another study also evidently pointed out that chronic treatment of eriodictyol had highly influenced the reduction of β-glucuronidase activity in DMH-induced colon cancer rat models. It is likely to be believed that oxidative stress and lipid peroxidation induce cancer cell initiation and proliferation (Peluso et al. 2011). In connection, extensive study with eriodictyol supplementation to colon cancer-bearing rats showed a notable decrease in lipid peroxidation and pro-oxidant status; thereby colon cancer

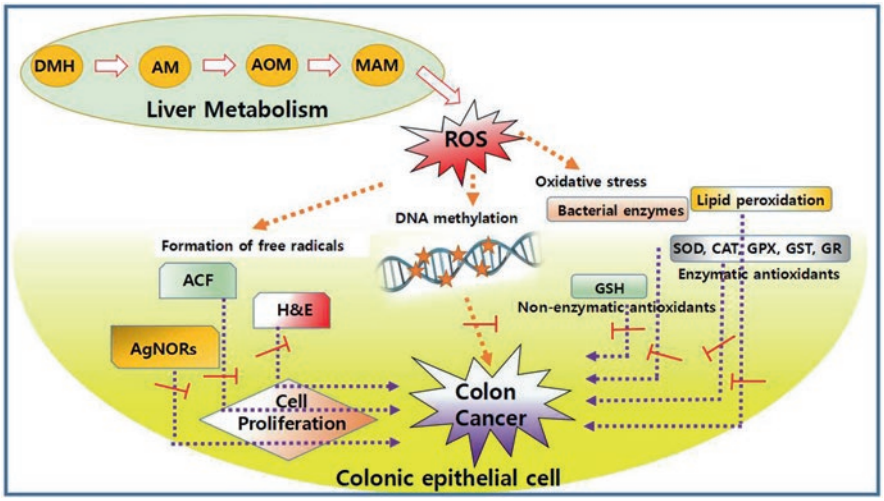


Fig. 2.2 Graphical representation of eriodictyol's protective mechanism against DMH-induced colorectal cancer models

progression and severity were highly reduced (Mariyappan et al. 2017). Highlights of eriodictyol on gut enzyme activity were reported as considerable inhibition of sulfo-conjugations; thereby nitroreductase sulfatase enzyme activities were thought to be decreased, and on the other hand it is well studied that high number of cancer was reported on increased activity of gut sulfatase and nitroreductase enzymes. As a pictorial proof, eriodictyol's anti-carcinogenic effect was reported with the histological examination on eriodictyol-supplemented rat models, and the study had pictured the architecture of the colon cancer cells after treatment, and the abnormal changes were highly reduced with decreased dysplastic cells in the colon tissue of flavonoid-treated rats. As a whole, this review about eriodictyol had briefly elaborated the mechanism of antioxidant potential and anti-carcinogenic effect against cancer models.

2.5.2 Umbelliferone

Umbelliferone had been a known and well-studied coumarin, a flavonoid with benzopyrone in nature, and was widely spread in common plants and herbs like parsley sanicle, fennel, celery, giant hogweed, cumin, and asafoetida (Mazimba 2017). This particular bioactive coumarin compound was reported to possess an effective antioxidant role; hence it has been derived from plant polyphenols and consumed as diet in form of fruits and vegetables from ancient days (Hoult and Payá 1996). Here we concise a summarized view on antioxidant potential and anti-carcinogenic effect of pharmacologically active 7-hydroxycoumarin, i.e., umbelliferone. A recent research was highly considered that the use of potentially active

phyto-flavonoids is a novel and efficient method to treat and eliminate colon cancer as illustrated in (Muthu et al. 2016). These bioactive compounds that include umbelliferone have been found to modulate the various signaling pathways; thereby it considerably inhibits the pathogenesis of colorectal cancer, and it is designated as a novel anticancer agent. One of the previous studies in our team had efficiently proved that umbelliferone had stiffly and strongly inhibited CRC in DMH-induced colon cancer rat models (Muthu et al. 2016). It is well studied that DMH induction in rats generates a large amount of ROS and causes genetic mutation in colon genes which would be resulted in an initial increase in aberrant crypt formation and later the pathogenesis that lead to colon epithelial carcinoma (Sengottuvelan et al. 2006). Earlier study on rats had reported that intraperitoneal administration of umbelliferone to CRC-bearing rats significantly inhibited and reduced the formation of a specified number of the aberrant crypt in colon epithelial at an early stage of colon cancer. It is to be highlighted that the study also confirmed with the histological pictures of reduced ACF in umbelliferone-treated CRC rat models. Further, the same study had stated that umbelliferone has efficacy to arrest cancer cell proliferation and the AgNOR quantification with image tools that had indexed the reduced cell activation in umbelliferone-treated to CRC-bearing rats (Sirri et al. 1995). Subsequently, mast cells provide a considerable microenvironment for cancer cells to proliferate and survive by means of increased angiogenesis (Oldford and Marshall 2015).

Further reports from previous literature had stated that umbelliferone-treated to CRC-bearing rats have a significant decrease in a number of mast cells, and it clearly indexed the anti-inflammatory effect of umbelliferone in carcinogenesis models. Extensive study reports of primary inflammatory markers like tumor necrosis factor-alpha (TNF-α), interleukin-1, *cyclooxygenase* (*COX*), and iNOS that were known to be activated by ROS on CRC models had indicated that umbelliferone significantly had changed the microenvironment of tumor cells by downregulating the expression of intestinal inflammatory marker in cancer-bearing rats (Takahashi et al. 2015). Thereby it has been evidently shown that umbelliferone modulates NF-kB signaling pathway.

Also, umbelliferone had been reported to induce apoptosis and DNA fragmentation by activation of Bax-dependent caspase pathway of apoptosis in CRC rats (Fig. 2.3). As a whole, this brief review about umbelliferone against CRC has clearly pictured the potential use of this particular flavonoid to eliminate colon cancer. Further intensive preclinical and clinical studies on cancer models would be helpful to unravel its complete mechanism of action and would be made commercially available for cancer patients.

2.5.3 Luteolin

Luteolin was classified under flavones of flavonoids based on its chemical structure. Chemically its architecture is of 3′,4′,5,7-tetrahydroxyflavone and was found widespread in most of the plants. Luteolin structure is composed of A and B, two benzene ring, one C ring with oxygen, and a double bond at 2–3 along with readily

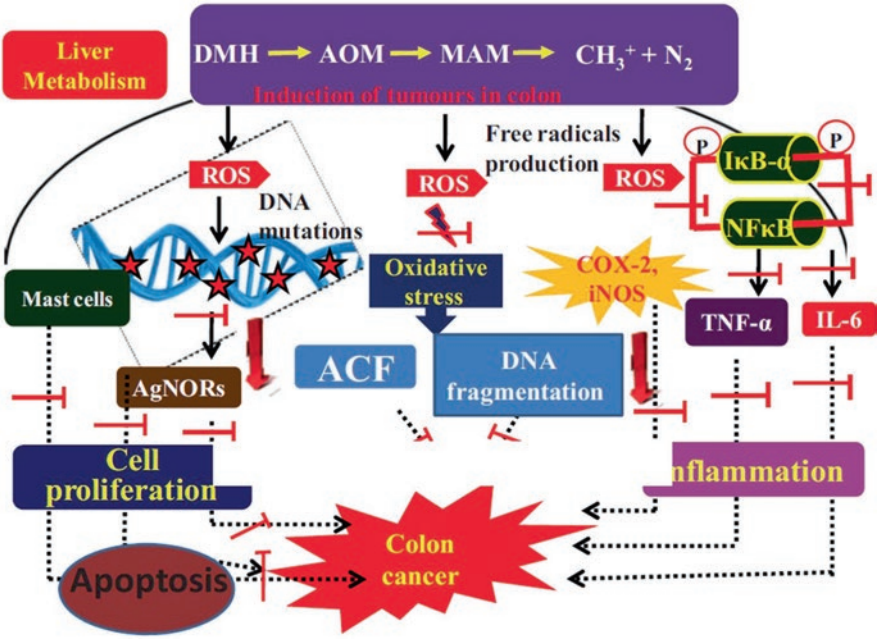


Fig. 2.3 Schematic representation of umbelliferone against DMH-induced colon cancer

reducing several hydroxyl groups at 5-, 7-, 3′-, and 4′-positions as shown in (Ross and Kasum 2002). Abundant and naturally occurring sources of luteolin supplementation that were available such as parsley, onion leaves, broccoli, celery, cabbages, chrysanthemum flowers, carrots, peppers, and peanuts were listed (Pandurangan and Esa 2014). Hence it consists of a large number of reducing groups, and it can readily donate an electron to free radicals and scavenge generated ROS. Further literature studies have cumulatively accounted pharmacological properties such like cardio-protective (Madhesh and Vaiyapuri 2013), antioxidant (Ashokkumar and Sudhandiran 2008), anticancer (Manju and Nalini 2005) (Manju), and anti-inflammatory activities (Nishitani et al. 2013). Previous investigations had stated that luteolin possesses significant antiproliferative effect against various cancers that include breast, liver, prostate, esophageal, and lung cancers; thereby it plays a key role as strong chemoprotective agent (Pandurangan and Esa 2014). Any abnormal increase in neoplastic cells due to the absence of apoptosis leads to tumor mass progression with increased cell differentiates, angiogenesis, oxidative stress due to over metabolic process and resulted with metastasis of cancer. Overproduction of ROS due to increased metabolism is not only the factor for cancer progression; lack of sufficient antioxidant defense to scavenge the radicals generated by cancer cell plays a vital role in carcinogenesis (Cheng et al. 2012). Therefore normal cells require endogenous and supplemented antioxidants to fight against the oxidative stress generated by cancer cells. Hence, luteolin possesses more electron donor

functional groups, and it serves as a rapid antioxidant to scavenge the unstable reactive free radicals to protect the cells from intracellular ROS lesions. In particular, luteolin induces cell cycle arrest and programmed cell death; thereby it efficiently blocks the invasion of cancer cells. Earlier research studies on cancer therapy had explained about the apoptosis mechanism and it was initiated by death receptors and sub-sequential activation of mitochondrial-dependent caspase pathway (Ma et al. 2018). Large number of bioactive compound has a potential chemoprotective effect to induce programmed cell death in cancer cells that were evaluated by a number of investigators in past decades, and also the previous study reports the anticancer efficacy of luteolin against human colon cancer cells that were sequenced by induced cell cycle arrest and followed with activation of caspase-dependent intrinsic apoptotic pathway (Pandurangan and Esa 2014). Pathogenesis of colon cancer in DMH rats involves lipid peroxidation to form active malondialdehyde, conjugated dienes, and lipid hydroperoxides, which causes considerable damage in cells. In our previous study using DMH-induced rate models, we had evidently pictured and elaborated mechanism of action on how the target flavonoid luteolin had significantly reduced the tumor cell number mediated by a decrease in lipid peroxidation and inversely increased endogenous enzyme-dependent antioxidant mechanism. For the past decades level of glycoprotein in serum was considered as one of the hallmark markers to assess cancer, hence this glycoprotein plays a key role in cell-cell recognition, cellular adhesion, binding, and cellular transport, during rapid proliferation and differentiation of cancer cells the level of this specific protein would be elevated and its server as valuable marker carcinogenic process. Luteolin-administered DMH rats found to have a lower level of these glycoproteins were reported (Pandurangan et al. 2012). Earlier literature reports on luteolin had stated to induce cell shrinkage followed by chromatin condensation and finally leads to DNA fragmentation, which was said to be the hallmark of apoptosis in colon cancer cells. Activation of effector caspases and Bax/Bcl2 ratio critically determine the fate of the cancer cell to induce apoptosis. This was followed by the successive release of mitochondrial cytochrome C conform the activation of mitochondrial-dependent intrinsic apoptosis and this hypothesis was tested with various cancer cell against luteolin treatment was reported (Attoub et al. 2011; Pandurangan and Ganapsam 2013). Use of such naturally occurring phytocompounds in the prevention of colon cancer was expected to be safe and avoid the adverse effect of anticancer drugs like synthetic chemotherapeutic compounds. This chapter also summarizes the ample of research evidence from the past study reports to show the chemopreventive potential of bioactive flavonoids in the prevention of colon carcinoma.

2.6 Conclusions

Consumption of dietary flavonoids in a consistent manner and an adequate amount has been proven to be a significant nutritional therapy to prevent and lower the risk of colorectal cancer, which could be implicated to enhance for cancer treatments. This chapter insensitively discussed about the flavonoids as chemopreventive drugs

to treat cancer, and also elaborated the primary mechanisms of action of such bioactive flavonoids on chemically/carcinogen-induced oxidative stress. Efficacy of flavonoids to reduce the oxidative stress by scavenging ROS is considered as a principal factor to act as antioxidant and anti-inflammatory properties. Hence, colon cancer is a chronic disease, and its progression was brought by continuous bowel inflammation caused by oxidative stress and various other factors. Supplementation of flavonoids potentially prevents the inflammation, thus controlling colon cancer progression and invasion. Further, it modulate the expression of oncogenic and apoptotic proteins in cancer models, thereby activating Bax/Bcl2-mediated mitochondrial apoptotic pathway. A number of recent studies also have pinpointed the synergetic effects of flavonoids along with other anticancer drugs. Hence, the present review concludes that flavonoids have a significant anticancer potential against colon cancer, and it can be used as drug/supplements to prevent inflammation, and it helps to eradicate cancer diseases. However, the prospective cohort preclinical and clinical studies on flavonoids would help to better understand other mechanisms of dietary flavonoids for improved implication in the treatment of a number of cancer diseases.

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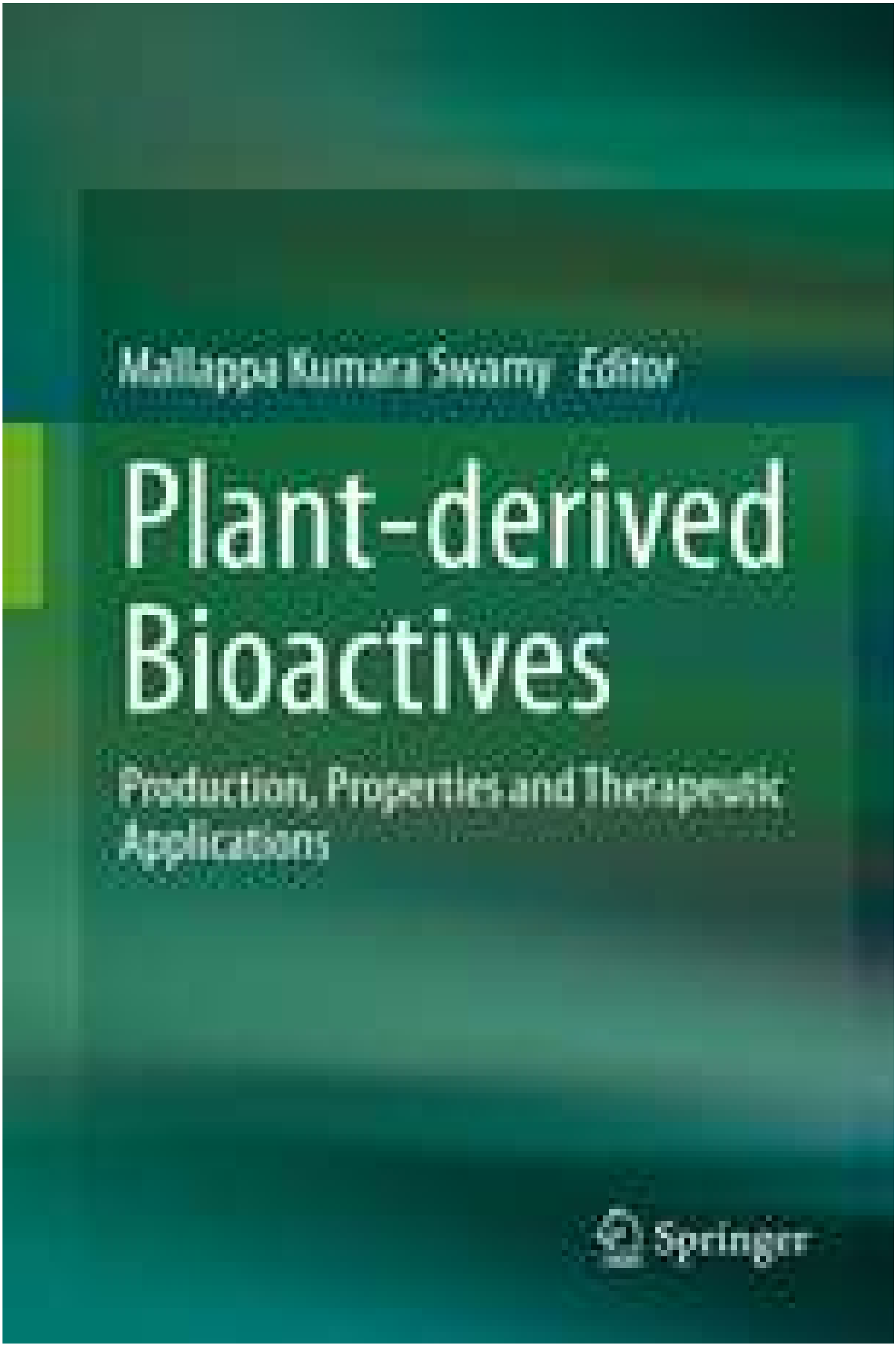
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About this book

Introduction

Plants produce a vast number of bioactive compounds with different chemical scaffolds, which modulate a diverse range of molecular targets and are used as drugs for treating numerous diseases. Most present-day medicines are derived either from plant compounds or their derivatives, and plant compounds continue to offer limitless reserves for the discovery of new medicines. While different classes of plant compounds, like phenolics, flavonoids, saponins and alkaloids, and their potential pharmacological applications are currently being explored, their curative mechanisms are yet to be understood in detail.

This book is divided into 2 volumes and offers detailed information on plant-derived bioactive compounds, including recent research findings. Volume 1, *"Plant-derived Bioactives: Chemistry and Mode of Action"* discusses the chemistry of highly valued plant bioactive compounds and their mode of actions at the molecular level. Volume 2, *"Plant-derived Bioactives: Production, Properties and Therapeutic Applications"* explores the sources, biosynthesis, production, biological properties and therapeutic applications of plant bioactives.

Given their scope, these books are valuable resources for members of the scientific community wishing to further explore various medicinal plants and the therapeutic applications of their bioactive compounds. They appeal to scholars, teachers and scientists involved in plant product research, and facilitate the development of new drugs.

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6 Pelargonidin, a Dietary Anthocyanidin in the Prevention of Colorectal Cancer and Its Chemoprotective Mechanisms

Manju Vaiyapuri, Srivalli Thimmarayan, Madhusmitha Dhupal, Harikrishna Reddy Rallabandi, Manjulatha Mekapogu, Bala Murali Krishna Vasamsetti, Mallappa Kumara Swamy, and Karthi Natesan

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Abstract

Diseases of bowl wall mucosa stemming from sudden mutation lead to the development of colorectal cancer (CRC) cells by the transformation of normal epithelial cells into neoplastic lesions. CRC is considered to be a global burden; hence, its incidence rate is expeditiously increased up to ten-fold higher, worldwide. The epidemiological report pinpointed CRC as the utmost third common malignancy in men and second in women. Because of greater efficacy, the synthetic drugs are unsatisfactory due to higher toxic effects to the normal cells, and a chance of developing multidrug resistance by tumor cells. Therefore, dietary flavonoids with potent anticarcinogenic effects have been focused on recent investigations. Pelargonidin (PD), a bioactive molecule classified under anthocyanidin is present in red and pink pigmented berries. PD efficiently modulates intercellular antioxidant status, thereby reducing oxidative DNA damage, cellular proliferation, differentiation, apoptosis, angiogenesis, and reverse drug resistance of metastatic cells, and potentially induces cell cycle arrest, thereby interfering in colorectal carcinogenesis. PD scavenges and normalizes the intracellular reactive oxygen species (ROS), which results in gene mutation and induction of colon carcinogenesis. Therefore, the proliferation of tumor cells would be affected or blocked potentially due to disturbance in cell cycle protein by these ROS. Considering the wide pharmacological benefits of PD, this chapter deliberately reviews the cumulative research data from in vitro human colon cancer cell line studies on chemoprotective property of PD against CRC, and also summarizes the underlying mechanism in experimental models.

Keywords

Colorectal cancer (CRC) · Pelargonidin · Antioxidant · Apoptosis · Chemoprevention

6.1 Introduction

Flavonoids are low-molecular-weight large group bioactive polyphenols with a basic benzo-γ-pyrone as a backbone structure, and are widespread in a variety of plants. These bioactive compounds potentially induce apoptosis and modulate tumor cell proliferation, angiogenesis, and differentiation, thereby directly interfering at each step of carcinogenesis (Ramos 2007). A number of research studies evidenced that

secondary metabolites include flavonoids which are phenolic in nature and possess several pharmacological activities based on its unique chemical structure (Mahomoodally et al. 2005). Basically, the degree of chemical reactions such as hydroxylation, substitutions, polymerization, and conjugations determines its specific chemical properties. More interestingly, the antioxidant, metal chelating, and free radical scavenging efficiency of flavonoids were enumerated by the number of hydroxyl groups present in the flavonoids. Chelating property of flavonoids primarily prevents damage of biomolecule by stress-induced intracellular free radicals. Previous studies had evidence that flavonoids possess a chemoprotective effect against various degenerative and infectious diseases like cancer and cardiovascular diseases. Pelargonidin (PD), a bioactive molecule classified under anthocyanidin, is present in red and pink pigmented berries. This phytochemical efficiently modulates intercellular antioxidant status, thereby reducing oxidative DNA damage, cellular proliferation, differentiation, apoptosis, angiogenesis, and reverse drug resistance of metastatic cells, and potentially induces cell cycle arrest, thereby interfering in colorectal carcinogenesis. PD scavenges and normalizes the intracellular reactive oxygen species (ROS), which results in gene mutation and induction of colon carcinogenesis. Therefore, this chapter aims to provide a cumulative research data from in vitro human colon cancer cell line studies on chemoprotective property of PD against CRC, and also focuses to summarize the underlying mechanism in experimental models.

6.2 Colorectal Cancer (CRC): A General Overview

Rapid growth and progressive spreading through adjoining tissues lead to metastasis, and the formation of secondary tumors at different sites is the basic nature of the tumor cells (Tanaka 2009). Successive angiogenesis and uncontrolled proliferation of stem cells are the two important hallmarks of carcinogenesis (Neergheen et al. 2010). Colorectal cancer can be mentioned as a mucosal disease. Bowel wall mucosal lining is found to be the basal origin of colon cancer. This bowel wall anatomically consists of different layers, such as mucosa, submucosa, the serosa, and the muscularis propria. In particular, single-layered columnar epithelial goblet cells of bowel wall were termed as mucosa, which produces mucus, and identified as the primary site of colon cancer induction due to genetic mutations. The mutated cells in this region usually proliferate very rapidly and spread into the lumen. Further progression takes place at microvilli, where the crypts of Lieberkuhn were reprocessed. The strongest layer stand under mucosa is submucosa, and it is considered as an important region for carcinogenesis, and hence this layer includes vascular blood vessels and terminal and lymphatics nerve fibers by the way the tumor cells invade the circulatory system and spread throughout the body.

6.2.1 Colorectal Cancer Epidemiology

Worldwide, third most frequently recorded cancer in men and the second common cancer in women was statically reported as CRC (Ferlay et al. 2015). The incidence

rate increased up to ten-fold higher worldwide with a steep increase in notable countries, such as Australia, New Zealand, the Czech Republic, Slovakia, Kuwait, Israel, and low middle-income countries. Increased risk factors including an unbalanced diet, increased body weight, alcohol, and habitual tobacco consumption are the major reasons behind the sudden increase in the prevalence of CRC in Asian and Eastern European countries (Torre et al. 2015). Moreover, poor diagnosis at initial stage of CRC would lead to metastasis, and cordial epidemiological report had stated that it would be the universal burden which would record more new colon cancer cases approximately 2.2 million peoples and mortality may reach up to 1.1 million by the year of 2030 (Arnold et al. 2017; Ouakrim et al. 2015). Even though the mortality rates throughout the world have been declining in a huge amount in a number of countries, mortality still occurs in few countries like Romania, South America, Russia, and Brazil (Torre et al. 2015).

6.2.2 Etiology of Colorectal Cancer

The major lifestyle-related risk factors include lack of physical activity, over bodyweight, red meat and canned food intake in large amounts, habitual smoking, consumption of alcohol, and a diet lacking in vegetables and fruits. Previous family or individual history of colon polyps, and individual history of type 2 diabetes, bowel disease due to chronic inflammation, or genetic diseases such as Lynch syndrome or familial adenomatous polyposis has been proved as an important risk factor for CRC. The precise causes of colorectal cancer seem to be unknown. However, few studies state the etiology of developing colorectal cancer. The prevalence of CRC has been gradually increasing in urbanized countries, and also the rate of incidence in economically transitioning countries has been raised due to Western lifestyle culture. High fat, high calories diet, processed meats, and low fiber intake are strongly associated with the development of colorectal cancer. It has been proved that the chemical carcinogen produced while the meat was overcooked at a very high temperature, which includes frying, boiling, and grilling, is prone to cause colon cancer (Gingras and Béliveau 2011). Sedentary lifestyle and obesity play a major part in the development and progression of the number of cancer including CRC were evident by epidemiological reports. Lack of physical activity and increased body weight are the two important modifiable and inter-relatable risk factors that account third of CRC. The physical activity, which stimulates the movement of colon and the passage of waste through the colon activity, is associated with a decreased risk of CRC (Lee et al. 2007). Epidemiological evidence indicates that increased consumption of red meat such as beef, pork, and lamb are prone to cause colorectal cancer in both men and women. Stastical data had shown substantial proportion, ranging from 30% to 70%, of all colorectal cancer cases are attributable to diet with red and processed meat intakes, which is implicated as important dietary risk factors. Red meat, processed meat, and meat derived heterocyclic amines (HCAs), polycyclic aromatic hydrocarbons (PAHs), nitrites, and nitrates are the known animal mutagenic compounds formed when muscle meat is cooked using high temperature. Nitrites are

harmful and are more susceptible to develop cancer at proximal colon, whereas HCAs and PHAs cause cancer in the region of the distal colon and rectum. Greater red meat and processed meat intakes were more consistently associated with colorectal carcinoma (Miller et al. 2013).

6.2.3 Pathogenesis of Colorectal Cancer

In accordance to etiology of CRC, chronic inflammation and sudden mutation resulted in the formation of polyps on distinct sites of colon and rectum, and epithelial lining is the primary characteristic of colorectal cancer development, and these polyps can be nonneoplastic or neoplastic. The microenvironment of cancer cells and epigenetic changes along with genetic mutations play a key role in multistep carcinogenesis. These epigenetic mechanisms mostly programmed in most of the cancer cells in the process of DNA methylation along with alterations in histone proteins (Bardhan and Liu 2013). The CRC development in most of the cases would be a subsequential modulation in signaling pathways as a result of respective oncogenes activation and also inactivation of tumor suppressor genes. In addition, chromosomal gains or losses are termed as chromosomal instability (CIN), and sudden insertion/deletion in the specific DNA sequence would be the reason for microsatellite instability (MSI) (Jass 2007). Most often, etiology of distal colon cancer development and progression was mainly due to CIN, which accounts for about 60–70% of total CRC cases. However, most common proximal colon cancer was observed in MSI cases. Mutations in adenomatous polyposis coli (APC) were induced by dysplastic aberrant crypt foci, where it pawed away in the transformation of polyps to cancer by activation Wnt pathway. Such mutations in APC or genes involved in Wnt signaling pathways such as KRAS or TP53 would help in the progression of dACF to tumor cells (Nosho et al. 2008). Also, epigenetic alterations in the promoter region of the respective gene including DNA methylation and histone modifications is the key factor in cancer cells epigenetic inheritance DNA methylation involves the enzymatic addition of a methyl group to the 5′-position of cytosine by DNA methyltransferases (DNMTs) to form 5-methylcytosine. The DNMTs work on specific CG dinucleotide sequences, known as CpGs. More than 70% of the cytosine (C) bases in the context of CpG dinucleotides are supposed to undergo methylation. The biallelic promoter CpG island methylation of the mismatch repair gene MLH1 is characterized to be the primary epigenetic mechanism leading to the development of sporadic colorectal cancer associated with MSI-H (Bardhan and Liu 2013). Histone deacetyl transferases (HDACs) are the most widely characterized proteins among the histone modification enzymes that play predominant roles in the development of CRC. The high HDAC expression has been shown to be associated with reduced survival in CRC patients (Ashktorab et al. 2009).

Intracellular oxidative stress is mainly because of the imbalanced state of unstable highly reactive free radicals and the intermediate metabolites. These free radicals were commonly called reactive oxygen species (ROS), and also the inbuilt cellular mechanism to neutralize and protect cells from such ROS is termed as

antioxidants. ROS rapidly attacks the bricks of the cellular components such as all the important biomolecules that cause serious damage and defect to the whole organism (Ďuračková 2010). Intensive studies on oxidative stress mechanism during the last 20 years by a number of researchers have unmasked its key role in chronic inflammation; thereby, it has a significant role in the progression of several inflammation-related disease conditions, including cancer, cardiovascular, diabetes, pulmonary, and neurological diseases. When cells encounter a sudden attack by oxidative stress, it triggers several subsequent inflammation-related molecular pathways, such as NF-κB, HIF-1α, AP-1, PPAR-γ, p53, β-catenin/Wnt, and Nrf2 (Reuter et al. 2010). Widely occuring procarcinogens, the toxin from environmental pollution, and intracellular phagocytosis by chemo drugs generate an enormous amount of ROS as the metabolic intermediates (Klaunig et al. 2011). Oxidative stress has been found to take part in the aging process, and also it has a major impact on the prevalence of cancer in old age. More interestingly, any serious damage to the genomic DNA or mitochondrial DNA due to ROS will imitate carcinogenesis in most cases. Further, such a process may vary based on the type of tissue or triggered/suppressed transcription of certain gene or modulation in the signaling pathway or some mutational errors in replication, which would significantly result in genetic instability. It has also been studied that a notable amount of intracellular ROS was generated in tumor cells which leads to a specific microenvironment that maintains constant oxidative stress in tumor cells which favors cancer progression. Human cancer is a major activator of antioxidant defense mechanisms. With respect to its apoptosis-inducing capacity, molecules that promote ROS production may be novel therapeutics, proposed to selectively target cancer cells by elevating ROS levels beyond a tolerable threshold to induce mitochondrial outer membrane permeabilization (MOMP) and cell death (Graham et al. 2010).

Most of the common physical work and intermediates of cellular metabolism results in the inevitable production of oxidants and free radicals. At the same time, an inbuilt protective mechanism for the human body is antioxidants and that will be different for each cell type and tissues, and its mode of action might vary as a synergistic effect or even antagonistic effect based on the site of action. The cellular antioxidant defense system includes natural enzymatic antioxidant, namely catalase (CAT) which hydrolyzes H_2O_2, superoxide neutralizing enzyme superoxide dismutase (SOD), glutathione-dependent catalytic enzymes glutathione peroxidase (GPx), glutathione reductase (GR), and glutathione-S-transferase (GST), and nonenzymatic antioxidants such as retinol (Vit A), ascorbic acid (Vit C), and tocopherol (Vit E) which includes vitamin A, vitamin C, vitamin E, polyphenols, pigmented carotenoids, and other natural by-products as antioxidants, paying attention great interest in recent decades. Antioxidants at very low concentrations have a higher efficacy to prevent any oxidative damage to cells when compared to antioxidants that donate an electron to stabilize free radicals and thereby inhibit its detrimental effects. SOD is an endogenous antioxidant that involves catalysis dismutation reaction, thereby producing hydrogen peroxide (H_2O_2) from most of the superoxides (O_2^-). Further, CAT catalyzes H_2O_2, the end product of SOD, and splits them into oxygen and water. On the other hand, glutathione-dependent enzyme glutathione peroxidase

(GPx) significantly neutralizes the transition metals, and with the help of GSH as cofactor, it also catalyzes H_2O_2 in the aqueous phase of the cell membrane (Valadez-Vega et al. 2013). GR catalyzes the reduction of oxidized glutathione and thereby maintains the cellular GSH level, thus altering the GSH/GSSH ratio. Further, GSH and intracellular electrophile conjugation were facilitated by glutathione-S-transferase (GST), also called Phase II detoxifying enzymes. The conjugation of GSH to electrophilic compounds is catalyzed by Phase II detoxifying enzymes called glutathione-S-transferase (GST). GSH has been considered as an important natural intracellular antioxidant and has a major role in neutralization and detoxification of ROS such as peroxides, which is produced as a result of increased LPO. It also takes a role in conjugation and excretion of toxic molecules, and thereby it maintains the normal cell structure and function (Dickinson and Forman 2002).

Human beings are constantly bombarded by ROS by means of exogenous factors, such as tobacco, smoking, chemicals, ultraviolet (UV) rays, and many other agents. It also includes drugs or medicines which are used for medical practice. The aerobic cellular metabolism generates highly reactive free radicals in terms of oxidants, which cause serious damage to different types of cells and tissues due to normal physiological conditions. The protection mechanism against infection involves NADPH enzyme activity found in neutrophils and macrophages, and also the electron transfer system of mitochondria or microsomes and peroxisomes takes a vital role in the production of ROS endogenously (Noda and Wakasugi 2001). ROS are not only prone to cause cancer but also many other human diseases (Hippeli et al. 1999). The necrotic lesion was formed by the peroxidation of the biological membrane by highly reactive oxygen with lipids (Halliwell 1994). These ROS in higher amounts alter the biomolecules, such as proteins, lipids, lipoproteins, and deoxyribonucleic acid (DNA). The active oxygen species also induce gene mutation, which results in the development of cancer; on the other hand, it also modulates signal transduction and either triggers/suppresses transcription factors which are also a mechanism of induction of carcinogenesis (Floyd et al. 1986). Tumor suppressor genes p53 and gene involved in cell cycle regulation are highly susceptible to mutations as a result of DNA damage in the presence of ROS. Also the product of LOP, malondialdehyde, potentially induces mutation. Many researchers have pointed out the necessity of enzymatic and nonenzymatic antioxidants to maintain the natural oxidative homeostasis of the organism especially in tumor therapy. Endogenous enzymatic antioxidants, such as SOD, CAT, GPx, GR, and GSt, play a vital role in chelating superoxides and peroxides. Therefore, tumor therapy is basically based on oxidative stress and antioxidant homeostasis (Čipak gašparović et al. 2010).

Plant products are widely used in the present world as medicines, due to the fact that they are very effective therapeutically. Moreover, they are relatively more safe when compared to any synthetic drugs (Singh and Tripathi 2018; Datir 2018; Akhtar and Swamy 2018). Natural products, mainly plant metabolites, exert superior antitumor properties by reducing the action of reactive oxygen species and protecting the critical constituents of cells, that is, macromolecules like nucleic acids and proteins from oxidative damages (Ravichandra et al. 2018). As a result, plant-derived metabolites have attracted researchers in the field of natural medicines to design effective chemodrugs for

treating cancers. Thus, plant-derived compounds are well recognized as anticancer agents, and some of them are being used in the present market for treating various cancer types (Akhtar and Swamy 2018). Drug molecules like camptothecin, vincristine, and vinblastine are some of the examples of chemodrugs derived from plant sources. However, these drugs pose a challenge of toxicity and cause side effects. Hence, a continuous search is in progress to innovate novel drug molecules against cancers. In this regard, different plant species are being explored to isolate new phytochemicals and to evaluate their bioactivities. Likewise, plant molecules are also evaluated for their antiproliferative potentials. Pelargonidin, an anthocyanidin, is among them, and the details of it are given in the following section. Also, the role of a phytochemical against different CRC cells is discussed, emphasizing on its mechanisms of actions.

6.3 Pelargonidin: An Anthocyanidin

The chemical structure of anthocyanins consists of flavylium cation, which is linked to hydroxyl (–OH) and/or methoxyl ($–OCH_3$) groups along with one or more sugar molecules. Anthocyanins without sugars are known as anthocyanidins. Six major anthocyanidins which are abundant in fruits and vegetables are pelargonidin, malvidin, delphinidin, cyanidin, peonidin, and petunidin. They differ by position and number of –OH and $–OCH_3$ group present in it. Based on the position of the functional group, either hydroxyl, methyl, sugar moiety, or several other functional substituents, about 500 and more anthocyanins have been identified and are classified under 31 anthocyanidins. Cited previous literature stated that 31 anthocyanidins account for cyanidin (30%), delphinidin (22%), and pelargonidin (18%). Also, other methylated derivatives of anthocyanidins account for 20% of all anthocyanins. Consequently, about 90% of all the anthocyanins are cyanidin, delphinidin, pelargonidin, and its derivatives (methylated). Naturally, these anthocyanidins are present in the form of glycosides with the respective sugar moiety at 3-position on the C-ring or the 5-position on the A-ring to the aglycone chromophores. Basically, pelargonidin can be chemically structured as 1-benzopyrylium, 3,5,7-trihydroxy-2-(4-hydroxyphenyl), chloride, n anthocyanidin cation that is flavylium substituted by a hydroxy group at positions 3′, 5′, 7′, and 4′ (Barnes et al. 2011).

6.3.1 Natural Occurrence of Pelargonidin

Anthocyanins are one among the subgroup of water-soluble flavonoids found widespread in the plant kingdom, and their specific compounds are responsible for floral pigmentation and other parts of plants. The color of the pigments may vary from vibrant red, purple, to blue pigments, and this is because of its conjugated structure that draws light at 500 nm (Wang et al. 2012). In particular, widespread and usually found anthocyanins are the 3-*O*-glycosides or 3,5-di-*O*-glycosides of delphinidin, cyanidin, petunidin, peonidin, malvidin, and pelargonidin. Anthocyanins are important polyphenolic components of fruits, especially berries. Bioactive component

pelargonidin is rich in berries, such as strawberry, blackberry, black currant, elderberry, sour cherry, and pomegranate. Consumption of anthocyanin and polyphenol-rich juice enhanced antioxidant status, reduced oxidative DNA damage, and stimulated immune cell functions (Ferretti et al. 2010).

6.3.2 Pharmacological Activities of Pelargonidin

Flavonoids most prevalently found in floral, fruit, and vegetable have been reported as pelargonidin and consuming them as fresh or processed food has a major impact in prevention and control of devastating chronic human diseases, such as inflammatory diseases, cancer, and cardiovascular diseases, where it directly acts as potent antioxidant, plays significant role in detoxification, induces apoptosis, fights against inflammation, etc. (Nikkhah et al. 2008). The antioxidant property of pelargonidin (anthocyanidin) was due to scavenging efficacy of ONOO− function group, and it was evidently first reported by Tsuda et al. (2003) (anthocyanidin). The mechanism behind its antioxidant activity was due to the conversion of pelargonidin to p-hydroxybenzoic and further formation of 4-hydroxy-3-nitrobenzoic acid by the catalytic conversion with ONOO− present in its structure. In vitro studies on anthocyanin had significantly downregulated the signaling pathways including NF-κB and MAPK pathways, resulting in the reduced proinflammatory cytokine expression and inhibiting inflammation (Wang et al. 1999; Pergola et al. 2006). In addition, extensive study on literature of anthocyanidin unraveled its anti-inflammatory mechanism, where significant downregulation of certain vital inflammatory markers at both transcription and translational levels in some cell line models such as downregulation of cyclooxygenase-2 (COX-2) expression in stimulated macrophage (RAW 264 cells) with lipopolysaccharide (LPS) and another case potential inhibition was observed against the transcription and expression of inducible nitric oxide (iNOS) murine macrophages (J774) activated with LPS (Hou et al. 2005; Hämäläinen et al. 2007). Isolated leucopelargonidin-3-*O*-alpha-L rhamnoside from the bark of *Ficus benghalensis*, oral administration at a dose of 100 mg/kg, showed a significant decrease in glucose level with a rise in serum insulin level of diabetic dogs induced by alloxan at a time period of 2 h. The findings state that leucopelargonidin-3-*O*-alpha-L rhamnoside stimulates insulin secretion (Augusti et al. 1994). Also, few studies have reported the estrogenic property of anthocyanidins, including pelargonidin, delphinidin, and cyanidin. These anthocyanidins were categorized as nongenotoxic, and it efficiently modulates DNA damage caused by oxidative stress and 4-nitroquinoline 1-oxide by its estrogenic activity. Therefore, the stated study has substantial evidence for the chemopreventive effects of anthocyanins against carcinogenesis on HL-60 cells (Abraham et al. 2007). A recent study on *F. benghalensis* root extract showed an antimicrobial activity when compared to the standard drug. Also, two important flavonoid compounds such as leucopelargonidin 3-*O*-alpha-L rhamnoside and 5, 3′-dimethyl ether of leucocyanidin 3-*O*-alpha-D galactosyl cellobioside were isolated from the bark of *F. benghalensis*, which inhibits the Gram-negative bacteria and also the fungal species (Aswar et al. 2008).

6.3.3 Bioavailability

Till now, very few numbers of literature are available to understand bioavailability including absorption/excretion of anthocyanins in humans, still, we found some of the contradictory conclusions. Previous studies have shown that wine from graphs rich in pelargonidin, it may or may not contain alcohol do not block the anthocyanin's absorption (Bub et al. 2001; Frank et al. 2003). Later, few other studies by Wu et al., (2006) also stated the similar pattern of specific anthocyanin pelargonidin-3-*O*-glucoside absorption form strawberries and blackberries (Wu et al. 2006). Felgines et al. (2007) stated that pelargonidin-3-*O*-glucoside present in strawberry was metabolically converted into respective pelargonidin glucuronides and pelargonidin sulfate and got excreted in the urine along with a very minute concentration of pelargonidin glucoside and pelargonidin alone a trace of pelargonidin as parent glucoside and its aglycone. More than 80% of urinary excreted pelargonidin accounts as pelargonidin glucuronides (Felgines et al. 2005). Bioactive compound like Cyanidin-3-*O*-glucoside, 3DA or 3 deoxy derivative, pelargonidin-3-*O*-glucoside, which is present in blackberry was reported as much as less than ten times its bioavailability with the corresponding 0.16% of intake and it is excreted as glucurono, sulfo and methylated metabolites which account for about 13% (Felgines et al. 2005). Pelargonidin glucuronides along with pelargonidin-3-*O*-glucoside are the two forms of anthocyanidins from strawberries found in the blood stream, and it undergoes a metabolic modification before being excreted in the urine along with trace quantities (1–3%) of pelargonidin and pelargonidin-*O*-sulfate, whereas the remaining quantity of pelargonidin was detected in plasma. In human beings on ingestion with strawberries pelargonidin-3-*O*-glucoside, it was metabolically converted to pelargonidin-*O*-glucuronide, which is present predominantly in both plasma and urine rather than the parent glucoside. The Cmax of this metabolite was found to be 274 ± 24 nmol/l after 1.1 ± 0.4 h. The major anthocyanin in strawberries, pelargonidin-*O*-glucuronide, was excreted after its metabolic process within the period of 24 h after its intake (Mullen et al. 2008).

6.4 Anticancer Mechanisms of Pelargonidin

6.4.1 Anticancer Activity Via Inducing Apoptosis

Pelargonidin, an anthocyanin found widespread in most of the berries including blackberry, raspberry, strawberry, and pomegranate, were studied in human colon adenocarcinoma cells (HT-29) (Felgines et al. 2007; Beekwilder et al. 2005). The primary anticancer effect of pelargonidin was screened with well-defined in vitro MTT assay on HT-29 cells. Followed by treatment with a determined concentration of pelargonidin (GI_{50}) against HT-29, induction of apoptosis in cancer cells had been reported. Also, the same study had stated the activation of caspase-dependent apoptotic pathway along with the fragmentation of genomic DNA. Additionally, the microscopical observation of treated cancer cells was found to be pictured with

distinct morphology, including floating cells, cellular shrinkage, and membrane blebbing, which are the hallmark features of apoptosis. A similar pattern of cell morphology in another study was reported as characteristic features of apoptotic induction in cancer cells (Sivalokanathan et al. 2006). HT-29 cell architecture had been pictured with high alterations such as round-up of cancer cells with distorted patterns (Karthi et al. 2016). AO and EtBr (AO/EtBr) fluorescent screening had further pictured the intensive morphology of apoptosis-induced HT-29 cancer cells after pelargonidin treatment in a dose-dependent manner. Basically, AO dye stains both live cells with the rigid cell membrane and permeable dead cells, whereas EtBr stains only apoptotic cells with no cell membrane integrity (Raju et al. 2004). Pelargonidin supplement had reported the notable percentage of both early and late apoptotic colon cancer cells with morphological alterations during apoptosis such as cell shrinkage along with chromatin condensation.

The development and maintenance of a living organism have to be brought by the standard and controlled the homeostatic balance of both cell proliferation and cell death. Numerous physiological functions and pathological processes were based on the key role played by the apoptosis of individual cells. Modulation in the expression pattern of certain antiapoptotic proteins (Bcl-XL, Bcl-2, and A1) was notably unregulated by the specific transcription factor of NF-κB, and that was a key role in the inflammation process. Also, the unique transcription factors of this Bax family along with the contribution of NF-κB induce apoptosis. Apoptotic induction by the pelargonidin in HT-29 cells was illustrated with DNA fragmentation protocol, which has been considered as exemplary biochemical features of apoptosis. The ladder pattern after pelargonidin treatment was evident as a result of oligonucleosomal fragmentation of chromosomal DNA at the early apoptotic stage. The previous research study had stated that pelargonidin with short incubation time brings about early apoptosis and longer exposure of pelargonidin was reported to increase the volume of nuclear fragmentation which evidences the basal mechanism of anticancer effect of the pelargonidin, and also it may act through the apoptotic signaling. Bcl-2 family are known cytoplasmic proteins that regulate apoptosis, in particular sub-group of pro-apoptotic proteins Bax, significantly promotes cell death where other members of the Bcl-2 possess anti-apoptotic activity namely, Bcl-x Land Bcl-w, those includes four regions of similarity with Bcl-2. In this review, it is significant to pinpoint that pelargonidin alters the expression level of Bcl-2 family proteins in cancer cells and thereby induces apoptosis. Consciously, the expression of these particular proteins after pelargonidin treatment was deliberated with the immunoblot analysis, and the study has reported that the expression level of Bax was found to be markedly increased dose dependently in HT-29. At the same time, pelargonidin modulations in BH3 interacting-domain (BID) death were also upregulated. As per the study by Karthi et al., (2016), this treatment also down-regulates the expression of antiapoptosis protein Bcl-2 and Bcl-xL Briefly, this review conveys that pelargonidin specifically promotes the translocation of mitochondrial Bax to the cytosol and triggers the signaling pathway for apoptosis in colon cancer cells.

6.4.2 Pelargonidin and Mitochondrial Pathway

The apoptotic proteins from the mitochondria due to its permeabilization make the cancer cells to induce apoptosis by three major toxic proteins: direct caspase activators, indirect caspase activators, and caspase-independent proapoptotic factors. Initially, the apoptosome was formed by conjugation of cytochrome c with apoptosis-protease activating factor pro-caspase-9, thereby caspase-9 gets activated. Subsequently, this initiator caspase-9 activates downstream caspases 3, 6, and 7, which were denoted as effectors, thereby it activates the last step of the pathway to induce apoptosis (Pradelli et al. 2010). Tumor suppressor p53 induces autophagy and/or apoptosis through its cytosolic and nuclear effects in response to DNA damage and other stresses. Oxidative stress, i.e., increased production of reactive oxygen species (ROS), can also induce apoptosis and autophagy (Fimia and Piacentini 2010). As in the case of pelargonidin treatment against colon cancer cells, Bcl-2 family members that come under proapoptotic activity significantly activate mitochondrial-mediated intrinsic apoptosis, where pelargonidin potentially induces the loss of mitochondrial membrane potential, which in turn activates caspase-9 cascade. Briefly, the cascade was initiated with the release of cytochrome C followed by activation of caspase 3 and caspase 7, where the program cell death was initiated with sequential degradation of cellular functional proteins (Karthi et al. 2016; Adams 2003). On the other hand, this review also explores the upregulation of apoptotic proteins on pelargonidin exposure such as PARP and P53. Based on the previous literature and the various study reports, the current review has summarized the activation of the intrinsic apoptotic mechanism of pelargonidin against colon cancer cells.

6.4.3 Pelargonidin Affects Cell Cycle Regulators

Tumor cell possesses unique characteristic futures by modulating the regulation of the cell cycle in cancer cells. This chapter also concentrates on elaborating on the mechanism of cell cycle arrest induced by pelargonidin in colon cancer cells. Basically, the transition between cell cycle phases is tightly regulated by cyclin-dependent kinases (Cdk). The role of Cdks is to control cell cycle progression by phosphorylation of protein substrates on serine and threonine amino acids. The protein substrates have specific roles that contribute to the cellular events that occur during the cell cycle. For example, Lamin B protein is phosphorylated by Cdk1 during mitosis, which causes nuclear envelope break down. The correct timing of cell cycle phase changes is regulated by specific cyclin-dependent protein kinase complexes. Cyclin-dependent kinases are composed of two proteins: a catalytic subunit known as Cdk and a regulatory protein subunit known as cyclin. The cyclin proteins do not have enzymatic activity; however, they bind and activate the catalytic 6 subunits. At least 25 catalytic Cdks have been described, and each binds to at least one of a large family of cyclin binding partners, creating many possibilities for Cdk cyclin protein pairings (Bruyère and Meijer 2013). The timing of the synthesis of specific cyclins is carefully regulated, which ensures that certain Cdk-cyclin

complexes trigger different stages of the cell cycle. For example, the Cdk4/cyclin D complex functions early in the G1 phase of the cell cycle in response to growth factors, whereas the Cdk1/cyclin B complex enables cells to enter mitosis. There are several biochemical steps required to activate Cdks in addition to cyclin synthesis, thus ensuring cell cycle fidelity. The cell is blocked in the G2 phase of the cell cycle if Cdk1 remains phosphorylated on tyrosine 15, which holds the enzyme in an inactive state regardless of cyclin B1 levels. Eukaryotic cells (including human cells) have a second biochemical system that can regulate CDK activity if the cell has damaged DNA. Another protein kinase, Chk1 (Checkpoint kinase 1), can prevent the activation of Cdk1 by phosphorylating and promoting the degradation of Cdc25 phosphatases. Without Cdc25 phosphatases, cells cannot dephosphorylate tyrosine 15 of the catalytic subunit of Cdk1, thus remain blocked in interphase, usually the G2 phase. Overall, a series of protein phosphorylation and protein synthesis pathways converge to regulate cyclin-dependent protein kinases. It appears that the complexity of these steps provides cells with opportunities to ensure that their genomes are accurately copied and distributed to daughter cells while avoiding genome change (Smith et al. 2007). This part of the chapter specifically focused to reveal the cell cycle arrest and checkpoint adaptation due to induced DNA damage and interface with the cancer cells to enter mitosis. Cells with damaged DNA initiate a biochemical pathway called the "DNA damage checkpoint," which causes a delay in the cell cycle during S phase or G2 phase to allow repair. It is believed that the role of DNA damage checkpoints is to prevent damaged DNA from being transmitted to daughter cells. Cells with damaged DNA initiate a biochemical pathway called the "DNA damage checkpoint," which causes a delay in the cell cycle during S phase or G2 phase to allow repair. Thus, the review study has strongly deliberated the role of pelargonidin-induced DNA damage, and its role in cell cycle checkpoints is to prevent damaged DNA from being transmitted to daughter cells. The DNA damage checkpoint is composed of several overlapping checkpoint systems. S-phase checkpoint provides continuous monitoring of the DNA during DNA replication to ensure that blocked replication complexes or damaged DNA were repaired before replication. The successful completion of DNA replication is assessed in the G2 checkpoint. The G2 checkpoint enables cells to detect unreplicated DNA or DNA that may have been damaged by a variety of means such as genotoxic agents. The cell will delay its progression through the cell cycle at the G2 phase until errors are corrected (Palou et al. 2010). The previous study of our laboratory had strongly pinpointed that the G2/M phase arrest of colon cancer cells was significantly induced by pelargonidin treatment in a dose-dependent manner and take part in a potential role of regulating the expression of subsequential cell cycle regulatory proteins (Karthi et al. 2016). Also, pelargonidin has a minimal effect to inhibit the cells at the G1-S phase of the cell cycle in cancer cells and is mainly due to transition-related CDKs, and their expressions were highly modulated by pelargonidin with inhibiting the function of mutated P53 in colon cancer cells. Thus, the literature study on anthocyanidin, pelargonidin the drug of interest, has high efficacy and efficiency to modulate the expression of functional protein in inhibition of CRC, and thereby it possesses a significant anticancer activity which was summarized in this chapter.

6.5 Conclusions

This comprehensive review about the anticarcinogenic effect of pelargonidin concludes that most of the commercial synthetic and isolated compounds used to treat cancer not only kill cancer cells, but are also proven to be highly cytotoxic to normal cells and would cause a severe adverse effect after therapy. Whereas, pelargonidin being pinpoint and speculate that naturally occurring dietary flavonoid acts as an anticancer therapeutic agent, which inhibits colon carcinogenesis by activating the immune system and by regulating the hyperproliferation, inflammation, angiogenesis, and mitochondrial-mediated apoptosis. In particular, this chapter signifies the importance of pelargonidin in the treatment of colon cancer. Briefly, the review study states that pelargonidin can affect the basic cell functions associated with cancer development. Also, it induces significant cell cycle arrest and apoptosis in cancer cells; thereby, pelargonidin would control the formation and progression of tumors. The previous literature evidence that any alteration in the inhibition of proteins involved in the cell cycle would potentially reflect in inhibition of cell proliferation and block carcinogenesis in tumor cells. Thus, this chapter highlights the pharmacological potential of pelargonidin, and it may be very useful in the prevention of oxidative stress-induced diseases and takes part in vanquishing colon carcinogenesis. Further, a detailed study on pelargonidin would effectively promote the development of new antitumor drugs and regimens for human colorectal carcinoma.

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Oscillatory Behavior of Damped Second-order Nonlinear Delay Differential Equations with Riemann-Stieltjes Integral

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Abstract. The purpose of this paper is to investigate the oscillatory behavior of certain type of damped second-order nonlinear delay differential equations with Riemann-Stieltjes integral. By using the Riccati transformation, some inequalities and integral averaging technique, interval oscillation criteria of El-Sayed type is established. Finally, an example is presented to illustrate the theoretical results.

INTRODUCTION

In this paper, we are concerned with the oscillatory behavior of solutions of the following damped second-order nonlinear delay differential equations with Riemann-Stieltjes integral

$$\frac{d}{dx}\left(A(x)\Lambda_\beta(y'(x))\right)+B_0(x)\Lambda_\beta(y'(x))+B(x)\Lambda_\beta(y(\delta(x)))+\int_0^h F(x,s)d\xi(s)=E(x), x\geq x_0, \tag{1}$$

where $F(x,s)=R(x,s)\Lambda_{\gamma(s)}(y(\psi(x,s)))$ and $\Lambda_*(z)=|z|^*\,\mathrm{sgn}z$, under the following hypothesis $(\mathfrak{R})$:

$(\mathfrak{R}_1)$ For a positive number h, the integral involved in equation (1) is the Riemann-Stieltjes integral of F on $[0,h)$ with respect to ξ and $\xi:[0,h)\to\mathbb{R}$ is non- decreasing;

$(\mathfrak{R}_2)$ $\gamma(s)$ is strictly increasing continuous function on $[0,h)$ satisfying $0\leq\gamma(0)<1<\gamma(h-)$;

$(\mathfrak{R}_3)$ $A(x)\in C^1\big([x_0,\infty)\big)$ with $A(x)>0, B_0(x), B(x), E(x)\in C\big([x_0,\infty)\big)$ and $R(x,s)\in C\big([x_0,\infty)\times[0,h)\big)$;

$(\mathfrak{R}_4)$ $\delta:[x_0,\infty)\to[\alpha,\infty), \psi:[x_0,\infty)\times[0,h)\to[\alpha,\infty)$ with $\alpha\leq x_0$ are continuous functions satisfying $\lim_{x\to\infty}\delta(x)=\lim_{x\to\infty}\psi(x,s)=\infty$ for $(x,s)\in[x_0,\infty)\times[0,h)$ and $\delta(x),\ \psi(x,s)\leq t$.

The theory of oscillation is an extremely important branch of the qualitative theory of differential equations. During the last decades, the oscillatory behaviour of functional differential equations and their applications have been studied and still are getting intensive deliberation. In fact, over the most couple of years several monographs have been written [1, 5, 7, 11]. Recently, there has been a great deal of work on the oscillation of solutions of delay differential equations [2, 3, 13, 14]. In particular, there has been an increasing interest in finding the oscillation criteria for second order differential equations, see [6, 12, 15, 16, 17].

In [15], Sun and Kong studied the oscillation of the second- order forced differential equation with the nonlinearities given by Riemann-Stieltjes integral of the form

$$(p(t)x')'+q(t)x+\int_0^b r(t,s)|x(t)|^{\alpha(s)}\mathrm{sgn}x(t)d\xi(s)=e(t), \tag{2}$$

where $p,q,e\in C[0,\infty)$ with $p(t)>0, r\in C([0,\infty)\times[0,b)), \alpha\in C[0,b)$ is strictly increasing such that $0\leq\alpha(0)<1<\alpha(b-)$. Also, they extended the results for equation (2) to forced nonlinear differential equations with delays in the form

$$(p(t)x')'+q(t)x+\int_0^b r(t,s)|x(\tau(t))|^{\alpha(s)}\mathrm{sgn}x(\tau(t))d\xi(s)=e(t), \tag{3}$$

where p,q,r,e and α satisfy the same assumption as for equation (2) and $\tau\in C[0,\infty)$ with $\tau(t)\leq t$ and $\lim_{t\to\infty}\tau(t)=\infty$.

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Contemporary Contemplations on New Literatures in English

14

The 'Nobel' Maverick Australian and his Legacy

V. SANGEETHA

The Swedish academy has drafted a citation "To Patrick White for an epic and psychological narrative art which has introduced a new continent into literature" (Marr, *Life* 535) for his winning the Nobel Prize for literature in 1973. As a maverick Australian writer Patrick White ushered in a new meaning to Australian literature. Through his words, "I feel what I am, I don't feel particularly Australian. I live here and work here. A Londoner is what I think I am at heart but my blood is Australian and that's what gets me going" (Marr, *Life* 536) one can understand the plain speaking, seemingly arrogant writer – always a stickler for facts. His oeuvre comprising of *Happy Valley* (1939), *The Living and the Dead* (1941), *The Aunt's Story* (1948), *The Tree of Man* (1956), *Voss* (1957), *Riders in the Chariot* (1961), *The Solid Mandala* (1966), *The Vivisector* (1970), *The Eye of the Strom* (1973), *A Fringe of Leaves* (1976) *The Twyborn Affairs* (1979), *Memoirs of Many in One* (1986) and posthumously published *The Hanging Garden* (2012); an autobiography *Flaws in the Glass: A Self-Portrait* (1981); short story collections *Burnt Ones* (1964), *Cockatoos* (1975) and *Three Uneasy Pieces*(1988); collections of Poems *Thirteen Poems* (1930) and *The Ploughman and Other Poems*(1935); *Plays Return to Abyssinia* (1947), *Four Plays* (1965), *Big Toys* (1977) and *Signal*

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16 Enhancement of biocompatibility by coatings

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s0010 16.1 Introduction

p0010 In recent years, millions of people are suffering from numerous bone-related diseases or disorders for instance osteoporosis, arthritis, bone fracture, trauma due to road traffic injuries or sports and also due to nutritional deficiencies. Among these people, unfortunately some of them are dying due to lack of ideal bone substitutes [1]. Metallic implants are widely utilized for load-bearing implant applications, for example, artificial bone joints, bone plates, and dental implant materials because of its highly appreciable mechanical properties such as tensile strength, comprehensive strength, hardness and toughness, fatigue strength, and resistance to time-dependent deformation.

p0015 Bio-inert metals, such as surgical stainless steel (316L), Ti, Ti- and Co-based alloys are more appropriate for load-bearing applications due to their combination of good mechanical strength and fracture toughness. Based on long-term stability under more reactive in vivo conditions and excellent mechanical properties, Ti and its alloys exhibit excellent anticorrosion performance, better biocompatibility, and osseoconductive properties. Thus they are currently the best implant materials in the manufacture of orthopedic and dental applications. Although metallic biomaterials are commonly used for bone replacement material, in general they are bioinert (i.e.) they do not possess biofunctionalities such as bioactivity, bone conductivity, and blood compatibility. The bone biocompatibility of metallic implants can be enhanced by coating with bioactive ceramics such as calcium phosphates (CaPs), silica, alumina, zirconia, and titanium dioxide, etc. The bioactive ceramic-based coating enhances the interaction between cell and implant, and also increases the life of metallic implant [2–5].

p0020 Among bioactive ceramics, hydroxyapatite [HAP, $Ca_{10}(PO_4)_6(OH)_2$], is probably the most employed bioceramic in orthopedics and dentistry [6–8]. Moreover, this ceramic actively takes part in the formation of physically powerful bonds with host bone tissues. However, the brittleness and inflexibility of synthetic HAP limits its applications in load bearing and poor mechanical properties that makes HAP nonideal to be used as bone substitute. It is

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HANDLING AND MANAGING DATA

Edited by
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Chapter



Forecasting Dengue Incidence Rate in Tamil Nadu Using ARIMA Time Series Model

By S. Dhamodharavadhani, R. Rathipriya

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ABSTRACT

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13

Forecasting Dengue Incidence Rate in Tamil Nadu Using ARIMA Time Series Model

S. Dhamodharavadhani, R. Rathipriya

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13.1 Introduction

Mosquitoes are one of India's toxic insects. They have the ability to carry and spread disease to humans and this causes millions of deaths every year. In the year 2015, there 10,683 outbreaks of India Similarly, the worldwide incidence of dengue has risen 30-fold in the past 30 years, and an increasing number of countries are reporting their first outbreaks of the disease. The Aedesa Aegypti mosquito transmits Mosquito-Borne Disease (MBD) such as chikungunya, dengue, yellow fever, and zika virus to humans. Sustained and effective mosquito control efforts are necessary to avoid outbreaks of such diseases (Yong-Su Kwon 2015).

In India, the challenge MBD poses is serious because the increases in geographic distribution of vectors and MBD have the potential to affect 90% of the population. MBD is mostly an urban public health problem; however, outbreaks are being increasingly documented in rural areas too (Dhamodharavadhani and Rathipriya 2016).

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Geographical Factors of Dengue:

1. Water
2. Housing
3. Climate change
4. Poverty
5. Air Travel
6. Health System

Climate change has had substantial consequences in the global distribution of MBD. Climate change often impacts dengue transmission, as mosquitoes grow faster in higher temperatures and bite more often. Researchers have developed a tool that can forecast the possibility of dengue outbreaks in different parts of India on the basis of environmental conditions; a development that can help to take preventive measures against deadly infection (Descloux 2012).

A climate-based model of dengue prediction will assist health authorities in assessing disease intensity in a country or region. On this basis, authorities may have systematic a plan for disease control well in advance and optimize the use of available resources for the same reason (Descloux 2012).

Dengue has been known in India since the 1940s, but the spread of the disease was previously very limited. The most important MBDs that affect humans are dengue viruses. According to the World Health Organization (WHO), dengue is divided into two: types 1 and type 2. Type 1 is a common form dengue that leads to dengue fever, Dengue Hemorrhagic Fever (DHF) is type 2. Four types of Dengue Hemorrhagic Fever exist: DHF1, DHF2, DHF3, and DHF4. Infection of dengue is one of the world's fastest spreading MBDs – a viral disease that accounts for nearly 50 million cases annually (Allard 1998).

- The rate of dengue virus transmission is dangerously high due to global warming, climate change, rapid urbanization, unsuitable sanitation, insufficient public health services, and migratory populations.
- Regions such as East Mediterranean, Latin America, South East Asia, and Western Pacific, and Africa are all susceptible to recurrent dengue fever outbreaks.

Figure 13.1 indicates that in 2017 the dengue cases had been the highest in a decade. In dengue cases, an increase of more than 300% occurred in 2009, and the total MBD-related death cases in 2017 was the highest in the last decade. According to data from the National Program for Vector Borne Disease Control (NVBDCP) and National Health Profile of 2018, dengue

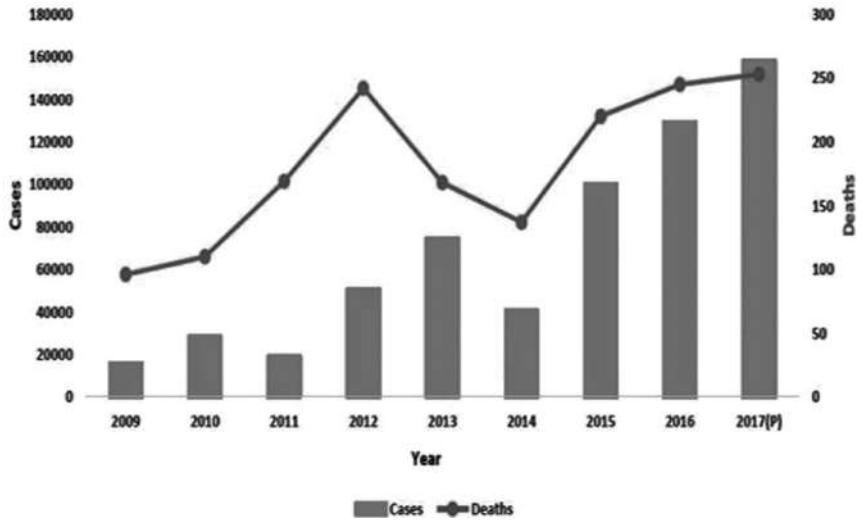


FIGURE 13.1
Dengue cases and deaths in India.

cases rose to 188,401 in 2017 a than a 300% leap from less than 60,000 cases in 2009. It is more than a 250% jump compared to the 75,808 events in 2013 (Chiung Ching Ho 2015).

For example, Tamil Nadu has seen Dengue cases rise to 20,945 in 2017 and Puducherry's union territory has registered 4,507 dengue cases for the same year. This means that 2% of the entire population of Puducherry has been affected by dengue.

Other southern states like Kerala and Karnataka have been badly affected by this huge dengue outbreak. Kerala showed a dramatic rise from 7,439 cases of dengue in 2016 to 19,638 in 2017. In Karnataka, 16,209 people were affected by it which translates as 260% higher than in 2016 (Chandran and Azeez 2015).

As such, successful monitoring and prediction of the incidence rate of MBD is important in preventing disease spread. Passive, preventive, and reactive monitoring systems are used to monitor the MBD outbreaks and incidence rate in Tamilnadu (Dhamodharavadhani and Rathipriya 2020[a]). Nonetheless, these programs face problems such as preference for eradication over surveillance, difficulty in interpreting findings, and most importantly, lack of coordination between MBD eradication units and MBD monitoring units (Karnaboopathy and Venkatesan 2018).

As a result of the above factors, there is a compelling case for alternative forms of MBD tracking and forecasting. Therefore, this chapter proposed an approach based on ARIMA time-series model for forecasting MBD incidence rate using meteorological data.

13.2 Literature Review

This section provides a state-of-the-art ARIMA models as used in the literature for predictive analytics. Table 13.1 presents the comparative analysis of various works.

13.2.1 Findings

From this study, it is clear that efficient and effective dengue forecast tool with higher accuracy a pressing need in order to control and prevent such outbreaks all over the world. This study reveals that time series model using meteorological data has been successful aimed to forecast of specific transmissible diseases.

13.3 Methods and Materials

13.3.1 Study Area

In this research, two datasets are taken to predict the dengue incidence rate using meteorological data in Tamil Nadu. Dataset 1 contains weekly dengue cases data for the periods 1990–2009 of Tamil Nadu. Dataset 2 contains weekly minimum temperatures, maximum temperatures, average temperatures, rainfall, and precipitation for the period of 1990–2009 in Tamil Nadu District (Yong-Su Kwon 2015)

13.3.2 Snapshot for Dataset

Dataset 1

week_start_date	total_cases
4/30/1990	4
5/7/1990	5
5/14/1990	4
5/21/1990	3
5/28/1990	6
6/4/1990	2
6/11/1990	4
6/18/1990	5
6/25/1990	10
7/2/1990	6
7/9/1990	8

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TABLE 13.1

Comparative Analysis

Technique	Description	Dataset	Recommendation/Prediction
Exponential smoothing ARIMA	STL decomposition forecasts trend and seasonal patterns in a better way. (Chiung Ching Ho 2015)	Malaysian Open Data Portal	To study the impact of the out-of-sample data on the models and integrate correlation studies with meteorological data. Prediction: Dengue fever outbreaks in Malaysia (Sahanaa and Mishra 2018)
Trend of morbidity and mortality	Tamil Nadu has been witnessing a fall in the morbidity trend over the past five years, and dengue deaths since 2015. Nevertheless, cases of dengue morbidity are increasing and median mortality is rising from 2012 to 2016, nationally.	Morbidity and dengue-related mortality at Puducherry and Tamil Nadu, India (2012–2016).	This work had assessed the Dengue in Puducherry and Tamil Nadu and proposed the model to reduce and eradicate the dengue outburst Prediction: early detection of the dengue outbreak, in fact prediction of dengue (Sahanaa and Mishra 2018)
Statistical analysis and modeling: Time series analysis, Bivariate analysis, Multivariate analysis.	Dengue cases in Noumea were basically driven by climate during the last forty years. (Descloux 2012)	Epidemiological data: January 1971– December 2010 Meteorological data: January 1971 to December 2010 Entomological surveillance data: since 1997	(Earnest 2012) (Elodie Descloux 2012) Prediction: Climate-based Dengue Epidemic Models for Understanding and Forecasting
support vector machine (SVM), classification and regression tree (CART), and random forest (RF).	To examine the spatial and temporal variations in the frequency of urban mosquitoes and the relationships with meteorological and habitat conditions such as type of land use.	Mosquito data collected from 2011 to 2012 at 12 locations, and environmental data (Yong-Su Kwon 2015).	Applied for the efficient control of urban mosquitoes. Prediction: Mosquito Occurrence (Yong-Su Kwon 2015).

(Continued)

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TABLE 13.1 (CONTINUED)

Comparative Analysis

Technique	Description	Dataset	Recommendation/Prediction
Auto Regressive Integrated Moving Average (ARIMA) Model.	The trend in forecast dengue cases for the years 2018 to 2025 shows that there is a stable growth of Dengue cases, which is of serious concern.	Dengue cases in Tamil Nadu 1997–2017.	(Karnaboopathy and Venkatesan 2018) To avoid the disease from becoming endemic, new interventions with increased intensity of existing interventions and help from the international community together with the WHO are essential in order to stop the epidemics. Prediction: Number of cases till December 2025
Seasonal Autoregressive Integrated Moving Average (SARIMA) models	To model the monthly number of dengue fever (DF) cases in Dhaka, Bangladesh, and forecast the dengue incidence using time series analysis (Zamil Choudhurya and Banu 2008).	Dengue fever (DF) cases in Dhaka Bangladesh monthly data January 2000 to October 2007 (M.A.H. Zamil Choudhurya and Banu, 2008).	Separate modelling approaches for DF, DHF and DSS would provide better information to policy-makers and planners Prediction: forecast for the period. November 2007 to December 2008.

Dataset 2

week_start_date	TMAX	TMIN	TAVG	RAINFALL	PRCP
4/30/1990	28.78571	21.74286	25.25714	7.042857	1.428571
5/7/1990	29.11429	21.58571	25.32857	7.528571	3.014286
5/14/1990	27.92857	21.65714	24.78571	6.271429	7.314286
5/21/1990	28.4	21.1	24.72857	7.3	3.985714
5/28/1990	28.32857	21.28571	24.82857	7.042857	2.242857
6/4/1990	28.17143	20.71429	24.45714	7.457143	4.285714
6/11/1990	28.41429	21.44286	24.95714	6.971429	2.3
6/18/1990	27.77143	21.12857	24.47143	6.642857	2.571429
6/25/1990	28.48571	21.6	25.04286	6.885714	0.657143
7/2/1990	27.85714	21.28571	24.57143	6.571429	4.9
7/9/1990	27.38571	21.65714	24.52857	5.728571	3.271429

13.3.3 Proposed Model

Time series analysis Brockwell (2013) may be classified as linear and nonlinear (Dhamodharavadhani Rathipriya2020b). Extremely specific techniques are used for the study of time series ARIMA, such as the Box-Jenkins multivariate and Holt winter exponential smoothing (single, double, and triple). ARIMA models are traditional forecasting models that require historical empirical data as evidence to make predictions (Dhamodharavadhani and Rathipriya 2019). This model is a simple statistical framework that can be used as the basis for mathematical models. These three order variables (a, b, c) describe the process of fitting the ARIMA model to the Box-Jenkins system (Sahanaa and Mishra 2018).

The Figure 13.2 shows the methodology of time series forecasting using ARIMA model. The first step of the ARIMA model is preprocessing the data. Time series data are plotted and its patterns and irregularities are examined. Next, the outliers and missing values are removed. The second step is to decompose the data and then to stationary the series and after that to calculate the autocorrelation by choosing the model order based on the process to fit the ARIMA model, then to evaluate and improve the model. The following Table 13.2 describes the steps to fit the ARIMA to a dengue forecasting model and its mathematical format.

13.3.4 Estimate and Develop the Model

The prediction is iterated in two ways to enhance the forecast. One is to add the seasonal variable to be removed earlier. Another solution would be to require (A, B, C) components to be included in the model; refitting the model on the same results, so that its silent ability is determined by a particular seasonal trend in the sequence, with the seasonal aspect defined in AR (1) (Dalinina 2017). The parameters (a, b, c) have also been modified to include the seasonal variable. Once the same process of analyzing the residual model has been done, the ACF/PACF plots change the structure as appropriate. For

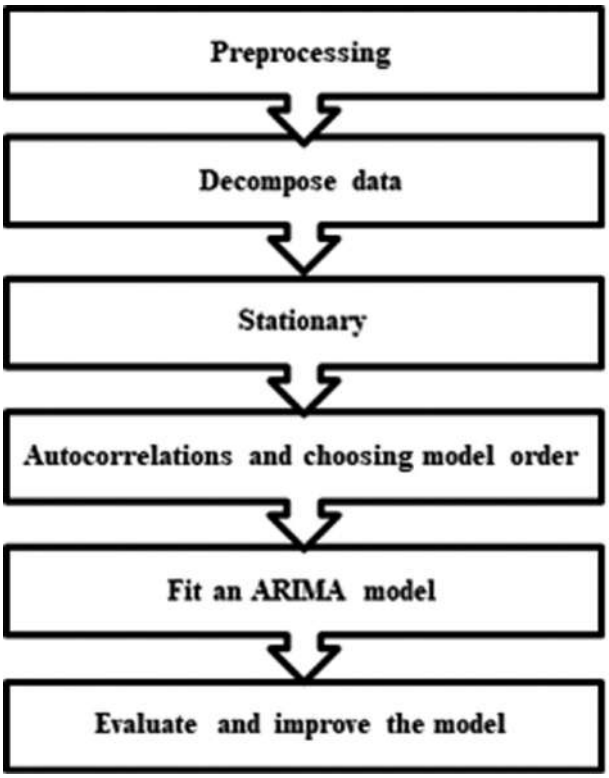


FIGURE 13.2
Workflow of proposed model.

example, finding the same higher-order evidence is present in auto correlations with lag 7, which indicates a higher-order component may be required.

13.4 Results and Discussions

By plotting the data, the outliers, randomness, or irregularities can be found as shown in Figure 13.3. In this case, dengue cases show a lot of variations from one week to another. Despite this, these variations do have a pattern. For example, the number of dengue cases is less in the winter months and a higher number dengue cases are observed in the summer months.

In total the number of dengue cases decreased less than 100 on the first week and to over 400 on the following week as shown in Figure 13.4. These are alleged outliers that by skewing the statistical summaries may distort the model. A preprocessing method is used to remove time series outliers. This

TABLE13.2

Proposed Model Description

Model	Mathematical Equations	Model parameter
Preprocessing using Moving Average (MA(*c*))	$m = 2k + 1$	c = number of terms in model m = series average Y k = period point
ARIMA model	$R_t = c + \alpha_1 R_{b\,t-1} + \alpha_a e_{b\,t-a} + \ldots$ $+\alpha_1 e_{t-1} + \alpha_a e_{a-1} + e_t$	R_b is R differenced b times c = constant e_t = error a = alpha
Decomposition	$x_t = T + S + R$ $x_t = T * S * R$ $Y = S_t * T_t * E_t$	T = Trend S = seasonal R = Random of series $x_t = x$ differenced t times Y = total number of dengue cases St = seasonal variable T_t = pattern and cycle E_t = rest of the error
Stationary	$Y_{d_t} = Y_t - Y_{t-1}$ $Y_{d2_t} = Y_{dt} - Y_{dt-1} = (Y_t - Y_{t-1}) - (Y_{t-1} - Y_{t-2})$ $Y_{d2_t} = Y_{dt} - Y_{dt-1} = (Y_t - Y_{t-1}) - (Y_{t-1} - Y_{t-2})$	d = 2 Y = total number of dengue cases t = times point
Autocorrelations	$r_k = \frac{\sum_{t=k+1}^{n} \left(y_t - y'\right)\left(y_t - k^{-y'}\right)}{\sum_{t=1}^{n} \left(y_t - y'\right)^2}$	rk = lag k autocorrelation k = the time lag n = total number of dengue cases
Fitting Dengue ARIMA Model	$\hat{Y}_{d_t} = 0.4551 Y_{t-1} - 0.3496 e_{t-1} + E$	Y = total number of dengue cases t = times point E = error original dengue cases differentiates from order 1

will identify and remove outliers with time series smoothing and decomposition. This process is effective in passing missed values to the array.

The more varied the gap of the moving average, the smoother the original series develops. For Tamil Nadu's dengue dataset, the weekly moving average is considered for smoothing the series.

The Figure 13.5 shows decomposition of data into different components. They are: data variables represented as weekly data; trend variable is complete pattern series; seasonal variable denotes that fluctuations in the data related to calendar cycles; and remainder elements consisting of decreasing or increasing non-seasonal trends.

Figure 13.6 shows that the left panel is stationary, where data values oscillate with a constant variance around the average of 1. The right side of the

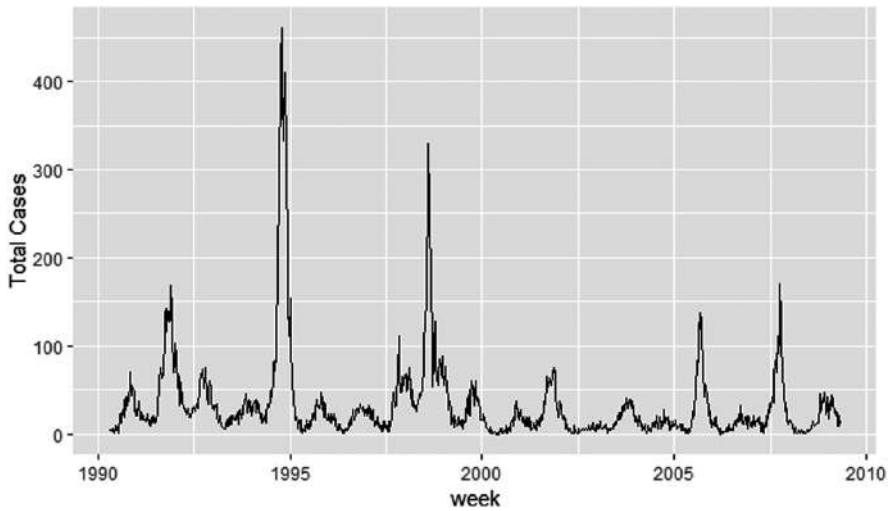


FIGURE13.3
weekly dengue cases in Tamil Nadu.

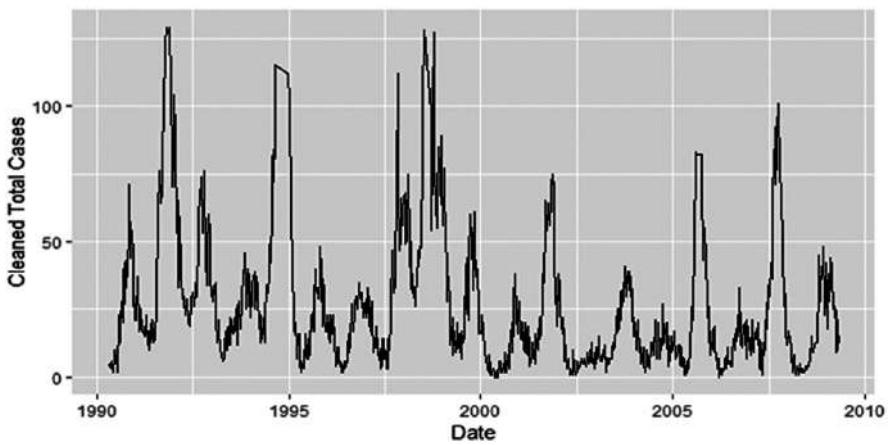


FIGURE 13.4
Cleaned data.

plot displays a non-stationary sequence; thus the series mean value will differ across various time periods. Figure 13.6 shows stationary and non-stationary series

The meteorological data is non-stationary; the total number of cases of dengue varies over time, and shifts in scales. A proper ADF test does not reject the non-stationary null hypothesis which confirms graphical representation.

In Figure 13.7 ACF shows correlation between a series and its lags. ACF plots can assist in taking responsibility for MA(b) (Dalinina 2017) order in

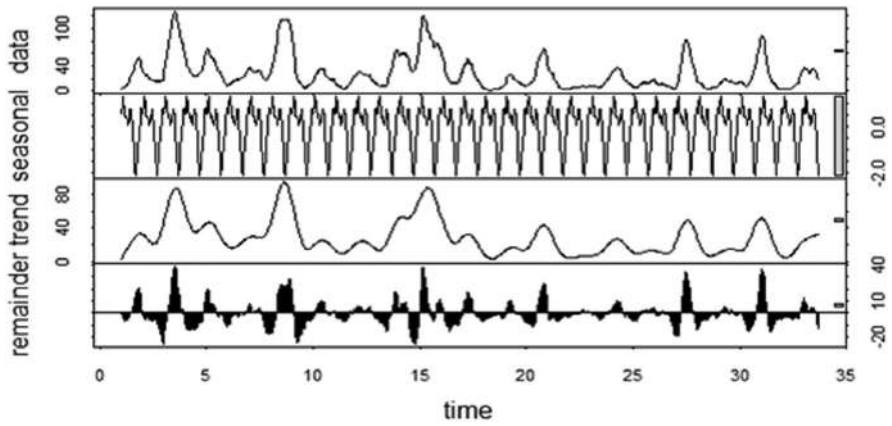


FIGURE 13.5
Decomposition of data. Left panel.

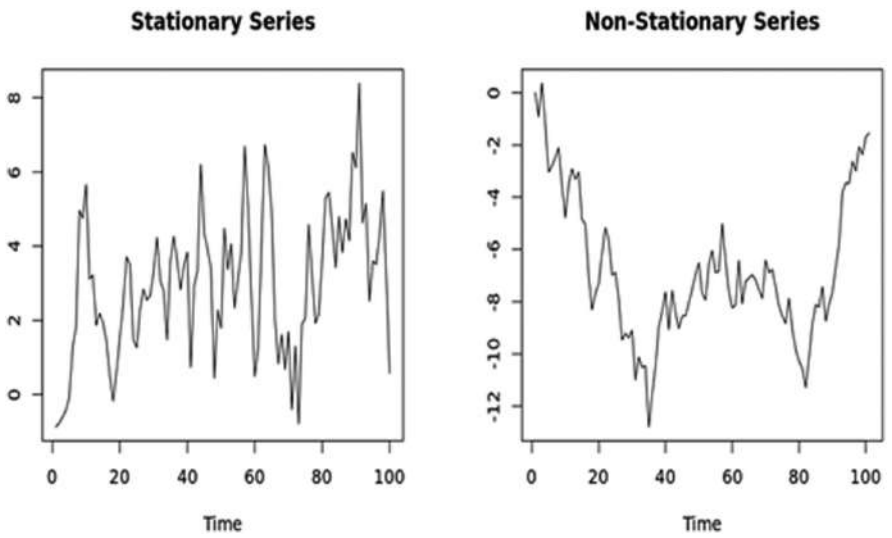


FIGURE 13.6
Stationary and non-stationary series.

addition to recommending the order of variation. PACF denotes that a relationship between a variable and its lags that could not be explained by previous lags. It useful to fit the AR(a) order model.

As blue dotted lines, the plots are borders of 95% importance. There are important meteorological data auto-correlations with many lags, as shown in the ACF map. It is possible to the transfer effect after the initial lags, as shown in the PACF point at lags (1,7,7).

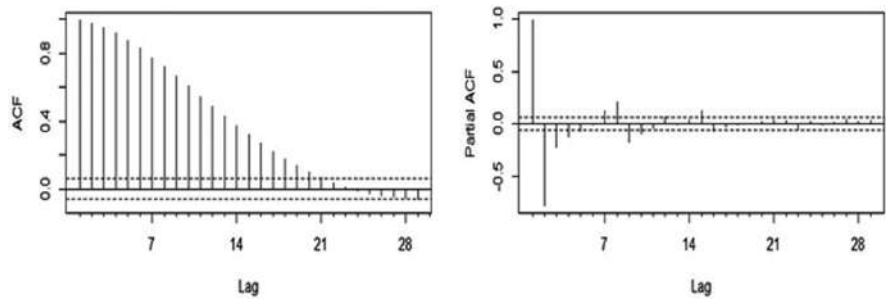


FIGURE 13.7
ACF and partial ACF.

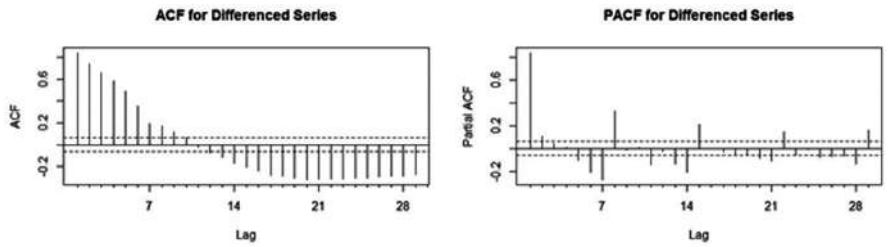


FIGURE13.8
ACF and PACF for differenced series.

To continue with the order d = 1 and reassess if further distinction is necessary. The Dickey-Fuller modified research on separated data discards the non-stationary null hypotheses. To plot Separate sequence with no noticeable effect, oscillate pattern about 0. This indicates that there is ample distinction between the terms of order 1 and should be included in the model (Dalinina, 2017).

Figure 13.8 points at similar lags of the differentiated series that help to inform our model's choice of a or b. There are important auto similarities at, and beyond, Lag 1 and 2.

In Table 13.3 shows a summary of the model. Total dengue cases are represented as response variables and TMAX, TMIN, TAVG, RAINFALL, PRCP are represented as predictors.

Figure 13.9 indicates plots for configuration residuals of ACF and PACF. Parameters of the model's order and construction are correctly defined, so there are no major autocorrelations to predict.

Forecasting (ARIMA [1,1,7]) using a fitted model to determine forward forecast horizon h intervals for full predictions, and using the fitted model to produce such predictions as shown in Figure 13.10.

The light blue line indicates the fit given by the model in Figure 13.11, and how the model will work in Tamil Nadu in future dengue cases. One

TABLE 13.3

Dengue ARIMA Model

Model = total dengue cases ~TMAX+TMIN+TAVG+ RAINFALL+PRCP			
Deviance Residuals	**Min**	**MEDIAN**	**MAX**
	−50.72	−9.82	419.70
Null Deviance	2146476 on 789 degree of freedom		
Residual Deviance	1992815 on 784 degree of freedom		
AIC	84		

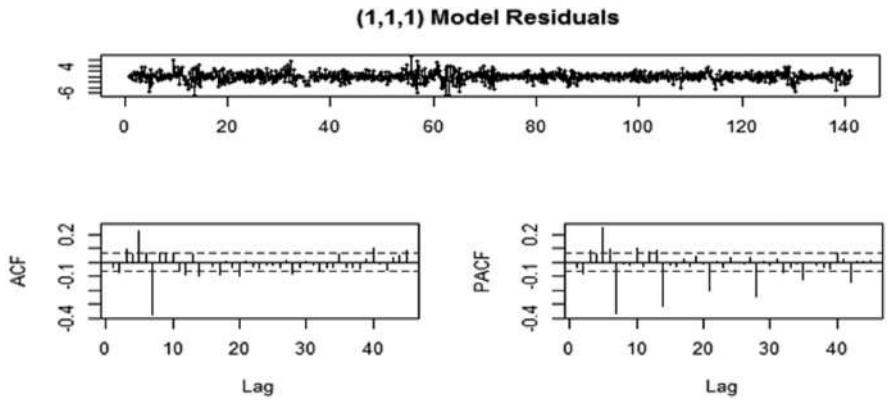


FIGURE 13.9
ACF and PACF for model residuals.

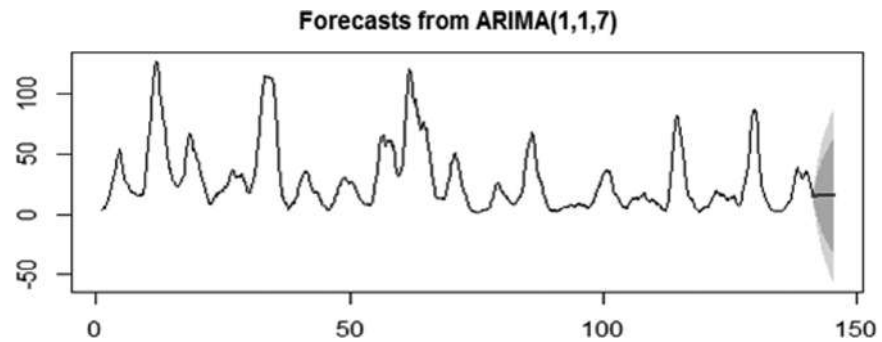


FIGURE 13.10
Forecasts from ARIMA (1,1,7).

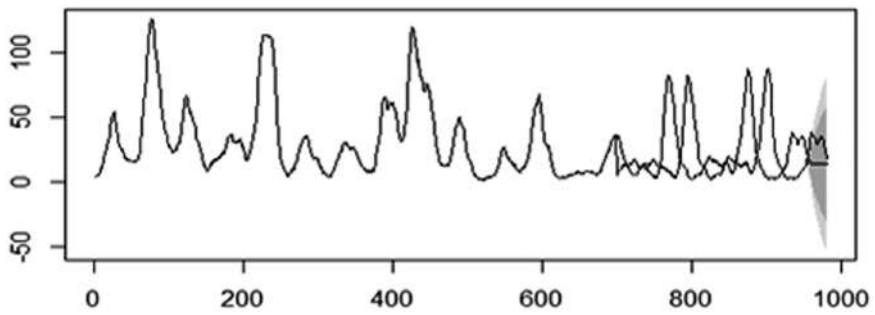


FIGURE13.11
Forecast compare to the actual values.

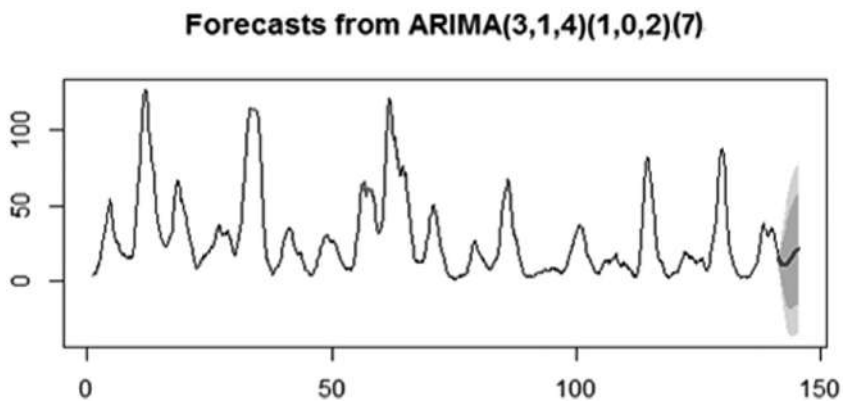


FIGURE13.12
Improving Forecasts from ARIMA.

approach is to substitute a portion of our data as a collection of "hold-outs", match the model and then compare the predicted values with the actual observed values (Dalinina 2017)

The blue line that reflects the projection, though, seems very naive: it follows a straight line fairly soon, which seems unlikely given the series of past behavior. Note that the model assumes a seasonal-free series and differentiates the original non-stationary results. In other words, the plotted predictions are based on the assumption that there will be no other seasonal variations in the data, and the change in number of cases of dengue from one year to another is more or less constant in mean and variance.

This forecast may be a simplistic model, but it shows the selection process for an ARIMA model and could also serve as a baseline against which to assess when more complex models are designed. All estimates are given confidence boundaries for Figure 13.12. 80% trust boundaries are shaded in darker blue (Dalinina 2017) and 95% in lighter blue. Longer-term predictions will usually have more volatility as the formula will return to future Y on

expected values. In this case, this is reflected in the outline of the trust limits, as they begin to grow with rising horizon. The trust boundaries trend may point to the need for a more reliable model. Looking at the forecast limits, the estimated error associated with point predictions is very important.

13.5 Conclusion

In this chapter, the time series proposed ARIMA models are used to predict the number of dengue cases in Tamil Nadu. The result of the ARIMA model is more accurate. This model provides significant benefits in predicting dengue incidence rate in advance. It may help health officials to take effective timely preventative measures which saves time, cost, and human lives.

13.6 Acknowledgment

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The proposed study in this paper provides long-term crop prediction for Tamilnadu, India. Nonlinear Autoregressive (NAR) Neural Network (NN) with different parameter settings has been used to facilitate the correct quality and quantity of crop production. At the core of this study is to compare the effect of training algorithms (such as trainlm, trainbr, trainscg, traincgf, trainbfg, traincgf) and activation functions (such as tansig, elliotsig, logsig and purelin) in the performance of the crop yield forecasting model. This study showed that activation functions elliotsig and tansig with the training algorithm trainbr of NARNN delivered the most promising results based on the smallest error between actual and predicted value compared to the other activation and training functions of NARNN.

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Crop yield forecasting model is essential tool for global food producer or agriculturist to take timely decision about their cropping strategy [1] [2]. Authorities are also rely on accurate predictions to make decisions to strengthen food security of a nation by exporting or importing the agriculture products [3]. However, crop yield forecasting using chronological data is the biggest challenge in determining trends in the data for accurate forecasting. This is because it involves many other complex factors. But, still it is very useful to identify the multi crops for cultivation according to the demand.

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Key Generation For DNA Cryptography Using Genetic Operators And Diffi-Hellmen Key Exchange Algorithm

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A lot of information is transmitted and stored in the networks; these are not in the secure format. Information security is one of the critical issues in the networks. Many of the cryptography techniques and systems are developed but they are not given higher-level security. To overcome this problem, the DNA cryptography is introduced.

The DNA cryptography is one of the new techniques used to given information with higher-level security. DNA means Deoxyribonucleic Acid which is constructed by DNA computing. DNA computing consists of four nucleic acids they are Adenine (A), Guanine(G), Cytosine(C) and Thymine(T). The DNA cryptography is used these nucleic acids to secure the information with a higher level. The two-bit binary values are assigned to every nucleic acid which is represented in table 1. The DNA cryptography technique contains two process encryption and decryption described in figure 1.

Tabel 1. DNA Nucleotide to Binary value

DNA NUCLEOTIDE	BINARY VALUE
A	00
G	01
C	10
T	11

The main advantage of the DNA cryptography is to store the 10^8 terabytes of information in a 1 gram of DNA. The disadvantage is that this technique does not contain a key generation process. To overcome this problem, the genetic algorithm is used to generate a key.

The genetic algorithm is one of the optimization algorithms. This algorithm contains four basic operations they are Fitness function, Selection, Crossover, and Mutation. In the proposed work, the key is generated using only the two operations. They are Crossover and Mutation. The key is generated but not in a strong format because it is not in the form of a hard problem. To overcome this problem the Diffie-Hellmen key exchange algorithm is used.

The Diffie-Hellmen key exchange algorithm is used to generate a strong key. The key generated by a discrete-logarithm problem, which is a hard problem for an attacker. This algorithm is used only for a key generation not for encryption and decryption.

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Optimizing Node Coverage and Lifespan of Body Area SensorNetwork using Swarm Intelligence

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Swarm intelligence (SI) is the groupperformance of decentralized, self-organized systems, natural or artificial. Swarm intelligence techniques are heuristic stochastic processes.SI approaches can be generalized follows: All approach is a release with a set of a solution called group, and then in the following steps, eachapplicant of the collection learns together from other candidates and adapt itself in agreement to the resolution space. The approachincluded and knowledge mechanism of these techniques mostly minimum the essential information and phenomenon. Such nature-inspired mathematical models can be plugged into one framework.The applicability of a discrete version of a popular benchmark swarm intelligence algorithm called and its hybrid version for energy-optimized Body Area Sensor Network (BASN) using node coverage and network lifespan. Mainly successful classes of swarm intelligence (SI) based algorithm for solving energy-based life span optimization problem.

The components of this chapter are:

i. To show how standard Swarm intelligence-based energy efficiency model can be used to identify optimal node-set selection with maximum network lifespan.
ii. To compare the performance of swarm intelligence (SI) and its variants with the different QoS parameters.

The energy model for BASN by considering node coverage simulated in the Network Simulation tool (NS-2) environment. This simulated study conducted to test whether the proposed work increases the lifespan of the entire network or not. Its performances are evaluated by using parameters like energy cost, throughput, End-End delay, and Packet Delivery Ratio.

Keywords: Body Area Sensor Network, Node coverage, lifespan, wireless sensor network, Swarm Intelligence.

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Surface Irrigation-Based Multi-Crop Selection Using Firefly Optimization

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The multi-crop selection model is the method by which crops are selected to cultivate according to specific requirements such as accessibility of water, soil accessibility, climate variables, market price, Net Profit, etc. Furthermore, the amount of water required by the crop depends on the crop and the climate in which the crop is cultivated. It's, therefore, classified as an optimization problem. The purpose of this research article is to identify the optimal crop set based on water availability propose Multi-Crop Selection Model using a Binary Particle Swarm Optimization (MCS-BPSO).The study is conducted with different Water Availability (Wa) ranges from 50000000 (mm) to 10000000 (mm) for the total cultivatable area is 4500 (Ha). The multiple crop pattern for the Ta=6500 is sugarcane and maize is the common crop for the availability of water, and from this experiment going to know that the Sugar cane crop is the perfect choice when it comes to choosing the right crops with a wide variety of water availability. Sugarcane crop is common even though different crops vary. We can see that sugarcane crop is the right choice when growing in high water availability and in other regular times or when water levels are low availability. The Firefly algorithm revealed that it is an effective multi-crop selection algorithm under specific conditions such as total crop area, water availability. These findings enable farmers to select the most suitable crop, thereby increasing net profit and productivity in the agricultural region with available water.

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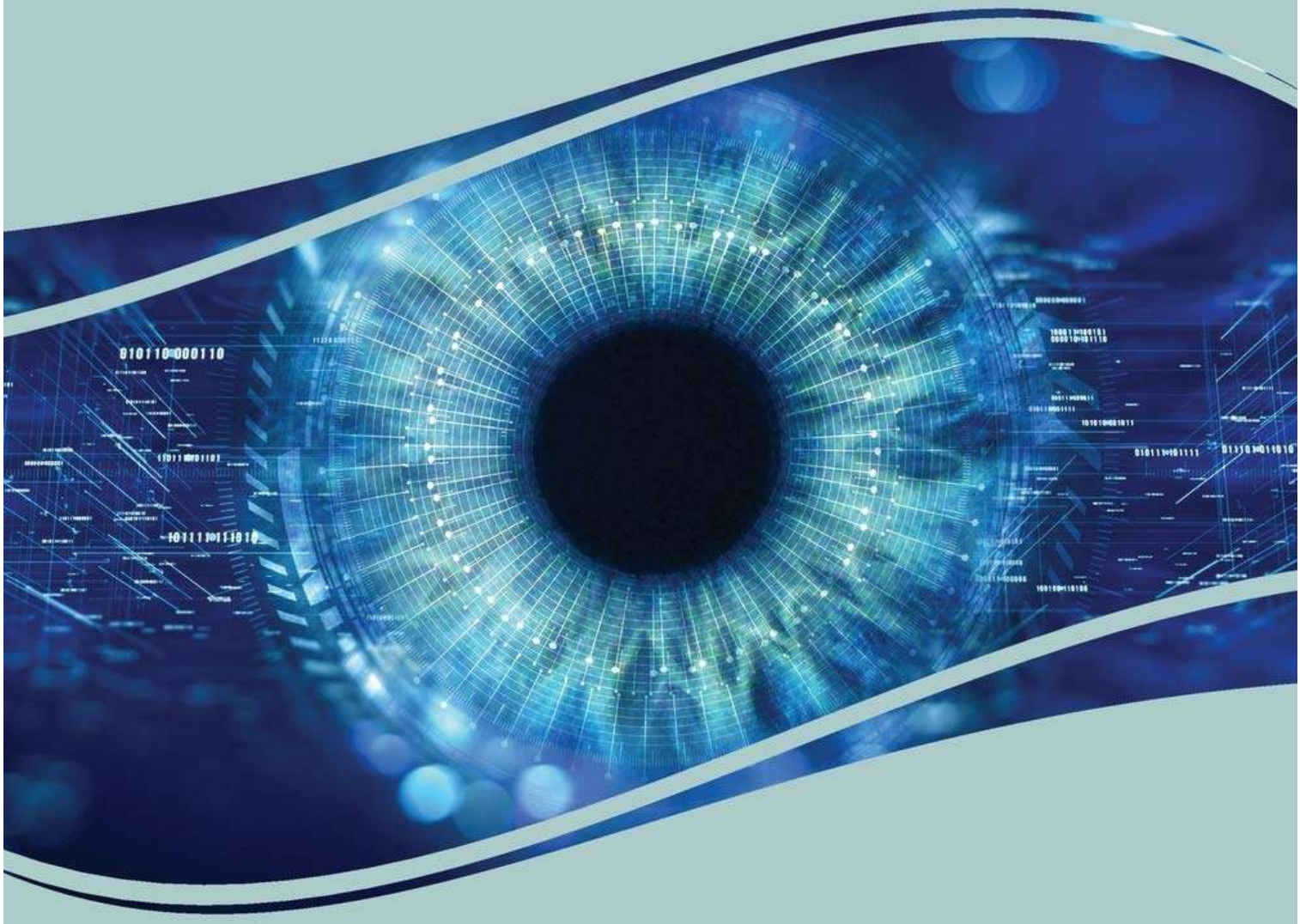
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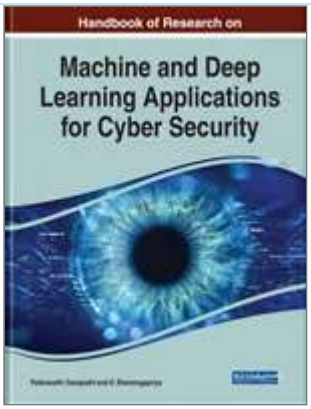
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Variable Selection Method for Regression Models Using Computational Intelligence Techniques

Dhamodharavadhani S. (Periyar University, India) and Rathipriya R. (Periyar University, India)

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Abstract

Regression model (RM) is an important tool for modeling and analyzing data. It is one of the popular predictive modeling techniques which explore the relationship between a dependent (target) and independent (predictor) variables. The variable selection method is used to form a good and effective regression model. Many variable selection methods existing for regression model such as filter method, wrapper method, embedded methods, forward selection method, Backward Elimination methods, stepwise methods, and so on. In this chapter, computational intelligence-based variable selection method is discussed with respect to the regression model in cybersecurity. Generally, these regression models depend on the set of (predictor) variables. Therefore, variable selection methods are used to select the best subset of predictors from the entire set of variables. Genetic algorithm-based quick-reduct method is proposed to extract optimal predictor subset from the given data to form an optimal regression model.

Chapter Preview

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Introduction

Describe Variable selection method plays a vital role to select the best subset of predictors. Variable selection method is the process of selection a subset of relevant predictors for fitting the model. In Regression model, variable selection is used to select the best subset of predictors to build the best regression model. Because redundant predictors are occurs in model that changes the behavior of effective predictors and also degree of freedom is misrepresented (Abraham A, 2003). There are many existing in the literature for regression model. Basically, three methods are used to select the variables for regression model. They are graphical represented in figure 1

Figure 1. Variable selection methods

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Figure 2. Workflow of variable selection method

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The figure 2 describes the workflow of variable selection method. Generation Procedure implements a search method. This is used to generate subset of variables (Bjorvand, 1997). Evaluation Procedure is used to halt the process when an optimal subset is reached. Stopping Criterion is tested every iteration to determine whether the variable selection process should continue or not. If stopping condition has been satisfied, then the loop has been terminated. Validation procedure is used to validate the subset of variables (C. B. Lucasius, 1992).

Filter Methods

Filter feature selection methods apply a statistical measure to allocate a value to each feature. The features are ranked based on the value and also selected or removed from the dataset. The methods are frequently univariate and reflect the feature independently, or with regard to the dependent variable.

Wrapper Methods

A wrapper method is used to selection of a set of features as a search problem. sometimes different combinations are prepared, evaluated and compared to other combinations. A predictive model us used to evaluate a combination of features and assign a value based on model accuracy.

Embedded Methods

Embedded methods study which features best donate to the accuracy of the model. The most common type of embedded feature selection methods are regularization methods. Regularization methods are also called penalization methods that introduce additional constraints into the optimization of a predictive algorithm (such as a regression algorithm) that bias the model toward lower complexity (fewer coefficients) (Airong Cai, 2009) (Bruce Ratner, 2010).

Feature selection is the method of reducing data dimension while doing predictive analysis. Various kinds of feature selection techniques are used in machine learning problem. The feature selection techniques simplify the machine learning models in order to make it easier to interpret by the researchers. Also, this technique reduces the problem of overfitting by enhancing the generalization in the model. Hence, it helps in better understanding of data, improves prediction performance, reducing the computational time as well as space which is required to run the algorithm (Airong Cai, 2009) (Bruce Ratner, 2010).

In this chapter, computational intelligence based variable selection method is introduced for regression model. It identify the optimal subset of predictors to build the effective regression model for better predicting accuracy.

Key Terms in this Chapter

Swarm Intelligence (/dictionary/swarm-intelligence/28881): It refers to the peculiar group behavior followed by any of the biological systems.

Particle Swarm Optimization (PSO) (/dictionary/particle-swarm-optimization-pso/41338): Commonly used swarm intelligence algorithm devised based on the bird flocking behavior.

Genetic Algorithm (GA) (/dictionary/genetic-algorithm-ga/12064): It is an evolutionary algorithm used for solving various optimization problems.

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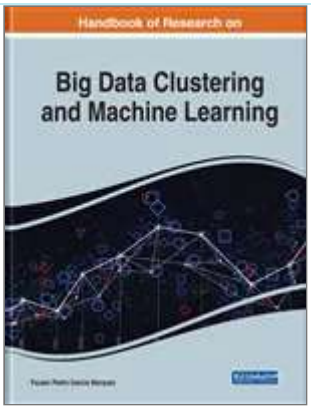
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Enhanced Logistic Regression (ELR) Model for Big Data

Dhamodharavadhani S. (Periyar University, India) and Rathipriya R. (Periyar University, India)

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Abstract

Regression model is an important tool for modeling and analyzing data. In this chapter, the proposed model comprises three phases. The first phase concentrates on sampling techniques to get best sample for building the regression model. The second phase is to predict the residual of logistic regression (LR) model using time series analysis method: autoregressive. The third phase is to develop enhanced logistic regression (ELR) model by combining both LR model and residual prediction (RP) model. The empirical study is carried out to study the performance of the ELR model using large diabetic dataset. The results show that ELR model has a higher level of accuracy than the traditional logistic regression model.

Chapter Preview

Top

Introduction

In the emerging data analytics for big data, regression analysis is one of them used in this research work. It mainly focuses the two class classification problems in the big data. The regression techniques are applicable only for minimal dataset having around some hundreds of records which is evident from the literature. So, the application of regression for big data is also a challenging task. The regression analysis is chosen because they entirely based on the variable dependency.

The data classification will be meaningful when that approach considers the relationships among the attributes. In that sense, the regression analysis is chosen in this research. This entire study deals with the logistic regression for big data having two class problem. Acquiring the knowledge by applying the regression to the entire large dataset is complex, so the sampling is one of the solutions to acquire the knowledge from the large dataset. The first phase data is sampled and then the regression analysis is performed on those samples. It concentrates on sampling techniques to get best sample for building the regression model. Second phase is to predict the residual of Logistic Regression (LR) model using time series analysis method- Autoregressive. Third phase is to develop Enhanced Logistic Regression (ELR) model by combining the both LR model and Residual Prediction (RP) Model. The empirical study is carried out to the study the performance of the ELR model using large diabetic dataset. The results show that ELR model has higher level of accuracy than the traditional Logistic Regression model

Chapter Organization

The rest of the chapter is organized as follows: First section describes the literature study done for this research work. Second section deals with the methods and material used for the logistic regression analysis on big data. The experimental results of the proposed work are discussed in third section. Finally, summarizes this research work and suggests some ideas for future extension.

Top

Review Of Literature

In the literature survey, the previous research contributions are studied. A lot of machine learning techniques are used for data analysis. They are discussed further in this chapter

(Strack, et al., 2014), An multivariate logistic regression is used to fit the relationship between the measurement of HbAlc early readmission while controlling for covariates such as demographics, severity and type of the dieses and type of admission. Results show that the measurement of HbAlc was performed frequently (18.4%) in the inpatient setting.

(Combes.C, Kadari.F, & Chaabane.S, 2014), A linear regression to identify the factors (variable) characterizing the length of stay (LOS) in Emergency department(ED) in- order to propose model to predict the length of stay.

(NM, T, P, & S, 2015), Using the predictive analysis algorithm in Hadoop and Map Reduce goal of their research deals with the study of diabetic treatment in HealthCare industry using big data analytics. The predictive analysis system of diabetic treatment is produce greats in healthcare. They mainly focused the patients in the rural area to generate proper treatment at low cast.

(Luo, 2016), The machine learning predictive model is using the electronic medical record dataset from practice fusion diabetes classification competition containing patient records from all 50 states in the united states. They explained the prediction result for 87.4% of patients who were correctly predicted by the model to have type 2 diagnoses with the next year.

(Carter & Potts, 2014), The poission regression and the negative binomial model for predicting length of stay were age, gender, consltant, discharge destination applying a negative binomial model to the variable was successful. The models can be successfully created to help improve resource planning and from which a simple decision support system can be produced to help patient explanation on length of stay.

(Ho, et al., 2016), An T Test, Chi square test and multivariate Logistic Regression analysis the variables in aciute stroke can predict in hospitality and help decision makes in clinical practice musing Nanogram. The nanogrames may help physicians in risk prediction in hospital mortality.

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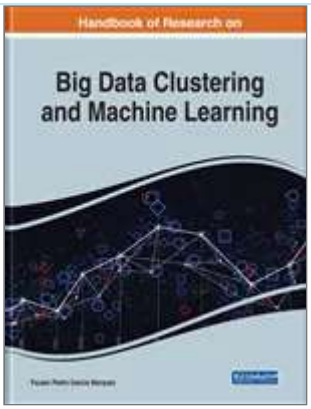
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An Optimized Three-Dimensional Clustering for Microarray Data

Narmadha N. (Periyar University, India) and R. Rathipriya (Periyar University, India)

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Abstract

This chapter focuses on discrete firefly optimization algorithm (FA)-based microarray data, which is a meta-heuristic, bio-inspired, optimization algorithm based on the flashing behaviour of fireflies, or lighting bugs. Its primary advantage is the global communication among the fireflies, and as a result, it seems more effective for triclustering problem. This chapter aims to render a clear description of a new firefly algorithm (FA) for optimization of tricluster applications. This research work proposes discrete firefly optimization-based triclustering model first time to find the highly correlated tricluster from microarray data. This model is reliable and robust triclustering model because of efficient global communication among the swarming particles called fireflies.

Chapter Preview

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1.1 Introduction

This chapter focuses on Discrete Firefly Optimization Algorithm (FA) based Microarray Data which is a meta-heuristic, bio-inspired, optimization algorithm based on the flashing behaviour of fireflies, or lighting bugs. Its primary advantage is the global communication among the fireflies, and as a result, it seems more effective for triclustering problem.

This chapter aims to render a clear description of a new Firefly Algorithm (FA) for optimization of tricluster applications. The chapter organization is given as follows. Section 2 discusses the Firefly Optimization Algorithm. Section 3 outlines the development of the proposed biclustering model. Hybrid Firefly Optimization Based Biclustering model is introduced and discussed in the Section 4. The experimental results analysis of the proposed models is elaborated in the Section 5. Section 6 concludes the chapter with the future research possibility.

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Breast cancer is considered as one of the life-threatening disease among woman population in developing as well as developed countries. This...
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Rhoda Joseph, Patrick Brown

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Sandeep Lakaraju, Dianxiang Xu, Yong Wang

Healthcare information systems deal with sensitive data across complex workflows. They often allow various stakeholders from different environments...
Sample PDF (/viewtitlesample.aspx?id=243172&ptid=231660&t=Analysis of Healthcare Workflows in Accordance with Access Control Policies&isxn=9781799812043)

Chapter 65
Extraction of Protein Sequence Motif Information using Bio-Inspired Computing

Gowri Rajasekaran
Periyar University, India

Rathipriya R
Periyar University, India

ABSTRACT

Nowadays there are many people affected by the genetic disorder, hereditary diseases, etc. The protein complexes and their functions are detected, in order to find the irregularity in the gene expression. In a group of related proteins, there exist some conserved sequence patterns (motifs) either functionally or structurally similar. The main objective of this work is to find the motif information from the given protein sequence dataset. The functionalities of the proteins are ideally found from their motif information. Clustering approach is a main data mining technique. Besides the clustering approach, the biclustering is also used in many Bioinformatics related research works. The PSO K-Means clustering and biclustering approach is proposed in this work to extract the motif information. The Motif is extracted based on the structure homogeneity of the protein sequence. In this work, the clusters and biclusters are compared based on homogeneity and motif information extracted. This study shows that biclustering approach yields better result than the clustering approach.

INTRODUCTION

Protein Sequence

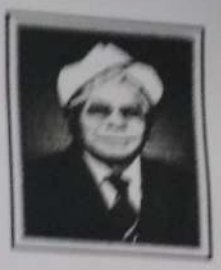
Proteins (Vincent, Bernard, & SinanKockara, n.d.) are present in every cell of the organisms. They are involved virtually almost in all cellular activities. They are responsible for the various metabolic activities, nutrition transportation, regulations and etc. They exist as single chain molecule, as a three dimensional

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CHEMO PREVENTIVE EFFECT OF BLACK RICE ON COLON CANCER

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Introduction

Among health problems cancer is considered as a significant health concern. One in eight deaths worldwide is due to cancer. Most of the cancer cases and deaths worldwide are actually preventable Nowadays, colon cancer remains as the third highest causes of mortality worldwide than other type of cancers. Carcinogenesis is a complex multistage process consisting of initiation, promotion, and progression stage. Cancer chemoprevention involves the use of natural, synthetic, or biological agents that delay, inhibit, or prevent the initial phases of carcinogenesis, as well as the progression of premalignant cells to invasive disease. In chemoprevention, a vital goal is to block tumor progression .Chemo preventive agents play a critical role in suppressing local inflammation, arresting the cancer cell cycle, promoting cancer cell apoptosis, and enhancing the chemo preventive effects..Black rice is rich in fiber, antioxidants, vitamins B, vitamin E, iron, thiamine, magnesium, niacin and phosphorous .The anti-carcinogenic activities of black rice includes anti- oxidative, anti-inflammatory and anti mutagenesis activities.

Colon Cancer

Colon cancer is a type of cancer that begins in the large intestine (colon). The colon is t final part of the digestive tract. It usually begins as small, noncancerous (benign) clumps cells called polyps that form on the inside of the colon. Some of these polyps can bec colon cancers. Signs and symptoms of colon cancer includes diarrhea or constipa changes in stool consistency, blood in the stool. abdominal pain, cramping, bloa weakness and fatigue, unexplained weight loss .irritable bowel syndrome,

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NCEST53

PREPARATION OF ROSE LIKE $CoMoO_4$/r-GO HYBRID COMPOSITES FOR ENHANCED ELECTROCHEMICAL PERFORMANCES OF ASYMMETRIC SUPERCAPACITORS

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ABSTRACT

In this work, rose like $CoMoO_4$/r-GO_x (x=0, 1, 3, 5, 10, 15wt. %) hybrid composites were synthesized by a facile hydrothermal method. The rose like structure, which consisted of nanoflakes, was observed in $CoMoO_4$ samples. The rose like $CoMoO_4$ are fully covered by mesoporous r-GO nanosheets. The specific capacitances at 1 A g^{-1} are 151, 220, 382, 443, 784, and 586 F g^{-1} for samples with $CoMoO_4$/r-GO_x (x=0, 1, 3, 5, 10, 15wt. %), respectively. The high retain capacitances of $CoMoO_4$/r-GO(10.wt%) hybrid composite show the fine long-cycle stability after 10,000 charge-discharge cycles at current density of 6 A g^{-1}. Furthermore, an asymmetric capacitor can deliver an energy density of 34.12 Wh/kg at a power density of 1245 W/kg, and an energy density of 24.23Wh/kg at a high power density of 4560 W/kg. These results indicate $CoMoO_4$/r-GO(10.wt%)//r-GO have prominent properties, which can be considered as promising material for supercapacitor.

Keywords: Hydrothermal method, rose-like $CoMoO_4$, asymmetric supercapacitor.

NCEST54

SYNTHESIS OF 3D FLOWER-LIKE CuO/Co3O4/rGO HYBRID COMPOSITE AND HIGH PERFORMANCE ASYMMETRIC HYBRID SUPERCAPACITOR

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ABSTRACT

With increasing energy demand and rapid depletion of fossil fuels, the development of novel renewable and sustainable energy resource become one of the greatest challenges in

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Karaikudi - 630003, Tamil Nadu, India.

OP-54

3D Flower-Like CuO/Co_3O_4/r-GO Heterostructure with High Performance Asymmetric Hybrid Supercapacitor

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Abstract

With increasing energy demand and rapid depletion of fossil fuels, the development of novel renewable and sustainable energy resource become one of the greatest challenges in the energy storage field. Supercapacitors are promising energy storage devices for flexible electronics because of their integration of lightweight, tiny volume and high flexibility. Herein, we described a facile hydrothermal method to synthesized 3D flower-like CuO/Co_3O_4/r-GO composites. FE-SEM result revealed that Co_3O_4 nanoclusters was embroidered on 3D flower like CuO are anchored homogeneously on the reduced graphene oxide (r-GO) nanosheets. The CuO/Co_3O_4/r-GO composites shows a high specific capacitance of 1458 F/g at a charge/discharge current density of 0.5 A/g in 3M KOH electrolyte solution. The asymmetric supercapacitor composed of 3D flower like CuO/Co_3O_4/r-GO and r-GO exhibited a specific capacitance of 198 F/g at 2 A/g. Moreover, excellent cycling stability with 97% of the 10000 cycles at 5 A/g both three and asymmetric hybrid supercapacitor system. These findings demonstrate that the CuO/Co_3O_4/r-GO composite material is a promising candidate for supercapacitor applications.

Keywords: 3D flower-like CuO; Hydrothermal approach; Electrochemical study: Asymmetric supercapacitor.

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OP-50

A Ternary Fe_2O_3/rGO/SnO_2 Composites as an Anode Material for Supercapacitor Application

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Abstract

The rapid growth of energy demand with increasing population and lack of sustainable energy storage devices has made the supercapacitor an inevitable alternate to current storage systems. However, the major limitation in supercapacitor is relatively low energy density compared to batteries. Herein, we synthesized ternary composite α-Fe_2O_3/rGO/SnO_2 by hydrothermal process as an efficient electrode material with enhanced energy density. In the composite, rGO serves as a conductive and robust matrix, due to the space-confined effect of simultaneous nucleation and growth of α-Fe_2O_3 and SnO_2 nanoparticles which are uniformly distributed on the rGO sheets. As an anode material for supercapacitor application, the α-Fe_2O_3/rGO/SnO_2composite exhibited specific capacitance of the samples id 550Fg^{-1} at 1Ag^{-1} current densities for α-Fe_2O_3/rGO/SnO_2which is higher than that of binary α-Fe_2O_3/rGO (500 Fg^{-1}at 1 Ag^{-1}) and pure α-Fe_2O_3(450Fg^{-1}at 1 Ag^{-1}). The enhancement is due to the synergetic effect in the ternary composite. The cyclic performance of the α-Fe_2O_3/rGO/SnO_2 is markedly improved compared with the pure and binary counterparts obtained in the control experiment.

Keywords: Metal oxide, composites, specific capacitance and energy density.

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CROSS GENDER FRIENDSHIP IN ROSA CUTHBERT GUY'S AND I HEARD A BIRD SING

Ms. S. SNEKHA SRI, Ph.D Research Scholar (PT), Assistant Professor, Periyar University, Salem -11

Unlike common youths, black youth encounters many issues and challenges due to their race and colour. Generally, discrimination on blacks is vividly seen in the research of black literature. In the black literature, the research gap finds in studying the life style, friendship, dreams, parental influence, challenges and trauma of black youths lived after the civil war i.e. during 1960 and 1970. Many black writers and feminists talked the racial and gender discrimination that deployed on their community. In that category, very few writers touched the stories of young adults who are deliberately needed in time. Among them Rosa Cuthbert Guy is one of the writers of young adults in Harlem society. She has written two trilogies for black teenagers. Innocence, growth, courage, dreams, friendship, choice and responsibility of teens are recurring concepts throughout the trilogy. In these themes, the present research paper studies the cross gender friendship between a teen boy and a teen girl is analyzed in Rosa Cuthbert Guy's the last novel of the second trilogy And I Heard a Bird Sing. There are some locally important and culturally differentiated limitations on the categories of persons with whom someone may make friends. Cross – gender friendships among young children, soon dissipates because of the physical and cultural transformations in adolescence. But it is the actual stage where they realize the value of friendship in the present and future life. The immeasurable relationship in the human bonding is friendship. It happens casually and voluntarily across boundaries and borders. Thus this paper studies the vitality of friendship in the life of teenagers.

Keywords: Cross Gender, friendship, dreams, race

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Unstable cell efficiency in CdS quantum dot sensitized solar cell using low cost lugols iodine aqueous electrolyte

R. Vignesh [a], B. Arjun kumar [a], A. Muthuvinayagam [b], T. Elangovan [c], K. Kaviyarasu [d,e], G. Theophil Anand [f], G. Ramalingam [a,*]

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ABSTRACT

We have designed and synthesis rutile TiO_2 rod like nanoflower on the FTO glass by one step hydrothermal method operating at 150 °C for 15 h. The lower concentration of CdS Quantum dots was deposited on the surface of TiO_2 through chemical bath deposition (CBD) method. The samples were characterized x-ray diffraction pattern (XRD), Scanning electron microscopy (SEM) and UV–Vis absorption studies. In this work lugols iodine was used as an aqueous electrolyte between FTO/TiO_2/CdS photoanode and Cu_2S as counter electrode respectively. The result of photo conversion efficiency (PCE) is decreased from 0.13 to 0.033%, this may be the reason photo degradation and corrosion were happened in CdS.
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1. Introduction

Due to increasing energy demands in the human society alternative sources of energy must be found from the natural ways and among the various natural sources for garnering energy from the Sun is most important and reliable [1]. Required electricity were taken from sunlight by through various ways such as photovoltaics (PV), thin film solar cells, quantum dot cells, concentrating PV and thermal solar power stations [2,3]. In this various method, in practical term Quantum dot sensitized solar cells (QDSSCs) is one of the next generation photovoltaic devices to producing electricity from sunlight for, because of high efficiency with low cost [4]. The efficiency of QDSSCs is still lower compare to Dye Sensitized solar cells (DSSCs); because of the electron recombination process was take place inside of TiO_2/QD/electrolyte [3]. In recent years, most of the researchers have done so far increasing the efficiency of QDSSCs, but not yet reached up to required level. The components for fabrication of QDSSCs such as, semiconducting nanomaterial (TiO_2, ZnO) on transparent conducting glass (FTO, ITO glass slide), sensitizing layer (Quantum dots), electrolyte (polysulfide) and counter electrode (Pt, Carbon and Cu_2S) are used usually [4]. Electrolyte is responsible for charge carrier transport between the electrodes (anode/cathode) [5]. The prominent role extent to play of electrolyte is similar in case of QDSSCs, DSSCs, capacitors, supercapacitor and fuel cell etc., it is working as a charge transportation medium to form ions in between the electrodes.

In QDSSCs, most often polysulfide redox couples (S_2-/Sn_2-) are used as an electrolyte to achieve acceptable photo to current conversion efficiencies (CCE) [6]. Lugol's iodine is an iodine solution which contains potassium iodide with iodine water, and it was first made by Jean lugol. In a drop of Lugol's iodine have two parts, one is potassium iodide and remaining is iodine in water. It is also called strong iodine solution, markodine and iodine-potassium iodide (I_2KI) [9]. In medical field lugol's iodine was used for oral

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Quantum Confinement

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Abstract

Quantum Confinement is the spatial confinement of electron-hole pairs (excitons) in one or more dimensions within a material and also electronic energy levels are discrete. It is due to the confinement of the electronic wave function to the physical dimensions of the particles. Furthermore this can be divided in to three ways: 1D confinement (free carrier in a plane) -Quantum Wells, 2D confinement (carriers are free to move down) - Quantum Wire and 3D-confinement (carriers are confined in all directions) are discussed in details. In addition the formation mechanism of exciton, quantum confinement behaviour of strong, moderate and week confinement have been discussed below.

Keywords: Quantum dots; Energy level; Exciton; Confinement; Bohr radius;

1. Introduction of Quantum confinement

The term ‘quantum confinement’ is mainly deals with energy of confined electrons (electrons or electron-hole). The energy levels of electrons will not remain continuous as in the case of bulk materials compare to the nanocrystal. Moreover, obtains the confined electron wave functions, they become a discrete set of energy levels as shown in the figure 1. Such kinds of effects appear when the dimensions of the potential approach nearly to de Broglie wavelength of electrons and resulting in the changes or discreteing levels of energy. The effects are defined as quantum confinement and consequently, for nano-crystals are often called quantum dots (QDs). Furthermore, this quantum dot effect influence into the nanomaterial properties such as electrical, optical as well as mechanical behavior of material . It is due to the peculiar nature in nano material possess higher energy electrons than the bulk material’s. Depending on the QDs size, confined electrons have higher energy than the electrons in bulk materials.

புதிய அணுகுமுறைகளின் வழி தமிழ்மொழி கற்பித்தல் முறைகளும் கருத்துப் புலப்பாடும்

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சுருக்கம்

இணையத்தில் பனுவல், ஒளிப்படம், காண்பொளிகள், அசைவூட்டப்படங்கள், ஒலிக்கோப்புகள் என கல்வி சார் இணையத்தமிழ் வளங்கள் நாளுக்கு நாள் மேம்பட்டு வருகின்றன. இவ்வுள்ளடக்கங்கள் பதிப்புரிமையோடும் கட்டற்ற முறையிலும் நமக்கு கிடைக்கின்றது. கட்டற்ற முறை அஃதாவது படைப்பாக்கப் பொதும உரிம அடிப்படையில் இணையத்தில் உள்ள கல்வி சார் தமிழ் உள்ளடக்கங்களை மேம்படுத்துவதற்கான வழிமுறைகளை இவ்வாய்வுக்கட்டுரை ஆராயவுள்ளது.

தங்களுக்குள் அறிவைப் பகிர்ந்து கொள்வதன் பொருட்டு ஒரு முறையான கட்டமைப்புடன் உருவாக்கப்பட்ட தொகுப்புகளே நூல்களே கலைக்களஞ்சியங்கள். கலைக்களஞ்சிய உள்ளடக்கங்கள் அகரவரிசைப்படி அளிக்கப்பட்டு, ஒரு குறிப்பிட்ட பொருண்மைக் குறித்து முழுமையானத் தரவுகளைக் கலைக்களஞ்சிய நடையில் அளிக்கும் தன்மையுடன் இருக்கும். பிரித்தானிக்கா கலைக்களஞ்சியம் மூன்று தொகுதிகளாக 1768-1771 வாக்கில் பிரான்சிலிருந்து ஆங்கிலத்தில் வெளியிடப்பட்டது. இக்கலைக்களஞ்சியமே இவ்வுலகின் பழமையான கலைக்களஞ்சியமாகும். அண்மையில் வெளிவந்திருக்கும் பிரித்தானிக்கா கலைக்களஞ்சியம் 32 தொகுதிகளுடன் பதிப்பிக்கப்பட்டுள்ளது. காலத்தின் தேவைக்கேற்ப பிரித்தானிக்கா கலைக்களஞ்சியம் தற்போது இணையத்தில் கிடைக்கின்றது. தற்போது அனைத்துத் துறைகளிலும் பொருண்மை சார் கலைக்களஞ்சியங்கள் பெருகி வருகின்றன.

அச்சு நூல் வடிவில் இருக்கும் பிரித்தானிக்கா போன்ற கலைக்களஞ்சியங்கள் காப்புரிமை கொண்டவை, ஒரு குறிப்பிட்ட ஆசிரியர் அல்லது ஆசிரியர் குழுவால் உருவாக்கப்பட்டவை. இவற்றினை நாம் தொகுக்கவோ, சீராக்கிடவோ, பகிரவோ, பதிப்பிக்கவோ, மொழிபெயர்க்கவோ இயலாது. பிரித்தானிக்காவின் உள்ளடக்கங்களை தமிழில் அளிக்கும் நோக்குடன் விகடன் பிரசுரம், பிரிட்டானிகாவுடன் இணைந்து பிரிட்டானிகா தகவல் களஞ்சியம் என்னும் நூலினை 28 ஆயிரம் கலைக்களஞ்சியக் கட்டுரைகளுடன் மூன்று தொகுதிகளாக வெளியிட்டுள்ளது.

பிரித்தானிக்கா கலைக்களஞ்சியத்தின் 32 தொகுதிகளை அணுகுவது அனைவருக்கும் எளிய ஒன்றல்ல. இதன் விலையும் எல்லோருக்கும் உரியது அல்ல. பிரித்தானிக்கா போன்ற கலைக்களஞ்சியங்கள் கட்டற்ற அறிவுப்பரவலை மேற்கொள்வதில் காப்புரிமைச்சிக்கல்கள் உள்ளன.

எனவே கட்டற்ற முறையில் காப்புரிமைச் சிக்கலற்று யாருடனும் பகிரும் வகையில், சேமிக்கும் வகையில், இணையத்தில் வாயிலாக நமக்கு கலைக்களஞ்சிய உள்ளடக்கங்களை அளிக்கும் தன்மையுடன் செயல்படும் இணையக்கல்வி வளங்களை அளிக்கும் விக்கிப்பீடியா போன்ற கட்டற்ற கலைக்களஞ்சிய, தமிழ் விக்சனரி போன்ற அகராதி, விக்கிமூலம் போன்ற மூலநூல் நூலகம் ஆகியனவற்றை ஆராய்து தமிழின் கல்விசார் உள்ளடக்கங்களை மேம்படுத்துவது தேவையான ஒன்றாகும்.

இன்றையச்சூழலில் எதுவொன்றைத் தேடினாலும் பெரும்பாலும் அதற்கான முதல் விடையாக வருவது விக்கிப்பீடியா, விக்சனரி, விக்கிமூலத்தின் உள்ளடக்கங்களாகவே உள்ளன. விக்கிமீடியா என்னும் அறக்கட்டளையில் இருபதுக்கும் மேற்பட்ட கட்டற்ற கல்விசார் வளங்கள் கிடைக்கின்றன. கடந்த 18 ஆண்டுகளில் ஆங்கில விக்கிப்பீடியாவிலும் தமிழ் விக்கிப்பீடியா, தமிழ் விக்சனரி, தமிழ் விக்கிமூலங்கள், விக்கித்தரவுகள் ஆகிய திட்டங்களில் நிகழ்ந்து வரும் உள்ளடக்க மேம்பாடு/ கட்டுரை உருவாக்கச் செயற்பாடுகளின் அடிப்படையில் தமிழ் விக்கிப்மீடியாவின் திட்டங்களில் தரமான உள்ளடக்கம் கொண்ட வளங்களை எப்படி உருவாக்கலாம்? கட்டற்ற தமிழ் வளங்களை உருவாக்குதற்காக காப்புரிமைச்சிக்கல் இல்லாமல் எங்கெங்கு

உள்ளடக்கங்கள் கிடைக்கின்றன? அவற்றைக்கொண்டு தமிழ் விக்கி உள்ளடக்கங்களை எவ்வாறு மேம்படுத்தலாம்? என்பதே இவ்வாய்வுக் கட்டுரையின் நோக்கங்கள் ஆகும்.

இக்கட்டுரை தமிழ் விக்கிப்பீடியாவின் பயனர்களுடன் நிகழ்த்தப்பெற்ற குழு கலந்துரையாடல், தமிழ்/ ஆங்கில விக்கிப்பீடியா பக்கங்களின் தரவு ஒப்பாய்வுகளின் அடிப்படையில் உருவாக்கப்பட்டுள்ளது. தமிழ்நாட்டு அரசின் படைப்பாக்கப் பொது உரிமை ஆணையின் அடிப்படையில் தமிழ் விக்கிப்பீடியாவில் கட்டுரைகளை உருவாக்கவதற்கான மூலங்களையும் தரவுகளையும் இக்கட்டுரை இனங்கண்டுள்ளது. தமிழ் விக்கிப்பீடியாவில் பொதுமக்களும், ஆய்வாளர்களும் பங்கேற்பதில் காணப்படும் இடைவெளிகள் ஆராயப்பட்டு, அவற்றினைச் சரி/சீர் செய்வதற்கான பரிந்துரைகள் அளிக்கப்பட்டுள்ளன. விக்கி மூலம், விக்சனரியில் இருக்கும் தமிழ் உள்ளடக்க வளங்களை எவ்வாறு தமிழ் விக்கிப்பீடியா திட்டங்களில் பயன்படுத்தி கட்டுரை, கல்விசார் உருவாக்கலாம் என்பதற்கான வழிகள், வாய்ப்புகள், மூலங்கள் ஆராயப்பட்டுள்ளன.

விக்கிப்பீடியாவின் நிலை

ஆங்கில விக்கிப்பீடியாவில் உள்ள 59,88,485 கட்டுரைகளும் தமிழ் விக்கிப்பீடியாவில் 1,26,024 கட்டுரைகளும் உள்ளன. உலக அளவில் 301க்கும் மேற்பட்ட மொழிகளில் விக்கிப்பீடியா நிறுவனத்தால் கட்டற்ற கலைக்களஞ்சியங்கள் உருவாக்கப்பட்டு இருப்பினும் அதில் தமிழ் கட்டுரைகள் தரத்தின் அடிப்படையில் 32ஆம் இடத்தில் இருப்பது குறிப்பிடத்தக்க ஒன்று. ஆங்கில விக்கிப்பீடியாவில் ஏன் கட்டுரைகள் அதிகமாக உள்ளன? தமிழ் விக்கிப்பீடியாவில் கட்டுரைகள் ஏன் குறைவாக உள்ளன? என்று ஆராய்ந்து இடைவெளிகளைக் களைய வேண்டியது காலத்தின் தேவை. தமிழ் விக்கிப்பீடியாவில் கட்டுரைகளின் எண்ணிக்கையை உயர்த்துவது, அதன் உள்ளடக்கத்தரத்தை மேம்படுத்துவது என்பது தமிழின் இருப்பை இணையத்தில் வலுப்படுத்துவதற்குரிய தேவைகளில் முதன்மையான ஒன்றாகும்.

இவ்வாய்வின் பொருட்டு தமிழில் உள்ளடக்கங்களை மேம்படுத்துவதற்கு கட்டற்ற உரிமத்தின் கீழ் கிடைக்கும் மூலங்கள், நூல்கள், தரவுகள் போன்றவை ஆராயப்பெற்றுள்ளன. இவ்வாய்வு தமிழ்நாட்டு அரசின் படைப்பாக்கப் பொதும உரிமை குறித்த

அரசாணை எவ்வாறு தமிழ் விக்கிப்பீடியா உள்ளடக்க மேம்பாட்டிற்கு உதவும் என்பதை ஆராய்ந்து அதன் அடிப்படையில் தமிழ் விக்கிப்பீடியாவில் உள்ள உள்ளடக்கத்தின் தரத்தினையும் அதன் பண்புகளையும் இடைவெளிகளையும் ஆராய்ந்து அதனை மேம்படுத்துவதற்குரியப் பரிந்துரைகளை வழங்கி உள்ளது.

மின்னணுக்கருவிகளில் தமிழ் உள்ளீட்டில் உள்ள இடைவெளிகள், மென்பொருள்கள், செயலிகளில் தேவைப்படும் மாற்றங்கள், பயனர்கள் தமிழில் கட்டுரை எழுத/ மேம்படுத்துதலில் உள்ள தடைகள், அவர்களின் மனப்பாங்கு ஆகியனவற்றின் அடிப்படையில் இவ்வாய்வு தன் முடிவுகளை வழங்கி உள்ளது. மின்னணுக்கருவிகளில் தமிழ் உள்ளீட்டு முறையை செந்தரப்படுத்துவது தமிழ் விக்கிப்பீடியாவில் கட்டுரைகளை உருவாக்குவது/ மேம்படுத்துவது/ செறிவாக்குவது என்பனவற்றோடு நேரிடைத் தொடர்புகளைக் கொண்டுள்ளன.

மக்கள் பங்கேற்புடன் ஆங்கில விக்கிப்பீடியாவைப் போல் தமிழ் விக்கிப்பீடியாவை 59,88,485 இலக்கத்திற்கும் மேற்பட்ட கட்டுரைகளைக் கொண்ட தரமான ஓர் இணையக் கலைக்களஞ்சியமாக மாற்றுவதற்கான அடிப்படைச் செயல் திட்டத்தினை இவ்வாய்வு எதிர்காலவியல் பார்வையில் அணுகி அளித்துள்ளது. தமிழ் விக்கிப்பீடியாவில் தன்னியக்கமாக கட்டுரைகளை எந்தெந்தத் துறைகளில் உருவாக்கலாம் என்பதை இவ்வாய்வு வெளிக்கொணர்ந்துள்ளது.

விக்கிப்பீடியா

ஜிம்மி வேல்ஸ், லாரி சாங்கரால் சனவரி 15, 2001இல் முதலில் ஆங்கிலத்தில் தொடங்கப்பட்ட விக்கிப்பீடியா என்னும் கட்டற்ற கலைக்களஞ்சியம் உலகின் 301 மொழிகளில் கட்டற்ற கலைக்களஞ்சிய உருவாக்கத்திற்கு உறுதுணை செய்து, கலைக்களஞ்சிய உள்ளடக்கங்களை அளித்து வருகின்றது. தமிழ் விக்கிப்பீடியா தமிழின் இணைய உள்ளடக்கத்திற்கான உறைவிடமாகத் திகழ்ந்து வருகிறது. விக்கிப்பீடியாவில் தமிழில் பக்கங்களை அளிக்கும் முயற்சியானது 2003 ஆம் ஆண்டு தொடங்கப்பட்டது. தற்போது தமிழ் விக்கிப்பீடியாவில் இதில் 1,26,024 கட்டுரைகள் உள்ளன. 1,66,747 பயனர் கணக்குகள் பதிவு செய்யப்பட்டுள்ளன.

தமிழை இணையத்தில் நிலைநிறுத்தியதற்கும் உலகுதழுவி தமிழை 24/7 ஆக மாற்றியதிலும் தமிழ் விக்கிப்பீடியாவின் பங்கு குறிப்பிடத்தக்கது. 2003இல் தொடங்கிய தமிழ் விக்கிப்பீடியா 1,26,024க்கும் மேற்பட்ட கட்டுரைகளுடன் (சூலை 14, 2018 அன்றைய கணக்கின்படி) தரத்தின் அடிப்படையில் 32ஆவது இடத்தில் இருந்து வருகின்றது. ஆங்கில விக்கிப்பீடியாவில் உள்ள 59,88,485 கட்டுரைகளை தமிழ் விக்கிப்பீடியாவில் உள்ள 1,26,024 கட்டுரைகளுடன் ஒப்பிடும்போது, தமிழ் விக்கிப்பீடியாவை நாம் மேம்படுத்த வேண்டிய தேவைகளை அறியலாம். ஆங்கிலத்தை ஒப்பிடும்போது 59.89 மடங்கு இடைவெளி உள்ளது எனும் நிலை ஒருபுறம். ஆனால், தர அடிப்படையில் ஆங்கில விக்கிப்பீடியா 90ஆம் இடத்திலும் தமிழ் விக்கிப்பீடியா 32ஆம் இடத்திலும் இருப்பது தமிழ் உள்ளடக்கங்கள் மீதான நம்பிக்கையை ஏற்படுத்துகின்றது.

தமிழ் விக்சனரி

விக்சனரி என்பது இணைய வழியே கட்டற்ற முறையில் செயல்படும் அகரமுதலி. ஆங்கில விக்சனரியில் 61,85,060 சொற்பதிவுகள் உள்ளன. தமிழ் விக்சனரியில் 3,49,494 சொற்பதிவுகள் உள்ளன. ஆங்கில விக்சனரியை உலக அளவில் முதலிடத்திலும் தமிழ் விக்சனரி 19ஆம் இடத்திலும் உள்ளது.

ஆங்கில விக்சனரியில் 36,46,243 பயனர்களும் தமிழ் விக்சனரியில் 14810 பயனர்களும் உள்ளனர். தமிழில் பயனர்களின் எண்ணிக்கை மிகக்குறைவாக இருப்பதால் தமிழில் குறைவான பதிவுகளே தமிழ் விக்சனரியில் உள்ளன. தமிழில் 67 பயனர்கள் மட்டுமே வினையாற்றி வருகின்றனர். ஆனால் ஆங்கிலத்தில் 1601 பயனர்கள் வினையாற்றி வருகின்றனர்.

தமிழ் விக்கிமூலம்

விக்கிமூலம் என்பது இணைய வழியே கட்டற்ற முறையில் செயல்படும் மூல நூல்களுக்கான தரவுக்களம். பக்க விவரங்கள்

தமிழ் விக்கிமூலத்தின் நிலை

தமிழ் விக்கிமூலத்தில் நாட்டுடைமை நூல்களில் 3,73,779 பக்கங்கள் மெய்ப்பு பார்க்கப்படாமல் உள்ளன. 17,460 பக்கங்கள் சரிபார்க்கப்பட்டன. 18,619 பக்கங்கள் மெய்ப்பு பார்க்கப்பட்டன. 127 பக்கங்கள் வெற்றுப் பக்கங்கள். 71 பக்கங்கள் மெய்ப்பு பார்க்க

சிக்கலானவை. மெய்ப்பு பார்க்கப்படாத மின்னூல்களின் எண்ணிக்கை 2,047, மெய்ப்பு முடிந்தது. சரிபார்க்க வேண்டிய மின்னூல்களின் எண்ணிக்கை 71. மெய்ப்பும் சரிபார்ப்பும் முடிந்த மின்னூல்களின் எண்ணிக்கை 83.

ஆங்கில விக்கிமூலம் 7,66,220 பக்கங்களுடன் 2,926,262 பதிவுசெய்யப்பட்ட பயனர்களுடன் பயன்பாட்டில் உள்ளது. ஆனால் தமிழ் விக்கிமூலம் 6,746 பதிவுசெய்யப்பட்ட புயனர்களுடன் 9,780 பக்கங்களுடன் உள்ளது.

தமிழ் விக்கிப்பீடியா எதிர்நோக்கும் சிக்கல்கள்

தமிழ் விக்கிப்பீடியா தொகுத்தல் பணி குறித்த விழிப்புணர்வு பொதுமக்கள், ஆசிரியர்கள், மாணவர்கள் ஆகிய மூன்று நிலைகளிலும் போதுமான அளவில் இல்லை. தமிழ் விக்கிப்பீடியா தொகுப்பு குறித்து தமிழ்நாட்டின் எழுத்தாளர்கள், ஆய்வாளர்கள், ஆசிரியர்களிடையே உரிய விழிப்புணர்வு இல்லை.

தமிழ் விக்கிப்பீடியா- தமிழ் இணையக் கல்விக்கழகத்தின் உறுதுணைகள்

தமிழ் இணையக் கல்விக்கழகத்தின் உறுதுணையோடு தமிழ்நாட்டின் ஊராட்சிகள், திருக்கோயில்கள் போன்றவற்றின் தரவுகள் தன்னியக்கமாக ஆயிரக்கணக்கான கட்டுரைகளாக மாற்றப்பெற்று தமிழ் விக்கிப்பீடியாவில் சேர்க்கப்பட்டுள்ளன. பக்க அடிப்படையில் 58ஆம் இடத்தில் இருந்த தமிழ் விக்கி மூலம் இன்று உலக அளவில் எட்டாம் இடத்திற்கு வந்துள்ளது. தமிழ் இணையக்கல்விக் கழகம் மின்னுருவாக்கம் செய்துள்ள நூல்கள், ஆவணங்கள், ஒலைச்சுவடிகள் ஆகியனவற்றை இணையத்தில் படைப்பாகப் பொதும உரிமையின் கீழ் பகிர்ந்தால் அவற்றில் அடிப்படையில் தமிழ் விக்கிப்பீடியாவின் உள்ளடக்கத்தரமும் கட்டுரைகளின் எண்ணிக்கையும் மேம்படும். தமிழ் விக்கி மூலத்தில் உள்ள தரவுகளை விக்கிப்பீடியாவிற்கு ஏற்றவகையில் மாற்றுவதன் வாயிலாக தமிழில் தரமான மின் உள்ளடக்கங்களை உருவாக்கி மேம்படுத்தலாம்.

தமிழ்நாட்டு அரசின் அரசாணையும் உறுதுணையும்

தமிழ்நாட்டு அரசும் அதன் சார்பு நிறுவனங்களும் வெளியிடுகின்ற படைப்புகளைப் படைப்பாக்க பொதும உரிமையின் (Attribution-ShareAlike Unported- CC BY-SA) கீழ் 01.07.2016 அன்று தமிழ்நாட்டு

அரசு அறிவித்து ஆணை வெளியிட்டுள்ளது. இந்த அரசாணையின் (தமிழ் வளர்ச்சி மற்றும் செய்தி (தவ2-2)த்துறை, அரசாணை நிலை எண்: 25, நாள்: 01.07.2016) அடிப்படையில் பின்வரும் ஆக்கங்கள், படைப்புகளின் படைப்பாக்க பொதும உரிமையின் கீழ் அறிவிக்கப்பட்டுள்ளன.

1. நாட்டுடைமையாக்கப்பட்ட நூல்கள்/ படைப்புகள்.
2. தமிழ் வளர்ச்சித்துறை/ தமிழ்ப்பல்கலைக்கழகம் மற்றும் இதர அரசுத்துறைகள் வெளியிடும் நூல்கள் மற்றும் படைப்புகள்.
3. தமிழ் வளர்ச்சித்துறை மற்றும் தமிழ்ப்பல்கலைக்கழகம் உள்ளிட்ட இதர அரசுத்துறைகள் சேகரித்துள்ள அரிய நூல்கள், ஓலைச்சுவடிகள், கல்வெட்டுகள், ஒளிப்படங்கள் ஆகியற்றின் மின்னுருவாக்கப் படிகள்.

எனவே தமிழ்நாட்டு அரசின் ஆணையின் அடிப்படையில் தமிழ்நாட்டு அரசின்கீழ் செயல்படும் அனைத்து துறைகள், சார்பு நிறுவனங்கள், வாரியங்கள் ஆகியனவற்றின் வெளியீடுகளை எளிதில் இனங்கண்டு, கலைக்களஞ்சிய உள்ளடக்க உருவாக்கத்திற்குப் பயன்படுத்தும் வகையில் அட்டவணைப் படுத்தப்பட்டு தரவுப்பட்டியல் உருவாக்கப்பெற வேண்டும். இதுவரை எண்மயப்படுத்தப்பட்ட ஆவணங்களை விக்கி பொதுவகத்தில் வெளியிட்டு அதனை விக்கி மூலத்தில் சேர்க்கலாம்; பிறகு தமிழ் விக்கிப்பீடியாவில் கட்டுரைகளை உருவாக்கலாம்.

தமிழ்ப்பல்கலைக்கழகத்தின் மூலங்கள்/ தரவுகள்

தமிழ்ப்பல்கலைக்கழகம் வெளியிட்டுள்ள பின்வரும் களஞ்சிய வடிவிலான நூல்களை விக்கிப்பீடியாவிற்கு உரிய வகையில் சீர் செய்து ஆயிரக்கணக்கான கட்டுரைகளை உருவாக்கலாம். அறிவியல் களஞ்சியம் தொகுதி 1 முதல் 19 தொகுதிகள், கோயிற் களஞ்சியம், செங்கை எம்.ஜி.ஆர். மாவட்ட காஞ்சிபுரம் கோயில்கள், கோயிற் களஞ்சியம், வடார்க்காடு மாவட்டம் தொகுதி 1, 2, கோயிற் களஞ்சியம், கோயிற்களஞ்சியம் அறிமுகம், சங்க இலக்கியப் பொருட்களஞ்சியம் தொகுதி 1 முதல் 4 தொகுதிகள், தற்காலத் தமிழ்ச் சொற்களஞ்சியம் (30 ஆயிரம் சொற்கள்), நாடகக் களஞ்சியம் தொகுதி 1, 2, வாழ்வியற் களஞ்சியம் தொகுதி 1 முதல் 15.

தமிழ் விக்சனரியை மேம்படுத்த உதவும் அகரமுதலி - கலைச்சொல் தரவுகள்

தமிழ்ப்பல்கலைக்கழகம் வெளியிட்டுள்ள பின்வரும் அகராதி வடிவிலான நூல்களின் உள்ளடக்கங்களை தமிழ் விக்கிப்பீடியாவில் உரிய வகையில் சேர்க்கலாம். அகராதியியல், அருங்கலைச்சொல் அகரமுதலி (ஆங்கிலம் - தமிழ்), ஆங்கிலம் - தமிழ் வழிகாட்டி அகராதி, கல்வியியல் கலைச்சொல் விளக்க அகராதி, சங்க இலக்கியச் சொல்லடைவு, சித்த மருத்துவத் தொகை அகராதி, தமிழ் அகராதியியல் ஆய்வடங்கல் (1992 வரை), தமிழ் நிகண்டுகள் உள்ளடக்கமும் வரலாறும், தமிழ் பாரம்பரியமிக்க வெளிநாட்டு அறிவிப்புகள், தமிழ் மின்சொற்களஞ்சியம், நாமதீப நிகண்டு, பெருஞ்சொல்லகராதி தொகுதிகள் 1- 6, மர இனப்பெயர்த் தொகுதி 1, 2, வயது வந்தோர் கல்வியியல் கலைச்சொல் விளக்க அகராதி.

தமிழ்ப்பல்கலைக்கழகம் வெளியிட்டுள்ள பின்வரும் நூல்களின் துணையோடு பல்வகைத்துறைகளுக்கான அடிப்படை கலைச்சொற்களை விளக்கும் கட்டுரைகளை உருவாக்கலாம். இயந்திரவியல் இயந்திரப் பொறியியல் கலைச்சொற்கள், இயற்பியல், வேதியியல், கணிதவியல் கலைச்சொற்கள், இரும்புத் தொழில் கலைச்சொல்லகராதி, உயிரியல் கலைச்சொல் விளக்க அகராதி சமூகவியல் மற்றும் மானிடவியல் கலைச்சொல்லகராதி, தொழில் கலைச்சொல் அகராதி, பொறியியல் தொழில் நுட்பவியல் கலைச்சொற்கள், மருத்துவக் கலைச்சொற்கள், மின்னணு-மின்னியல் கலைச்சொல் விளக்க அகராதி, மின்னியல் மற்றும் மின்னணுவியல் கலைச்சொற்கள், வேளாண்மையியல் மண்ணியல் கலைச்சொற்கள்.

தமிழ்நாட்டுப் பாடநூல் நிறுவனத்தின் தரவுகள்

தமிழ்நாட்டுப் பாடநூல் நிறுவனம் வெளியிட்டுள்ள ஆயிரத்திற்கும் மேற்பட்ட நூல்களின் தரவுகளை தமிழ் விக்கிப்பீடியாவிற்கு ஏற்ற வகையில் கட்டுரைகளாக உருவாக்கலாம். இந்நிறுவனம் வெளியிட்ட தமிழ்நாட்டு வரலாற்று நூல்கள், பாடநூல்கள், அறிவியல் தொழிற்நுட்ப நூல்கள் செறிவான மூலங்களுடன் உருவாக்கப்பட்டுள்ளன. இந்நிறுவனம் பறவைகளுக்கும், நிலைத்திணைகளுக்கும் வெளியிட்டுள்ள நூல்கள் உயிரியியல் புலத்திற்கான அடிப்படைக் கட்டுரைகளை உருவாக்க உதவும்.

தமிழ் வளர்ச்சித்துறையின் கட்டுப்பாட்டில் செயல்பட்டு வரும் தமிழ்ப்பல்கலைக்கழகம், உலகத்தமிழாராய்ச்சி நிறுவனம், செந்தமிழ் சொற்பிறப்பியல் அகரமுதலித்திட்டம், உலகத் தமிழ்ச்சங்கம் ஆகிய நிறுவனங்களின் படைப்புகள் அனைத்தும் படைப்பாக்கப் பொதும உரிமையின்கீழ் அறிவிக்கப்பட்டுள்ளதால் இப்படைப்புகளை விக்கி மூலத்தில் தரவேற்றம் செய்யப்பட்டு, உரிய வகையில் தமிழ் விக்கிப்பீடியாவிற்கு ஏற்றாற்போல் மாற்றப்பட்டு தமிழ் கட்டுரைகளாக்கப்பட வேண்டும்.

தமிழ்நாட்டுப் பல்கலைக்கழக, கல்லூரிகளின் நூல்களும் தரவுகளும்

தமிழ்நாட்டிலுள்ள அனைத்துப் பல்கலைக்கழக வெளியீடுகளையும் ஒப்புநோக்கி அவற்றின் அடிப்படையில் ஆயிரக்கணக்கான கட்டுரைகளை உருவாக்கலாம்.

தரவுகளைக் கட்டுரைகளாக மாற்றுதல்

தமிழ்நாட்டு அரசின் பள்ளிக்கல்வித்துறையின் கீழ் செயல்படும் அனைத்துப்பள்ளிகளின் தரவுகளையும் கட்டுரைகளாக உருவாக்கி ஆயிரக்கணக்கான கட்டுரைகளைத் தன்னியக்கமாக தமிழ் விக்கிப்பீடியாவில் சேர்க்கலாம். தமிழ்நாட்டின் சட்டமன்ற உறுப்பினர்கள், பாராளுமன்ற உறுப்பினர்கள் குறித்த தரவுகளைத் தமிழ் விக்கிப்பீடியாவில் சேர்க்கலாம்.

நாட்டுடைமை நூல்கள்

தமிழ்நாட்டு அரசு நாட்டுடைமை ஆக்கியுள்ள நூல்களின் தரவுகள் விக்கி மூலத்திற்கு அளிக்கப்பட்டுள்ளதால் இந்த நூல்களின் தரவுகளின் அடிப்படையில் தமிழ் விக்கிப்பீடியாவில் கட்டுரைகளை உருவாக்கலாம்.

ஒருங்கிணைப்பு தேவைப்படும் துறைகள்

தமிழ் வளர்ச்சிக்கழகம் நூற்றுக்கணக்கான நூல்களைக் கலைக்களஞ்சிய வடிவில் வெளியிட்டுள்ளது. தமிழ் வளர்ச்சிக்கழகம் வெளியிட்ட குழந்தைகள் கலைக்களஞ்சியம் படைப்பாக்க பொதும உரிமையின் கீழ் முன்னமே தமிழ் விக்கி மூலத்திற்கு கொடையளித்துள்ளது. தமிழ் வளர்ச்சிக்கழகம் வெளியிட்டுள்ள கலைக்களஞ்சியம் - 10 தொகுதிகள், மருத்துவக் களஞ்சியம் -10 தொகுதிகள், வேளாண்மை, வனவியல், தகவல்

தொழிற்நுட்பவியல் போன்றவற்றைப் படைப்பாக்க பொதும உரிமையின் கீழ் வெளியிடச்செய்தால் ஆயிரக்கணக்கான கட்டுரைகளைத் தமிழ் விக்கிப்பீடியாவில் உருவாக்கலாம்.

தொகுப்புரை

1. கலைக்களஞ்சியங்கள் குறித்த விழிப்புணர்வை பாடத்திட்டத்தில் சேர்க்கப்பட வேண்டும். தமிழ் விக்கிப்பீடியா போன்ற படைப்பாக்கப் பொதும அடிப்படையில் செயல்படும் கலைக்களஞ்சியத்தின் தொகுப்புப்பணிகள் பள்ளி, கல்லூரி, பல்கலைக்கழகப் பாடத்திட்டங்களில் சேர்க்கப்பட வேண்டும்.

2. தமிழக புதலியல் (botany), விலங்கினங்களின் அளவாய்வு அடிப்படையில் தமிழ் விக்கிப்பீடியாவில் கட்டுரைகள் உருவாக்கப்பட/ மேம்படுத்தப்பட வேண்டும்.

3. தமிழகத்தின் அனைத்துப் பல்கலைக்கழகங்களிலும் அகராதியியல் துறை, கணினித்தமிழ்த்துறைகள் தொடங்கப்பெற வேண்டும்.

4. தமிழ் இணையக்கல்விக்கழகம் மின்னுருவாக்கம் செய்துள்ள தஞ்சை சரசுவதி மகால் நூலகத்தின் ஆவணங்களையும், ஓலைச்சுவடிகளையும், நூல்களையும் இணையத்தில் படைப்பாக்க பொதும உரிமையின்கீழ் வெளியிடுவது தமிழ் விக்கிப்பீடியாவில் கட்டுரை உருவாக்கத்திற்குப் பயன்படும்.

5. தமிழ் விக்கிப்பீடியா அதன் வளங்கள், தொகுப்பு முறைகள் குறித்து மாணவர்கள், ஆசிரியர்கள், அரசு ஊழியர்கள் என்னும் நிலைகளில் பயிலரங்குகளை அரசு நடத்த வேண்டும்.

6. தமிழ்நாடு வேளாண்மைப் பல்கலைக்கழகம் உருவாக்கியுள்ள வேளாண் தொழிற்நுட்ப இணையம் படைப்பாக்க பொதும உரிமையில் அறிவிக்கப்பட்டால் தமிழ் விக்கிப்பீடியாவில் ஐந்து இலக்கத்திற்கும் மேற்பட்ட கட்டுரைகளை உருவாக்கும் வாய்ப்புகள் உள்ளன.

7. தமிழ்நாட்டரசின் ஒவ்வொருத்துறையும் தங்களின் துறை சார்ந்த உள்ளடக்கங்களைத் தமிழில் கலைக்களஞ்சிய வடிவில் உருவாக்க வேண்டும்.

8. தமிழ்நாட்டின் அரசு நூலகங்களில் உள்ள காப்புரிமைச்சிக்கல் இல்லாத தமிழ் நூல்களை எண்மயப்படுத்தி இணையத்தில் வெளியிட்டால் கட்டற்ற முறையில் தமிழ்க்கட்டுரைகள் தமிழ் விக்கிப்பீடியாவில் சேர்க்க ஏதுவாகும்.

9. தமிழ்நாட்டு அரசின் ஆவணக்காப்பகத் தரவுகள் இணையத்தில் படைப்பாக்க பொதும உரிமையின்கீழ் வெளியிடப்பட்டால் அவை தமிழ் விக்கிப்பீடியாவில் கட்டுரை உருவாக்கத்திற்குப் பயன்படும்.

10. தமிழ்நாட்டு அரசின் தொல்லியல் துறை வெளியீடுகளின் அடிப்படையில் கட்டுரைகள் தமிழ் விக்கிப்பீடியாவில் உருவாக்கப்பட வேண்டும்.

11. தமிழ்நாட்டு அரசு வெளியீடுகளுக்கான ஒருங்கிணைந்த நூற்தொகை உருவாக்கப்பட்டு இணையத்தில் வெளியிட வேண்டும்.

12. தமிழ்ப்பல்கலைக்கழக, தமிழ் வளர்ச்சித்துறை, உலகத்தமிழாராய்ச்சி நிறுவனத்தின் அகரமுதலி நூல்கள், சொற்றொகைகள், சொற்குவைப்பதிவுகள் தமிழ்நாட்டு அரசின் கட்டற்ற உரிமை அரசாணையின் அடிப்படையில் தமிழ் விக்சனரியில் இணைக்கப்பெற வேண்டும்.

13. தமிழ்ப்பல்கலைக்கழக, தமிழ் வளர்ச்சித்துறை, உலகத்தமிழாராய்ச்சி நிறுவனத்தின் நூல்கள், செப்பேடுகள், ஓலைச்சுவடி, அரியவகை தாள் ஆவணங்கள் தமிழ்நாட்டு அரசின் கட்டற்ற உரிமை அரசாணையின் அடிப்படையில் தமிழ் விக்கி மூலத்தில் இணைக்கப்பெற வேண்டும்.

14. மின்னணுக்கருவிகளில் தமிழ் உள்ளீட்டில் உள்ள இடைவெளிகளைக் களைவதற்கு ஏதுவாக தமிழ்நாட்டு அரசு அனைத்து மின்னணுக்கருவிகளும் தமிழ் உள்ளீட்டிற்கான ஒத்திசைவோடு வெளியிடப்படுவதை உறுதி செய்ய வேண்டும்.

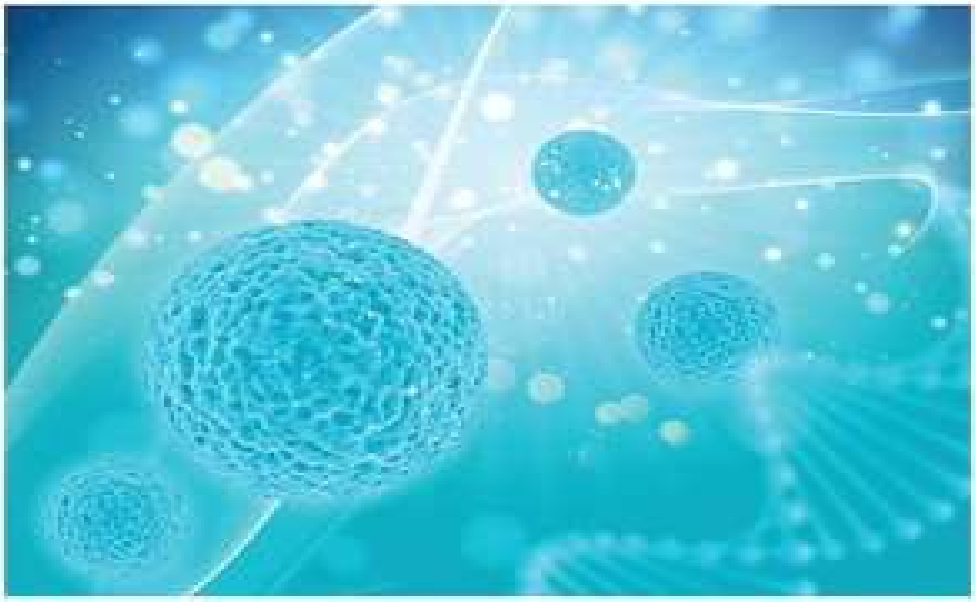
15. மென்பொருள்கள், செயலிகளில் தமிழ்ப்பதிப்புகளை அரசு உறுதி செய்ய, தமிழின் பொருத்தப்பாடு/ ஒத்திசைவினை தமிழ்நாடு அரசு சான்றளிப்புச் செய்து உறுதிபடுத்த வேண்டும்.

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குறிச்சொற்கள்:

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Drug Development for Cancer and Diabetes

A Path to 2030

Editors

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3 Laccase: Recombinant Expression, Engineering and Its Promising Applications

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Abstract

Laccases are cuproproteins belonging to the oxidoreductase family that catalyse the oxidation of various aromatic and non-aromatic compounds. With wide occurrence in bacteria, fungi, higher plants and insects, laccases have been majorly exploited due to their pivotal role in bioremediation and industrial uses. Low productivity and high cost limit the use of native laccases. Besides these drawbacks, native sources yield a mixture of isozymes, which is not desirable for commercial scopes. Thus, in conjunction with this, recombinant laccases have gained importance for sustainable processing due to their improved catalysis, stabilities, and solvent and anionic tolerance. Henceforth, this review mainly focuses to accentuate the recombinant laccases from fungal, mushroom, bacterial and actinobacterial sources, laccase engineering and their proficient industrial applications. The characteristic traits of the recombinant forms of laccase from distinct sources emphasise the requirement to study them more for their upcoming, hidden environmental and biotechnological applications.

3.1 Introduction

Laccases are oxidoreductases or *p*-diphenol oxidases (EC 1.10.3.2). They belong to the enzyme superfamily of multicopper oxidases, which is a widely distributed protein family among prokaryotes and eukaryotes (Hoegger et al. 2006). Laccases can

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Applications of Nanomaterials in Human Health
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Application of nanomaterials in cancer diagnosis, drug delivery, and therapy

(Book Chapter)

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Abstract

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Cancer diagnostics and therapy has a lot to gain from advances in nanotechnology. Liposomes like nanoparticles can be loaded with probes and anti-cancer drugs to target cancer tissues. Drug delivery requires the specificity of targeting the cancer tissue; prolonged circulation of the nanoparticles in the blood; assessment of the tumor microenvironment (TME) and the controlled release of nanoparticles. This is particularly important from enhanced permeability and retention of nanomaterials, also known as the EPR effect. Thus, controlling the nanoparticles for different cancer types and in different formulations is critical. Efficacy and access of nanoparticles to the cancer cells may be monitored and regulated for specific tumor types that could lead to patient specific precision medicine. Hence, innovative nanotechnology can supplement existing molecular, cellular, and genetic techniques to study alterations across different cancer types, enabling the sorting of normal and malignant cells and tissues. For diagnostics, nanoparticle biosensors may be used in monitoring molecular signals specific to tumorigenesis, to assess tumor specific changes occurring in the malignant tissues. Here we also review novel nanotechnologies including the use of CRISPR/Cas9, CAR-T immunotherapy, and DNA and RNA nanotechnology studies in cancer theranostics design. © Springer Nature Singapore Pte Ltd. 2020.

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AIP Conference Proceedings

Volume 2270, 2 November 2020, Article number 110025

2020 International Conference on Physics and Chemistry of Materials in Novel Engineering Applications, PCMNEA 2020; Kumaraguru College of TechnologyCoimbatore, Tamilnadu; India; 6 February 2020 through 7 February 2020; Code 164723

Halloysite nanotubes strengthened hydroxyapatite/biopolymer composite coating on titanium for implant applications(Conference Paper)

Bhagya Mathi, D., Gopi, D., Kavitha, L.

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[a]Department of Physics, School of Basic and Applied Sciences, Central University of Tamilnadu, Thiruvarur, Tamilnadu, 610 005, India
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Abstract

An approach combining hydroxyapatite (HAP) with Polyhydroxybutyrate (PHB) and Halloysite Nanotubes (HNT) has been dealt in this work towards orthopedic implant applications. Through electrodeposition method HAP/HNT/PHB composite have been deposited on titanium. HAP/HNT/PHB composite coated Ti were characterized to confirm the presence of functional groups using Fourier Transform Infrared Spectroscopy (FTIR). To view the morphology Scanning Electron Microscopy (SEM) analysis is performed. Vicker's microhardness analysis was executed to find out the mechanical strength. Also, In-vitro cytotoxicity test has been performed to perceive the bioactivity of the composite. All results point to the feasibility of HAP/HNT/PHB composite coated Ti to be developed into orthopedic bioimplant material. © 2020 American Institute of Physics Inc.. All rights reserved.

SciVal Topic Prominence

Topic: Hydroxyapatites | Bioceramics | Potentiodynamic Polarization

Prominence percentile: 88.470

Author keywords

Biopolymer Electrodeposition Halloysite Nanotubes Hydroxyapatite Implant

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Source Type: Conference Proceeding
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Volume Editors: Aranganayagam K.R.
Publisher: American Institute of Physics Inc.

Bhagya Mathi, D.; Department of Physics, School of Basic and Applied Sciences, Central University of Tamilnadu, Thiruvarur, Tamilnadu, India;
Kavitha, L.; Department of Physics, School of Basic and Applied Sciences, Central University of Tamilnadu, Thiruvarur, Tamilnadu, India;
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AIP Conference Proceedings

Volume 2269, 12 October 2020, Article number 030108

2019 International Conference on Multifunctional Materials, ICMM 2019; Hyderabad; India; 19 December 2019 through 21 December 2019; Code 164101

Facile hydrothermal synthesis of zinc cobalt sulfide nanosheets with enhanced electrochemical performance as supercapacitor electrode materials(Conference Paper)(Open Access)

Dakshana, M., Meyvel, S., Silambarasan, M., Sathya, P., Malarvizhi, M., Ramesh, R., Prabhu, S.

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Abstract

Ternary transition metal sulfides are propitious electrode materials caused by low electronegativity, high conductivity and higher electrochemical activity in comparison to transition metal oxides and single metal sulfides. In this work, Zinc Cobalt Sulfide (ZCS)nanosheets have been successfully prepared through a simple, cost-effective hydrothermal method and characterized by X- Ray Diffraction (XRD), Field Emission Scanning Electron Microscope (FE-SEM) with Energy Dispersive X- Ray Analysis (EDX), Transmission Electron Microscope (TEM), and X-Ray Photoelectron Spectroscopy (XPS). The supercapacitor performance of ZCS nanomaterial electrodes was done by electrochemical measurements and ZCS nanosheets revealed a clear enhancement in specific capacity and cycling stability. Electrochemical impedance spectroscopy showed a much lower charge transfer resistance of the samples. These results proved that the ZCS nanosheets may be utilized as capable electrode materials for next generation energy storage devices. © 2020 American Institute of Physics Inc.. All rights reserved.

SciVal Topic Prominence

Topic: Electrochemical Capacitors | Cobaltous Sulfide | Electrode Materials

Prominence percentile: 99.993

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Publisher: American Institute of Physics Inc.

Dakshana, M.; Department of Physics, Chikkaiah Naicker College, Erode, Tamilnadu, India;

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AIP Conference Proceedings

Volume 2261, 5 October 2020, Article number 030140

2020 International Conference on Advances in Applicable Mathematics, ICAAM 2020; Coimbatore; India; 21 February 2020 through 22 February 2020; Code 163834

The exact solutions of heat equation by RDTM for the fractional order(Conference Paper)

Thangavelu, Padmasekaran, S.

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Department of Mathematics, Periyar University, Salem, Tamilnadu, India

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Abstract

In this paper,we pursue Fractional Reduced Differential Transform Method (DTM)to the one-dimensional heat equation, so that fractional order partial differential equations (PDEs) can be resolved effectively. The most distinct aspect of this method is that no prescribed assumptions are required and the huge computational exertion is reduced and round-off errors are also evaded. We utilize the proposed scheme on some initial value problem and approximate numerical solutions of linear time fractional PDEs are obtained, which shows that the method is highly accurate and simple to apply. The proposed technique is thus an influential technique for solving the fractional PDEs and fractional order problems occurring in the field of physics, science etc. Numerical results are obtained for verification and demonstration purpose by using mathematica software. © 2020 Author(s).

SciVal Topic Prominence

Topic: Fins | Differential Transformation Method | Biot Number

Prominence percentile: 87.920

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Source Type: Conference Proceeding
Original language: English
DOI: 10.1063/5.0017176
Document Type: Conference Paper
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Publisher: American Institute of Physics Inc.

Thangavelu, ; Department of Mathematics, Periyar University, Salem, Tamilnadu, India

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Journal of Physics: Conference Series

Volume 1597, Issue 1, 20 August 2020, Article number 012024

2019 International Conference on New Trends in Mathematical Modelling with Applications, ICNTMMA 2019; Uthangarai; India; 29 July 2019 through 30 July 2019; Code 162477

Radio analytic mean labeling of some graphs(Conference Paper)(Open Access)

Poomalai, P., Vikramaprasad, R., Malliga, P.

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Abstract

A Radio Analytic mean Labeling of an associated diagram G is a balanced guide V from the vertex set v(G) to the arrangement of z+ with the end goal that for any two distinct vertices x and y of G. d (x, y)+[|(f(u))-(f(u))|/2]≥1+diam G. The Radio Analytic mean number of n, RAMN (n) is the greatest number relegated to any vertex of G. The Radio Analytic mean number of G, is the least value of RAMN(n) taken over all Radio Analytic mean labeling n of G. In this paper we locate the radio Analytic mean number of splitting of Bistar graph, standing graph, wheel graph. © 2020 IOP Publishing Ltd. All rights reserved.

SciVal Topic Prominence

Topic: L(2, 1)-Labeling | Chromatic Number | Colouring

Prominence percentile: 67.714

Indexed keywords

Engineering uncontrolled terms: Least value, Vertex set

Engineering main heading: Physics

ISSN: 17426588
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Original language: English

DOI: 10.1088/1742-6596/1597/1/012024
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2020 6th International Conference on Advanced Computing and Communication Systems, ICACCS 2020

March 2020, Article number 9074454, Pages 951-956

6th International Conference on Advanced Computing and Communication Systems, ICACCS 2020; Coimbatore; India; 6 March 2020 through 7 March 2020; Category numberCFP20YAF-ART; Code 159486

Internet of Vehicle: Effects of Target Tracking Cluster Routing in Vehicle Network(Conference Paper)(Open Access)

Kulanthaiyappan, S., Settu, S., Chellaih, C.

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Periyar University, Department of Computer Science, Salem, Tamilnadu, India

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Abstract

Nowadays, the Internet of Vehicle around the road among the smart city's development. This platform relayed on the Internet of Things. The vehicle has a relationship to the primaries (Vehicle, RSU, Backhaul, and Cell tower), cloud, architecture, protocol, and macro connections. The proposed paper is VANET based target tracking clustering for significant topology changes in vehicle and vehicle affinities establishments. Numerous cluster lead can use to establish and maintains inter, intra-cluster connection for either local or global and both. Especially cluster gateways, heads, members can propagate data among themselves and maintains the affinity between the clusters. © 2020 IEEE.

SciVal Topic Prominence

Topic: Vehicular Ad Hoc Networks | Vehicular Communications | Medium Access Control

Prominence percentile: 99.040

Author keywords

Dynamic Topology | Internet of Vehicle | Target Tracking | Timeline Clustering | VANET

Indexed keywords

Engineering controlled terms: Base stations | Clutter (information theory) | Network architecture | Target tracking | Vehicle to vehicle communications | Vehicles

Engineering uncontrolled terms: In-vehicle networks | Intra-cluster | Topology changes

Engineering main heading: Vehicular ad hoc networks

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Cheung, S.

Implementation and application of big data platform for the internet of vehicles

(2020) 2020 8th International Conference on Power Electronics Systems and Applications: Future Mobility and Future Power Transfer, PESA 2020

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Communications in Computer and Information Science

Volume 1213, 2020, Pages 36-48

4th International Conference on Computational Intelligence, Cyber Security, and Computational Models, ICC3 2019; Coimbatore; India; 19 December 2019 through 21 December 2019; Code 250959

Prediction of Patient Readmission Using Machine Learning Techniques(Conference Paper)

Diviya Prabha, V., Rathipriya, R.

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Abstract

Prediction analysis on hospital readmission has become perplexing due to large volume of data. In today's world, data generated from hospitals, sensors, reports from doctor, etc., accurate readmission prediction for large dataset is a challenging task. The aim of this paper is to develop an accurate prediction model for readmission to improve healthcare. A new approach called Entropy Based Feature Selection and Entropy Based Hyper Parameter Tuning for Logistic Regression is developed for accurate prediction of readmission and enhances machine performance for large dataset. The evaluation shows the proposed model provides accuracy of 96% comparatively greater than other models and less computation time. © 2020, Springer Nature Singapore Pte Ltd.

SciVal Topic Prominence

Topic: Decision Trees | Rule Induction | Genetic Operator Regions

Prominence percentile: 83.781

Author keywords

Decision making | Logistic regression | Machine learning | Predictive analytics

Indexed keywords

Engineering controlled terms: Computation theory | Computational methods | Entropy | Forecasting | Hospitals | Intelligent computing | Large dataset | Logistic regression | Machine learning | Security of data

Engineering uncontrolled terms: Accurate prediction | Computation time | Entropy-based | Hyper-parameter | Large volumes | Machine learning techniques | Machine performance | New approaches

Engineering main heading: Predictive analytics

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Materials Today: Proceedings

Volume 33, 2020, Pages 2660-2664

2019 International Conference on Nanotechnology: Ideas, Innovation and Industries, ICN 2019; Tamilnadu; India; 12 December 2019 through 14 December 2019; Code 165932

Technology strategy for improved safety management in steel industry(Conference Paper)

Satish, R., Murugabhoopathy, K., Rajendhiran, N., Vijayan, V.

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Abstract

Steel Industry provides a major contribution to the development of an economy of any nation. This industry comprises of various risks and hazards in its process. With the advent of technology, quality and safe steel is now becoming a matter of important concern. Amongst the various strategies used to create a safe working environment in the steel industry - "Technology" takes the priority. © 2019 Elsevier Ltd. All rights reserved.

SciVal Topic Prominence

Topic: Ti-6Al-4V | Fiber | Mechanical Properties

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Hazards | Refined process | Safety management system | Steel | Technology

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Vijayan, V.; Department of Mechanical Engineering, K. Ramakrishnan College of Technology, Trichy, Tamil Nadu, India

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Zhao, J. , Ma, L. , Zayed, M.E.

Industrial reheating furnaces: A review of energy efficiency assessments, waste heat recovery potentials, heating process characteristics and perspectives for steel industry

(2021) Process Safety and Environmental Protection

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Materials Today: Proceedings

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2019 International Conference on Nanotechnology: Ideas, Innovation and Industries, ICN 2019; Tamilnadu; India; 12 December 2019 through 14 December 2019; Code 165932

Assessment of microbial diversity and enumeration of metal tolerant autochthonous bacteria from tailings of magnesite and bauxite mines(Conference Paper)

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Abstract

The magnesite and bauxite mines are a major source for some minerals and metals. The tailings of these magnesite and bauxite mines contains massive amount of Mn. (3221.2 ± 6.51 & 7102.8.4 ± 10.24), Cd (40.95 ± 2.12 & 892.86 ± 8.48), Zn (951.08 ± 4.31 &724.12 ± 3.18), and Pb (425.8 ± 5.21 & 812.13 ± 9.19 mg Kg^{-1}) with alkaline and acid pH respectively. In the microbial diversity analysis, the results 8 (Thiobacillus thiooxidans, Leptospirillum ferrooxidans, Acetobacter methanolicus, T. intermedius, Bacillus cereus, Sulfobacillus acidophilus, Methylobacterium sp, and Thiobacillus ferooxidans) and 12 (Serratia marcescens, Metalogenium symbioticum 1, Metallogenium symbioticum 2, Bacillus alcalophilus, Aminobacter sp, Naumaniella neustonica, Staphylococcus aureus 1, Methylbacillus sp, Pandoraea sputorum, Acenetobacter sp, S. aureus 2, Pseudomonas aeruginosa) bacteria species were isolated from bauxite and magnesite mine tailings. The fungus such as Rhizopus arrhizus, Mucor sp, Aspergillus niger and Penicillium sp were obtained in both acid and alkaline environment. Among this microbial diversity, P. sputorum and B. cereus (identified through 16S rDNA sequencing) were shown better resistance to these four metals for up to 250 mg L^{-1}. The bacterial diversity indexes, concludes that there was least diverse among the three sites. The evenness/equitability index also conform lower level of variation among these sites. © 2019 Elsevier Ltd. All rights reserved. Selection and peer-review under responsibility of the scientific committee of the International Conference on Nanotechnology: Ideas, Innovation and Industries.

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(2021) Chemosphere

Narayanan, M. , Kandasamy, S. , Kumarasamy, S.

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IMPACT OF MULTIMEDIA INTEGRATED MULTISENSORY INSTRUCTION ON LEARNING MATHEMATICS AMONG HIGHER SECONDARY STUDENTS

***Mr.N.RAJKUMAR **Dr.K.NACHIMUTHU ***Mrs.D.JAYASREE**

Abstract

The main objectives of the study is to find out whether the package use to enhancing learning mathematics among higher secondary students is effective. The researcher adopted the Quasi-Experiment method has gathered information to measure a Multimedia Integrated Multisensory Instruction definitely enhanced learning mathematics of higher secondary students in mathematics. The investigator used simple random sampling technique for selecting the sample from the population. The sample consists of 46 higher secondary students studying in secondary level in Dharmapuri District, Tamil Nadu. The researcher has constructed and standardized the following research tool (Achievement in Mathematics questionnaire) to collect data from the sample. The statistical used descriptive analysis, differential analysis. This researcher concluded, there is a significant difference in the post test scores of learning mathematics among higher secondary students with a control group and experimental group. This research outcome highlighted, Multimedia Integrated Multisensory Instruction definitely enhanced learning mathematics among higher secondary students for an experimental group its effectiveness on the development of the adolescent students. Finally, using multisensory teaching can help stimulate students' minds and give them the ability to get better learning mathematics outcomes.

Keywords: Multimedia Integrated Multisensory, learning mathematics, higher secondary students and effective

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INTRODUCTION

Mathematics is subject has extensive application in our day-to-day life calculates wages, expenses and balances are making use a lot of simple mathematics. Aims of education the individual way that becomes contributory of students understand knowledge, skills development of attitude and their ideas. In the present day to feel more and more practical value of mathematics in our life. Mathematics helps student interest of highly disciplined mode of thinking, computational skills, structure relationship, regularity and systematic variation knowledge of skills. Multisensory teaching helps students understand concepts, methods of reasoning and effective ways of presenting their ideas to learning to use of discovery method is the most important future of modern mathematics.

REVIEW OF RELATED STUDIES

Yu, K., Tang, H., Gong, R., Dong, J., & Hu, S. (2018). Evaluated this study on the effects of the Application of Multimedia to Library Use Education on Learning Motivation and Learning Satisfaction. The research results show most correlations between the library use education and learning motivation, library use education and learning satisfaction, and learning motivation and learning satisfaction and expecting to enhance students' library resource use frequency to promote learning motivation and satisfaction.

Jadhav, A. K., & Gathoo, V. S. (2018). The study focussed on the effect of Abacus training on numerical ability (comprising of counting and mathematical operations) of children with hearing loss. The findings revealed that the experimental group which was instructed through Abacus showed higher proficiency in numerical ability as compared to the control group instructed through the conventional method. Gender as a variable seems to influence the mean achievement of numerical ability of students with hearing loss. While girls and boys did not differ in simple tasks such as counting, boys were found to be better in mathematical operations and overall numerical ability.

Magulod, G. C. (2017) evaluated the acceptability, usefulness and appropriateness of multisensory instructional material package for elementary learners. The study employed design and development research method is evaluating the learning materials, the descriptive-comparative method was engaged. Findings exposed that the multisensory instructional materials were acceptable, useful and correct to be utilized in the elementary classroom. Test of difference showed that teacher evaluators perceived higher evaluation on the usefulness of the materials than the student teacher respondents.

Obaid, (2013) investigated the study on effect of using the Multi-Sensory Approach for teaching students with learning disabilities on the sixth grade students' achievement in mathematics at Jordanian public schools. The results of the study point out that there is a significant difference in the post- test between the control and the experimental groups in support of the experimental group. The Multi-Sensory move towards teaching mathematics to sixth graders is evidence for a significant level of mathematical achievement gained.

Jubran, S. (2012). Investigate the effect of using Multi Sensory Approach for teaching English language skills on the tenth grade students' achievement in English at Jordanian public schools. The findings of the study indicated that there were statistically significant differences in the post- test between the control and the experimental groups in favor of the experimental group. The researcher concluded that students were more engaged in learning when they were given a chance to use all their senses and using multi sensory approach is a powerful tool with which students can learn English language with entertainment.

STATEMENT OF THE PROBLEM

The starting step of research process is identifying research problem. Students need to ideas of using methods for meaningful learning to a concrete level of understanding mathematics. The use of mathematics is one method to help student's achievement in their life. Students will be active participants of their own learning and create the formation of ideas. Multisensory Instruction used to teach different modalities at the same time, reaching a larger percentage of students learning. The investigator carries out this study to the positive goals in learning mathematics on the achievement of higher secondary students who use a Multimedia Integrated Multisensory Instruction approach to learning mathematics.

OBJECTIVES OF THE STUDY

- To find out the significant differences in the pre test scores of learning mathematics among higher secondary students for control group with respect to demographic variables.
- To find out the significant differences in the post test scores of learning mathematics among higher secondary students through traditional method for control group with respect to demographic variables.
- To find out the significant differences in the pre scores of learning mathematics among higher secondary students for experimental group with respect to demographic variables.
- To find out the significant differences in the post test scores of learning mathematics among higher secondary students through administration of Multimedia Integrated

Multisensory Instruction for experimental group with respect to demographic variables.

- To find out the significant differences in the post test scores of learning mathematics among higher secondary students between control and experimental group.
- To find whether the package use to enhancing learning mathematics among higher secondary students is effective.

The demographic variables are gender, locality of students, Are you going tuition for Mathematics and Learning through internet.

HYPOTHESES OF THE STUDY

- There may be significant differences in the pre test scores of learning mathematics among higher secondary students for control group with respect to demographic variables.
- There may be significant differences in the post test scores of learning mathematics among higher secondary students through traditional method for control group with respect to demographic variables.
- There may be significant differences in the pre test scores of learning mathematics among higher secondary students for experimental group with respect to demographic variables.
- There may be significant differences in the post test scores of learning mathematics among higher secondary students through administration of Multimedia Integrated Multisensory Instruction for experimental group with respect to demographic variables.
- There may be significant differences in the post test scores of learning mathematics among higher secondary students between control and experimental group.
- The package used to enhancing learning mathematics among higher secondary students may be effective.

The demographic variables are gender, locality of students, Are you going tuition for Mathematics and Learning through internet.

METHODOLOGY OF THE STUDY

The advantage of the investigators adopted the Quasi-Experimental method has gathered information to much a Impact of Multimedia Integrated Multisensory Instruction on Learning Mathematics among Higher Secondary Students. The investigator used a simple random sampling technique for selecting the sample from the population. The sample

consists of 46 higher secondary students studying in schools of Dharmapuri District in Tamil Nadu. The researcher has constructed and standardized the following research tool (mathematics achievement questionnaire) to collect data from the sample. The data was tabulated then the way analyzed statistically using descriptive analysis and differential analysis.

TESTING OF HYPOTHESES

Hypothesis: 1

There may be significant differences in the pre test scores of learning mathematics among higher secondary students for control group with respect to demographic variables.

Significance Difference in the achievement on learning mathematics among higher secondary students with respect to demographic variables in the pre test of control group students

Demographic Variables		N	Mean	Std. Deviation	t value	P value
Gender	Male	14	6.93	1.439	0.267	0.79 (NS)
	Female	9	7.11	1.691		
Locality of Students	Rural	10	6.10	0.994	3.062	0.01 (S)
	Urban	13	7.69	1.494		
Learning through Internet	Yes	11	8.09	1.221	4.549	0.01 (S)
	No	12	6.00	0.953		
Are you going tuition for Mathematics	Yes	12	8.00	1.206	4.650	0.01 (S)
	No	11	5.91	0.944		

NS – Not Significant at 5% level, S – Significant at 5% level

Inference:

From the above table 1, since p values are greater than 0.05, so the null hypothesis accepted at 5% level of significance in the gender. Hence it is concluded that there is no significant difference exists in gender of higher secondary students.

From the above table, since p values are less than 0.05, so the null hypothesis rejected at 5% level of significance in the Locality of Students, learning through Internet and tuition for Mathematics. Hence it is concluded that there is significant difference in Locality of Students, learning through Internet and tuition for Mathematics of higher secondary students.

Hypothesis: 2

There may be significant differences in the post test scores of learning mathematics among higher secondary students through traditional method for control group with respect to demographic variables.

Significance Difference in the achievement on learning mathematics among higher secondary students through traditional method with respect to demographic variables in the post test of control group students

Demographic Variables		N	Mean	Std. Deviation	t value	P value
Gender	Male	14	23.43	1.989	0.643	0.53 (NS)
	Female	9	24.11	2.759		
Locality of Students	Rural	10	22.40	1.578	2.841	0.01 (S)
	Urban	13	24.69	2.287		
Learning through Internet	Yes	11	25.45	1.440	5.281	0.01 (S)
	No	12	22.08	1.621		
Are you going tuition for Mathematics	Yes	12	25.33	1.435	5.427	0.01 (S)
	No	11	21.91	1.578		

NS – Not Significant at 5% level, S – Significant at 5% level

Inference:

From the above table 2, since p values are greater than 0.05, so the null hypothesis accepted at 5% level of significance in the gender. Hence it is concluded that there is no significant difference exists in gender of higher secondary students.

From the above table, since p values are less than 0.05, so the null hypothesis rejected at 5% level of significance in the Locality of Students, learning through Internet and tuition for Mathematics. Hence it is concluded that there is significant difference in Locality of Students, learning through Internet and tuition for Mathematics of higher secondary students.

Hypothesis: 3

There may be significant differences in the pre test scores of learning mathematics among higher secondary students for experimental group with respect to demographic variables.

Significance Difference in the achievement on learning mathematics among higher secondary students with respect to demographic variables in the post test of experimental group students

Demographic Variables		N	Mean	Std. Deviation	t value	P value
Gender	Male	14	6.71	1.383	1.033	0.32 (NS)
	Female	9	7.33	1.414		
Locality of Students	Rural	11	5.91	0.701	5.056	0.01 (S)
	Urban	12	7.92	1.165		
Learning through Internet	Yes	10	8.30	0.675	7.926	0.01 (S)
	No	13	5.92	0.760		
Are you going tuition for Mathematics	Yes	13	7.62	1.325	3.133	0.01 (S)
	No	10	6.10	0.994		

NS – Not Significant at 5% level, S – Significant at 5% level

Inference:

From the above table 1, since p values are greater than 0.05, so the null hypothesis accepted at 5% level of significance in the gender. Hence it is concluded that there is no significant difference exists in gender of higher secondary students.

From the above table, since p values are less than 0.05, so the null hypothesis rejected at 5% level of significance in the Locality of Students, learning through Internet and tuition for Mathematics. Hence it is concluded that there is significant difference in Locality of Students, learning through Internet and tuition for Mathematics of higher secondary students.

Hypothesis: 4

There may be significant differences in the post test scores of learning mathematics among higher secondary students through administration of Multimedia Integrated Multisensory Instruction for experimental group with respect to demographic variables.

Significance Difference in the achievement on learning mathematics among higher secondary students through administration of Multimedia integrated multi-sensory Instruction with respect to demographic variables in the post test of experimental group students

Demographic Variables		N	Mean	Std. Deviation	t value	P value
Gender	Male	14	26.93	1.859	0.209	0.84 (NS)
	Female	9	27.11	2.147		
Locality of Students	Rural	11	25.36	1.027	6.852	0.01 (S)
	Urban	12	28.50	1.168		
Learning through Internet	Yes	10	28.80	1.033	7.063	0.01 (S)
	No	13	25.62	1.121		
Are you going tuition for Mathematics	Yes	13	28.38	1.193	7.232	0.01 (S)
	No	10	25.20	0.919		

NS – Not Significant at 5% level, S – Significant at 5% level

Inference:

From the above table 1, since p values are greater than 0.05, so the null hypothesis accepted at 5% level of significance in the gender. Hence it is concluded that there is no significant difference exists in gender of higher secondary students.

From the above table, since p values are less than 0.05, so the null hypothesis rejected at 5% level of significance in the Locality of Students, learning through Internet and tuition for Mathematics. Hence it is concluded that there is significant difference in Locality of Students, learning through Internet and tuition for Mathematics of higher secondary students.

Hypothesis: 5

There may be significant differences in the post test scores of learning mathematics among higher secondary students between control and experimental group.

Table No: 3

Significance of Difference between control group and experimental group post-test of learning mathematics among higher secondary students

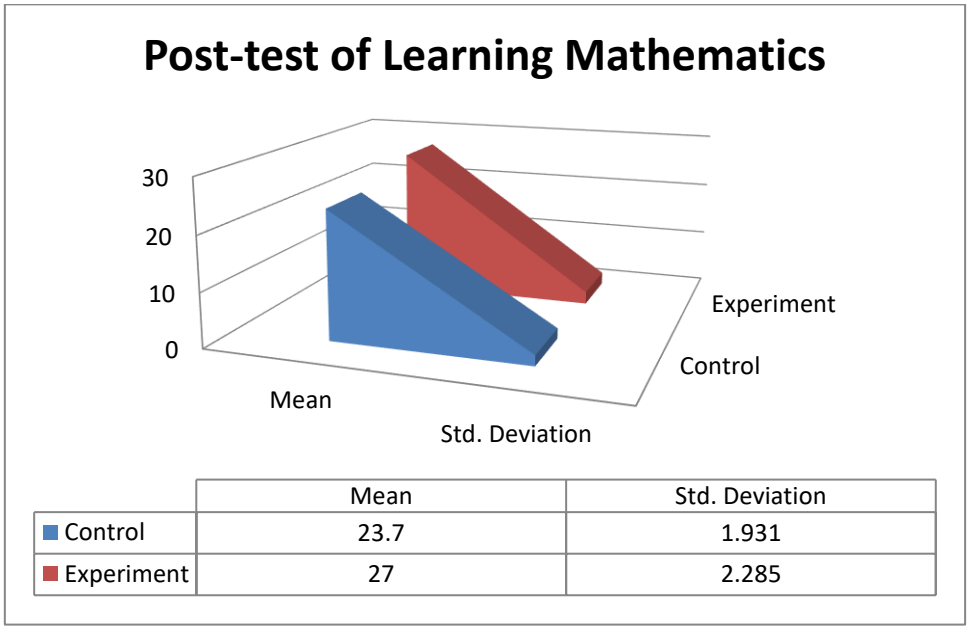
Post Test	N	Mean	Std. Deviation	r value	t value	P value
Control	23	23.70	1.931	0.155	4.935	0.01 (S)
Experiment	23	27.00	2.285			

S – Significant at 5% level

Inference:

From the above table 5, since p values are 0.01 is lesser than the table value at 0.05 so the null hypothesis rejected at 5% level of significance. Hence, there is significant difference in the post test scores of learning mathematics among higher secondary students through administration of Multimedia Integrated Multisensory Instruction between control group and experimental group.

Figure No: 1



RESULTS AND DISCUSSION

The data analysis result reveals that the Multimedia Integrated Multisensory Instruction has significant effect in learning selected mathematical concepts among higher secondary students.

The researcher believe that the difference in the control group pre test mean score of urban students [7.69] have better knowledge than rural students [6.10]. The result showed that the mean score of learning through Internet said yes [8.09] have enhanced learning through Internet than said no [6.00]. The result showed that the mean score of tuition for Mathematics said yes [8.00] have enriched tuition for Mathematics than said no [5.91].

The researcher believe that the difference in the control group post test mean score of urban students [24.69] have better knowledge than rural students [22.40]. The result showed that the mean score of learning through Internet said yes [24.45] have improved learning through Internet than said no [22. 08]. The result showed that the mean score of tuition for Mathematics said yes [25.33] have enriched tuition for Mathematics than said no [21.91].

The researcher believe that the difference in the experimental group pre test mean score of urban students [7.92] have better knowledge than rural students [5.91]. The result showed that the mean score of learning through Internet said yes [8.30] have enriched learning through Internet than said no [5.92]. The result showed that the mean score of tuition for Mathematics said yes [7.62] have enhanced tuition for Mathematics than said no [6.10].

The researcher believe that the difference in the experimental group post test mean score of urban students [28.50] have better knowledge than rural students [25.36]. The result showed that the mean score of learning through Internet said yes [28.80] have enhanced learning through Internet than said no [25.62]. The result showed that the mean score of tuition for Mathematics said yes [28.38] have improved tuition for Mathematics than said no [25.20].

The result showed that the mean and standard Deviation values of Post-test scores in the experimental group 27.00 and 2.285 have improved than control group 23.70 and 1.931 respectively. Hence concluded used a Multimedia Integrated Multisensory Instruction approach to learning mathematics enriched for experimental method among higher secondary students.

CONCLUSION

Effective teaching involves in a student's motivated transmission of information, understanding, creativity and problem solving skills to creating positive classroom environments. This researcher concluded, there is a significant difference in the post test scores of learning mathematics among higher secondary students with a control group and experimental group. This research outcome highlighted, Multimedia Integrated Multisensory Instruction definitely enhanced learning mathematics among higher secondary students for an experimental group its effectiveness on the development of the adolescent students. The

retention of students' involvement in the problem-solving task and multi-media Integrated Multisensory Instruction helps knowledge and motivates interest can be applied to other mathematical materials to improve this technology. Finally, using multisensory teaching can help stimulate students' minds and give them the ability to get better learning mathematics outcomes.

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The Influence of demographic factors in teaching competence among the student-teachers of B.Ed through Cognitive Intervention

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&
Dr K Dhanalakshmi, Professor, Department of Education, Periyar University, Salem-11,

ABSTRACT

Cognitive intervention has been defined as "the procedural facilitators. Cognitive Intervention will be very much useful to student-teachers to develop their skill and pedagogical knowledge. This article mentioning the influence of Demographic variables how influencing the competence of student-teachers. The methodology followed to make student-teachers to practice learning and relearning of materials, utilization of various strategies in order to help students to retain materials read by them and recognizing the ways to incorporate in teaching learning methods.

Method: Experimental intervention used. To analyze the Five point scale questionnaire has used to find the significance in Teaching Competence. The Randomized data collected and statistical interpretation has done

Result: Based on the gender there is no significant mean score difference. The result shown based on the locality of institution significance difference.

Keywords: Cognitive Intervention , Demographic variable, pedagogical knowledge, skill, etc.

Introduction

A competence has best described as ‘a complex combination of knowledge, skills, understanding, values, attitudes and desire which lead to effective, embodied human action in the world in a particular domain’. Competence is therefore distinguished from skill, which is defined as the ability to perform complex acts with ease, precision and adaptability. Important teaching competencies are Communicative competence, Pedogogical competence and Technological competence etc

COGNITIVE INTERVENTION

Cognitive Interventions are the techniques and approaches very useful to the students with learning problems. In this study pre-service teachers are the sample. By using this techniques student-teacher can make the class room in effective manner.

OBJECTIVIES OF THE STUDY

- To validate the module
- To enhance the teaching competence among the student –teachers of B.Ed
- To explore the increase in mean score of teaching competence of student -teachers in demographic variables

Sample

The study was carried out on 160 B.Ed student - teacher in Education colleges of salem and Namakkal District in three streams of colleges like Govt, Govt – Aided, and self – finance.

Methodology

In this study the researcher adopted the experimental method for B.Ed trainees. Module based orientation given about cognitive Intervention to enhance their teaching competence.

Tool for the Study

Teaching competence scale was constructed with 6 dimensions and 44 items. Tool has validated by item analysis. The cronbach alpha value is 0.8.

Statistical Technique used

Statistical techniques serve the fundamental purpose of the description and inferential analysis. The following statistical techniques were used in the study. Such as Mean, Standard Deviation and t – test, f –test, Post- Hoc.

ANALYSIS AND INTERPRETATION

Hypothesis 1

There is significant difference in the pre-test mean scores of teaching competence of student-teachers based on gender. **TABLE 1**

Mean difference of male and female student- teachers in teaching competence in pre-test

Teaching competence	Male (N1=24)		Female (N2=136)		T	P
	M	SD	M	SD		
Professional Competence	17.58	2.34	14.04	3.83	4.38	S
Effective classroom Competence	13.50	2.23	12.45	3.32	1.49	NS
Technological Competence	27.46	3.53	24.74	6.50	2.00	S
Social Competence	16.33	2.90	15.07	4.20	1.41	NS
Pedagogical Competence	11.46	1.50	10.59	2.86	1.45	NS
Communicative Competence	16.58	2.80	15.31	4.37	1.38	NS
Total	102.92	11.93	92.20	23.86	2.15	S

*S- Significant at 0.05 level *NS- Not Significant at 0.05 level

Independent sample t test has conducted to find the difference between mean scores of the male and female student-teachers on teaching competence in total and in dimension in pre-test. The results indicated that the calculated 't' values were lesser than that of the critical table 't' value at 0.05 significance level in dimensions namely Effective classroom Competence, Social Competence, Pedagogical Competence and Communicative Competence. Thus alternative hypothesis was rejected and null hypothesis was accepted with regard to gender.

Hypothesis 2

There is significant difference in the post- test mean scores of teaching competence of student - teachers based on gender. **TABLE 2**

Mean difference of male and female student – teachers in teaching competence in post- test

Teaching competence	**Male (N1=24)**		**Female (N2=136)**		**t**	**P**
	M	**SD**	**M**	**SD**		
Professional Competence	20.72	4.04	19.53	6.86	0.83	NS
Effective classroom Competence	17.76	3.12	16.96	6.05	0.63	NS
Technological Competence	34.62	7.43	33.68	11.93	0.37	NS
Social Competence	21.04	3.54	19.51	7.26	1.00	NS
Pedagogical Competence	14.92	2.85	14.01	5.15	0.83	NS
Communicative Competence	20.18	3.17	19.91	7.36	0.18	NS
Total	129.24	22.74	123.61	43.64	0.62	NS

*NS- Not Significant at 0.05 level

Independent sample t test was conducted to find the difference between mean scores of the male and female student-teachers on teaching competence in total and in dimension in post-test. The results indicated that the calculated 't' values were lesser than that of the critical table 't' value at 0.05 significance level. Thus the alternative hypothesis was rejected and null hypothesis was accepted.

Hypothesis 3

There is significant difference in the pre - tests mean scores of teaching competence of student – teachers based on management and locality of institution.

TABLE .3

Mean difference of student – teachers in teaching competence based on management and locality of institution in pre - test

Teaching competence	Govt. Semi rural (N1=60)		Govt. aided Urban (N2=50)		Self finance Rural (N3=50)		F	p
	M	SD	M	SD	M	SD		
Professional Competence	17.49	2.25	15.51	3.19	10.18	0.94	140.17	S
Effective class room Competence	14.27	2.12	14.18	2.85	9.04	0.88	103.31	S
Technological Competence	28.69	3.53	28.24	5.28	17.80	1.43	139.04	S
Social Competence	17.49	2.59	17.25	3.36	10.60	1.18	121.50	S
Pedagogical Competence	11.88	1.46	12.31	2.63	7.72	0.93	100.81	S
Communicative Competence	17.51	2.45	18.04	3.43	10.54	1.11	141.19	S
Total	107.34	11.98	105.53	17.96	65.88	5.02	173.64	S

*S- Significant at 0.05 level

One way Anova has conducted to find the difference between mean scores of student – teachers with regard to teaching competence in total and its dimensions based on Management and locality of institution in Pre - tests. The results indicated that the calculated F' values were greater than that of the critical table 'p' value at 0.05 significance level. Thus the alternative hypothesis was accepted.

HYPOTHESIS 4

There is significant difference in the post-test mean scores of teaching competence of student-teachers based on management and locality of institution.

TABLE 4

Mean Difference of Student – Teachers in Teaching Competence Based on Management and Locality of Institution in Post- Test

Teaching competence	Govt. Semi rural (N1=60)		Govt. aided Urban (N2=50)		Self finance Rural (N3=50)		F	p
	M	SD	M	SD	M	SD		
Professional Competence	28.49	5.13	21.67	10.03	20.60	10.57	13.33	S
Effective class room Competence	24.59	4.14	19.00	8.80	17.78	8.94	13.13	S
Technological Competence	49.76	7.82	37.80	17.21	35.94	18.20	14.22	S
Social Competence	29.36	4.33	22.00	10.48	21.10	11.04	14.30	S
Pedagogical Competence	20.93	3.60	15.86	7.29	15.16	7.57	13.95	S
Communicative Competence	29.20	4.98	22.63	10.42	21.04	10.73	13.07	S
Total	182.34	28.20	138.96	63.92	131.62	66.77	14.01	S

*S- Significant at 0.05 level

One way Anova has conducted to find the difference between mean scores of student-teachers with regard to teaching competence in total and its dimensions based on Management and locality of institution in Post- tests. The results indicated that the calculated F' value was greater than that of the critical table 'P' value at 0.05 significance level. Thus the alternative hypothesis was accepted. Therefore, Bonferroni post hoc was conducted to find the best predictor of teaching competence of student-teachers.

TABLE 5

Post HOC of Teaching Competence Based on Management and Locality of Institution in Post- Test

Variable	sub category 1	sub category 2	MD	SE	p
Professional Competence	Govt. Semi rural	Govt.aided Urban	6.82	1.67	S
		Self Finance Rural	7.89	1.68	S
	Govt.aided	Self Finance Rural	1.06	1.74	NS
Effective class	Govt.	Govt.aided	5.59	1.42	S

room Competence	Semi rural	Urban			
		Self Finance Rural	6.81	1.43	S
	Govt.aided	Self Finance Rural	1.22	1.48	NS
Technological Competence	Govt. Semi rural	Govt.aided Urban	11.95	2.83	S
		Self Finance Rural	13.82	2.85	S
	Govt.aided	Self Finance Rural	1.86	2.95	NS
Social Competence	Govt. Semi rural	Govt.aided Urban	7.35	1.71	S
		Self Finance Rural	8.25	1.71	S
	Govt.aided	Self Finance Rural	0.90	1.78	NS
Pedagogical Competence	Govt. Semi rural	Govt.aided Urban	5.06	1.20	S
		Self Finance Rural	5.77	1.21	S
	Govt.aided	Self Finance Rural	0.70	1.25	NS
Communicative Competence	Govt. Semi rural	Govt.aided Urban	6.57	1.70	S
		Self Finance Rural	8.16	1.71	S
	Govt.aided	Self Finance Rural	1.58	1.77	NS
Total	Govt. Semi rural	Govt.aided Urban	43.37	10.44	S
		Self Finance Rural	50.71	10.50	S
	Govt.aided	Self Finance Rural	7.34	10.87	NS

*S- Significant at 0.05 level *NS- Not Significant at 0.05 level

From table 6, it has been inferred as student-teachers were studying in Self finance institution were the least predictor of the Teaching competence and student – teachers were studying in Government institution were considered as the best predictor of the Teaching competence in Post- test.

CONCLUSION

From the above findings of this present study indicates there is no significant difference in the score of gender whereas based on the locality govt college is best predictor which is located in semi-rural, then the self- finance college is the least predictor which is located in rural area. This study indicates that demographic variable also influence the teaching competence of student-teachers. The competent teaching leads to goal achievement and effective learning.

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EFFECT OF MULTIMEDIA ON ACHIEVEMENT IN ENHANCING PROBLEM SOLVING ABILITY OF TAMIL GRAMMAR AMONG HIGH SCHOOL STUDENTS

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Abstract

The main objectives of the study is to find out whether the package use to enhancing Problem Solving Ability of Tamil grammar among high school students is effective. The researcher adopted the Quasi-Experiment method has gathered information from effect of multimedia on achievement in Enhancing Problem Solving Ability of Tamil grammar among high school students. The investigator used simple random sampling technique for selecting the sample from the population. The sample consists of 44 high school students studying in Salem District, Tamil Nadu. The researcher has constructed and standardized the following research tool (Achievement in Tamil Grammar questionnaire) to collect data from the sample. The statistical used descriptive analysis, differential analysis. This researcher concluded that of the study there is a significant difference in the retention test scores of Achievement in Enhancing Problem Solving Ability of Tamil Grammar among high school students through administration of multimedia package between control group and experimental group. The research outcomes highlighted Multimedia Package definitely enhanced Problem Solving Ability of Tamil grammar among high school students for experimental group it effectiveness on the development of the Learning Tamil grammar.

Keywords: Multimedia, Problem Solving Ability, Tamil Grammar, High School Students and Achievement

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INTRODUCTION

"Education is the heart of human life," so students aim from walks life for quality education. Once provide to him, or her with the right skills to face any problem of life. Language is one of the significant elements that affect international communication activities. Students utilize different parts of English language skills such as listening, speaking, reading, and writing for their proficiency and communication. Multimedia provides students with opportunities to represent and express their prior knowledge among high school students. Multimedia is explaining the grammar in an easy understanding with the graphical representations that induce the students to learn eagerness on Tamil grammar content. From the definitions, it could be deduced that multimedia involves communication or presentation of information through multiple channels. Some or all of these elements (i.e. sound, animation, text, audio, image, graphic, video, etc.) could be combined and used in Tamil grammar classroom for the teaching process.

STATEMENT OF THE PROBLEM

Multimedia teaching is flexible context can be created not only used in the classroom but also used after anytime and anywhere. Language teaching can also create a peaceful learning environment for motivating and interesting in teaching Tamil grammar. Multimedia teaching focuses on the direction of teachers and it also student centered method used different models at the same time and reaches a large group of students learning. The researchers to investigate the positive gains in their Achievement in Enhancing Problem Solving Ability of high school students who use multimedia to learning Tamil grammar.

REVIEW OF RELATED STUDIES

Revathi Subashini and Singaravelu (2016) study enlightens the impact of Multimedia Package in Learning Pagupada Urruppukal of Tamil Grammar at standard IX. The results show that Multimedia Package is more effective than conventional method. Hence it will be more supportive to enrich grammar in Tamil.

Geetha, and Navaneetha Krishnan (2012). Investigators tried to improve the written ability of the students, particularly the slow learners, who find it difficult when it comes to writing any text. The achievement scores of the post-test was greater than the pre-test scores as well as the post attitude score was also considerably greater than the scores in the pre attitude, confirming the effectiveness of multimedia self-learning package. The gap closure in the achievement was 41.69 percentages and in the attitude was 17.7 percentages, proving that the teaching via multimedia self-learning package was more effective in developing written English.

Cheng, Y. H., Cheng, J. T., & Chen, D. J. (2012) investigate the effect of multimedia computer assisted instruction on student learning achievement using the high school curriculum entitled "molecules that dominate secret of life" from high school biology. The results show that when compared to traditional models of instruction, students using the multimedia computer assisted instruction model scored significantly better in learning achievement assessments. Secondly, the study also discussed the combined effect of instruction model and learning style on student learning achievement. The results show that students exposed to a converging learning style with traditional instruction perform significantly better than those exposed to three other learning styles. Nonetheless, students exposed to these same three other learning styles performed better when exposed to the multimedia computer assisted instruction model. As a result, under the influence of multimedia instruction, students exposed to the four learning styles (Diverger, Assimilator, Converger, and Accommodator) do not shown any significant difference.

Liu, Q. X., & Shi, J. F. (2007). Examined Language teaching approaches and methods have cast light on the language teaching theory and practice. There are still many controversies about their usefulness and appropriateness. This paper tries to analyze their effectiveness and weakness of several most influential teaching approaches and methods: Grammar-translation Method, Direct Method, Audio-lingual Method, Communicative Teaching Method, in order to have a better understanding and application in the future teaching practice.

OBJECTIVES OF THE STUDY

- To find out the significant differences between the pre and post test scores of Achievement in Enhancing Problem Solving Ability of Tamil Grammar among high school students through Traditional method for control group.

- To find out the significant differences between the pre and post test scores of Achievement in Enhancing Problem Solving Ability of Tamil Grammar among high school students through administration of multimedia package for experimental group.
- To find out the significant differences in the post test scores of Achievement in Enhancing Problem Solving Ability of Tamil Grammar among high school students through Traditional method and multimedia package between control and experimental group.
- To find out the significant differences between the retention and post test scores of Achievement in Enhancing Problem Solving Ability of Tamil Grammar among high school students through Traditional method for control group.
- To find out the significant differences between the retention and post test scores of Achievement in Enhancing Problem Solving Ability of Tamil Grammar among high school students through administration of multimedia package for experimental group.
- To find out the significant differences in the retention test scores of Achievement in Enhancing Problem Solving Ability of Tamil Grammar among high school students through Traditional method and multimedia package between control and experimental group.
- To find whether the package use to enhancing Problem Solving Ability of Tamil grammar among high school students is effective.

Hypotheses of the study

- There may be significant differences between the pre and post test scores of Achievement in Enhancing Problem Solving Ability of Tamil Grammar among high school students through Traditional method for control group.
- There may be significant differences between the pre and post test scores of Achievement in Enhancing Problem Solving Ability of Tamil Grammar among high school students through administration of multimedia package for experimental group.
- There may be significant differences in the post test scores of Achievement in Enhancing Problem Solving Ability of Tamil Grammar among high school students through Traditional method and multimedia package between control and experimental group.

- There may be significant differences between the retention and post test scores of Achievement in Enhancing Problem Solving Ability of Tamil Grammar among high school students through Traditional method for control group.
- There may be significant differences between the retention and post test scores of Achievement in Enhancing Problem Solving Ability of Tamil Grammar among high school students through administration of multimedia package for experimental group.
- There may be significant differences in the retention test scores of Achievement in Enhancing Problem Solving Ability of Tamil Grammar among high school students through Traditional method and multimedia package between control and experimental group.
- The package use to enhancing Problem Solving Ability of Tamil grammar among high school students is effective.

METHODOLOGY OF THE STUDY

The advantage of Quasi-Experiment method is that it becomes possible to study on the problem thoroughly and deeply in all aspects. Therefore the investigator adopted the Quasi-Experiment method has gathered information from effect of multimedia on achievement in Enhancing Problem Solving Ability of Tamil grammar among high school students. The investigator used simple random sampling technique for selecting the sample from the population. The sample consists of 44 high school students studying in secondary level in Salem District, Tamil Nadu. The researcher has constructed and standardized the following research tool to collect data from the sample. The data was tabulated then the way analyzed statistically using descriptive analysis, differential analysis.

TESTING OF HYPOTHESES

Hypothesis: 1

There may be significant differences between in the pre and post test scores of Achievement in Enhancing Problem Solving Ability of Tamil Grammar among high school students through Traditional method for control groups.

Table No: 1

Significance of Difference between in the pre and post-test of Achievement in Enhancing Problem Solving Ability of Tamil Grammar among high school students through Traditional method for control groups

Control Group	N	Mean	Std. Deviation	r value	t value	P value
Pre test	22	7.14	1.81	0.84	37.51	0.01 (S)
Post test	22	21.82	3.08			

S – Significant at 5% level

Inference:

From the above table 5, since p values are 0.01 is lesser than the table value at 0.05 so the null hypothesis rejected at 5% level of significance. Hence, there is significant difference between in the pre and post test scores of Achievement in Enhancing Problem Solving Ability of Tamil Grammar among high school students through Traditional method for control groups.

Hypothesis: 2

There may be significant differences between in the pre and post test scores of Achievement in Enhancing Problem Solving Ability of Tamil Grammar among high school students through administration of multimedia package for experimental groups.

Table No: 2

Significance of Difference between in the pre and post-test of Achievement in Enhancing Problem Solving Ability of Tamil Grammar among high school students through administration of multimedia package for experimental group

Experimental Group	N	Mean	Std. Deviation	r value	t value	P value
Pre test	22	7.82	1.65	0.76	79.01	0.01 (S)
Post test	22	26.36	1.50			

S – Significant at 5% level

Inference:

From the above table 5, since p values are 0.01 is lesser than the table value at 0.05 so the null hypothesis rejected at 5% level of significance. Hence, there is significant difference between in the pre and post test scores of Achievement in Enhancing Problem Solving Ability of

Tamil Grammar among high school students through administration of multimedia package for experimental group.

Hypothesis: 3

There may be significant differences in the post test scores of Achievement in Enhancing Problem Solving Ability of Tamil Grammar among high school students through Traditional method and multimedia package between control group and experimental group.

Table: 3

Significance of Difference in the post-test of Achievement in Enhancing Problem Solving Ability of Tamil Grammar among high school students through Traditional method and multimedia package between control group and experimental group

Post Test	N	Mean	Std. Deviation	r value	t value	P value
Control	22	21.82	3.08	0.31	7.17	0.01 (S)
Experiment	22	26.36	1.50			

S – Significant at 5% level

Inference:

From the above table 5, since p values are 0.01 is lesser than the table value at 0.05 so the null hypothesis rejected at 5% level of significance. Hence, there is significant difference in the post test scores of Achievement in Enhancing Problem Solving Ability of Tamil Grammar among high school students through Traditional method and multimedia package between control group and experimental group.

Hypothesis: 4

There may be significant differences between in the post and retention test scores of Achievement in Enhancing Problem Solving Ability of Tamil Grammar among high school students through Traditional method for control group.

Table No: 4

Significance of Difference between in the post and retention test scores of Achievement in Enhancing Problem Solving Ability of Tamil Grammar among high school students through Traditional method for control group

Control group	N	Mean	Std. Deviation	r value	t value	P value

Retention test	22	13.50	5.22	0.89	13.76	0.01 (S)
Post test	22	21.82	3.08			

S – Significant at 5% level

Inference:

From the above table 5, since p values are 0.01 is lesser than the table value at 0.05 so the null hypothesis rejected at 5% level of significance. Hence, there is significant difference between in the post and retention test scores of Achievement in Enhancing Problem Solving Ability of Tamil Grammar among high school students through administration Traditional method for control group.

Hypothesis: 5

There may be significant differences between in the post and retention test scores of Achievement in Enhancing Problem Solving Ability of Tamil Grammar among high school students through administration of multimedia package for experimental group.

Table No: 5

Significance of Difference between in the post and retention test scores of Achievement in Enhancing Problem Solving Ability of Tamil Grammar among high school students through administration of multimedia package for experimental group

Experimental Group	N	Mean	Std. Deviation	r value	t value	P value
Retention test	22	25.05	1.76	0.95	10.89	0.01 (S)
Post test	22	26.36	1.50			

S – Significant at 5% level

Inference:

From the above table 5, since p values are 0.01 is lesser than the table value at 0.05 so the null hypothesis rejected at 5% level of significance. Hence, there is significant difference between in the post and retention test scores of Achievement in Enhancing Problem Solving Ability of Tamil Grammar among high school students through administration of multimedia package for experimental group.

Hypothesis: 6

There may be significant differences in the retention test scores of Achievement in Enhancing Problem Solving Ability of Tamil Grammar among high school students through Traditional method and multimedia package between control group and experimental group.

Table: 6
Significance of Difference in the retention test scores of Achievement in Enhancing Problem Solving Ability of Tamil Grammar among high school students through Traditional method and multimedia package between control group and experimental group.

Retention Test	N	Mean	Std. Deviation	r value	t value	P value
Control	22	13.50	5.22	0.21	10.51	0.01 (S)
Experiment	22	25.05	1.76			

S – Significant at 5% level

Inference:

From the above table 5, since p values are 0.01 is lesser than the table value at 0.05 so the null hypothesis rejected at 5% level of significance. Hence, there is significant difference in the retention test scores of Achievement in Enhancing Problem Solving Ability of Tamil Grammar among high school students through Traditional method and multimedia package between control group and experimental group.

RESULTS AND DISCUSSION

The data analysis result reveals that the Multimedia on Achievement in Enhancing Problem Solving Ability has significant effect in learning selected Tamil Grammar concepts among High School Students.

The researcher believe that the mean and standard Deviation values of pre test scores in the control group 25.05 and 1.76 have better than post test scores in the control group 13.50 and 5.22 respectively.

The researcher believe that the mean and standard Deviation values of pre test scores in the experimental group 25.05 and 1.76 have improved than post test scores in the experimental group 13.50 and 5.22 respectively.

The researcher believe that the mean and standard Deviation values of post test scores in the experimental group 25.05 and 1.76 have enriched than post test scores in the control group 13.50 and 5.22 respectively.

The researcher believe that the mean and standard Deviation values of post test scores in the control group 25.05 and 1.76 have enhanced than retention test scores in the control group 13.50 and 5.22 respectively.

The researcher believe that the mean and standard Deviation values of post test scores in the experimental group 25.05 and 1.76 have improved than retention test scores in the experimental group 13.50 and 5.22 respectively.

The researcher believe that the mean and standard Deviation values of retention test scores in the experimental group 25.05 and 1.76 have enriched than control group 13.50 and 5.22 respectively. Hence concluded used a Multimedia on Achievement in Enhanced Problem Solving Ability of Tamil Grammar for experimental method among High School Students.

CONCLUSION

This researcher concluded that of the study there is a significant difference in the retention test scores of Achievement in Enhancing Problem Solving Ability of Tamil Grammar among high school students through administration of multimedia package between control group and experimental group. The research outcomes highlighted Multimedia Package definitely enhanced Problem Solving Ability of Tamil grammar among high school students for experimental group it effectiveness on the development of the Learning Tamil grammar. The teacher can also create shared experiences for the entire class through other cooperative activities through a digital learning multimedia. Teacher show this respect, students are more likely to have positive attitude towards their language creating a supportive environment that can benefit to the learning of all students.

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IMPROVING PROBLEM SOLVING ABILITY IN MATHEMATICS OF HIGHER SECONDARY SCHOOL STUDENTS

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Abstract

The main objective of the study is to find out the level of Improving Problem Solving Ability in Mathematics of Higher Secondary School Students. The researcher adopted the normative survey method has gathered information to measure a Improving Problem Solving Ability in Mathematics of Higher Secondary School Students. The investigator used simple random sampling technique for selecting the sample from the population. The sample consists of 519 higher secondary students studying in secondary level in Dharmapuri District, Tamil Nadu. The researcher has constructed and standardized the following research tool (Problem Solving Ability questionnaire) to collect data from the sample. The data was tabulated then the way analyzed statistically using descriptive analysis and differential analysis. The findings of the present study give valuable contribution learners, teachers, school administrators and educational planners on student's Improving Problem Solving Ability in Mathematics. The study focuses on the behavior aspects of each and every student's who are in the adolescence stage.

***Keywords**: Problem Solving Ability, Mathematics, Higher Secondary Students*

INTRODUCTION

Life is nothing but a series of problems. Experience in dealing with problems will help the individual in cultivating strategies, which may prove to be of great value at crucial moments of life. A major objective of instruction, especially in mathematics and science, is to strengthen students' skills in solving problems.

Teaching mathematics and learning mathematics to develop the abilities to solve a problem in mathematics and to find the solution to problems in daily life. What person does not face a number of problems each day? To understand how people solve problems is, to a large degree, to understand basic human behaviour, the goal of every psychologist. The importance of problem solving strategies and obstacles lie at the foundation of understanding humankind (Magill 1996).

Man faces many problems in course of living. He needs to have some willed to live, desires to possess some, to achieve some, and to continue to do certain things up to his satisfaction. But all his attempts may not be successful due to obstacles and interferences. These need a serious attention to overcome them. He may have to think and reason to proceed systematically.

REVIEW OF RELATED STUDIES

Rattanatumma Tawachai and Puncreobutr Vichian (2016) studied assessing the effectiveness of STAD model and problem based learning in mathematics learning achievement and problem solving ability. The objective of this study was to compare the effectiveness of teaching methods in improving Mathematics Learning Achievement and Problem solving ability of students at an international college. The study results revealed that, among the 2 teaching methods, the students groups taught through STAD model of cooperative learning have secured high scores in the post-test conducted to measure mathematics learning achievement and problem solving ability. Hence there is a significant difference between the teaching methods, mathematical learning achievement and problem solving ability. However, both the methods have improvement in post-test, further it is evidenced that STAD model of cooperative learning is effective compared to problem based learning for improving students in mathematics.

Hemalatha Kalaimathi (2015) examined that this study is an attempt to find out the relationship between problem solving ability and working memory of secondary school students. Hence this study is concerned with ninety secondary School students, were selected as sample and data were collected by the tools of working memory- sentence span, Real Life Problems A to Z with Academic performance scores were collected from their class teachers. Results showed significantly positive relationships exist between Problem solving ability and Working Memory of Secondary School students.

Parkash Chandra Jena (2014) investigates the cognitive styles and problem solving ability of under graduate students. The purpose of the study is to find out the difference in cognitive styles undergraduate students in relation to their problem solving ability. The Cognitive style inventory (CSI) and Problem solving ability test tools are to be used this study. The finding of the study revealed that there exists a significance difference and positive relationship between cognitive styles and problem solving abilities.

Senduran Fatih and Amman Tayfun (2014) examined problem solving approaches of high school students exercising regularly in sports teams. The aim of the study is effect of regular sports activities on the solution approaches performed for solving the problem by high school students when they encountered the said problem, was analyzed. Findings which were obtained, a significant difference was found among self-confident approach values of athlete and non-athlete students. A significant difference was observed among assessor approach values of athlete and non-athlete students. The students who did sport regularly were more self confident than those who did not do sport regularly and of the same age when they encountered a problem and they evaluated phase of solving problem and results that they obtained more carefully than the students who did not do sport regularly and of the same age.

Nirupama Pathak (2013) reviewed that **t**he present investigation focuses on the study of problem solving ability among the undergraduate mathematical gifted students of Jabalpur, Madhya Pradesh. Normative survey method used to collect data. By using random sampling technique, 40 mathematical gifted students, studying in Government and Private Colleges were selected. The collected data has been studied and subjected to statistical analysis. The results revealed that (i) the problem solving ability of mathematical gifted students are high in colleges at Jabalpur and in respect of fathers" education there is no significant difference on their problem solving ability.

STATEMENT OF THE PROBLEM

Students are frequently troubled with their problems because they do not have the capacity and training to solve problems. Citizens of tomorrow must be effectively altered to control emotions and ways of adjusting to situations in the society. As a consequence of this, they may aware of anxious conditions and becomes emotionally balanced and problem solving in their behavior favoring good fame for them in the society. Hence the researcher studied this study. The present study is entitled as Improving Problem Solving Ability in Mathematics of Higher Secondary School Students.

OBJECTIVES OF THE STUDY

- To find out the level of Improving Problem Solving Ability in Mathematics of Higher Secondary School Students.
- To find out if any significant differences in Improving Problem Solving Ability in Mathematics of Higher Secondary School Students with respect to their selected background variables.

The selected background variables are QR Code, Mathematics related Competition, Parental Qualification, and Parental Occupation.

HYPOTHESES OF THE STUDY

- The level of Improving Problem Solving Ability in Mathematics of Higher Secondary School Students is low.
- There is no significant difference in Improving Problem Solving Ability in Mathematics of Higher Secondary School Students with respect to their selected background variables.

The selected background variables are QR Code, Mathematics related Competition, Parental Qualification, and Parental Occupation.

METHOD USED FOR THE STUDY

The normative survey research is a method for collecting data obtained from a large number of respondents, representing a specific population. The advantage of normative survey method is that it becomes possible to study on the problem thoroughly and deeply in all aspects. Therefore the investigator adopted the survey method has gathered information to

measure the Problem Solving Ability in Mathematics of Higher Secondary School Students. The investigator used a simple random sampling technique for selecting the sample from the population. The sample consists of 519 higher secondary students studying in secondary level in Dharmapuri District, Tamil Nadu. The researcher has constructed and standardized the following research tool (Problem Solving Ability questionnaire) to collect data from the sample. The data was tabulated then the way analyzed statistically using descriptive analysis and differential analysis.

TESTING OF HYPOTHESES

Hypothesis: 1

Level of Improving Problem Solving Ability in Mathematics of Higher Secondary School Students is low.

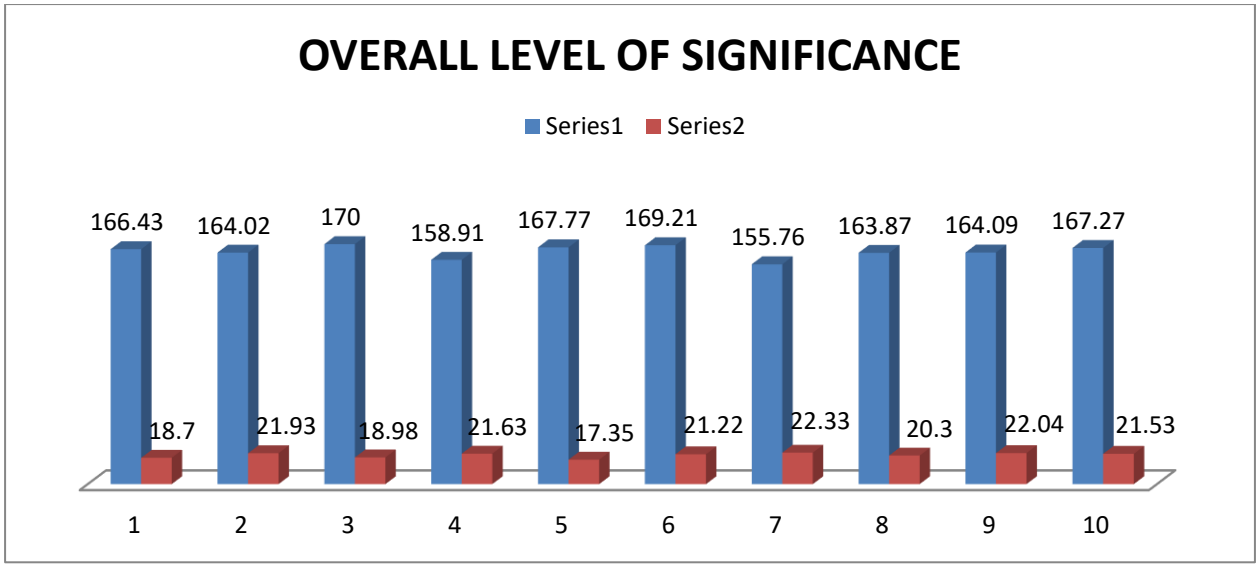
Table 5.1

Level of Improving Problem Solving Ability in Mathematics of Higher Secondary School Students based on Background variables

Maximum Score-200

Background Variables		N	Mean	SD
QR Code	Yes	160	166.43	18.70
	No	359	164.02	21.93
Mathematics related Competition	Yes	274	170.00	18.98
	No	245	158.91	21.63
Parental Qualification	Un educated	193	167.77	17.35
	School education	175	169.21	21.22
	College education	151	155.76	22.33
Parental Occupation	Private	279	163.87	20.30
	Government	111	164.09	22.04
	Others	129	167.27	21.53
Average			164.73	20.61

The above table show that represented that mean values of Problem Solving Ability on studying mathematics students are greater than the mid score value is 100. It is concluded that the higher secondary students having a high level Problem Solving Ability on studying mathematics. Hence, the hypothesis is rejected. The graphical representation of this hypothesis is given below,



Hypothesis: 2

There is no significant difference in Improving Problem Solving Ability in Mathematics of Higher Secondary School Students with respect to QR Code and Mathematics related Competition.

Significant difference in Improving Problem Solving Ability in Mathematics of Higher Secondary School Students with respect to QR Code and Mathematics related Competition

Problem Solving Ability	Variables	N	Mean	SD	t- value
QR Code	Yes	160	166.43	18.70	1.279 (NS)
	No	359	164.02	21.93	
Mathematics related Competition	Yes	274	170.00	18.98	6.174 (S)
	No	245	158.91	21.63	

NS – Not Significant at 5% level, S – Significant at 5% level

Inference:

From the above table show that t values are less than at level 0.05, so the null hypothesis accepted at 5% level of significance in the QR Code. Hence it is concluded that there is no significant difference exists in QR Code of higher secondary students.

From the above table, since t values are greater than at level 0.05, so the null hypothesis rejected at 5% level of significance in the Mathematics related Competition. Hence it is concluded that there is significant difference in Mathematics related Competition for Problem Solving Ability in Mathematics of higher secondary students.

Hypothesis: 3

There is no significant difference in Improving Problem Solving Ability in Mathematics of Higher Secondary School Students with respect to Parental Qualification and Parental Occupation.

Significant difference in Improving Problem Solving Ability in Mathematics of Higher Secondary School Students with respect to Parental Qualification and Parental Occupation

Problem Solving Ability	Variables	N	Mean	SD	F Value
Parental Qualification	School education	193	167.77	17.35	21.321 (S)
	College education	175	169.21	21.22	
	Un educated	151	155.76	22.33	
Parental Occupation	Private	279	163.87	20.30	1.231 (NS)
	Government	111	164.09	22.04	
	Others	129	167.27	21.53	

NS – Not Significant at 5% level, S – Significant at 5% level

Inference:

From the above table show that F values are less than at level 0.05, so the null hypothesis accepted at 5% level of significance in the Parental Occupation. Hence it is concluded that there is no significant difference exists in Parental Occupation of higher secondary students.

From the above table, since F values are greater than at level 0.05, so the null hypothesis rejected at 5% level of significance in the Parental Qualification. Hence it is concluded that there is significant difference in Parental Qualification for Problem Solving Ability in Mathematics of higher secondary students.

RESULTS AND DISCUSSION

Level of Improving Problem Solving Ability in Mathematics of Higher Secondary School Students based on Background variables

The researcher believes that the difference in the mean and standard deviation of demographic variable is 164.73 and 20.60 respectively. The mid score is 100. So, it can be concluded that undergraduate students have high level in problem solving Ability in Mathematics.

The researcher believe that the difference in the control group pre-test mean score of Mathematics related Competition participation students [170.00] have better knowledge than Mathematics related Competition not participation students [158.91].

The researcher believe that the difference in the control group pre-test mean score of Mathematics related Students Parent completed college education [169.21] have better knowledge than Students Parent completed school education and Un educated [167.77] and [155.76] .

DELIMITATIONS OF THE STUDY

It is expected from the investigator to study all the aspects relevant to survey research undertaken. It is not impossible but beyond capacity of any researcher to cover all the aspects. Thus, it is in the interest of any researcher to delimit the problem. For the present research,

1. The study was restricted to Dharmapuri district only.

2. The sampled students of higher secondary were randomly selected from the colleges from different areas of the Dharmapuri district.

CONCLUSION

The findings of the present study give valuable contribution to learners, teachers, school administrators and educational planners on student's Improving Problem Solving Ability in Mathematics. The study focuses on the behavior aspects of each and every student's who are in the adolescence stage. The study focuses on the highest form of learning problem solving. Any form of instruction and any form of the instructional system has the goal of manifesting problem solving behaviour in the pupil. As a method of teaching, it enjoys the highest prestige when compared to other methods of teaching. Positive peer relationship promotes peer group motivation: create the qualities' like helping, socialization etc., within them.

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EFFECT OF MULTIMEDIA PACKAGE IN LEARNING TAMIL AMONG HIGH SCHOOL STUDENTS

***Mrs.D.JAYASREE** ****Dr.K.NACHIMUTHU**

Abstract

'Education is the heart of human life', therefore students aim from walks life for quality education. Once provide to him or her with the right skills to face any problem of life. Language is one of the significant elements that affect international communication activities. In this study, the sample was selected as simple random sampling and Quasi-experimental research was adopted. In this study used Pre-test and post-test was followed non-equivalent group design. The sample consists of 40 students studying in government high school in Salem district, Tamil Nadu. Both groups; the experimental group as well the control group, were taught by the investigator. The researcher has constructed and standardized the following research tool (Tamil achievement questionnaire) to collect data from the sample. The data was tabulated then the way analyzed statistically using descriptive analysis and differential analysis. Based on the results and findings of the present study, it is concluded that the developed Multimedia package for learning Tamil for a high level of students is a highly effective tool for learning Tamil. The multimedia method proved to be better than the traditional method in the teaching of Tamil. Hence the researcher strongly concluded the students showed effective learning outcome in Tamil through experimental method only because of the Multimedia Package developed for learning Tamil.

Keywords: *Multimedia, Tamil, High School, Education, Achievement and Effective*

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INTRODUCTION

'Education is the heart of human life', therefore students aim from walks life for quality education. Once provide to him or her with the right skills to face any problem of life. Language is one of the significant elements that affect international communication activities. Students utilize different parts of language skills such as listening, speaking, reading, and writing for their proficiency and communication. Malik & Agarwal (2012) refers to multimedia as the exciting combination of computer hardware and software that allows integration of text resources, audio, animation, graphics, video to develop an effective presentation on an affordable desktop computer. Multimedia is characterized by the presence of text, pictures, sound, animation, and video; some or all of which are organized into a coherent program (Phillips, 1997). Multimedia is a term frequently heard and discussed among educational technologist today. Unless clearly defined, the term can alternately mean a provident mix of various mass media such as text, audio and video or it may mean the development of computer-based hardware and software packages produced on a mass scale and yet individualize use and learning (Almara'beh, H., Amer, E. F., & Sulieman, A. 2015).

REVIEW OF RELATED STUDIES

Khiyabani, H., Ghonsooly, B., & Ghabanchi, Z. (2014). The present study tried to observe the impact of using multimedia on teaching vocabulary to see if it could improve learning vocabulary in high school classes. The findings suggested that using multimedia was more effective in the acquisition and learning unknown vocabulary than traditional methods. It had a positive effect on retention of vocabulary knowledge. Therefore, the use of multimedia provided the bridge to a deeper understanding. Li, J., & Kang, M. (2014, May). With the rapid development of informationtechnology and the urgent need for modernization of pedagogy, multimedia-centred teaching techniques have come into usefor classroom instruction. The application of multimedia devices to classroom teaching helps enlarge the amount of classroom information, enrich teaching content, enhance interactivity between teacher and student, increase teachers' personal competence and capacity for information, and as a result helps teachers achieve the goal of remarkably promoting teaching effectiveness in the classroom. Prauzner, T. (2010). The development of computer technology is reflected, among others, in the development of modern didactics. Current pedagogy and media education, as a fast developing discipline of general pedagogy, is a topic of a number of studies. Applying the modern multimedia aids at various stages and in various types of education is considered as an indispensable element of modern didactics, due to new opportunities the modern media offer. An interactive white board is an example of such a

modern teaching aid applied at present in education. Liu, Q. X., & Shi, J. F. (2007). Language teaching approaches and methods have cast light on the language teaching theory and practice. There are still many controversies about their usefulness and appropriateness. This research tries to analyze their effectiveness and weakness of several most influential teaching approaches and methods: Grammar-translation Method, Direct Method, Audio-lingual Method, Communicative Teaching Method, in order to have a better understanding and application in the future teaching practice.

STATEMENT OF THE PROBLEM

At present, day by day classroom is becoming worse due to the teacher's difficult to give proper attention to the students. This classroom can be dealing with the help of the Multimedia package. A multimedia package can be more advantageous to both students and teachers. It allows the teacher to give attention to individual students. Inventions like the radio, tape recorder, video cassette recorder, Television, Computer, Video conference, e-learning, e-content and multimedia are useful for teaching learning process and to develop techno-pedagogical principles of instruction. Today teachers will need to prepare tomorrow's classrooms. Multimedia Package can provide more drilling practice with a different situation. A multimedia approach to education is an audio visual education with planning and preparation of electronic instructional material and use of devices and materials that involve sight, sound or both for educational purposes. Language is the important role of the society so the researcher choosing the present study entitled as 'Effect of Multimedia package in Learning Tamil Grammar among High School Students'

OBJECTIVES OF THE STUDY

- To find out the significant differences in the pre-test scores of learning Tamil among high school students for control group with respect to selected demographic variables.
- To find out the significant differences in the pre-test scores of learning Tamil among high school students for experimental group with respect to selected demographic variables.
- To find out the significant differences in the post-test scores of learning Tamil among high school students through traditional method for control group with respect to selected demographic variables.
- To find out the significant differences in the post-test scores of learning Tamil among high school students through multimedia package for experimental group with respect to selected demographic variables.

- To find out the significant differences in the post-test scores of learning Tamil among high school students through traditional method and multimedia package between control and experimental group.

The selected demographic variables are gender, Basic Computer knowledge, Computer Availability and QR Code.

Hypotheses of the study

- There may be significant differences in the pre-test scores of learning Tamil among high school students for control group with respect to selected demographic variables
- There may be significant differences in the pre-test scores of learning Tamil among high school students for experimental group with respect to selected demographic variables.
- There may be significant differences in the post-test scores of learning Tamil among high school students through traditional method for control group with respect to selected demographic variables.
- There may be significant differences in the post-test scores of learning Tamil among high school students through multimedia package for experimental group with respect to selected demographic variables.
- There may be significant differences in the post-test scores of learning Tamil among high school students through traditional method and multimedia package between control and experimental group

The selected demographic variables are gender, Basic Computer knowledge, Computer Availability and QR Code.

METHODOLOGY

In this study, the sample was selected as simple random sampling and Quasi-experimental research was adopted. In this study used Pre-test and post-test was followed non-equivalent group design. For the purpose of effect of Multimedia package in Learning Tamil by the High School level adopted the following procedures to select High School students. A population is defined for the intended research was conducted on high school students under in the Salem district. The sample consists of 40 students studying in government high school in Salem district, Tamil Nadu.Both groups; the experimental group as well the control group, were taught by the investigator.The researcher has constructed and standardized the following research tool (Tamil achievement questionnaire) to collect data from the sample. The data was tabulated then the way analyzed statistically using descriptive analysis and differential analysis.

TESTING OF HYPOTHESES

Hypothesis: 1

There may be significant differences in the pre test scores of learning Tamil among high school students for control group with respect to demographic variables.

Significance Difference in the achievement on learning Tamil among high school studentswith respect to demographic variables in the Pre-test of control group students

Table No: 1

Demographic Variables		N	Mean	Std. Deviation	t value	P value
Gender	Male	12	6.58	1.165	0.474	0.64 (NS)
	Female	08	6.88	1.458		
Basic Computer knowledge	Yes	11	7.36	1.206	0.223	0.83 (NS)
	No	09	7.22	1.563		
Availability of Computer	Yes	11	6.73	1.104	0.101	0.92 (NS)
	No	09	6.67	1.500		
QR Code	Yes	13	7.46	1.450	0.778	0.45 (NS)
	No	07	7.00	1.155		

NS – Not Significant at 5% level

Inference:

From the above table 1, since p values are greater than 0.05, so the null hypothesis accepted at 5% level of significance in the gender, Basic Computer knowledge, Availability of Computer and QR Code. Hence it is concluded that there is no significant difference exists in gender, Basic Computer knowledge, Availability of Computer and QR Code of high school students.

Hypothesis: 2

There may be significant differences in the post test scores of learning Tamil among high school students through traditional method for control group with respect to demographic variables.

Significance Difference in the achievement on learning Tamil among high school studentsthrough traditional method with respect to demographic variables in the Post-test of control group students

Table No: 2

Demographic Variables		N	Mean	Std. Deviation	t value	P value
Gender	Male	12	17.92	2.109	0.290	0.78 (NS)
	Female	08	17.63	2.264		
Basic Computer knowledge	Yes	11	26.82	1.888	2.075	0.06 (NS)
	No	09	25.44	1.014		
Availability of Computer	Yes	11	19.09	1.578	4.065	0.01 (S)
	No	09	16.22	1.563		
QR Code	Yes	13	26.46	1.391	0.834	0.43 (NS)
	No	07	25.71	2.138		

NS – Not Significant at 5% level, S – Significant at 5% level

Inference:

From the above table 2, since p values are greater than 0.05, so the null hypothesis accepted at 5% level of significance in the gender, Basic Computer knowledge and QR Code. Hence it is concluded that there is no significant difference exists in gender, Basic Computer knowledgeand QR Code of high school students.

From the above table, since p values are less than 0.05, so the null hypothesis rejected at 5% level of significance in the Availability of Computer. Hence it is concluded that there is significant difference in Availability of Computer for learning Tamil among high school students.

Hypothesis: 3

There may be significant differences in the pre-test scores of learning Tamil among high school students for experimental group with respect to demographic variables.

Significance Difference in the achievement on learning Tamil among high school studentswith respect to demographic variables in the pre-test of experimental group students

Table No: 3

Demographic Variables		N	Mean	Std. Deviation	t value	P value
Gender	Male	12	7.17	1.403	0.542	0.60 (NS)
	Female	08	7.50	1.309		
Basic Computer knowledge	Yes	07	7.14	1.069	1.245	0.23 (NS)
	No	13	6.46	1.330		
Availability of Computer	Yes	14	7.50	1.286	0.963	0.36 (NS)
	No	06	6.83	1.472		

QR Code	Yes	09	6.78	1.202	0.247	0.81 (NS)
	No	11	6.64	1.362		

NS – Not Significant at 5% level

Inference:

From the above table 1, since p values are greater than 0.05, so the null hypothesis accepted at 5% level of significance in the gender, Basic Computer knowledge, Availability of Computer and QR Code. Hence it is concluded that there is no significant difference exists in gender,Basic Computer knowledge, Availability of Computer and QR Code of high school students.

Hypothesis: 4

There may be significant differences in the post-test scores of learning Tamil among high school students through administration of Multimedia Package for experimental group with respect to demographic variables.

Significance Difference in the achievement on learning Tamil among high school studentsthrough administration of Multimedia Package with respect to demographic variables in the post-test of experimental group students

Table No: 4

Demographic Variables		N	Mean	Std. Deviation	t value	P value
Gender	Male	12	26.08	1.881	0.396	0.70 (NS)
	Female	08	26.38	1.408		
Basic Computer knowledge	Yes	07	20.00	1.155	5.711	0.01 (S)
	No	13	16.62	1.446		
Availability of Computer	Yes	14	26.79	1.626	3.669	0.02 (S)
	No	06	24.83	0.753		
QR Code	Yes	09	19.67	1.225	6.059	0.01 (S)
	No	11	16.27	1.272		

NS – Not Significant at 5% level, S – Significant at 5% level

Inference:

From the above table 1, since p values are greater than 0.05, so the null hypothesis accepted at 5% level of significance in the gender. Hence it is concluded that there is no significant difference exists in gender of high school students.

From the above table, since p values are less than 0.05, so the null hypothesis rejected at 5% level of significance in the Basic Computer knowledge, Availability of Computer and QR Code. Hence it is concluded that there is significant difference in Basic Computer

knowledge, Availability of Computer and QR Code for learning Tamil among high school students.

Hypothesis: 5

There may be significant differences in the post-test scores of learning Tamil among high school students between control and experimental group.

Table No: 5

Significance of Difference between control group and experimental group post-test of learning Tamil among high school students

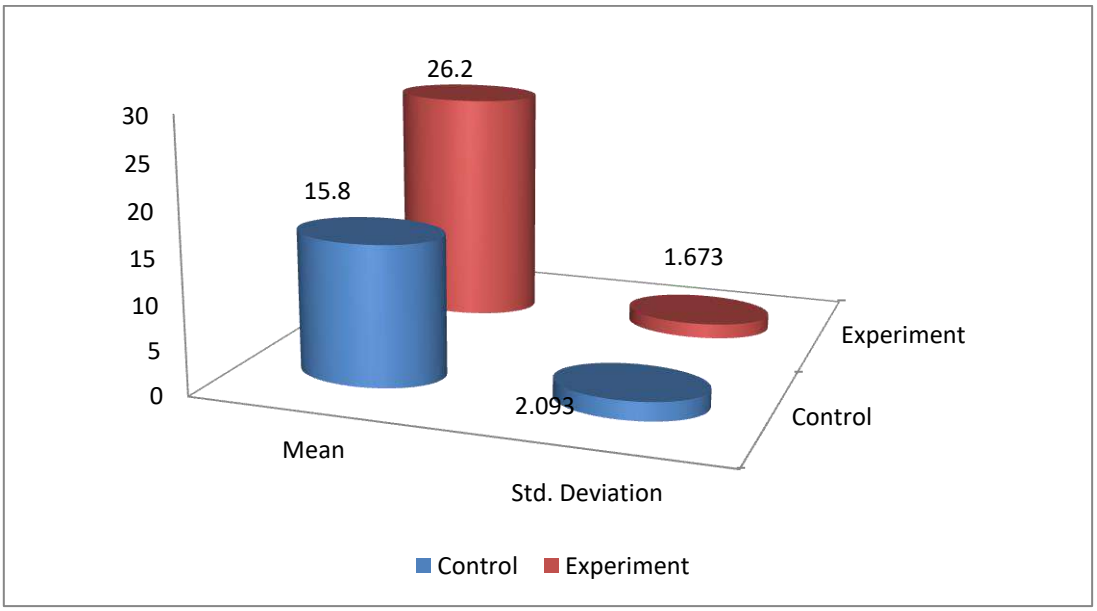
Post Test	N	Mean	Std. Deviation	r value	t value	P value
Control	20	15.80	2.093	0.373	21.760	0.01 (S)
Experiment	20	26.20	1.673			

S – Significant at 5% level

Inference:

From the above table 5, since p values are 0.01 is lesser than the table value at 0.05 so the null hypothesis rejected at 5% level of significance. Hence, there is significant difference in the post test scores of learning Tamil among high school students through administration of Multimedia Package between control group and experimental group.

Figure No: 1



RESULTS AND DISCUSSION

The data analysis result reveals that the Multimedia Package has significant effect in learning selected Tamil among high school students.

The researcher believe that the difference in the control group post-test mean score of Availability of Computer said yes [19.09] have improved Availability of Computer than said no [16.22].

The researcher believe that the difference in the experimental group post-test mean score of Basic Computer knowledge said yes [20.00] have better knowledge than Basic Computer knowledge said no [16.22]. The result showed that the mean scoreof Availability of Computer said yes [26.79] have improved Availability of Computer than said no [24.83]. The result showed that the mean score of QR Code said yes [19.67] have enriched QR Code than said no [16.27].

The result showed that the mean and standard Deviation values of Post-test scores in the experimental group 26.20 and 1.673 have improved than control group 15.80 and 2.093 respectively. Hence concluded used a Multimedia Package approach to learning Tamil enriched for experimental method among high school students.

CONCLUSION

Based on the results and findings of the present study, it is concluded that the developed Multimedia package for learning Tamil for a high level of students is a highly effective tool for learning Tamil. The multimedia method proved to be better than the traditional method in the teaching of Tamil. When both groups of students were taught Tamil through the traditional method and experimental group through the multimedia method, it was concluded that the achievement test of the experimental group was better knowledge than the control group in post-test. After the analysis of the acquire posttest was enhanced their knowledge of the interactive multimedia method. Hence it can be strongly concluded that the students showed effective learning outcome in Tamil through experimental method only because of the Multimedia Package developed for learning Tamil.

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EFFECTIVENESS OF BLENDED LEARNING ON PHYSICS AMONG DEGREE STUDENTS

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INTRODUCTION

Blended learning is primarily a learner-centric approach that offers learners autonomy and flexibility throughout their learning process. Blended learning which embraces various combinations of classroom presence and online study is now considered a mainstream approach to learning in most educational organizations. The method combines "brick-and-mortar" attendance with teachers in face-to-face classroom practices and computer-mediated content and delivery. Most humans in many countries around the world are now able to access the digital world. For the billions of people connected by mobile devices with unprecedented processing power, storage capacity, and access to knowledge, the possibilities are unlimited. The use of these devices has led to an increase in mobile and ubiquitous learning, which has implications for blended learning. Blended learning environments include not only the physical presence of teachers and students but also the students' ownership and control of the time, place, setting, path, and pace at which learning takes place (Banditvilai, 2016).

REVIEW OF RELATED STUDIES

Most of the Review of studies fell into one or more of the following categories: unpublished papers, such as blog posts by researchers with international reputations; position papers by governmental organizations, such as UNESCO and the ERIC, journals, and books. Some related reviews are following, Freihat (2004) found out the effect of blended learning which combines distance learning and face-to-face learning in teaching computer skills to 157 students in the pre-medicine stage in the Arabian Gulf University in Bahrain. The results concluded that the method of blending proved valid and it developed the educational skills needed by students in their future studies.

Shahin (2008) measured the extent of the effectiveness of the blended learning on achievement and develop the science operations among the fifth graders in Al-Naser Experimental School in Tanta and their trends towards it and concluded favor towards the blended learning. Jeffries et al.,(2016) blended instruction combines web-based learning with face-to-face classroom interaction and when used in student-centered ways, blended instruction

allows students to explore and master content at their own pace, form strong, technology-enhanced connections with peers and teachers, and become more self-directed and confident learners.

Al-Hasan (2013) experimented to identify the technology of blended learning in biology course among the second graders in the private secondary 41 students into two unequal groups and the research concluded that there are statistically significant differences in favor of the students who have studied through the blended e-learning in the experimental group. Blended learning is also used in professional development and training settings because it is cost-effective, time-saving, efficient, and learner-friendly (Lothridge et al., 2013). Al-Rimawi (2014) investigated the effect of blended learning on the direct and delayed achievement of the sixth graders in the English language course of 60 students of Um-Qasir School for boys in Quwaismeh and resulted in significant differences between the means of the direct and delayed achievement for the members of the experimental group.

Saritepeci and Cakir (2015) argued that blended learning methods could result in levels of student achievement that were higher than in face-to-face learning. Maccoun(2016) explored the effect of using blended learning in students' achievement and information preservation for the fifth graders in the biology course in high schools of the Baghdad, that each group consisted of 30 students and to achieve blended learning in science is effective.

Porter and Graham (2016) proposed a three-stage framework for the institutional adoption of blended learning: awareness and exploration; adoption and early implementation; mature implementation and growth. They concluded blended learning was most effective in implementation with good planning of teachers. According to Bates (2017), blended learning can consist of PowerPoint slides in a classroom lecture, extra homework online after a face-to-face class, or a classroom where the lecture is recorded and available online, and the class time is used for discussion and questions about the video.

METHODOLOGY

The online materials were presented to students within the learning management system (LMS) of Moodle (Modular Object-Oriented Dynamic Learning Environment). Moodle is ‘a global development project designed to support a social constructionist framework of education'. For this study, the investigators each had their content created in Moodle. Within these contents, each Physics teacher conducted forum discussions, administered quizzes and assignments, and provided links to external online resources that the students had to study. The external online resources were typically websites with information and exercises related to the course outcomes. The Physics teachers communicated with the students online by replying to their forum postings and by sending them email messages through Moodle. Within Moodle, the Physics teachers quickly discovered the ability to share activities and materials and proceeded to share various worksheets and exercises with quizzes and assignments.

This study aimed at determining the effect of a 'blended learning' model toward students' achievement from Physics Students of Undergraduates in Salem District of Tamil Nadu State in India. This experimental research study used one group pre-test and post-test design. From the population of 120 students in Bachelor's degree in Physics Class of Government, Aided and Self-financed Arts and Sciences Colleges in September 2019 were selected by convenience sampling technique. The data were collected from each college 60 Third-year Physics students by using pre and post-tests techniques through a developed and validated Opinions Tool (40 items) and an Physics achievement (30 statements). Both tools found out content validity and reliability 0.78 and 0.82 respectively. The control group was treated by traditional whereas the experimental group was treated through blended learning mode. The data were analyzed using mean, standard deviation, 't' test and F Test with a significance of 5%.

DATA ANALYSIS

The post-test scores of the students who were exposed to non-blended learning (control group) showed an increased academic achievement. It shows 48.98% 'strongly agree', 28.57% 'agree', 20.41% 'disagree', and 2.04% 'strongly disagree' results. On the post-test of students exposed to blend learning approach (experimental group), it shows that there is also an increase in their academic achievement. They obtained 64.85% strongly agree', 30.45% 'agree', and 3.68% 'disagree', and 1.02% 'strongly disagree' results. This means that the students who were exposed to blended learning shows an improvement in their academic achievement in Physics, since their performances leveled-up with the control group that were not exposed to blended learning approach.

Table-1. 't'-test results of Blended Learning Opinion level (Gender-wise)

Gender	**N**	**Mean**	**S.D**	**'t' value**	**p-value**
Male Students	60	74.40	17.02	2.8937*	0.0045
Female Students	60	82.28	12.46		

(* = Significant at 0.05 level)

Table-1 shows that there was significant difference between the blended learning Opinion of Physics students in their gender-wise (male & female) with the value 't' = 2.89 and p = 0.0045 ($p < 0.05$). Based on the meaning obtained, Female students in the Physics Classroom have a higher mean (mean = 82.28) compared with the mean of Female students in the Physics Classroom (mean = 74.40). This shows that blended learning Opinion of Physics students in their gender-wise. The investigators concluded that there is a significant difference exists between the opinions of blended learning in physics classrooms concerning their gender.

Table-2. 't'-test results of Blended Learning Opinion level (Locality-wise)

Locality	N	Mean	S.D	't' value	p-value
Rural Area	60	72.86	16.84	3.942*	0.0001
Urban Area	60	83.68	12.98		

(* = Significant at 0.05 level)

Table-2 shows that there was a significant difference between the blended learning Opinion of Physics students in their locality-wise (rural & urban) with the value 't' = 3.94 and p = 0.0001 ($p < 0.05$). Based on the meaning obtained, urban students in the Physics Classroom have a higher mean (mean = 83.68) compared with the mean of rural students in the Physics Classroom (mean = 72.86). This shows that blended learning Opinion of Physics students in their gender-wise. The investigators concluded that there is a significant difference exists between the opinions of blended learning in physics classrooms concerning their locality.

Table-3. ANOVA results of Blended Learning utility level (Type of Institution wise)

Sources	Sum of Squares	df	Mean Squares	F value	p-value
Between	187.7986	2	93.8993	6.0178*	0.0043*
Within	1825.5978	117	15.6034		
Total	2013.3964	119			

(* = Significant at 0.05 level)

From the table-3, explains the test statistic is the F value of 6.02. Using α of 0.05, we have F 0.05; df 2,117 in the F distribution table= 3.087. Since the test statistic is much larger than the critical value, the investigators reject the null hypothesis of equal population means and conclude that there is a statistically significant difference among the population means. The p-value for F=6.46 is 0.0043, so the test statistic is significant at that level. Hence, it is concluded that the control and experimental groups differ. If the p-value (0.0043) is less than or equal to the significance level, the investigators reject the null hypothesis and conclude that not all of the population means are equal. This indicates that there is a significant relationship exists between the achievement level of blended learning in Physics experimental group compared to the control group concerning their Institution (Government, Aided and Self-financed) wise.

Table-4. ANOVA results of Blended Learning utility level (Type of net-sources wise)

Sources	**Sum of Squares**	**df**	**Mean Squares**	**F value**	**p-value**
Between	191.9748	2	95.9874	6.4576*	0.0001*
Within	1739.1114	117	14.8642		
Total	1751.0862	119			

(* = Significant at 0.05 level)

From the table-4, explains the test statistic is the F value of 6.46. Using an α of 0.05, we have F 0.05;df 2,117 in the F distribution table= 3.087. Since the test statistic is much larger than the critical value, the investigators reject the null hypothesis of equal population means and conclude that there is a statistically significant difference among the population means. The p-value for F=6.46 is 0.0001, so the test statistic is significant at that level. If the p-value (0.0001) is less than or equal to the significance level, the investigators reject the null hypothesis and conclude that not all of the population means are equal. Hence, it is concluded that the control and experimental groups differ. This indicates that there is a significant relationship exists between the achievement level of blended learning in the Physics experimental group compared to the control group concerning their type of net-sources (Institution, Home and Cyber-cafe) wise.

The results showed that there is no significant difference between the two groups; this means that the academic achievement of the experimental group equates with the control group. This indicates an improvement in academic performance for the experimental group. These findings adhere to the study of Nachimuthu (2019) that those students exposed to a blended learning model of instruction performed better than those in traditional teaching methods.

In conclusion, the results of this study are in line with many of the previous studies which have discovered lots of benefits of blended learning over face-to-face instruction. The students achieved great learning outcomes by the end of the one month blended learning program in the blended format. Findings indicate that the proposed blended learning strategy improved the students' achievement. By and large, the students were satisfied with the proposed blended learning strategy in teaching Physics and prefer it to the traditional classroom-based learning, as it allows them to work independently at their own pace.

The major limitation of this study is that the research findings are based on the practice in a single institution in each type of category, although they do cover a range of disciplines. A suggested future research area is to adopt the research methodology developed in this project to research several universities to obtain a broader picture of the use of blended learning in the

sector. Another proposed research area is to conduct an extensive study on the use of blended learning in particular subject disciplines.

CONCLUSION

The use of blended instruction is growing rapidly because instructors believe diverse delivery methods may significantly enhance learning outcomes as well as increase student's satisfaction from the learning experience. (Lim & Morris, 2009). A combination of face-to-face classroom activity with the online instruction, referred to as blended learning, has become the alternative that is popular with Physical science educators. So far several studies have shown that blended learning is highly appreciated and positively rated by the students (Fandey, 2012; Popolzina, 2014). Blended learning model has many advantages such as: improving the effectiveness and efficiency of learning by exploring students' abilities through online media; and building communication with students through online media (Clyde & Delohery, 2005).

The blended learning approach, when introduced in Physics class would enable the learners to perform better performances. Teachers, therefore, need to explore more teaching variables and examine a learning environment that enhances academic achievement. The educational approach toward the blended learning environment requires the learners to be actively involved, hence Physical Science educators with blended learning environment should accommodate instructional strategy and materials and assess student's Physical Science learning skills. The implemented blended learning approach needs further investigation by looking at the goal structures and other combined learning strategies and assess students' academic learning outcomes. Under the students' Physics learning skills development, various teaching methods should be adopted. Course contents should be determined with the aim of improving the Physics learning skills of the students.

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/Appendix/

Tool for Opinion of Blended Learning Class (Nachimuthu,K. 2019)

No	**Statements related to Opinion of Blended Learning Class**	**a**	**b**	**c**	**d**
1	I received the Blended Learning content support, I needed during the class				
2	I had enough influence to learn on the content in the Blended Learning class.				
3	I made an effort to integrate classroom with each other in Blended Learning.				
4	I felt technically developed to learn this course in the Blended Learning.				
5	I received the technical knowledge; I needed during this Blended Learning.				
6	I would like to learn other subjects using Blended Learning.				
7	I decide when I want to learn in the Blended Learning class.				
8	I can access the learning activities at times convenient to me in Blended Learning.				
9	I am worked at my own speed to achieve learning objectives in Blended Learning.				
10	I decide how much I want to learn in a given period through Blended Learning.				

11	I communicate with other students in this subject electronically (email, discussion forums) in the Blended Learning class.				
12	I have the freedom to ask my teacher, what I do not understand in the Blended Learning class.				
13	I have the freedom to ask other students, what I do not understand in the Blended Learning class.				
14	I am regularly asked to evaluate my own work in the Blended Learning class.				
15	I was supported by a positive attitude from my classmates in Blended Learning.				
16	I felt a sense of satisfaction & achievement of this Blended Learning class.				
17	I enjoy learning in this Blended Learning environment.				
18	I could learn more in this Blended Learning environment.				
19	My learning style matches well with the Blended Learning.				
20	My classmates & I evaluate each other's' work in the Blended Learning class.				
21	The online and classroom activities integrated well in the Blended Learning class.				
22	The online activities worked well in the Blended Learning class.				
23	The learning activities worked well in the Blended Learning class.				
24	The online material is available at locations suitable for me in Blended Learning.				
25	The online classroom activities helped me learn in the Blended Learning class.				
26	The Blended Learning environment held my interest throughout the class.				
27	The Blended Learning quizzes enhance my learning process.				
28	Using Blended Learning did not make this course more demanding to learn.				
29	Using Blended Learning allows me to meet my learning goals.				
30	Using Blended Learning allows me to explore my own areas of interest.				
31	Using Blended Learning makes me able to interact with other students and the teacher synchronously.				
32	Managing the online activities was good in the Blended Learning class.				
33	Managing the classroom activities was good in the Blended Learning class.				
34	Other students respond promptly to my requests for help in the Blended Learning.				
35	It is easy to work together with other students involved in Blended Learning class.				
36	Getting technical support was sufficient in the Blended Learning class.				
37	Integrating the online and classroom activities was sufficient.				
38	In this Blended Learning environment, I have to be motivated in order to learn.				
39	There was a good balance between online & Blended Learning activities.				
40	After getting the Blended Learning class, I felt pedagogically prepared to learn.				

(Note: a = Strongly agree; b =Agree; c = Dis Agree; and d =Strongly Dis Agree)

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EFFECT OF EDMODO ON ACHIEVEMENT OF LEARNING BOTANY

Nachimuthu

Abstract

Blended Learning environment combines face to face classroom methods with computer-mediated activities to form an integrated instructional approach. Edmodo is a network platform that enables students and teachers to share educational activities, collaborate, and access notifications. The aim of the study is to determine the effect of using the Edmodo platform on students' academic achievement in learning Botany. The design of the study is quasi-experimental, specifically, the pre-test and post-test of equivalent design administered to both control and experimental groups of 284 second-year Undergraduate Botany students studying in Arts & Science Colleges affiliated to Periyar University, Salem District of Tamil Nadu State of India. The validated statements of questions in the two tools were presented to University Professors to obtain feedback and ascertain the validity of the tool. The tool for the study was an achievement test in Botany as a survey and utility tool about Edmodo content as online. The achievement test in Botany consists of 30 items of multiple-choice tests developed by the researcher in the Anatomy unit as MCQ with good face validity with a reliability of 0.82. In the pre-test, Edmodo mean scores are equal for control and experimental (''t=0.70) and in post-test Edmodo mean scores are not equal for both groups ('t'=5.1). Likewise, Edmodo Utility calculations were made on the basis of demographic variables and the researcher concluded that the Edmodo platform is positively in the teaching and learning of Botany which is capable of increasing the achievement levels of instruction.

Keywords: Edmodo Platform, Edmodo Learning, Edmodo Utility.

Introduction

Web technologies have become an indispensable constituent of learning the process. Teachers, children, and parents use a wide range of applications to develop a diverse learning environment and improve participation, feedback, and interactivity. Students have spent their entire lives surrounded by and using computers, videogames, digital music players, video cams, cell phones, and all the other toys and tools of the digital age (Prensky, 2001). Blended Learning environment allows a normal teacher an opportunity to reframe her/his roles. It combines face to face classroom methods with computer-mediated activities to form an integrated instructional approach. It

helps the learners to get the advantage of personal guidance as well as self- learning playfully. Edmodo is a social networking website can be used as a Blended Learning Platform wherein the teacher can teach the learners through the lecture method and as well as use Edmodo for practice sessions and online discussions. Edmodo is a network platform that enables students and teachers to share educational activities, collaborate, and access notifications, home-works, and classroom memories.

Structure of Edmodo

Edmodo, which is available at www.edmodo.com, was designed and developed by Jeff O'Hara and Nick Borg in 2008. This website is a free, private, and secure learning network that looks similar to Facebook (Jarc, 2010), so it may not cause students to face any difficulties. Edmodo is a social networking website exclusively designed with a specific didactic purpose and for users. The teacher is the administrative head of the group whereas the students and parents are the members. Teachers can invite students into private groups, and post assignments, quizzes for the students. Once the group is formed by the teacher is provided with a separate group code for students and parents. Using their respective group codes the students and parents can sign up and login thereafter. The teacher can even lock the group from new members at any time. The students can thus, solve the learning tasks given by the teacher and parents can view their wards' performance.

Usefulness of Edmodo

Edmodo offers a wide array of advantages to its users. Edmodo tasks help students to study effectively whereas the teachers can monitor their progress through testing quizzes, and messages alert. Edmodo is a tool which is used by the teachers to examine what skills should be developed reading or writing in a particular content. This knowledge allows planning homework assignments regarding students' needs.

Edmodo strengthens a sense of community in learners, making them feel respected and significant. Students make a connection between their experiences, thus understanding better the purpose of each task and the overall objective of the content. This knowledge appears to increase the effectiveness of the learning process. With the help of Edmodo, the teachers create a motivating environment in which

supportive students slightly beyond so that they learned without assistance. Kumelashvili (2016) has discovered that the use of this application stimulates students to reduce the time between the tasks given.

Edmodo does facilitate the variety of file types, including word document, excel, pdf, ppt, mp3, gif, and jpeg. The users shared web site links and embed flash objects such as Google forms, games, YouTube videos, etc. The video also conveys useful information about the particular subject content and helps to train to listen. Each video file is supported with useful links to an assignment or online forums. Testing materials are also convenient as this platform enables the investigator to create quizzes, analyze the results, and estimate whether the learning goals have been accomplished. Edmodo makes the learning environment more flexible and adaptive to students needs (Vijayakumari, 2011).

Edmodo aims at involving the community in the learning process (Balasubramaniam et al., 2014). For this reason, it ensures that parents can become a part of the educational process. They can create parent accounts and get access to assignments and grades of their children. They are also allowed to communicate directly with an investigator or teacher. They also get an opportunity to inform the parents about the forthcoming events, missed assignments, and students' progress. The online platform has archives that allow reviewing the materials later if it is necessary. If an assignment is made successfully, the investigator is also able to delete it.

Edmodo Learning

Edmodo offers privacy to both the investigator (teacher) and their students. Only the investigator creates and manages accounts with their sample students, who receive a group code and register in the group can access and join the group. No one else student can participate or spy on the group. Via Edmodo, investigator send text (SMS) alerts, messages attached with a file or a link, reply students' messages, send out quizzes and assignments, receive completed assignments, give feedback, assign grades for 'assignments', store and share content in the form of files and links, maintain a class calendar, and contact with the whole class, small groups, or even individual student.

Student activity in Edmodo is monitored by the investigator and examined how much time is spent on the learning process, how many times a student visits the platform, what their interested in, and what commentaries they post. The investigator monitored the level of learners' activity then and there.

Need for the Study

Students are also sent a message attached with a file or a link, store and share content in the form of a file or a link, submit homework, assignments, and quizzes, receive their investigator's (teacher's) feedback, messages, alerts, and reply to the teacher as well as set their own calendar. Students can communicate with their teachers, the whole class, and their small group. Since Edmodo allows to be synchronized with the other websites and it could motivate and facilitate students to construct their knowledge individually and collaboratively.

Methodology

The objective of the study is to determine the effect of using the Edmodo platform on students' academic achievement in learning Botany. The hypothesis of the study is, there is no significant difference in the mean achievement scores of students taught Botany by lecture method as the control group and those taught using the Edmodo learning platform by a treatment method as the experimental group. The sample collected was second-year Undergraduate students of Government, aided and self-financed Arts and Science Colleges of Salem District in Tamil Nadu State.

Experimental research has been used with Edmodo learning platform as an ICT tool. The experimental design is meant to determine the effects of Edmodo on student's learning level in Botany Subject. A questionnaire was used to gather the data on their opinion about using Edmodo and to find out its effectiveness. The students were initially taught topics from the Second year Botany syllabus entitled 'Anatomy' through Lecture Method. The notes and assignments were prepared based on the Anatomy topic of Botany and were posted to the students to solve through Edmodo. The assignments were according to the University Paper pattern 2017-2018, which also helped them in provided with a separate group code for second-year students and parents. Using their respective group codes the students and parents are signing up and log in thereafter.

At the beginning of the Third semester, the teacher set up 3 online classes via Edmodo. Then all the sample students were asked to register and join the online classes according to their groups. Small groups of about 4-5 students were then set up via their Edmodo online class to allow students to work on the required tasks of the course collaboratively. Then the teacher blended his normal classes with the online classes throughout the third semester.

The investigator is planning the assignments of a week. The planned assignments are received by the students after they log in. It is a calendar within Edmodo which keeps the students reminding them about their assignments in the coming days with deadlines. The investigator is saved the teaching material in the storehouse called a Backpack. It is used as a virtual library from where the investigator has streamlined the process of sharing content repetitively at different times. Thus it saves time as the teacher just needs to share the content and not upload every time the user needs to use it.

The task of the investigator is to post class notes, quizzes, assignments, online forums, shared web-links, SMS alerts and different types of files to the group and initiate the learning process of this virtual classroom. The investigator is also attaching files or website links and other resources, such as classroom notes or instructions. The investigator is assessing the assignments after they are submitted and give feedback and to see the progress of the students in the 'Progress Bar'. The students have restricted the private messaging facility and all student posts are visible by teachers or investigators.

The statements of the two research tools were presented to University Professors to obtain feedback and ascertain the validity of the tool. According to the views of the Botany experts, some questions were removed from the tools, some questions were rearranged and some questions were added. The tool for the study was prepared by the investigator to validate the Anatomy unit of Botany subject by the achievement test in Botany and Utility tool about Edmodo contents. The online Utility Tool about Edmodo Content with a five-point scale to assess student preference on the use of Edmodo was distributed to the student's using Google drive. The data recorded automatically by Google drive to analyzes the use of Edmodo. Further, one achievement test in Botany was conducted as pre and post-tests.

Data Collection

The design of the study is quasi-experimental, involving the pre-test and post-test of equivalent design. Pre-tests were administered to both control and experimental groups. The sample consisted of two hundred and eighty-four (284) second-year Undergraduate Botany students studying in Government, aided and self-financed Arts & Science Colleges affiliated to Periyar University, Salem participated in the research. The experimental sample (N = 142) consisted of 65 boys and 77 girls, while the control sample (N = 142) consisted of 56 boys and 86 girls.

The tool for the study was an achievement test in Botany as a survey and utility tool about Edmodo content as online. The achievement test in Botany consists of 30 items of multiple-choice tests developed by the researcher in the Anatomy unit. Face validity was established by evaluating both items of the tools by three professors at the university level and two experienced Arts and Science College Botany professors. 30 items out of the 50 items were found suitable in terms of discrimination and facility indices after careful item analysis in an achievement test in Botany. Likewise, 30 utility of Edmodo content was prepared as an online tool. A reliability coefficient of 0.84 was established using Cronbach Alpha in the achievement test and 0.82 was established in an online utility tool. Students who participated in the experimental treatment were subjected for Four weeks at two hours per week. The students were asked to fill the achievement test in Botany using the Edmodo learning platform. The data from the five-point scale were analyzed by using a rating guide as follows: 2-strongly agree, 1-agree; 0-neutral; -1-disagree and -2-strongly disagree. Finally, the data collected from the utility of the Edmodo online tool and achievement tests were also analyzed and through a computerized Statistical Package for Social Science (SPSS).

Data Analysis

Table-1. Analysis of 't' values of Academic Achievement Scores in Pre & Post-tests

Test	Variables	N	Mean	S.D	't' value	p-value
Pre	Control	142	1.86	1.09	0.7022 @	0.48313
	Experimental	142	1.98	1.72		
Post	Control	142	1.92	1.18	5.1245 *	0.00001
	Experimental	142	2.86	1.84		

(@ = no significant at 0.05 level, * Significant at 0.05 level)

The result as presented in Table-1 showed that the Control group pre-test mean score is 1.86 and post-test mean score is 1.92 with standard deviation of 1.09 and 1.18 respectively. On the other hand, the Experimental group pretest mean score is 1.98 and post-test mean score is 2.86 with Standard deviation scores of 1.72 and 1.84 respectively. The pretest 't' value 0.70 is less than the table value which indicates both the groups are equal and there is no significant difference between them. The experimental group 't' value i.e., 5.12 is greater than the table value which indicates that there is a significant difference between pre and post-tests of achievement of Botany.

Mokhtar (2018) reported that those students success increases when the Edmodo learning platform is supported by their perceptions at the undergraduate level. Further, Alqahtani (2019) found that Edmodo as a teaching method enhanced students performance in mathematics. Fryer (2016) found that low achieving students and their areas of interest in social media improved better when taught with Edmodo.

Table-2. Analysis of 't' test on Academic Achievement Scores in the Experimental Group

Variables	N	Mean	S.D	't' value	p-value
Pre-test	142	1.98	1.72	4.1634 *	0.00004
Post-test	142	2.86	1.84		

(* Significant at 0.05 level)

The result as presented in Table-2 showed that while the experimental group students pre and post-tests scores are compared, the 't' value is 4.16 which is greater than the table value of 1.96 it indicates both the groups are not equal and that there is a significant difference between in each other. It shows that there is a significant difference that occurred between pre and post-tests due to Edmodo. The Edmodo learning platform has a positive effect on the leaning of Botany at Undergraduate level in terms of students achievement.

Table–3. Analysis of the Significant of difference in Edmodo Utility by Students

Variables		N	Mean	S.D	't' value	p-value
Gender	Male	130	1.70	0.72	2.8039 *	0.0053
	Female	154	1.98	0.96		
Locality	Rural	120	1.94	0.76	2.9044 *	0.0039
	Urban	164	2.24	0.98		
Type of Institution	Govt.	080	1.62	0.66	2.8318 *	0.0049
	Private	204	1.90	0.94		
The Utility of Net Access at Home (Mobile & Computer)	Yes	170	1.88	0.68	2.9785 *	0.0031
	No	114	2.18	0.92		
Utility of Net Access at Cyber-cafes	Yes	140	1.58	0.64	2.7539 *	0.0062
	No	144	1.82	0.82		
Utility of Edmodo at Home	Yes	116	1.72	0.74	2.8467 *	0.0047
	No	168	1.98	0.78		

(* Significant at 0.05 level)

From the above table-3, it is seen that 't' values of Gender (2.80), locality (2.90), type of Institution (2.83), place of Net access in home (2.98), place of access in cyber-cafe (2.75) and utility of Edmodo at home (2.85) were significant at 0.05 level indicated that there is a significant difference among the sample students with respect to their above said demographic variables. These 't' values are significant at the 0.05 level and greater than the table value of 1.96., it indicates, that there is a significant difference among the second year Undergraduate students concerning their demographic variables. Hence, the framed null hypothesis is rejected in all the demographical variables. This implies that the Edmodo learning platform has significant effects on students achievement in Botany.

Table-4. Analysis of ANOVA on Edmodo Utility by Students

Dimensions	Groups	Sum of squares	Df	Mean square	F–value	p-value
Class notes	Between	419.280	2	209.64	3.892 *	0.0001
	Within	15135.784	281	53.864		
Quizzes	Between	698.80	2	349.40	3.864 *	0.0001
	Within	25409.144	281	90.424		
Assignments	Between	606.60	2	303.30	3.748 *	0.0002
	Within	22739.644	281	80.924		
Online Forums	Between	696.80	2	348.40	3.686 *	0.0002
	Within	25981.822	281	92.462		
Shared Web-links	Between	335.84	2	167.92	3.768 *	0.0002
	With in	12522.484	281	44.564		
Files of Word & pdf	Between	420.30	2	210.15	3.246 *	0.0013
	Within	18220.040	281	64.74		
Files of Excel & Ppt	Between	641.58	2	320.79	3.462 *	0.0006
	Within	26037.46	281	92.66		
Files of jpg & gif	Between	491.54	2	245.77	3.126 *	0.0019
	Within	22092.220	281	78.62		
SMS Alerts	Between	470.22	2	235.11	3.144 *	0.0018
	Within	21013.18	281	74.78		
Feedback	Between	497.86	2	248.93	3.248 *	0.0013
	Within	21535.84	281	76.64		

From the ANOVA table-4, the obtained the F values for Class notes (3.892), Quizzes (3.864), Assignments (3.748), Online Forums (3.686), Shared Web-links (3.768), Files of Word & pdf (3.246), Files of Excel & Ppt (3.462), Files of jpg & gif (3.126), SMS alerts (3.144) and feedback (3.248) are respectively greater than the

table value of 3.00 for the df of 2 numerator and 281 denominator, at the 0.05 level of significance, Hence, it is concluded that statistically significant difference existed in the utility of Edmodo learning platform in receiving the respective dimensions categories. Hence the hypothesis is rejected.

Discussion

One of the variables investigated in the study was the effect of the Edmodo learning platform on the achievement of students in Botany. The results in Table 1 show that the achievement levels of students taught Botany using the Edmodo learning platform are greater than the achievement levels those taught the same lesson using the lecture method.

This finding is in agreement with Johnson and Johnson (2015) who reported the students' success increases when the Edmodo lea ning platform is supported with classroom learning. The above findings are also in agreement with Uzun (2015) who found those students' attitudes towards Edmodo as a supplementary tool for higher education.

Again, results in table 2 analysis of the experimental group, also indicate that post-test mean scores have a significant effect on the use of the Edmodo learning platform in teaching Botany. According to the results in the table, the use of the Edmodo learning platform has a very high effect on post-test students with a mean gain of 1.98. The learning platform also has a high effect on the post-test achievement of students with a mean gain of 2.86. Thus, the method has a very high effect on pretest achievement of students with a mean difference of 1.14 against the post-test achievement of students.

The above findings are in agreement with Vijayakumari et al., (2019) who found that boys receive more criticisms in the class and perform higher than girls in the class. Senthilkumar (2017) and Giang et al., (2014) also corroborated the above findings when they found that female students are underachievers in terms of academic activities. The investigator conclude that the Edmodo learning platform has more effect on learning Botany subject at second-year Arts and Science Colleges of Salem District of Tamil Nadu State.

Recommendations

- Based on the findings of this study, the following recommendations are made.
- Arts and Science College libraries should be upgraded electronically to give students access to an electronic database to fully utilize the Edmodo learning platform in teaching and learning processes.
- Several workshops and seminars should be organized for teachers on the use of Edmodo learning platform to make it popular among the students.
- The Edmodo learning platform should be formally adopted at the Undergraduates level to improve students performance.

Educational Implications

Edmodo is a limited social network of e-learning platform with the teacher as the center. Everyone in Edmodo is anonymous, including teachers or investigators. It is easy to use, closed group collaboration, Only those that have group code can take classes. It is free, accessed online, available for smart phones, and accessible anywhere and anytime. Edmodo is used to communicate using social media models, learning materials, and evaluation. Teachers may also use other functions of Edmodo than what is offered by what is offered by Facebook offered. Teachers might also encourage both good and weak students to study the lessons they posted in the 'folder' functions in Edmodo. Teachers may also note the 'chat' function which is an active notification that indicates who is online in real-time.

Conclusion

Students benefit from this Edmodo learning platform; because, they can access all classroom materials and assignments from their home computers or mobile devices. The use of the Edmodo learning platform is a powerful innovation in the teaching and learning of Botany which is capable of increasing the achievement levels of instruction.

Edmodo is an application that has been designed for Windows and Android and it is easily downloaded from Google store (Al-said, 2015). It increases the mobility of the learning process as students and teachers get an opportunity to participate in activities, regardless of the location. It enables them to share useful learning materials

with the students, monitors their interest in the subject and progress. A teacher or investigator gets an opportunity to upload files of different formats and encourage students to join discussions.

Teachers have noticed that Edmodo not only empowers the relationships between students but also promotes a stronger classroom community (Mills, 2011). Students can also share content, submit homework, assignments and complete quizzes, receive their teachers' feedback, notes and alerts as well as filling out surveys (Nachimuthu, 2019). Subsequently, Edmodo can be seen as a Learning Management System (LMS) which can facilitate teachers to set up and deal with their online classes easily (Witherspoon, 2011).

The investigator found out that it is the most important thing because weak students have a chance to develop them and work better in their normal class since they had a chance to study the lessons online in advance and review the lessons after class. On the other hand, good students are also doing much better in the normal class, too if they studied the lessons online before coming to class and after class.

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Studies in Indian Place Names

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(UGC Care Journal)

Attitude towards ICT Among B.Ed Trainees

Dr.K.Nachimuthu, Mrs. Malathi Thirumaal

Abstract

The teacher is considered to be the architect of the nation. In other words, the future of the nation lies in the hands of the teacher. This shows the importance of the teacher. One can realize how important education is which makes one a teacher. A teacher plays a significant role not only in class teaching-learning situations but in social engineering too [1]. Society gives a respectable place to teachers who are perspective empowered. This empowerment is not in terms of physical perspective. It is in academic, intellectual, social, and national perspectives. The objectives of the study are, to analyze the general awareness of the mean score of B.Ed., trainees on ICT attitude; to study the difference if any in ICT attitude among the B.Ed., trainees of male and female and Physical Science & Non- Physical Science in Vellore district. The method of the study is the normative survey and the Sample for the study is concerned with B.Ed., colleges of Vellore District. The investigator has selected 180 B.Ed trainees studying at Thirumal College of Education, Vellore District of Tamil Nadu State. Finding reveals that there is a significant difference in ICT attitude among Physical Science & Non- Physical Science group B.Ed trainees and also there is a significant difference in ICT attitude among male and female B.Ed trainees. Hence, the study concluded the trainees have an effective level of ICT attitude.

Index Terms: ICT, B.Ed Trainees, ICT Attitude, Physical Science

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1. INTRODUCTION

The teacher education system empowered by ICT driven infrastructure can have a great opportunity to come up to the center stage and ensure academic excellence, quality instruction and leadership in a knowledge-based society- ICT and teacher education, role of teacher in enhancing learning achievement of student, importance, and role of ICT to elevate teachers education, paradigm shift through ICT in teacher education, ICT will also require a modification

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of the role of the teacher, who in addition to classroom teaching will have other skills and responsibilities [2]. This empowerment is not in terms of physical perspective. It is in academic, intellectual, social, and national perspectives [1]. Teachers and teacher educators are of central importance in tapping the potential offered by information and communication technologies (ICT) to enhance the quality of education. The central Government and state Governments observe how teaching and learning take place at schools and in the community. Consequently, building the capacity of the teachers and other facilitators to integrating appropriate ICT into the teaching-learning process needs special attention [4]. Asia and south specific regions have a wide range of policies concerning ICT in education. Pre-service training in ICT is necessary for the quality of education and if it is extended to in-service training for working teachers it will certainly ensure the innovative approaches in teaching and learning. In our country, the national council for teacher education is a statutory body constituted under an act of parliament to regulate all aspects of teacher education in the country [3]. It played a pivotal role in the promotion of computer attitude among teacher educators during the early stages of the introduction of ICT as a component in the teacher education curriculum in the country [5]. The NCTE also developed the curriculum guidelines. Hence ICT has a unique place in teacher education.

2. REVIEW OF RELATED STUDIES

Shokeen and Kaushik (2002) reported that social scientists of Haryana University in India used current journals in ICT, textbooks of ICT, and ICT reference books most frequently for their information needs. Baljinder Kaul and Rama Verma (2008) found out that, use of electronic information resources in a case study of Thapar University and concluded that, the awareness of UGC-Infonet e-Journals Digital Library Consortium is known the very few students and research scholars of Thapar University. So, they suggested that to conduct frequent user orientation programs and workshops for getting the awareness of e-journals. Vijayakumari (2012) explored the idea that the use of ICT resources and services is necessary to help scholars and student teachers meet their information requirements and finds that textbooks and journals are the most popular sources of information for their research work.

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Praveena and Nadaraj (2011) studied ICT usage among University Teachers and Research Scholars at the University of Tamil Nadu and they concluded that the Faculty and Research Scholars of Social Sciences have expressed positively and essentially about the e-resources which are frequently used by them. Likewise, Karisiddappa et al., (2010) have highlighted in their study stated the importance of e-journals digital library consortium in ICT. They expressed that the e-journals are very essential for the Indian Higher Education system. They suggested that to use more e-Journals in study and research in teacher education, there is a great need for conducting the user education workshops to know about the e-journals.

3. TITLE OF THE STUDY:

The title of the problem is 'Attitude towards ICT among B.Ed., Trainees' in Vellore District'. The major objectives of the study are; to analyze the general awareness on ICT attitude among the B.Ed., trainees; to study the difference if any in ICT attitude among the B.Ed., trainees of Physical Science & Non- Physical Science in Vellore District as well as Gender-wise. The hypothesis of the study are as follows; there will be no significant difference in ICT attitude among the B.Ed., trainees of Physical Science & Non- Physical Science in Vellore District and there will be no significant difference in ICT attitude among the male and female B.Ed., trainees of in Vellore District.

4. METHOD OF STUDY:

The present study attempted to collect data about "ICT Attitude among B.Ed., trainees of Vellore District". The investigator has used the normative survey method to collect the data for this study. The investigator has selected 180 B.Ed trainees studying in the B.Ed course at Thirumal College of Education, Tirupattur, Vellore District of Tamil Nadu State.

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5. TOOLS USED:

For this study, a test was prepared and validated by investigators and to assess the "ICT attitude among B.Ed., trainees". The assessment tool of ICT attitude among B.Ed. trainees contain the information and communication technology related to the following items. An input device, an Output device, Processing device, Memory device, Radio, Television, Mobile, Interactive Whiteboard, web activities, multimedia, e-content and virtual technology package, social media and Microsoft Windows, word, excel, PowerPoint. ICT attitude test contained 40 multiple-choice test items. The answer sheet consists of details like name, name of college, gender. If the B.Ed trainee chooses the correct option, positive one mark is awarded and for the wrong option, a negative one mark is awarded.

6. POPULATION:

The population for this study has been defined as all B.Ed., trainees of Vellore. To draw a representative sample, it was decided to have two B.Ed., colleges. The investigator has selected 180 B.Ed trainees studying in Thirumal College of Education, Tirupattur in Vellore District of Tamil Nadu.

7. COLLECTION OF DATA:

The investigator contacted and obtained permission from the principal of B.Ed., colleges. The willingness and co-operation of the respective faculties are also sought. The data were collected personally by the investigator, from all the 180 trainees, proper instructions were given to the trainees before starting to fill the questionnaire. Each student was provided with a questionnaire containing ICT knowledge test question paper and answer sheet with a personal detail form.

8. DATA ANALYSIS:

Hypotheses: 1 There is no significant difference in ICT Attitude among Physical Science & Non- Physical Science B.Ed Trainees.

Table 1. Data analysis on ICT Attitude (Subject-wise)

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Variable-Subject	N	Mean	S.D	't'-Value
Physical Science	060	23.57	5.18	2.7553 *
Non- Physical Science	120	26.02	6.42	

(* Significant at 0.05 level)

The above table-1, reveals that the calculated 't' value 2.76 is greater than the tabulated value at 0.05 level of significance. So, the hypothesis 'There is no significant difference in ICT Attitude among Physical Science & Non- Physical Science B.Ed' was rejected. Hence, there is a significant difference in ICT attitude among Physical Science & Non- Physical Science B.Ed Trainees in Vellore District.

Hypotheses: 2 There is no significant difference in ICT Attitude among male and female B.Ed Trainees.

Table 2 Data analysis on ICT Attitude (Student's Gender wise)

Variable-Gender	N	Mean	S.D	't'-Value
Male	108	23.42	5.78	4.46743*
Female	092	20.04	4.92	

(* Significant at 0.05 level)

The above table-2, reveals that the calculated 't' value 4.47 is greater than the tabulated value at 0.05 level of significance. So, the hypothesis 'There is no significant difference in ICT Attitude among male and female group B.Ed' was rejected. Hence, there is a significant difference in ICT attitude among a male and female group of B.Ed Trainees.

9. FINDINGS OF THE STUDY:

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There is a significant difference in ICT attitude among Physical Science & Non- Physical Science B.Ed., trainees (Vide table 1). ('t' value =2.76). There is a significant difference in ICT attitude among the male and female groups of B.Ed., trainees. (Vide table 2). ('t' value =4.47). The limitations of the study are, the study has been restricted only to the B.Ed., trainees studying in Vellore and it includes a sample size of 200 B.Ed., trainees only. Suggestions for Further Research are as follows; this study was confined to only Vellore B.Ed., colleges only; The same study may be conducted at Tamil Nadu State level in the future; This study may be extended to the working Teachers at various level in Government and non- governmental institutions.

10. CONCLUSION:

The purpose of the present investigation was to study ICT attitude among B.Ed., trainees in Vellore district relation to selected variables. The study reveals that there is a significant difference in ICT attitude among male and female group B.Ed Trainees and there is a significant difference in ICT attitude among Physical Science & Non- Physical Science B.Ed Trainees. Hence, the study concluded the trainees have a moderate level of ICT attitude. The development of technology will ensure that ICT will improve in the classroom [7]. It is predicted that there will be many benefits for both the teacher and the learner, including the resources, better access to information, the promotion of collaborative learning and radical new ways of teaching and learning [8]. ICT users will become specialists in the use of modern learning techniques, the design and development of shared working spaces and resources, and virtual guides for students who use electronic media [6]. Hence, the investigators concluded that the B.Ed trainees are having ICT attitude is enough and they need more future technological devices utility in classrooms.

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STUDENT TEACHER'S ATTITUDE TOWARDS ONLINE LEARNING DURING COVID-19

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Abstract

The purpose of this research is to determine the attitude towards online learning by the student teachers in the Covid-19 Period. In this research, the Survey type of tool used as google forms. Online learning supported instruction is an independent variable and student attitudes towards online learning through computers are dependent variables. As a data collection instrument used is an online learning attitude scale and the sample consists of 130 student teachers. According to analysis concludes, normal classroom practice does not affect attitudes of students towards online learning and there is no significant difference between the male and female attitude scores of student teachers toward online learning practice in Covid-19.

Keywords: *Covid-19, online learning, attitude, student teachers*

Introduction

The world today is facing pandemic as the Coronavirus is sweeping it's around the globe and its impact is going on. The pandemics have brought in many deaths; lakhs have been quarantined and have led to a serious situation of thinking towards a global health emergency. The Covid-19 pandemic has led to a total lockdown world over and India is no exception. The Period of the lockdown the educational institutions have moved online and social distancing.

Learning is rebooted during Covid-19. This Covid-19 is an ideal time to accept technological introduction and its latest offerings to make education delivery to students more efficient and make it more productive through online learning. The shutdown of the educational institutions has led to many apprehensions among the students and teaching fraternity. However, the teaching fraternity has been adopting innovative methods to interact with the students and focusing on the curriculum. Online learning also comes as an interesting and interactive additional resource as compared to the normal classroom.

Institutes and enterprising teachers are promoting online learning among their students through which all the students are ensured to be benefitted except a few belonging to underprivileged sections and those could not be reached due to network connections. Hence online learning will be the new format of learning which helps to improve the teaching-learning process in this Covid-19 period. Universities and Higher Education Institutions (HEIs) have instantly turned to conduct virtual classes, online assignment submissions, and teacher-student interactions in this COVID-19 situation.

Benefits of online learning

The Digital learning model is an Instruction that occurs via an online platform, with periodic face-to-face meetings called Blended learning. Now-a-days, students take online learning classes to supplement their normal class learning. The interactions between the teacher and students are via chats and feedback forms helps to improve the teaching-learning process. It will create the absence of a physical classroom setting. In this method, the students are interested to submit assignments or any other simple projects on their own are increase their contribution level of the particular units. The students also chat with their peers through messages or voices as per their willingness and interest in the contents.

Shufa Zheng et al, (2020) investigated the Online supported communication technologies between the teachers and students environment and the Online learning environment is more effective than face-to-face environments by Rubin et al, 2020 also supported this study. According to Senthilkumar (2012) found out that, the feedback session is necessary for the online learning process.

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Dumford and Miller (2018) point out that, the maintaining of student's retention and their attitudes towards online learning is a key challenge. But Sheffield et al (2015) supported online learning and the student's positive attitudes and they concluded that online learning improves their retention of subjects. Some of the research works done on online learning and its attitude also positive and it continues in the future. (Huang et al.2017; Joo et al. 2018) and effectiveness of online simulation training towards Nurses in medical education (Kim, 2017) and the need for the flipped classroom by Ng, (2018). These above researches are almost supported by the attitude towards online learning, interest in online learning and satisfactory effect towards online learning. From these research studies we concluded, that online learning courses are essential in the educational field. The present study aimed to examine how student teachers' attitudes towards online learning experiences in the Covid-19 period will shape their continuous intention to learn online.

Virtual reality and augmented classrooms today allow us to make more interaction between the teacher and students as close to a real classroom like experience, as possible. The challenges however are minimized with the use of many e-teaching and e-learning apps. The apps such as Google classroom, Zoom, Easy Class, Go To Meeting, Google Meet, Hang-outs, Remind, Slack, Free conference call, and many others have been adopted to reach the students as far as possible. Online learning is a temporary substitute aid during the Covid-19 period, which we are facing. As all professions are directly or indirectly been influenced by the COVID pandemic, such type of study is the need of the hour to know the consistency of their decision.

Methodology

The aim of the objectives of the study is, to find out and to compare the attitude of student teachers towards online teaching. The hypothesis of the study is, there is no significant difference in the attitude of student teachers towards online teaching concerning their demographical variables such as gender, type of institution, and their groups of study.

The sample for the study is, 130 student teachers studying in both first year and second year in selected teacher education colleges affiliated to Tamil Nadu Teacher Education University, Chennai. Data have been collected from April and May 2020. For assigning the students assignments, the researcher has used the Google classroom app. For students who cannot join the online classroom, the researcher has uploaded the PPT in digital share an online platform, so that the student teachers can download the PPT whenever they get internet access and any doubt clarification is conducted through normal calls.

This study is carried out to explore the attitude of student teachers towards online learning in the period of the Covid-19 situation. The tool used for data collection was a validated structured reliable questionnaire. The total number of statements was 20. Out of which statements were divided under Positive and Negative attitudes towards online learning during the Covid-19 period. Online learning supported instruction is an independent variable and student attitudes towards online learning through computers are dependent variables.

The researcher being the teacher educator handled the same to the student teachers who wanted to study the attitude of the students in learning online and therefore prepared a questionnaire and sent as Google forms as enclosed through WhatsApp groups and collected the data and analyzed.

Data Collection:

The link of the tool was sent to the student teachers via social media. Survey items were developed based on an extensive literature review. The set of 20 items of statement of questions was taken from the study of Voorveld, et al (2018), and Roy et al. (2020) and was changed to suit in the reliable context of the study and validated with good reliability (r=0.78) of the items, by the experts. The instrument in this study was an online survey that was used to gather data from 130 participants, from within a teacher education institution.

The study carried out only those student teachers who had access to the internet. The data has been received from all the student teachers. It has also been found that ninety-eight percent of the student teachers have participated in the classes taken via the Zoom app, and all those have been

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recorded. Around 130 student teachers had connected to the online class and they asked him questions via chat.

Data Analysis:

Participants' consent was approved through emails and what's app and accordingly the link of the survey tool was forwarded to them. The participants completed this 10 min survey and submitted it to the Researcher online itself. The study was conducted in a manner that protected the confidentiality of the participants. The study gathered quantitative data to answer the given questions.

Table-1. Analysis of the attitude of student teachers towards online teaching

Variables		N	Mean	S.D	't' value	p-value
Gender	Male	58	136.82	19.68	1.68 @	0.0477
	Female	72	144.86	34.26		
Type of Institution	Private	65	140.82	16.42	2.89 *	0.0022
	Govt.	65	152.94	25.84		
Group of Student Teachers	Arts	39	102.46	15.98	13.15 *	0.0001
	Science	91	144.98	18.84		

*(@ =No significant at 0.05 level, * = Significant at 0.05 level)*

The above table shows that in the case of male student teachers respondents, the mean of the scores in attitude towards online teaching was 136.82 and in the case of female respondents, it was 144.86. The 't' ratio in respect of the two means was 1.68 which is not significant at 0.05 level ($p>0.05$). Therefore, the null hypothesis "there is no significant difference in the attitude of male and female student teachers towards online teaching" is accepted. Likewise, in the case of private student teachers, the mean of the scores in attitude towards online teaching was 140.92 and in the case of government student teachers, it was 152.94. The 't' ratio in respect of the two means was 2.89 which is significant at 0.05 level. Therefore, the null hypothesis "there is no significant difference in the attitude of private and government student teachers towards online teaching" stands not accepted. The same table shows that in the case of student teachers, from the science stream, the mean of the scores in attitude towards online teaching was 144.98 and in the case of student teachers from the arts stream, it was 102.46. The 't' ratio in respect of the two means was 13.15 which is significant at 0.05 level. Therefore, the null hypothesis "there is no significant difference in the attitude of student teachers from science and arts stream towards online teaching" stands not accepted.

Discussion:

During Covid-19 Period, the students are rests in home are actively attended classes, because of the non-opening of their Colleges and Universities. The Government of India also supported online learning classes in the higher education field. It has been found that all the students are interested in learning online. It has been found that even the introvert students had good interaction as there is no face to face interaction. They are also very comfortable as they are seated in a very comfortable place at home and all the study materials in hand. In this study, both male and female student teachers attitude towards online learning is equal concludes their interest in the Covid-19 situation.

Online learning is not a substitute for classroom teachers; it can't do visual experiences of field trips and the social and cultural programs of academic activities in regular mode of campus life. Educators must recognize the significant causes of stress which students are dealing with during this

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crucial time of pandemic and should work to create a supportive and calm educational environment in online classes for their web-based learning. Educators should make them benefit online resources and personal guidance to assist students with adapting to their psychological mood.

Conclusion:

Many educational institutions supported and entered into the online platforms for conducting classes. While comparing the gender there is no significant difference in each other, but for their type of institution ('t'= 2.89) and their group-wise ('t'=13.15) are significantly different indicates their attitude towards online learning is different in this Covid-19 period. But in this Covid-19 situation, teachers must encourage the student's mental health and remove stress in their life due to interactions. At the same time, their studies also encourage online learning. Their attitude may be different as per their institutional analysis. But their interest in online learning is more due to their chats in that online classroom.

Some student teachers have no internet access and many students may not be able to afford a desktop computer or laptop in their homes. However, there is a serious apprehension from different corners that such an online teaching-learning process might create a digital divide. To conclude, the student teachers of both genders have accepted the online leaning method with an open heart without significant differences ('t'=1.68). They are really happy that all Institutions are putting so many efforts to keep the curriculum on track amidst the lockdown. On top of all the issues and challenges, we know that online creates better performance of students as well as teachers. Now teachers are also learning in the new technological devices to equip them.

During COVID-19 crisis based online teaching-learning process is a more vital role in the educational setting. Student teachers can use online learning components in different ways to aid the teaching-learning process. While the COVID-19 Crisis online teaching-learning process helps the teachers to improve the overall efficiency of being students. This is a positive stroke to the success of the teaching profession in such a critical situation too. Student teacher's attitudes towards online learning during COVID-19 are positive and no significantly different and it is the slight alternative situation of the lock-down period.

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EFFECTIVENESS OF BLENDED LEARNING FOR DEGREE STUDENTS

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ABSTRACT: Blended learning is emerging as an important teaching and learning model in schools and colleges including Universities because its elements are combined with online and face-to-face interactions. To examine the effectiveness of blended learning, as compared to the normal classroom mode, this research investigated the learning outcomes of students following the Botany classroom at the Undergraduate level of Salem City of Tamil Nadu State in India. A small database was analyzed including student variables (gender and their net-utilities), the different learning modes, and student performance in this study (N=145). Researches studies show that undergraduate students who participated in blended learning classes are effective. The independent variables are blended learning and the traditional method likewise; the dependent Variables are an Achievement test on Botany in the units of 'meristems and complex tissues' taken the course from the paper namely, Anatomy and Embryology of Angiosperms. The results show that students engaged in blended learning had better academic achievements in their Botany Classroom compared to students participating in the face-to-face learning mode. Students' factors (gender and locality) were taken as covariates to assess the opinions of blended learning also calculated with mean, standard deviation, F test and 't' tests. Findings reveal that blended learning access formats by themselves are of more benefit in achieving Botany unit's outcomes than the traditional model (F=5.76), particularly in gender-wise ('t'=3.63) and locality-wise ('t=2.98). And this research recommends, the proposed research line is to conduct an extensive study on the blended learning utility in any discipline.

KEYWORDS: Blended learning, Moodle, Botany subject, learning management.

I. INTRODUCTION

Many Science teachers have been searching for effective instruction to motivate students to learn biology so that the students achieve better academic performances. Technology has increasingly become important in the educational arena and it is seen as an important resource for instruction in Science teaching. Blended learning is primarily a learner-centric approach that offers learners autonomy and flexibility throughout their learning process. Blended learning which embraces various combinations of classroom presence and online study. The method combines 'brick-and-mortar' attendance with teachers in normal classroom practices with computer-managed content and delivery. Most teachers in many countries around the world are now able to access the digital world in their classrooms. Now-a-days, more number of students and teachers are connected by mobile devices with storage capacity, unprecedented processing power, and access to wisdom, the possibilities are unlimited. The use of these devices has led to an increase in mobile and ubiquitous learning, which has implications for blended learning. Blended learning environments include not only the presence of regular teachers and students but also the students' ownership and place, setting, path and control of the time at which learning takes place (Banditvilai, 2016).

II. REVIEW OF RELATED STUDIES

Most of the Review of studies fell into one or more of the following categories: unpublished papers on blended learning like blog posts with international reputations; relevant papers of governmental organizations, such as ERIC and the UNESCO, journals, and books. Some related reviews are following, according to Bates (2017), blended learning can consist of Classroom lecture with PowerPoint slides, extra home-works in online after a normal class, and a classroom where the lecture is recorded and available online, and the class time is used for discussion and questions about the video. Porter and Graham (2016) proposed a three-stage framework for the institutional adoption of blended learning: (i) awareness and exploration; (ii) adoption and early implementation and (iii) mature implementation and growth. They concluded blended learning was most effective in implementation with good planning of teachers.

Jeffries et al., (2016) blended instruction combines face-to-face classroom interaction with web learning and when used in student-centered ways, this instruction allows students to master and to explore content at their own pace, and become more self-directed and confident learners. Maccoun (2016) explored the study in Baghdad's fifth standard in schools, as the effect of using blended learning in students' achievement, that each group consisted of 30 students and to achieve blended learning in science is effective. Saritepeci and Cakir (2015) argued that blended learning methods could positively affect levels of student achievement that were higher than in normal classroom learning.

Al-Rimawi (2014) investigated in the Um-Qasir School for boys in Quwaismeh and his sample is Sixth standard in the English Language Class and to find out the effect of blended learning on the direct achievement and resulted in significant differences between the means of the direct achievement for the members of the experimental group. For Professional development and training settings, Blended learning is also used; because it is cost-effective, time-saving, efficient, and learner-friendly (Lothridge et al., 2013).

Al-Hasan (2013) experimented to identify the blended learning in biology class at the private secondary 41 students into two unequal groups. The research concluded that, there are statistically significant differences in favor of the students and also effectiveness occurs in the blended learning method of learning in the experimental group.

Shahin (2008) measured the Science Operations among Fifth standard Students and to find out the effectiveness of the blended learning on achievement at Al-Naser Experimental School in Tanta' and concluded favor towards blended learning. Freihat (2004) found out the effect of blended learning in teaching computer skills to the pre-medicine stage of 157 students at Arabian Gulf University in Bahrain. The results favored towards blending learning method of the teaching-learning process in future studies.

III. METHODOLOGY

The online content materials were presented to students within the learning management system (LMS) of Google Classroom environment. The primary purpose is to streamline the process of sharing files between teachers and students in free of charge manner. For this research, the investigators each had their content created in Moodle. Third-semester core course paper –IV (major) was selected and the units of 'meristems and complex tissues' taken the course from the paper namely, Anatomy and Embryology of Angiosperms. Within these contents, each Botany teacher conducted forum discussions, administered quizzes and assignments, and provided links to external online resources that the students had to study. The external online resources were typically websites with information and exercises related to the course outcomes. The Botany teachers communicated with the students online by replying to their forum postings and by sending them email messages through Moodle. Within Moodle, the Botany teachers quickly discovered the ability to share activities and materials and proceeded to share various worksheets and exercises with quizzes and assignments.

This study aimed at determining the effect of a 'blended learning' model toward students' achievement from Botany Students of Undergraduates in Salem District of Tamil Nadu State in India. This experimental research study used one group pre-test and post-test design. From the population of 145 students in Bachelor's degree in Botany Class of two Governments, One aided and Two self-financed arts and sciences colleges in November-December 2019 were selected by convenience sampling technique. The data were collected from each college 30 Third-year Botany students (in total 5 colleges and 145 total) by using pre and post-tests techniques through a developed and validated Opinions Tool (40 items) and a Botany achievement (30 statements). Both tools found out content validity and reliability 0.79 and 0.81 respectively. The control group was treated by conventional whereas the experimental group was treated through blended learning mode. The data were analyzed using mean, standard deviation, 't' test and F Test with a significance of 5%.

IV. DATA ANALYSIS

The post-test scores of the students who were exposed to the control group (normal classroom learning group) showed increased academic achievement. It shows 48.98% 'strongly agree', 28.57% 'agree', 20.41% 'disagree', and 2.04% 'strongly disagree' results. On the post-test of students exposed to a blended learning approach (experimental group), it shows that there is also an increase in their academic achievement. They obtained 64.85% strongly agree', 30.45% 'agree', and 3.68% 'disagree', and 1.02% 'strongly disagree' results. This means that the students who were exposed to blended learning show an improvement in their academic

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achievement in Botany, since their performances leveled-up with the control group that was not exposed to a blended learning approach.

Table-1. 't'-test analysis of Blended Learning Opinion level (Gender-wise)

Gender	N	Mean	S.D	't' value	p-value
Male Students	71	88.04	20.14	3.6291*	0.0001
Female Students	74	98.87	15.37		

(* = Significant at 0.05 level)

Table-1 shows that there was a significant difference between the blended learning Opinion of Botany students in their gender-wise (male & female) with the value 't' = 3.63 and p =0.0001 ($p < 0.05$). Based on the meaning obtained, Female students in the Botany Classroom have a higher mean (98.87) compared with the mean of male students in the Botany Classroom (88.04). This shows that blended learning Opinion of Botany students in their gender-wise. The investigators concluded that there is a significant difference exists between the opinions of blended learning in Botany classrooms concerning their gender.

Table-2. t'-test analysis of Blended Learning Opinion level (Locality-wise)

Locality	N	Mean	S.D	't' value	p-value
Rural Area	72	88.28	20.42	2.9846*	0.0017
Urban Area	73	97.52	16.64		

(* = Significant at 0.05 level)

Table-2 shows that there was a significant difference between the blended learning Opinion of Botany students in their locality-wise (rural & urban) with the value 't' = 2.98 and p =0.0017 ($p < 0.05$). Based on the meaning obtained, urban students in the Botany Classroom have a higher mean (mean = 97.52) compared with the mean of rural students in the Botany Classroom (mean = 88.28). This shows that blended learning Opinion of Botany students in their gender-wise. The investigators concluded that there is a significant difference that exists between the opinions of blended learning in Botany classrooms concerning their locality.

Table-3. ANOVA results of Blended Learning utility level (Type of Institution wise)

Sources	Sum of Squares	df	Mean Squares	F value	p-value
Between	193.3748	2	96.6874	5.7641 *	0.0039*
Within	2389.3772	142	16.8266		
Total	2582.7520	144			

(* = Significant at 0.05 level)

From the table-3, explains the statistical test of the F value of 5.76. Using α of 0.05, we have F 0.05; df; 2,142 in the F distribution table= 3.04. Since the test statistic is much larger than the critical value, the investigators not accepted the null hypothesis of equal population means and conclude that there is a statistically significant difference among the population means. The p-value for F=5.76 is 0.0039, so the test is statistically significant at that level. Hence, it is concluded that the control and experimental groups differ. If the p-value (0.0039) is less than or equal to the significance level, the investigators reject the null hypothesis and conclude that not all of the population means are equal. This indicates that there is a significant relationship that exists between the achievement levels of blended learning in Botany, the control group compared to the experimental group concerning their Institution (utility in Government, aided and self-financed) wise.

Table-4. ANOVA results of Blended Learning utility level (Type of net-sources wise)

Sources	Sum of Squares	df	Mean Squares	F value	p-value
Between	193.4578	2	96.7289	5.9070 *	0.0034*
Within	2325.2926	142	16.3753		
Total	2518.7504	144			

(* = Significant at 0.05 level)

From the table-4, explains the statistical test of the F value of 5.91. Using α of 0.05, we have F 0.05; df; 2,142 in the F distribution table= 3.04. Since the test statistic is much larger than the critical value, the investigators

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reject the null hypothesis of equal population means and conclude that there is a statistically significant difference among the population means. The p-value for F=5.91 is 0.0034, so the test statistic is significant at that level. If the p-value (0.0034) is less than or equal to the significance level, the investigators reject the null hypothesis and conclude that not all of the population means are equal. Hence, it is concluded that the control and experimental groups differ. This indicates that there is a significant relationship exists between the achievement level of blended learning in the Botany, the control group compared to the experimental group concerning their type of net-sources (utility in the institution, home, and cyber-cafe) wise.

The results showed that there is no significant difference between the two groups; this means that the academic achievement of the experimental group equates with the control group. This indicates an improvement in academic performance for the experimental group. These findings adhere to the study of Nachimuthu (2019) that those students exposed to a blended learning model of instruction performed better than those in conventional teaching methods. In conclusion, the results of this study are compared to the previous studies related to the benefits of blended learning over classroom instruction. The student's achievements are more learning occurred by the end of that one month of the blended learning program format. Findings concluded that the given blended learning method is improved the students' achievement.

The major limitation of this study is that the research findings are based on the practice in one or two institutions in each type of category, although they do cover a range of disciplines. A suggested future research area is to adopt the research developed in this project to research several universities to obtain a broader picture of the use of blended learning in the sector. Another proposed research area is to conduct an extensive study on the use of blended learning in any discipline.

V. CONCLUSION

A combination of Normal classroom interaction with online instruction, referred to as blended learning, has become popular with Biological science educators. The use of blended instruction is growing rapidly and it enhances student's satisfaction from the learning experience. (Lim & Morris, 2009). Likewise, lots of studies have shown that blended learning is highly effective and positively towards the teaching-learning process (Fandey, 2012; Popolzina, 2014). The blended learning approach, when introduced in Botany class particularly in from the paper namely, Anatomy and Embryology of Angiosperms would enable the learners to perform better performances. Teachers, therefore, need to explore more teaching variables and examine a learning environment that enhances academic achievement.

Blended learning model has many advantages such as: improving the effectiveness and efficiency of learning by exploring students' abilities through online media; and building communication with students through online media (Clyde & Delohery, 2005). The educational approach toward the blended learning environment requires the learners to be actively involved, hence Biological Science educators with blended learning environment should accommodate instructional strategy and materials and assess student's Biological Science learning skills. The implemented blended learning approach needs further investigation by looking at the goal structures and other combined learning strategies and assess students' academic learning outcomes. Under the students' Botany learning skills development, various teaching methods should be adopted. Course contents should be determined with the aim of improving the Botany learning skills of the students.

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ATTITUDE TOWARDS VIDEO ASSISTED INSTRUCTION FOR HR. SEC. STUDENTS

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Abstract

Video utility offers considerable potential for improving the quality of education and stimulating interest and involvement in academic excellence. Today, as innovations in teaching-learning have been developed, teachers have integrated these current technologies along with the other innovative teaching methods in their classrooms. Video-assisted instruction, particularly video technology, is now a primary and eye-catching instructional material in schools. The objectives of the study are, to analyze the attitude towards Video-assisted instruction of the mean score of higher secondary history subject students on Video-assisted instruction; to study the difference if any in Video-assisted instruction attitudes among the higher secondary history subject students in Salem district. The method of the study is the normative survey and the Sample for the study is concerned with higher secondary history group schools of Salem District. The investigator has selected 120 higher secondary history subject students studying at Government, aided and matriculation schools of Salem District of Tamil Nadu State. Finding reveals that there is a significant difference in Video-assisted instruction attitude among History group students of control and experimental groups. The experimental groups' History students proved the effectiveness of attitude towards Video-assisted Instruction indicates a positive level.

Index Terms: *Video-assisted instruction, higher secondary students, attitude, History group*

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INTRODUCTION

The perception of traditional teaching methods has been left and the perception of growing student-centered, information searching, free, productive individuals has become a more accepted approach in education [1]. In Tami Nadu, most of the schools have the gadgets; this experience has helped the teachers to be equipped in using video programs in their classrooms. Today, educators accept the fact that the computer has indeed succeeded in providing an individualized learning environment that is too difficult for a teacher to handle whole classes [2]. Hence, Video-assisted learning can allow an individual student to learn their own pace and remain motivated in learning through the challenging virtual learning environment. Once, the students are solely learned through traditional teaching. Today, as innovations in teaching-learning have been developed, teachers have integrated these current new technologies along with the other innovative teaching methods in their classrooms.

IMPORTANCE OF VIDEO-ASSISTED LEARNING

Video-assisted learning is the process of acquiring defined knowledge, competence and skills with the intelligent use of audio-visual aids as instructional resources, and its benefits for teaching and learning are as follows; it enables students and teachers to motivate with digital learning tools; it saves time and raises students' interest given their proficiency with technology; it increases the retention of knowledge and stimulates understanding and to foster creative and critical problem-solving skills and it provides a way of conveying information that can be viewed several times at any moment and from any place and it produces better cognitive and effective learning outcomes.

REVIEW OF RELATED STUDIES

Research has shown that advantages to video technology abound: video technology is under the control of the teacher, is accessible, can be used by students with a minimum amount of assistance, and allows presentations to be structured with a specific purpose for a specific audience [3]. The emphasis in future

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research should not focus on the machine but on the combination of machines and teachers that can most effectively facilitate instruction [4]. Technology will be the vehicle by which students can progress individually through a larger range of course material [5]. Educational materials prepared for use with advanced technologies make it possible for students to learn at their level while using their learning style. [6].

METHODOLOGY

For this study, a test was prepared and validated by investigators and to assess the "Video-assisted Instruction attitude among higher secondary students". The assessment tool of Video-assisted Instruction attitude among higher secondary students contains the Video-assisted Instruction related to the following items. An input device, an Output device, Processing device, Memory device, Radio, Television, Mobile, Interactive Whiteboard, web activities, multimedia, e-content and virtual technology package, social media and Microsoft Windows, word, excel, PowerPoint. Video-assisted Instruction attitude test contained 40 multiple-choice test items. The answer sheet consists of details like name, name of the school, gender. If the higher secondary student chooses the correct option, positive one mark is awarded and for the wrong option, a negative one mark is awarded.

By preparing the videos in advance, the teacher knew the sequence and scope of the History course for the first year of higher secondary level. This provided a more substantial review of each lesson and the opportunity for the teacher to correct unsuspected Social Science up-to-day activities in the lessons. When the regular teacher was absent, the students were able to start the video, receive appropriate instruction, and proceed as expected through the History sequence. The substitute teacher only had to monitor a student's work.

An experimental study using two equivalent classrooms was conducted to determine differences in student achievement and student attitude through the use of video-assisted Instruction. The null hypothesis stated that there would be no significant differences in the History achievement or the attitude toward History of students taught by video-assisted Instruction or students taught by live Instruction in higher secondary History. One classroom was taught by video-assisted Instruction In conjunction with standard teacher Instruction; the other was taught exclusively via traditional live Instruction.

This study investigated the effect of video-assisted instruction on higher secondary students' performance in History subject. The design for the study is quasi-experimental, of the type, pre-test, post-test control group design. The population of the study comprised of all higher secondary history group students in Government and matriculation schools of Salem district of Tamil Nadu State of India. One hundred and twenty (120) students in two co-educational schools made up the sample size. Two groups namely, the experimental group and control group were used for the study. The experimental group was taught social science class using video-assisted instruction (VAI) while the control group was taught social science class using the traditional instruction method (TIM).

Video is a medium of transmitting information in the form of sound and image to be displayed on the screen of the television tube. Video is always recorded in Compact disks on which sound and pictures are recorded. The result of this study implies that the type of teaching method and instructional material utilized in the teaching and learning process of History affects students' performances.

The null hypothesis Ho, which states that there is no significant difference between students exposed to Video-assisted instruction and those who were exposed to the conventional method, was rejected. This is because students exposed to video-assisted instruction performed better than those who were not. This result is accepted with the findings of [7] and [8] who said that there is indeed a significant difference between students who were exposed to video-assisted instruction and those who were not.

The population for this study has been defined as higher secondary students of Salem District. To draw a representative sample, it was decided to have One Government and One matriculation and One Aided higher Secondary school. The investigator has selected 130 higher secondary students studying in Salem District of Tamil Nadu.

The investigator contacted and obtained permission from the headmaster of the concern higher secondary schools in Salem District. The willingness and co-operation of the respective teachers are also sought. The data were collected personally by the investigator, from all the 120 higher secondary students, proper instructions were given to the students before starting to fill the questionnaire. Each student was provided with a questionnaire containing a video knowledge test question paper and answer sheet with a personal detail form.

The Research question is what the level of attitude is for history students exposed to Video-assisted instruction and not exposed to Video-assisted instruction (conventional group). Hypotheses are, there is no significant difference between the attitude of higher secondary students taught history subject using video-assisted instruction and those taught using the conventional method.

Hypotheses: 1. There is no significant difference in Video-assisted attitude among Pre and post-test of History students.

Table -1. Analysis of the Tests means scores of students (Test-wise)

Test	Groups	N	Mean	S.D	't' value	p-value
Pre	Control	60	42.89	21.58	0.012 @	0.49522
	Experimental	60	42.94	22.42		
Post	Control	60	46.82	21.18	8.510 *	0.00001
	Experimental	60	76.19	16.31		

(@= No Significant at 0.05 level, * = Significant at 0.05 level)

The above table-1, reveals that the calculated 't' value 0.01 (p=0.49) is lesser than the tabulated value at 0.05 level of significance. So, the hypothesis 'There is no significant difference in Video-assisted Instruction attitude among History students related to pre-test' was accepted. Whereas in the post-test, the calculated 't' value 8.51 (p=0.00001) is greater than the tabulated value at 0.05 level of significance. So, the hypothesis 'There is no significant difference in Video-assisted Instruction attitude among History students related to post-test' was rejected. Hence, there is a significant difference in Video-assisted Instruction attitude among History higher secondary students in Salem district.

Hypotheses: 2 There is no significant difference in Video-assisted instruction attitude among Control and Experimental groups of History students.

Table -2. Analysis of the Tests means scores of students (Group-wise)

Groups	Tests	N	Mean	S.D	't' value	p-value
Control	Pre-Test	60	42.89	21.58	0.494 @	0.3111
	Post-Test	60	44,82	21.18		
Experimental	Pre-Test	60	42.94	22.42	9.289 *	0.00001
	Post-Test	60	76.19	16.31		

(@= No Significant at 0.05 level, * = Significant at 0.05 level)

The above table-2, reveals that the calculated 't' value 0.49 (p=0.31) is lesser than the tabulated value at 0.05 level of significance. So, the hypothesis 'There is no significant difference in Video-assisted instruction attitude among History students related to control group' was accepted. Whereas in the experimental group, the calculated 't' value 9.29 (p=0.00001) is greater than the tabulated value at 0.05 level of significance. So, the hypothesis 'There is no significant difference in Video-assisted instruction attitude among History students related to the experimental group was rejected. Hence, there is a significant difference in Video-assisted instruction attitude among History higher secondary students in the Salem district in the experimental group proved the level of this Video-assisted instruction.

FINDINGS OF THE STUDY

There is a significant difference in Video-assisted instruction attitudes among History students in post-test (Vide table 1). ('t' value =8.51). There is a significant difference in Video-assisted instruction attitude among the control and experimental groups of higher secondary students (Vide table 2). ('t' value =9.29). The limitations of the study are, the study has been restricted only to the higher secondary students studying in Salem and it includes a sample size of 120 higher secondary students only. Suggestions for Further Research are as follows; this study was confined to only Salem District higher secondary schools only; the same study may be conducted

at Tamil Nadu State level in the future; this study may be extended to the DIET students and B.Ed Students at various levels in Government and non- governmental institutions.

ADVANTAGES OF VIDEO-ASSISTED LEARNING

Video-assisted instruction's advantages in education have been observed [5]; Provides students individual learning with their learning speed and their perception and doesn't bore student; By composing music, using colors, movements, and diagrams, it provides students the chance to have real-life experiences; As it has the talent of keeping a record it makes self-learning easier and provides the chance to observe the progress of the students, and it provides the teacher the opportunity to keep all the students under control in terms of education and it broadens productivity and provides effective learning.

DISCUSSIONS OF THE STUDY

This investigation was based upon the effectiveness of Video-assisted instruction compared to conventional teaching methods such as lectures and questioning for higher secondary school learners. According to the education level of the students used in the research when the frequency and percentage values are taken into consideration, it was observed that VAI is more effective for higher secondary level students.

The study by [8] studied computer-based video games to facilitate children's cognitive learning and they found out, computer-based video game playing not only improves participants' recall processes (F= 5.288) but also promotes problem-solving skills by recognizing multiple solutions for problems (F= 5.656). Challenges to Video-assisted learning are (i) Concerns about time; (ii) Concerns about trustworthy content and (iii) Concerns about safety.

An also supported the results obtained by [1] whose findings indicated that utilization of video in teaching and learning is as effective as a conventional teaching method for nursing students. The use of video in education has always been positive, especially physics and chemistry, but does not produce tangible effects in languages and literature [9]. Several unique advantages for understanding classroom activity have been attributed to video [10]. It has been stated that classrooms are complex environments and instruction is also complex, but the video could help surmount this problem [6].

According to Education, over 94% of teachers have effectively used video in a given academic year to aid teaching in their classrooms [9]. It has been noted that in some learning and teaching processes, video can be as good as an instructor in demonstrating procedures to students to enhance their understanding of complex clinical or mechanical procedures as many times as they need to view it [3]. More so, not only has video enhances classroom learning, but it can significantly help in research work. Video affords the teachers certain advantages over live observation of research lessons in terms of repeated viewing [11]. However, students' learning from the video is greatly increased when appropriate principles are purposefully and utilized [8].

CONCLUSION

From this study, it's no secret that video is everywhere in today's world, with the average eight–18-year-old consuming 6–9 hours of digital media each day and 71% of three–18-year-olds accessing and using the internet at home. With 92% of students and 83% of teachers reporting that videos have a positive impact on their classroom experiences, there's no denying that videos are being used for teaching more than ever in today's classrooms. Hence, the investigators concluded that the higher secondary students are having Video-assisted instruction attitude is enough and they need more future technological devices utility in classrooms. If we would like to utilize the benefits that video can bring to the classroom and are considering using the platform within lessons, Video-assisted learning is for us.

RECOMMENDATIONS

Based on the findings of this study, it is recommended that; Video-assisted instruction as a method of teaching should be included in the higher secondary History curriculum to improve students' performance; (b) Curriculum planners should engage Educational technologists to develop Video-assisted instructional packages on topics in the History curriculum to aid teaching and learning in our higher secondary schools, and (c) Universities and Colleges of education bodies should organize workshops and seminars to train History teachers on the use of Video-assisted instruction to keep them abreast with modern innovative teaching strategies.

Video-assisted instruction can be used as a teaching tool provided that the speed of narration of the storyboard has to be regulated to the speed of the mental processing of the pupils. Several factors have to be considered about video-viewing like expose pupils to viewing English Science videos to attune pupils to the use of it. The speed in the conversation and dubbing must be regulated or adjusted to Filipino pupils. Use more authored videos on various topics so that the Filipino pupils can cope with the English language used. Whereby, the author recommends expanding the scope of the study so that there can be adequate proof to support the results. A co relational study between the pupils' attitude towards the Video-assisted instruction and the lecture method is suggested. It is highly recommended that several trials should be made to compare the effectiveness of using videos in other countries and the Philippines and highly recommended that lower sections will be used as respondents to compare which of the two methods will work for the fast and low-performing groups. Lastly, it is recommended that Video-assisted instruction will be compared with other innovative tools in teaching.

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Impact of Parental Involvement in Training Social Skills to Children with Multiple Disabilities

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ABSTRACT--*Multiple Disabilities means as an individual having two or more than two types of disabilities in which required more attention and support in education programming. It is also called double disabilities or complex disability in various occasions. The purpose of the study is to investigate the social skill deficits in children with multiple disabilities and their effect of parental involvement in training social skills. Sixty parents and their children selected for this study with purposive sampling technique. The investigator used adapted functional assessment checklist to measure the independencies in social skills of children with multiple disabilities and parental involvement questionnaire to measure their involvement in training social skills whether no, low, moderate and high. The results found that there is a significant difference in social skills and their parental involvement in training. Parental involvement is extremely important to the ultimate success of their child's program.*

Key words-- *Multiple disabilities, Social skills, Parental involvement*

I. INTRODUCTION

Multiple Disabilities means more than one type of disabilities including deaf blindness, which means a condition in which a person may have combination of hearing and visual impairments causing severe communication, developmental, and educational problems (RPWD Act, 2016). In children with special needs that to a child with multiple disabilities affected with social skills that will impact the whole family due to isolation, poor or no speech, mobility difficulties etc.

Children with multiple disabilities have problems in social skills. They may have poor attention, concentration, lack of initiatives, poor communication skills, unable to follow the social situation and fail to understand the situations, etc. The limitations made their parents to, not to involve them in any of socialization activities other than their schools.

Multiple disabilities like cerebral palsy with additional disabilities and autism spectrum disorder with intellectual disabilities may find difficulty in sharing their enjoyment through the socialization due to their disabilities. Children with cerebral palsy due to their muscle tone they may find difficult to do social smile, extend their arm for to say hello to people, poor speech and communication skills make them more stress. Children with autism spectrum disorder also have problem in mingling with peers and others due to their poor socialization skills.

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Social skill deficits and consequent peer rejection during childhood can affect quality of life in many ways (Cappadocia & Weiss, 2010).

Children with autism spectrum disorder misunderstood by parents and members in the community due to their psychosocial behaviours and their inappropriate social regulated behaviour that they perceived as behaviour problems. The behaviour in which exhibited by mostly socialization related issues, and it is misinterpreted by parents and the caregivers.

Socialization is a tool to exchange information between people in a situation where one can understand his/ her roles. Socialization is the process of connecting to people and their environment when one struggles to maintain he or she may be loose his own social interaction. Social interaction makes the child enjoy, share, create funs, make friendships, build good relationships, develop communication opportunities, provide opportunities to learn to behave appropriately with their peers and adults. If social skills affected in children that will leads to failure in mingling with people, sharing thoughts, playing and making friendships, maintaining relationship, participate cooperatively in community and home.

Laugeson E.A, et al., (2012) examined the efficacy and durability of the peers program for high functioning adolescents with autism spectrum disorders of age group 12 to 17 years participated from twenty-eight middle schools with a parents assisted social skills group intervention. The study evidenced that who has received the peers program significantly improved their social skills in the area of communication, cognition, awareness, motivation, assertion, cooperation and responsibility and when there is decreased autistic tendencies there is an increasing peer interaction, friendships skills were found.

Sahoo, R, Rege S & Rao S (2018) states to identify the level of motor impairment and their social participation among children with cerebral palsy. There are 80 participants were recruited in the age range of 6- 12 years through convenient sampling technique. There are two groups like low and high severity with 40 males and 46 females of parents of children with cerebral palsy. The results revealed that children with cerebral palsy had limited social participation according to their severity of motor impairment in different context and activities.

Raynolds (1992) indicated that parental involvement as “any interaction between a parent and child that may contribute to the children development or direct parent perception with a child’s school in the interest of the child. Social skill deficits also affect interactions with family (Rao, Beidel, & Murray, 2008) and can play a critical role in successful social, emotional, and cognitive development (Bellini et al., 2007). The development of social skills lays a critical foundation for later academic achievement as well as work-related skills (McClelland & Morrison, 2003).

The well- researched paradigm of social learning theory (Bandura, 1977), social skills training programs utilize a wide variety of procedures; such as instructions, modelling, behavioral rehearsal, role playing, reinforcement, cueing, shaping and feedback. Social skill training programs aimed at modifying student interpersonal behaviors with peers and adults. Parent involvement and appropriate training make a difference in children. Stein and Kendall (2004), also recommend that caregivers redirect children toward more appropriate behaviours and teach them coping strategies. High level of parent’s interest during the child’s first years facilitates the commitment and involvement necessary for successful intervention (Bronfenbrenner, 1974). Therefore, the need for the study is to find out the social skill deficits in children with multiple disabilities and their parental involvement in training them appropriately in home and school environment.

Need for the study

Social skills are necessary to build relationship with others in the community. These skills developed through structured and unstructured environment. Social skills learned through verbal and nonverbally, set of skills that require maintaining good relationship, interacting with others, sharing ideas and views. Parental involvement equally important with teacher, parents' role in developing social skills is big challenge and to make their children to interact better with their peers, motivate to participate any group discussion, and building confidence. The investigator tries to find out the social skills and the impact of parental involvement in children with multiple disabilities for training appropriately.

Objective of the Study

1. To find out the level social skills in children with multiple disabilities
2. To find out the level of parental involvement and their impact in social skills

II. METHOD

Participants

Sixty parents (3 males and 57 females) and their children with multiple disabilities (41 males and 19 females) selected for the study using purposive sampling technique. Children age range from 6-19 years studying from primary level to prevocational level were participated.

Tools

Parental involvement Questionnaire (PIQ)

The parental involvement questionnaire developed in both English and Tamil based on the parameters of involvement in relation to parental aspects like regularity of training, time spend for training, concentration on training and professionally training their children to achieve their social skills. The content validity of the questionnaire was done by ten professionals working in the field of multiple disabilities at national institute. The questionnaire was rated like highly, moderately, low and no with numerical coding of 3, 2, 1 and 0.

Adapted Functional Assessment Checklist

The present level skill functioning was assessed with adapted functional checklist for measuring social skills in children. The skills was selected from standardized scales based on the developmental milestones to measure upto nineteen years and the individual skills validated by ten professionals working in the field of multiple disabilities. The adapted functional checklist has fifty items on social skills with their developmental age starting from one month to adulthood and the inter-rated reliability score is 84.6 with split half method.

Development of training manual on Social Skills

Based on the assessment report the investigator found the need for developing training manual for them to train their children. A manual developed with task analysis and pictorial illustration based on the developmental milestones included in the functional assessment checklist for training their children social skills through their parents. The manual was developed in both English and Tamil with systematic instruction and material adaptation.

Development of training module for parents training

The investigator developed a training module for training them on how to use the manual and home training methods for their children. The training was conducted weekly thrice for a period of three-month duration on handling children with multiple disabilities. The training module contended with objective, components of target skills, principles and strategies of teaching, individual skills with pictorial illustration and task analysis, method, materials, instructions and evaluation methods. The investigator used lecture method for training the parents with power point presentation, demonstration, modeling and videos.

Procedure

Written consent was obtained from the parents before the data collection. Face to face, interview was done to collect data in a quiet room. The investigator assessed the parental involvement with the help of parental involvement questionnaire, children present level performance assessed with the adapted functional assessment checklist. Parents were instructed to evaluate their involvement on training their children social skills, like social interaction, communication, listening, play, peer relationships and friendship, problem solving, behaviour management, and health and safety skills.

Their involvement was rated with three-point scale coded by 0,1,2,3 as no, low, moderate and high involvements in extending their help on regularly, concentrating, time spend, and professionally helping. Based on the assessment, investigator gave training in a weekly three days for a period of three months through lecture method with power point presentation and demonstration using different prompts and teaching methods. After three months of training, the investigator reassessed the involvement of parents on training their children and children performance.

III. RESULTS AND DISCUSSION

The purpose of the study is to investigate the social skill deficits in children with multiple disabilities and their effect on parental involvement in training social skills. The results of the present study analyzed with SPSS version 20. The mean and standard deviation of social skills used in order to determine the pre and post-test social skills performance of children with multiple disabilities.

Table 1: Comparison of Pre and post-test score of social skills in with multiple disabilities

Skill	**Test**	**N**	**Mean**	**SD**	**'t' value**	**S**
Social Skill	**Pre**	60	59.75	21.195	21.836	.000
	Post		73.33	20.994	27.057	

N-Number of children, SD-Standard deviation, S-Significant

The above table shows that the social skills of children with multiple disabilities pre-test mean score 59.75 and post-test mean score 73.33 and the result evidence that there is a significant difference between pre and post-test social skills of multiple disabilities before and after their parental involvement.

Table 2: Comparison of pre and post-test score of parental involvement in social skills of children with multiple disabilities

Domain	Test	N	Mean	SD	't' value	S
Social interaction	**Pre**	60	7.92	3.222	-1.741	.087
	Post		8.88	3.020		
Communication	**Pre**		6.80	3.521	-4.248	.000
	Post		9.07	3.041		
Listening	**Pre**		8.52	3.149	-2.701	.000
	Post		9.67	2.808		
Play	**Pre**		6.77	3.510	-4.018	.000
	Post		9.08	3.044		
Peer Relationship & Friendship	**Pre**		6.88	3.489	-4.240	.000
	Post		9.15	3.007		
Problem Solving	**Pre**		7.47	3.789	-2.964	.004
	Post		8.93	3.517		
Behavior Problems	**Pre**		8.43	3.514	-.697	.488
	Post		8.78	4.154		
Health & Safety	**Pre**		6.97	4.141	-4.337	.000
	Post		9.77	3.154		

N-Number of children, SD-Standard deviation, S-Significant

The above table shows that the pre-test mean score of social interaction, communication, listening, play, peer relationship & friendship, problem solving, behavior problems, and health safety skills were 7.92, 6.80, 8.52, 6.77, 6.88, 7.47, 8.43 and 6.97 and the post-test mean score the same group were 8.88, 9.07,9.67, 9.08, 9.15, 8.93, 8.78 and 9.77 respectively. Results shows that the pre-test and post-test score of communication, listening, play, peer relationship and friendship, problem solving and health and safety skills highly significant and the two social skills including social interaction and behavior problems statistically not significant.

Table 3: shows the pre and post-test mean and standard deviation of parental involvement in social skills of children with multiple disabilities

Group	Test	N	Mean	SD	't' value	S
CP	**Pre**	30	67.83	31.155	4.923	.000
	Post		55.23	32.119		
ASD	**Pre**	30	56.27	15.510	-5.539	
	Post		70.00	18.937		

N-Number of children, SD-Standard deviation, S-Significant

The above table shows that the mean score of pre in cerebral palsy group 67.83 and autism group 56.27 and the post-test mean score of cerebral palsy 55.23 and autism group 70.00. The result shows that there is a significant

difference between the two groups after the parental involvement. It is evidence that the parental involvement equally important in training the social skills at home and school.

Table 4: shows the level of involvement of parents in training social skills of children with multiple disabilities.

Variables	Test	N	Mean	SD	't' value	S
High	**Pre**	60	14.67	10.005	-.694	.491
	Post		15.92	11.037		
Moderate	**Pre**		7.27	7.194	.067	.947
	Post		7.18	8.380		
Low	**Pre**		6.47	7.786	.078	.938
	Post		6.35	8.875		

N-Number of children, SD-Standard deviation, S-Significant

The above table shows the level of parental involvement in training their children social skills. Both pre and post-test score evidence that the mean score differ significantly and the p-value is statistically not significant.

IV. DISCUSSION

The present study conducted to assess the social skills of children with multiple disabilities and their parental involvement in training these social skills. The result of the study evidence that the training module effective and based on the training parents involvement in training the social skills namely social interaction, communication, listening, play, peer relationship and friendship, problem solving, behavior problems, and health and safety skills. Parents highly involved in training all these skills and even the child has severe impairment. The instructional strategies for teaching social skills used such as modelling, role playing, positive reinforcement, practice and rehearsal, incidental teaching, prompting and coaching, self-monitored and self-directed training, cooperative learning, peer tutoring, were help them to initiate and develop their social skills (Randy L. Seevers & Michelle Jones-Blank 2008), John Heffernn (2011). Weiss & Harris (2001) said that social reciprocity and social communication deficits remain prominent issues for high treatment priority. Parents also an important member in the intervention process as proved by many studies, in this study parents as a primary intervention provider to train and evaluate their children independencies.

V. CONCLUSION

Children having multiple disabilities face great difficulty in acquiring personal, social, communication, motor, cognitive and other related skills without extra support from both parents as well as professionals. In order to develop their potential, these children with special needs require more support services beyond those that are considered most important for the development of their same age peers. If the problem is identified early and they benefit maximum in rehabilitation by professional and parental collaborative program. The Family involvement is extremely important to the ultimate success of their child's program, because they know better about their child.

The study also reveals that the parent involvement increased after the training program highly in social interaction, health and safety, behavior management, problem solving, play, listening, communication, peer relationship and friendship skills and before the training the involvement were identified in responses no and low involvement. The study concludes that parental involvement increases always, even though if the child's severity and associated condition is more the involvement considerably increased. So parents should be trained enough to handle their children effectively in social skills and community participation.

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AWARENESS OF INSTRUCTIONAL FACILITIES IN INCLUSIVE SCHOOL FOR SPECIAL NEEDS STUDENTS IN SALEM DISTRICT

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Abstract

Inclusive education is not a marginal issue but is central to the advancement of high quality education for all learners and the development of more inclusive societies. All childrenhave the Right to Education regardless of their disability, gender, race and nationality. To achieve Universalization of education, inclusive education is one of the most innovative approaches the educating the children with disability with normal students under the same roof. Today Government provides much Awareness programmes for instructional facilities, but does not reach all the students. Educated pupils and urban citizens are knows about these programmes. But rural students are unaware and they lose many educational provisions. It is useful to know about instructional facilities of higher education students. It develop the students' knowledge and motivate the students to get many more idea about the school level students.The present investigation aims at investigating the instructional facilities among the inclusive school for special needs students. The sample consistsof 303 special needs students. Survey method was adopted for this study. The data were analyzed by descriptive and differential analyses.The major finding of this study reveals that the special school students have high level of availability of resources in special school for special needs students in Salem district. It is inferred that the inclusive school students have average level of availability of resources in inclusive school for special needs students in Salem district.

Key Words: Inclusive education, Special needs students, Instructional facilities.

INTRODUCTION

Inclusive education means welcoming all children with and without discrimination, into regular or ordinary schools. It refers to the process of educating all children in their

neighbourhood school, regardless of the nature of their disabilities. Students participating in an inclusion programme follow the same schedule as the classmate and participate in age appropriate academic classes. Inclusion provides the appropriate support for everyone involved in the inclusion process. Friendship between students with and without disabilities becomes a possibility in a school that accepts inclusion students. The following list attempts to detail some of the general advantages commonly associated with learning for all mission.

NEED AND IMPORTANCE OF THE STUDY

- Awareness programme are very important to develop the special needs students.
- It will assist the students to know about the Government programmes for their development and it enhances the students curiosity for higher studies.
- It will be more helpful to the students to reduce their students' education level.
- The study provides more awareness regarding programmes at school level studies.
- It improves the literacy rate in the country.

OBJECTIVES OF THE STUDY

- To find out the level of awareness of instructional facilities in inclusive school for special needs students in Salem district.
- To find out the significant differences if any in awareness of instructional facilities in inclusive school for special needs students in Salem district due to variations in the
  - Gender (Boys/Girls)
  - Class (VIII/IX/X)
  - Management of School (Government/ Aided/Private)
  - Residence of School (Rural/urban)
  - Locality of Students (Rural/urban)
  - Medium of the Study (Tamil/English)
  - Type of School (Boys/Girls/Co-education)
  - Type of Disabilities (Hearing Impaired/Orthopedically Impaired/Visually Impaired)

HYPOTHESES OF THE STUDY

- Awareness of instructional facilities in inclusive school for special needs students in Salem district is high.
- There is no significant difference between and among the awareness of instructional facilities in inclusive school for special needs students in Salem district based on the following demographic variables,
  - Gender (Boys/Girls)

- Class (VIII/IX/X)
- Management of School (Government/ Aided/Private)
- Residence of School (Rural/urban)
- Locality of Students (Rural/urban)
- Medium of the Study (Tamil/English)
- Type of School (Boys/Girls/Co-education)
- Type of Disabilities (Hearing Impaired/Orthopedically Impaired/Visually Impaired)

METHODOLOGY OF THIS STUDY

Method: Normative survey method was adopted for the study.

Sample: The investigator used purposive sampling technique for selecting the sample from the population. For the present study the researcher selected **303**(Boys- 153 and Girls-150) VIIIth, IXth and Xthstandard special needs students in inclusive schools Salem District of Tamil Nadu, India.

Tool Used: The tool used to find the inclusive school special needs students in Salem district which contains 50awareness of the instructional facilities in special needs students. Reliability of the awareness of the instructional facilities in special needs students (0.78). Validity of the awareness of the instructional facilities in special needs students'questionnaire was validated of the special school teachers.

ANALYSIS AND INTERPRETATION OF DATA

HYPOTHESIS-1

Awareness of instructional facilities in inclusive school for special needs students in Salem district is high.

Table No: 1

Mean score of awareness of instructional facilities in inclusive school for special needs students

Maximum Score:50

S. No.	VARIABLES		SAMPLE (N)	MEAN	SD
1	**GENDER**	Boys	153	37.43	8.83
		Girls	150	38.58	6.49
2	**CLASS**	VIII	120	38.05	7.90
		IX	89	36.83	7.60
		X	94	39.04	7.70

3	**MANAGEMENT OF SCHOOL**	Government	217	37.53	8.28
		Aided	45	40.33	7.44
		Private	41	37.92	4.14
4	**RESIDENCE OF THE SCHOOL**	Urban	133	38.39	6.82
		Rural	170	37.70	8.45
5	**LOCALITY OF STUDENTS**	Urban	167	38.38	7.85
		Rural	136	37.52	7.67
6	**MEDIUM OF THE STUDY**	Tamil	244	37.80	8.27
		English	59	38.83	5.20
7	**TYPE OF SCHOOL**	Boys	61	37.08	10.06
		Girls	65	38.15	7.90
		Co-education	177	38.26	6.78
8	**TYPE OF DISABILITIES**	Hearing	103	36.86	9.01
		Orthopedically	117	39.81	6.20
		Visually	83	36.86	7.70
Over All Mean			**303**	38.06	7.51

According to the above table (1) shows that the mean and standard deviation of demographic variable is 38.06 and 7.51 respectively. It is inferred that the special needs students have above average awareness of instructional facilities in inclusive school for special needs students in Salem district. From the table revealed that the gender wise analysis, thegirls students (38.58) are higher than the boys students (37.43) on awareness of instructional facilities in inclusive school for special needs students in Salem district. Based on the Residence of school the urban school students (38.39) are better than the rural school students (37.70),the locality of students, the locale of urban students (38.38) are better than the locale of rural school students (37.52), medium of the study wise analysis English medium students (38.83) are better than the Tamil medium students (37.80) on awareness of instructional facilities in inclusive school for special needs students in Salem district. Based on the class wise analysis revealed that the X school students (39.04) are higher than the VIII students (38.05) and IX students (36.83), Management of school wise analysis Aided school students (40.33) are better than Private school students (37.92) and Government school students (37.53), Type of school wise analysis Co-education school students (38.26) are higher than Girls school students (38.15) and Boys school students (37.08), Type of disabled

wise analysis revealed that the orthopedically impaired students (39.81) are greater than the hearing impaired students (36.86)and visually impaired students (36.86) on awareness of instructional facilities in inclusive school for special needs students in Salem district.

HYPOTHESIS-2

There is no significant difference between the awareness of instructional facilities in inclusive school for special needs students in Salem district based on the following demographic variables,Gender,Residence of School, Locality of Students and Medium of the Study.

Table No: 2

t value of demographic variables of awareness of instructional facilities in inclusive school for special needs students

S. No.	VARIABLES		SAMPLE (N)	MEAN	SD	't' value	P-value
1	GENDER	Boys	153	37.43	8.83	1.28	0.61 (NS)
		Girls	150	38.58	6.49		
2	RESIDENCE OF THE SCHOOL	Urban	133	38.39	6.82	0.96	0.82 (NS)
		Rural	170	37.70	8.45		
3	LOCALITY OF STUDENTS	Urban	167	38.38	7.85	0.78	0.41 (NS)
		Rural	136	37.52	7.67		
4	MEDIUM OF THE STUDY	Tamil	244	37.80	8.27	1.19	0.31 (NS)
		English	59	38.83	5.20		

* = Not significant at 0.05 level.

It is inferred from the table (2) the calculated 't' value of gender (1.28), residence of the school (0.96), locality of students (0.78)andmedium of the study (1.19) are less than table value 1.98 at 0.05 level of significance.It is concluded that there is no significant difference in the awareness of instructional facilities in inclusive school for special needs students in Salem district. Hence the null hypothesis is accepted at 5% level of significance.

HYPOTHESIS-3

There is no significant difference between the awareness of instructional facilities in inclusive school for special needs students in Salem district based on the following

demographic variables Class, Management of School, Type of School and Type of Disabilities.

Table No: 3

F value of demographic variables of availability of resources in special school for special needsstudents

S. No.	VARIABLES		SAMPLE (N)	MEAN	SD	F value	P-value
1	**CLASS**	VIII	120	38.05	7.90	1.86	0.15 **(NS)**
		IX	89	36.83	7.60		
		X	94	39.04	7.70		
2	**MANAGEMENT OF SCHOOL**	Government	217	37.53	8.28	2.44	0.84 **(NS)**
		Aided	45	40.33	7.44		
		Private	41	37.92	4.14		
3	**TYPE OF SCHOOL**	Boys	61	37.08	10.06	0.54	0.58 **(NS)**
		Girls	65	38.15	7.90		
		Co-education	177	38.26	6.78		
4	**TYPE OF DISABILITIES**	Hearing	103	36.86	9.01	5.30	0.00 **(S)**
		Orthopedically	117	39.81	6.20		
		Visually	83	36.86	7.70		

* = Not significant at 0.05 level.

The calculated ‘F’ value of class (1.86), management of school (2.44) and type of school (0.54) lesser than table value 2.99 at 0.05 % level of significance. Therefore, it is concluded that there is no significant difference in the awareness of instructional facilities in inclusive school for special needs students in Salem district. Hence calculated ‘F’ value of type of disabilities (5.30) greater than table value 2.99 at 0.05 % level of significance. Therefore, it is concluded that there is significant difference in the awareness of instructional facilities in inclusive school for special needs students in Salem district.

FINDINDS OF THE STUDY

- **H.1:**The special needs students have above average awareness of instructional facilities in inclusive school for special needs students in Salem district.

- **H.2:**There is no significant difference in the awareness of instructional facilities in inclusive school for special needs students in Salem district with respect to the gender, residence of the school and locality of students and medium of the study.
- **H.3:** There is no significant difference in the class wise analysis, management of the school and type of school in the awareness of instructional facilities in inclusive school for special needs students in Salem districtand there is significant difference in the type of disabilities in the awareness of instructional facilities in inclusive school for special needs students in Salem district.

EDUCATIONAL IMPLICATIONS

- Awareness on various facilities to the special needs students should to be introduced and made to use by the authorities right from the school level.
- The lessons regarding instructional facilities may be placed as compulsory in the student's text books at school level.
- Programmes may be organized with in the school campus to create awareness about instructional facilities among the students.
- Field visit may be arranged to special education schools.
- It enables the students to know about the instructional facilities.
- It increases special needs students enrolment in higher education at school levels.
- Awareness helps to increase the literacy rate among the special needs students in the society.

CONCLUSION

The study reveals that the level of "Awareness of instructional facilities in inclusive school for special needs students in Salem district" is above average level. An ailment for human illness requires high economical expenditure. Majority of India people have less awareness about their physiology and illness and people are very high much misguided by various forms of instructional facilities. This study interestingly revealed that girls'students have more awareness on "Awareness of instructional facilities in inclusive school for special needs students in Salem district". Use of print, electronic media and information technology for public awareness programmes specifically arousing "Awareness of instructional facilities in inclusive school for special needs students in Salem district" among school and college students through the introduction topic on instructional facility. The teachers have a very important role in training the school students in the instructional facilities. So this is right time for curriculum instructional facilities introduced to include as a part of syllabus.

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IN GOOD HANDS

In the hands of a gifted teacher
a classroom is a magical place
In the hands of a gifted teacher
There's a smile on each child's face
In the Hands of a Gifted Teacher
Creative Energy is Everywhere
In the Hands of a Gifted Teacher
There's a Catalyst two Genuinely Cares
In the Hands of a Gifted Teacher
Desire and Wonder is Awakened
In the Hands of a Gifted Teacher
The Educational Agenda is shaken
In the Hands a Gifted Teacher
Self-Management Skills are Modeled
In the Hands of a Gifted Teacher
The Best of Reality is Bottled
In the Hands of a Gifted Teacher
Gifts and Talents are Refined
In the Hands of a Gifted Teacher
The Willed Future is Designed

- Ultimate Cyan.

Editorial for RRE – Jan – Mar 2020.

Dear Readers! Greetings from SXCE, the oldest portal of Teacher Education of Southern Tamilnadu.

Happy to share that our institution is celebrating the completion of seventy years of existence; it is celebrating its 70th year of service to the society at large. One of the major supporting pillars and the nerve center of any academic institution is the well-equipped and spacious Library which could accommodate more than the sufficient number of books and journals along with , in the context of 21st century, a well-networked learning resources. It is pertinent to raise a question here, whether the traditional library has its place in the modern educational curriculum or the library has failed in evoking a right response from the modern readers who seem to be leaning on internet-loaded contents.

After the advent of computers, the nature and functions of the academic libraries have changed a lot; no more the books borrowed and pages turned by the students rather they occupy the chairs in front of the computers and spend hours and hours in browsing. Today's libraries, named as digital libraries housing more electronic resources, are bounded by networked data that is connected to a vast ocean of Internet-based service (Mahajan, 2005). Students seem to be accessing more information for their academic requirements though it is also complained, that they are inclined to reproduce the content without following the ethical regulations. There is also a major complaint about the quality and originality of the content that are uploaded by individuals, which means the critical awareness and inquisitive thinking become the fundamental requisites of a reader.

While appreciating the potentials of electronic resources for gratifying the needs of academicians, a hue and cry is also raised from the learned persons about the dwindling habit of reading hard books. Remember, reading makes the man in all the ways, including the qualities of patience, concentration, acquisition of new knowledge etc.; this is true with soft (e-book) reading whereas the reading of hard-book has some more advantages. Firstly, the student will be at ease with book, not strained but sufficiently lighted with nature that makes him or her in a comfortable position in contrast to computers or any other electronic gadgets which will take away the physical flexibility and make their eyes and whole physiques tiring. This physical discomfort will disturb the mind and thus the thought process is hampered. No more questioning but only swallowing the matters without understanding. With electronic resources, there is a tendency to immediately copy and own the writing whereas in hard-reading, the reader mulls over the matter, accommodates and constructs a new knowledge. The hard-reading of books helps the reader in time management and personal habits; the reader cherishes the activity and learns to make notes of his reading. Today more concerns are raised by the librarians and the senior Professors about the decreasing reading activity. A clarion call comes from the parents and elderly people who were fortunate to have public libraries in their dwelling places for reading books say, 'Unread man becomes uncivilized'. It is an urgent task before us is to create an interest among prospective teachers to read books in the library along with the balanced usage of internet.

In this issue of RRE, we have researches on adolescents, soft skills, tribal education and right to education . Another paper on parental involvement in training the children is widely discussed. Have a wonderful reading and share your insights with others.

Thanking you. Editorial Team.

With Regards
Editorial Board

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LEVEL OF AWARENESS AMONG THE UNDERGRADUATE STUDENTS ON THE SOFT SKILLS FOR EMPLOYMENT IN THE GLOBALISED WORLD

Research Paper

ABSTRACT

The challenges of globalisation in the contemporary period make the institutions of higher education strive hard to create employable graduates as productive human capital. In India the rate of under-employme and unemployment of graduates keeps on increasing because the academic and technical skills provided such educational institutions are not sufficient to fulfil the demands of the workforce; more, hard-skills alo do not guarantee future job perspectives of undergraduate students. The recent review of literatures vivi reflects that the lack of soft skills is one of the major causes for unemployment and under-employment of graduates. In this context, a survey was conducted to find out the level of awareness of the undergradu students on soft skills such as time management, communication, interpersonal teamwork, work ethics, digi literacy, crisis management, emotional intelligence, and human resource management. 450 undergradu students from three degree colleges in Bangalore were selected as sample, by simple random sampling meth The findings of the study revealed that the awareness of undergraduate students on soft skills was low.

Keywords: Soft skills, Employability, Unemployment of graduates, Awareness level.

Introduction

The competitive globalised world poses numerous challenges to the job-seeking undergraduate students passing through the portals of various colleges and universities. The global working environment prefers undergraduates with blended knowledge of technical expertise with soft skills. The soft skills training will develop the relationship level of the leaders at various levels of the organization (Pereira & Costa, 2017). Since the globalisation challenges affect all sectors including education, the employability program should be focused on the soft skills required for the job with a contextual approach (Aida, Norails; Rozaini, 2015). The increasing demands of the globalised economy insist that institutions of higher education must empower the undergraduates with soft skills (Gibb Stephen, 2014). In India quite a few of the undergraduates suffer from unemployment and under-employment mainly due to the absence of soft skills. In the year 2015, the first integrated national policy for skills development and entrepreneurship was announced in India. This research paper is an attempt to study the awareness of undergraduate students on soft skills.

Review of Literature

The descriptive study of Sunita Mangla (20 assessed the challenges and reasons for unemployment it revealed two major reasons, namely, the outda curriculum with outmoded pedagogy and lack of knowle of soft skills. Vanitha and Jaganathan (2018) analysed gap between the employability perceived by the emplo and the skills actually possessed by the students. The st of Selvi, Anitha, and Padmini (2018) focused employability of engineering students and on enhancer of employability opportunities and skills, while conceptual paper of Santhi (2018) suggested some teac methods such as lectures, case study in order to enh the employability skills of the students. Jagdish Pr (2017) made an exploratory research based or secondary data related to Make-in-India program c

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Government of India announced in 2014. It revealed that the future course of action to reduce the gap between demands of skills required and existing skills. Muralidhar Reddy and Hanuman Kennedy (2017) conducted a survey to find out the perception of the employers on employability skills. The employability program of the graduates must focus on the soft skills needed for the job with a contextual approach since globalised challenges are affecting all the sectors including education (Aida, Norails and Rozaini, 2015). Esa, Ahmad; Padil, Suhaili; Selamat, Asri; Idris, Mohammad Talha Mohamed (2015) revealed that knowledge of soft skills was very relevant in the job market. The technical graduates and polytechnic graduates were expert in technical skills but lack far behind in the soft skills needed for employment (Mahesh Kumar; Santhosh Kumar, 2015). .

Purpose of the Study

Every year higher education institutions in India attempt to enhance the quality of graduation study to create productive human capital in the society. The existing graduate education lacks to guarantee employment opportunities, sustainability, and growth in the competitive job market. The literature review of recent years reveals the fact that the awareness level of the undergraduate students regarding soft skills is not high to compete in the job market. In the globalised context, employers demand graduate students with soft skills along with their regular graduate education. This research paper, aims to study the awareness level of undergraduate students on to soft skills needed for employability in the globalised world.

Limitations of the study

1. This study is limited to undergraduate students only.
2. The investigator has selected only 15 soft skills for his study.
3. The sample of the study is restricted to 450 undergraduate students.
4. The area of the study is limited only to the three colleges situated in Bengaluru.

Objectives of the study

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To find out the level of awareness on soft skills of undergraduate students.

Hypothesis

The level of awareness of the under graduate students on soft skills is moderate.

The research question of the study

Do the undergraduate students have the awareness of soft skills for employability in the globalised world?

Methodology

The researcher has used survey method to find out the awareness level of undergraduate students on soft skills needed for employability in the globalised world. The total sample of 450 undergraduate students were selected from three degree colleges situated in Bengaluru using simple random sampling technique.

Tools of data collection

The awareness of soft skills of the undergraduate students was measured by a questionnaire with three options. The questionnaire comprises questions on 15 soft skills: Leadership skill, Time management skill, Decision making skill, Communication skill, Digital literacy skill, Employability skill, Crisis management skill, Work ethics skill, Goal setting skill, Teamwork skill, Presentation skill, Human resource management skill, Creativity skill, Inter-personal and Emotional intelligence skills. The content validity was affirmed in consultation with experts. The suggestions given by the experts were carried out by modifying a few items in the questionnaire. The final tool had 75 questions and it was administered conveniently to 450 undergraduate students from three degree colleges in Bengaluru. The reliability was established using split half reliability test and the reliability coefficient was found to be 72.63. The secondary data includes journals and internet materials, related to soft skills and employability in globalisation.

Analysis of the Data

Level of soft skills among the undergraduate students

Table 1
Level of Awareness on soft skills among the undergraduate students

Soft Skills	Low		Moderate		High	
	N	%	N	%	N	%
Leadership skills / Qualities	325	72	117	26	8	2
Time Management Skill	302	67	138	31	10	2
Decision Making Skill	347	77	98	22	5	1
Communication Skill	338	75	106	24	6	1
Digital Literacy Skill	308	68	132	29	10	2
Employability Skill	305	68	136	30	9	2
Crisis / Disaster Management Skill	369	82	78	17	3	1
Work Ethics Skills	367	82	81	18	2	0
Goal Setting Skill	323	72	104	23	23	5
Team Work Skill	360	80	79	18	11	2
Presentation Skill	339	75	108	24	3	1
Human Resource Management Skill	352	78	94	21	4	1
Creativity Skill	344	76	101	22	5	1
Inter-Personal Skill	308	68	135	30	7	2

The table 1 above shows that 72% have low level Leadership skill, 67% have low level Time Management Skill, 77% have low level Decision Making Skill, 75% have low level Communication Skill, 68% have low level Digital Literacy Skill, 68% have low level Employability Skill, 82% have low level Crisis / Disaster Management Skill, 82% have low level Work Ethics Skill, 72% have low level Goal Setting Skill, 80% have low level Team Work Skill, 75% have low level Presentation Skill, 78% have low level Human Resource Management Skill, 76% have low level Creativity Skill, 68% have low level Inter-Personal Skill, and 74 %have low level Emotional Intelligence Skill. Hence it is concluded that the majority of the undergraduate students have a low level awareness on soft skills.

Discussion

The review of literature, such as the studies of Sunita Mangla (2018), Vanitha and Jaganathan (2018), Jagdish Prasad (2017), Anbuthambi, Chandrashekaram (2017) revealed that the soft skills for employability under globalisation clearly point out the lack of awareness on soft skills. The present survey also proves that the majority students have low level awareness on soft skills. The lack of awareness of soft skills is one of the major reasons for unemployment and under-employment that affect their future life skills and thus fail to contribute to the national econor

Research Paper

Suggestions and educational implications

1. The awareness level of the undergraduates require be increased through a revised curriculum or addir paper on soft skills as one of the electives.
2. Soft skills training program must be implemen blending with academic and technical education of undergraduates.
3. Organizing and arranging seminars, conferenc workshops related to soft skills may help undergraduate students to update their awareness le on soft skills which would pave a smooth way for th employability.

Conclusion

In the present context, the Higher Educati Institutions (HEI) are recommended to involve and inter with employers in the preparation and implementation soft skills development training to make it more effect and productive. Moreover, HEIs as effective agents national development are expected to enhance undergraduate students' soft skills so as to make th contributors to Indian economy. The impact of soft skill immense and further research in this regard will make soft skills training even more vast and practical.

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Research Paper

MULTIPHASIC INTERESTS...

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PEER RELATIONSHIP OF SPECIAL NEEDS STUDENTS AN INCLUSIVE EDUCATION SYSTEM

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Abstract

In India because of their own physical and mental special needs students. This students are not developed in the way of education. According to the census rate such type of special needs are more in our country. So the government has to recognize the special needs and frame the educational programmes for special needs students. The Government has identifies two types of educational systems for the special needs students. Those are special education and inclusive education. The mentally retarded, backward students, socially backward students and gifted students also were cone under the category of special education. The education especially given to the special needs students is known as special education. The inclusive education is the educational programmes given to special needs students along with the normal students in normal school. Peer relationship that can contribute to the quality of life of any student especially for special children. Peer relation is the powerful support for the special students in an inclusive education system that can help the student's social development, provide companionship and they can provide feelings of community and social support. Without peer relationship, a student can feel lonely and isolated that cab let into many physiological, psychological and severe emotional problems all these issues affect student's education very particularly their next level improvement. The major finding of this study revealed that the 252 special school students have above high peer relationship of special needs students in inclusive education system in Namakkal district.

Key Words: inclusive education, teaching learning materials, special school.

INTRODUCTION

Inclusive education is a phenomenon that is gaining world-wide focus and attention and has been described as a social movement against in education. It has as its focus, the restructuring of mainstream schools so they are better able to respond to the diversity of all students (UNESCO, 2005). In this regard, inclusive education is not concerned with remediating perceived deficits within students. Nor is it concerned with the integration or assimilation of diverse students into regular schools. Rather, inclusive education is concerned with overcoming the barriers to participation and learning that may be experienced by students,

particularly students have historically been excluded or marginalized from school. A basic premise of inclusive education is that all students belong at school and all students are able to meaningfully participate and learn at school. While inclusive education is concerned with making schools more responsive to all students, disabled students are reported to be the largest group of students excluded and marginalized from quality education in the world today.

NEED AND IMPORTANCE OF THE STUDY

Inclusion in education is an approach to educating students with special educational needs. Under the inclusion model, students with special needs spend most or all of their time with non-disabled students. Peer group relationship is strategy that involves placing students in pairs or in small groups to participate in learning activities that academic instruction and social skills. Peer group relationship provides teachers with learning tool enhance instruction for students with and without disabilities. This study support peer group relationship between the with and without disabilities. Peer group relationship concepts to understand the physical, psychological and emotional feeling of the special needs students to provide with suitable learning climate and increase the self-confident.

OBJECTIVES OF THE STUDY

- To find out the level of peer relationship of special needs students in inclusive education system in Namakkal district.
- To find out the significant differences if any in peer relationship of special needs students in inclusive education system in Namakkal district due to variations in the
  - Gender (Boys/Girls)
  - Class (VIII/IX/X)
  - Management of School (Government/ Aided/Private)
  - Residence of School (Rural/urban)
  - Locality of Students (Rural/urban)
  - Medium of the Study (Tamil/English)
  - Type of School (Boys/Girls/Co-education)
  - Type of Disabilities (Hearing Impaired/Orthopedically Impaired/Visually Impaired)
  - Parental Education (Literate/Illiterate)

HYPOTHESES OF THE STUDY

- Peer relationship of special needs students in inclusive education system in Namakkal district is high.
- There is no significant difference between the peer relationship of special needs students in inclusive education system in Namakkal district based on the following demographic variables,
  - Gender (Boys/Girls)
  - Class (VIII/IX/X)
  - Management of School (Government/ Aided/Private)
  - Residence of School (Rural/urban)

- Locality of Students (Rural/urban)
- Medium of the Study (Tamil/English)
- Type of School (Boys/Girls/Co-education)
- Type of Disabilities (Hearing Impaired/Orthopedically Impaired/Visually Impaired)
- Parental Education (Literate/Illiterate)

METHODOLOGY OF THIS STUDY

Method: Normative survey method is used in this research. The investigator used random sampling techniques for collecting data from the students of standard VIII, IX and X belongs to Namakkal District.

Sample: The study complies 252 samples and they are collected at random from different schools. Samples were drawn from students of standard VIII, IX and X belongs to Namakkal District schools.

Tool Used: The tool used to find the Peer relationship of special needs students in inclusive education system in Namakkal district which contains 252 peer relationships of special needs students. Reliability of the awareness of the instructional facilities in special needs students (0.78). Peer relationship of special needs students in inclusive education system tools were constructed and validated by the investigator with the help of supervisor.

ANALYSIS AND INTERPRETATION OF DATA

HYPOTHESIS-1

Peer relationship of special needs students in inclusive education system in Namakkal district is high.

Table No: 1

Mean score of peer relationship of special needs students in inclusive education system in Namakkal districts

Maximum Score: 50

S. No.	VARIABLES		SAMPLE (N)	MEAN	SD
1	**GENDER**	Boys	119	34.81	3.57
		Girls	133	33.65	3.57
2	**CLASS**	VIII	180	34.27	3.63
		IX	12	33.66	3.77
		X	60	34.08	3.58
3	**MANAGEMENT OF SCHOOL**	Government	146	34.25	3.61
		Aided	46	34.04	3.48
		Private	60	34.20	3.75
4	**RESIDENCE OF THE SCHOOL**	Rural	119	34.84	3.57
		Urban	133	33.65	3.57
5		Rural	222	34.24	3.64

	LOCALITY OF STUDENTS	Urban	30	33.90	3.42
6	**MEDIUM OF THE STUDY**	Tamil	198	34.92	3.64
		English	54	34.00	3.43
7	**TYPE OF SCHOOL**	Boys	83	34.28	3.38
		Girls	85	34.20	3.75
		Co-education	84	34.11	3.73
8	**TYPE OF DISABILITIES**	Hearing	142	33.15	3.60
		Orthopedically	50	33.04	3.47
		Visually	60	33.10	3.74
9	**PARENTAL QUALIFICATION**	Literate	151	34.33	3.62
		Illiterate	111	34.21	3.67
Over All Mean			**252**	34.04	3.59

According to the above table (1) shows that the mean and standard deviation of demographic variable is 34.04 and 3.59 respectively. It is inferred that the special needs students have above high peer relationship of special needs students in inclusive education system in Namakkal district. From the table revealed that the gender wise analysis, the boys students (34.81) are higher than the girls students (33.65) on peer relationship of special needs students in inclusive education system in Namakkal district. Based on the Residence of school the rural school students (34.84) are better than the urban school students (33.65), the locality of students, the locale of rural students (34.24) are better than the locale of urban school students (33.90), medium of the study wise analysis Tamil medium students (34.92) are better than the English medium students (34.00), parental qualification of the students literate parent students (34.33) are higher than illiterate parent student (34.21)on peer relationship of special needs students in inclusive education system in Namakkal district. Based on the class wise analysis revealed that the VIII school students (34.27) are higher than the X students (34.08) and IX students (33.66), Management of school wise analysis Government school students (34.25) are better than Private school students (34.20) and Aided school students (34.04), Type of school wise analysis Boys school students (34.28) are higher than girls school students (34.20) and Coeducation school students (34.11), Type of disabled wise analysis revealed that the Hearing impaired students (33.15) are greater than the visually impaired students (33.10) and orthopedically impaired students (33.04) on peer relationship of special needs students in inclusive education system in Namakkal district.

HYPOTHESIS-2

There is no significant difference between the peer relationship of special needs students in inclusive education system in Namakkal district based on the following demographic variables, Gender, Residence of School, Locality of Students, Medium of the Study and Parental Qualification.

Table No: 2

p value of demographic variables of peer relationship of special needs students in inclusive education system in Namakkal districts

S. No.	VARIABLES		SAMPLE (N)	MEAN	SD	't' value	Result
1	GENDER	Boys	119	34.81	3.57	2.57	0.71 (S)
		Girls	133	33.65	3.57		
2	RESIDENCE OF THE SCHOOL	Rural	119	34.84	3.57	0.51	0.97 (NS)
		Urban	133	33.65	3.57		
3	LOCALITY OF STUDENTS	Rural	222	34.24	3.64	0.51	0.54 (NS)
		Urban	30	33.90	3.42		
4	MEDIUM OF THE STUDY	Tamil	198	34.92	3.64	1.72	0.50 (NS)
		English	54	34.00	3.43		
5	PARENTAL QUALIFICATION	Literate	151	34.33	3.62	1.98	0.51 (S)
		Illiterate	111	34.21	3.67		

* = Not significant at 0.05 level.

It is inferred from the table (2) the calculated't' value of residence of the school (0.51), locality of students (0.51) and medium of study students (1.72) are less than table value 1.98 at 0.05 level of significance.It is concluded that there is no significant difference in the peer relationship of special needs students in inclusive education system in Namakkal district. Hence the null hypothesis is accepted at 5% level of significance. Hence calculated't' value of gender (2.57), parental qualification (1.98) are greater than table value 1.98 at 0.05 level of significance. It is concluded that there is significant difference in the peer relationship of special needs students in inclusive education system in Namakkal district. Hence the null hypothesis is rejected at 5% level of significance.

HYPOTHESIS-3

There is no significant difference between the peer relationship of special needs students in inclusive education system in Namakkal district based on the following demographic variables Class, Management of School, Type of School and Type of Disabilities.

Table No: 3

F value of demographic variables of peer relationship of special needs students in inclusive education system in Namakkal districts

S. No.	VARIABLES		SAMPLE (N)	MEAN	SD	F value	'p' value
1	CLASS	VIII	180	34.27	3.63	2.20	0.81 (NS)
		IX	12	33.66	3.77		
		X	60	34.08	3.58		
2		Government	146	34.25	3.61		0.94

	MANAGEMENT OF SCHOOL	Aided	46	34.04	3.48	3.05	(S)
		Private	60	34.20	3.75		
3	**TYPE OF SCHOOL**	Boys	83	34.28	3.38	3.01	0.85 (S)
		Girls	85	34.20	3.75		
		Co-education	84	34.11	3.73		
4	**TYPE OF DISABILITIES**	Hearing	142	33.15	3.60	3.04	0.08 (S)
		Orthopedically	50	33.04	3.47		
		Visually	60	33.10	3.74		

* = Not significant at 0.05 level.

The above table shows calculated F value of class (2.20) lesser than table value 2.99 at 0.05 % level of significance. Therefore, it is concluded that there is no significant difference in the peer relationship of special needs students in inclusive education system in Namakkal district. Hence calculated F value of Management of school (3.05), type of school (3.01) and type of disabilities (3.04) greater than table value 2.99 at 0.05 % level of significance. Therefore, it is concluded that there is significant difference in the peer relationship of special needs students in inclusive education system in Namakkal district.

FINDINDS OF THE STUDY

- **H.1:** The special needs students have high peer relationship of special needs students in inclusive education system in Namakkal district.
- **H.2:** There is no significant difference in the peer relationship of special needs students in inclusive education system in Namakkal district with respect to the residence of the school, locality of students and medium of the study. There is significant difference in the peer relationship of special needs students in inclusive education system in Namakkal district with respect to the gender and parental qualification.
- **H.3:** There is no significant difference in the class wise analysis in the peer relationship of special needs students in inclusive education system in Namakkal district and there is significant difference in the management of school, type of school and type of disabilities in the peer relationship of special needs students in inclusive education system in Namakkal district.

EDUCATIONAL IMPLICATIONS

Students with special needs faced with the limitations of their special needs in establishing relationship. Special needs students can benefit from involvement in recreational activities, like team work, group discussion, self-confident, self-esteem, educational and employment strategies and sports. Peer group relationship provides a venue for social interaction and social development among the students. This study is more helpful for teachers, parents, policy makers and curriculum planners to understand the importance of the peer group relationship between disabled and non-disabled students in inclusive education and to develop the strong understanding, recognizing and acceptance capacity among the students community.

CONCLUSION

It is inferred that the special needs students have above high peer relationship of special needs students in inclusive education system in Namakkal district. Making friends involves many complex verbal and non-verbal social interactions and requires the skilled use of social perception and self-regulatory behaviours. However, many special needs students show uneven and insecure growth in social interactions and often fail to resolve conflicts with peers in appropriate. The uneven and conflicts of the special needs students must be removed and provided with an appropriated developmental strategies for peer group relationship.

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The Effect of Soft Skills Training in Changing the Leadership Dimension of the Undergraduate Students in the Globalised World

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Abstract:

The challenging working environment in the globalised context has impacted various human activities including the field of higher education. The raising demands of the employers in this situation expects greater leadership skills and qualities from the graduates in the employment process with soft skills. The graduates with soft skills are preferred over the others in the job selection process as the soft skills provides newer dimensions to the leadership qualities of the undergraduate students. This study, included 80 students who were selected under simple random selection for experimental design with two independent groups. Pre-test was conducted on both the groups simultaneously to find out the awareness level of leadership dimension enhancing soft skills questionnaire with 30 questions with three dimensions related to each of the 10 soft skills. Following the pre-test analysis of both the groups, only one group (experimental group) was exposed to the soft skill training program, while the another group (control group) attending the regular classes. The research findings, of the study with independent samples t-test, indicated a positive statistically significant difference between the mean scores of experimental group and control group. This paper, focusing on the significance of soft skills knowledge proposes strongly the leadership enhancing soft skills training to undergraduate students enabling them for better future perspective.

Keywords:*Leadership skills, challenging environment, higher education.*

I. INTRODUCTION

The impact of globalisation in various fields of human activities for development has been challenging the higher education institutions to raise the quality level of education to meet the demands of the present corporate world. The graduate students endowed with communication skills with others, presenting creativity, decision making skills, teamwork skills, interpersonal skills, goal setting, human resource management skill, crisis management skill, emotional intelligence skill, digital skills, work ethics, problem solving skill add more value to their technical qualification. The meaning and implications of leadership requires to be modified to meet the present scenario of competitive global world job market. The undergraduates are to be keen contributors and assets to the society with their graduation qualifications endowed with soft skills education to change their dimension of leadership. The soft skills training at the graduation level empowers the undergraduates to develop their inherent soft skills related to their thinking level, social level and core

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level. The modern day IT industries, Multinational firms are based on the leadership qualities of employees at various stages. The undergraduates as future employees in these kind of establishments expected to work with team spirit, with well-defined goals, motivating one another as team leaders communicating, sharing the expertise, solving unexpected problems, crisis with professional ethics. Theses various roles in a team requires the future employees to interact and gel with each other striving towards the common goals as team leaders at horizontal and vertical levels. Therefore the raising demands of the employers expect leadership enhancing soft skills awareness along with the academic and technical qualifications of the undergraduate students.

II. Review of Literature

The study of RichaTalwar (2014), explains the impact of globalisation under four areas such as knowledge, business, government and society, influencing leadership, while MaitiMoinak (2015), study examines the major reasons for unemployment in India and also mentions about the gap between curriculum and what is required by firms. The study of Khandakar Akhter Hossain (2015), analysing the theories of leadership and the factors features of 21st century leaders elaborately, proposes that the persons with qualities such as honesty, simplicity, vision, dedication, inspiration, delegation, communication, courage, commitment, kindness, open mindedness, fairness, forwardness, competence, experience, knowledge can become great leaders in the 21st century. The conceptual study of Rudolph. P. T. Muteswara (2016), based on the literature review explains the qualities of good leaders in leading the employees with motivation and required persuasion to achieve the established goals of the organisation. Jose R. Perez (2017), paper points out the impact of globalisation on all aspects of human activities including, the leadership qualities required in the global environment, for an effective leadership. Victor E. Dike1, Ken Odiwe&Donatus M. Ehujor (2015), explains the need for effective leadership in this fast changing present circumstances of 21st century, the leadership qualities with passion, values, decision making and problem solving in relation to the followers and performance. MT Sanchez-Nunez, J Patti, A Holzer (2015), study suggest adding social and emotional intelligence in preparing effective leaders.

Grubb, W. L., III.,&Schwager, P. H. (2018), analyse the undergraduate college students leadership development program issue in a comprehensive manner by developing a comprehensive leadership and professional development program for all the students within the range of undergraduates of American university, including soft skills like communication skills, decision making skills, presentation skills and so on. All these various models of leadership development all over the world, gave exposure to soft skills. Aslam, Mohammad (2018), research exposed the perception of leadership and skill development. Lucy Chilvers and Joseph Waghorne (2018), analysing the effect of Peer Assisted Study Sessions (PASS) in improving the skills related to personal quality, professional ability, employability, suggest to use PASS leadership module to raise the leadership qualities of undergraduates. Ruben, Brent D.et. (2018), study created, the Rutgers Leadership Academy (RLA) to address this urgent needs within the higher education to provide a broad, integrated array of leadership education and development.

In recent decades, the employers demand leadership qualities from the graduates. This trend advanced various leadership development models and programs to enhance the leadership qualities of undergraduate students. Sousa M.J., Rocha Á. (2017), research study, analysing impact of the Game-based learning (GBL) suggested use this leadership development module to improve the soft skills related to personal and professional levels. Kiersch, Christa; Peters, Janet (2017), explores the determination of developing authentic leaders who can serve and contribute to future employers and the society, as Leadership skills and leadership

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development programs with soft skills. Greenleaf, Justin P.; Klaus, Kaley; Arensdorf, Jill (2017), describing a student cohort program with a competitive application process called as The Voss Advanced Undergraduate Leadership Experience (VALUE) for cultivating leadership development of undergraduate with soft skills.Alessandra Sax, StefanosGialamas (2017), deal with students as future leaders with soft skills required for the 21st century job market.Bauermeister Maria, C., et.al. (2016), study invented Red Winged Leadership (RWL) exercise to develop the leadership qualities of undergraduate students with soft skills. While, Jennifer Hill, Helen Walkington& Derek France (2016), analyses career competencies along with their successful studies including soft skills.

Significance and Purpose of the study

Globalisation has changed the concept and dimensions of leadership with soft skills. The academic and technical skill shows deficiency in assuring employment in the current working environment as the demands of the employers expects soft skills along with academic/technical skills qualifications. The review of literature of recent years exhibits the need for soft skills training to be included in the undergraduate course to develop new dimension of leadership suitable to the present working environment. In this context this paper aims to find out the effect of soft skills training in changing the leadership dimension of the undergraduate students, enabling them to be more competitive in the globalised job market.

III. Objectives of the Study

1. To prepare and administer the leadership oriented soft skills training program for enhancing the leadership dimensions of the undergraduate students of experimental group and to study its effect on the leadership dimension of undergraduate students.

2. To find out the impact level of soft skills perception of experimental group through post-test scores following the intervention of soft skills training program.

3. To suggest leadership enhancing prominent soft skills training to the undergraduates along with the regular curriculum.

IV. Hypothesis of the Study

H_0 1: There are no statistically significant differences between mean scores of experimental group from the mean scores of the control group relating to the perception of leadership dimension enhancing soft skills

H_1 1: There are statistically significant differences between mean scores of experimental group from the mean scores of the control group relating to the perception of leadership dimension enhancing soft skills

V. Research Design

This research study adopted 'Independent samples t-test' experimental design with one control group and one experimental group.The research study selected 80 students through simple random selection and divided them equally into two groups – control group and experimental group. The Likert scale questionnaire included the awareness level of soft skills such as presentation, motivation, creativity, teamwork, goal setting, crisis management, decision making, professional ethics, emotional intelligence, flexibility, time management, innovation, interpersonal, communication, multicultural. The intervention of soft skills training was provided only to the experimental group while the control group had only regular academic class. The study included the students who were homogenous with regard to certain demographic dimensions such as age, gender, educational qualification, economic background.

VI. Research Methodology

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6.1 Population and Sample

The study had 80 students from two different college students selected randomly for the study, segregating them as control group and experimental group, using simple random sampling method.

6.2 Data Collection tool

Soft skills awareness level of undergraduate students was measured utilising soft skills awareness level scale, prepared with the consultation of the experts. The soft skills awareness measurement level scale had five points on 30 questions with three dimensions on each of the 10 soft skills, having the Croanbach's Alpha (.992) reliability statistics.

VII. Leadership oriented Soft Skills Training

The leadership oriented soft skills training program enhances leadership dimensions of undergraduate students with the important skills such as communication skills with others, presenting creativity, decision making skills, teamwork skills, interpersonal skills, goal setting, human resource management skill, crisis management skill, emotional intelligence skill, digital skills, work ethics, problem solving skill. The research of Binsaeed, Rima &Syeda, Taj&Javed, Lubna (2017), describes the necessity of Soft Skills due the effects of privatisation policy and globalised approach of the economy. The plight of graduates from various educational institutions lack soft skills required in the modern job market. The paper suggests integration of soft skills training into the regular curriculum of the graduates. The soft skills also known as peoples skills exists and exhibits inherent qualities and capabilities of every individual in a nominal level. The conceptual paper of Mathur A K (2017), mentions concerning the significant soft skills deficiency of the graduates from technical institutions. These inherent capabilities are to be developed through a systematic training program in order to increase the awareness level by removing the hurdles in developing the innate soft skills of undergraduates.

The aim of various soft skills training program improves the level of soft skills awareness making them more competent in the competitive globalised job market. The soft skills once developed through soft skills training adds more value to the academic/technical skills, providing success to the future career of the undergraduate students. The soft skills training program had five major factors such as conceptual meaning, significance, features, advantages and personality development. The training program of 15 sessions, utilized methods of brainstorming, group discussion, role play and multimedia, with the intention of brining and raising the awareness level of undergraduate students on leadership enhancing soft skills.

VIII. Analysis Plan

This study clearly assumes that control group students and experimental group students had homogeneity at the time of selection and any positive significant differences found in the experimental group in comparison to the control group related to soft skills awareness or perception is credited to the intervention of the impact of the leadership oriented soft skills training programme. This significance of differences and the impact of the soft skills training program will be analysed using independent samples t-test using SPSS 26 application. The findings of the analysis will be proving or disproving the hypothesis no.01. The data were collected simultaneously from both the groups, to avoid the influence of any extraneous variables such as special training sessions of job placements.

IX. Result

Researcher collecting the data conducted an independent samples t-test to compare soft skill awareness level mean scores of Control group (without soft skills training program) and

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experimental group (with soft skills training program). The mean values of soft skills perception level was inferred separately for the control group and the experiment group.

X. Descriptive Analysis

Comparison of the perception of soft skills scores of control group and experimental group

Table 1. Group Statistics

	Independent Sample Groups	N	Mean	Std. Deviation	Std.Error Mean
Post-Test Scores	1 Control Group	40	62.63	7.228	1.143
	2 Experimental Group	40	133.60	5.569	.881

Significant at 0.05

In this statistical analysis (Table 1), between the control group and experimental group, the mean score value of 133.60 of the experimental group students, is higher than, the mean score value of 62.63 of the control group students. Even though the control group has the awareness and perception of soft skills, the level of soft skills awareness of the experimental group is much higher due to the intervention of soft skills training program related to the leadership dimension of the undergraduate students.

XI. Differential Analysis

Significant Difference between the Scores of Control group students and Experimental group students

H_0 1: There are no statistically significant differences between mean scores of experimental group from the mean scores of the control group relating to the perception of leadership dimension enhancing soft skills.

This research analysis study conducted independent ***t - test*** to determine and find out if there is any statistically significant difference existed between the mean scores of control group and experimental group. The main objective of the research study was to find out the impact level of the soft skills training program on the undergraduate students of the experimental group. In this process, the level of impact of the soft skills training program was analysed using the impact score, calculated as the difference between the post-test scores found separately for the control group and the experimental group. The independent t- test was used to find out the possible statistically significant difference between the post-test scores of control group and the experimental group.

Table 2. Independent Samples Test details

		Levens Test for Equality of variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	**Sig**	**t**	**df**	**P value Sig. (2-tailed)**	**Mean difference**	**Std. Error Difference**	**Lower**	**Upper**
Post-Test Score	Equal variances Assumed	2.55	0.114	-49.196	78	0	-70.975	1.443	-73.843	-68.103
	Equal Variances Not assumed			-49.196	73.24	0	-70.975	1.443	-73.843	-68.103
***Significant at 0.05 level**										

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The independent samples test details, show that there was a significant difference in the scores of control group (Mean = 62.63, SD = 7.228) and experimental group (Mean = 133.60, SD = 5.569), t (78) = -49.196, p = .000 (Table 2).

The comparison mean scores of the control group students and experimental group students were analysed using an Independent sample t-test. In the statistical analysis there was a significant difference in the scores of control group (Mean = 62.63, SD = 7.228) and Experimental group (Mean = 133.60, SD = 5.569). The t (78) value with -49.196, has the p =.000, having significant value less than .05 ($p<0.05$).

The overall analysis of the result highlights the effect and impact of the leadership oriented soft skills training program on the improvement of soft skills awareness and perception of the undergraduate students enhancing their leadership dimension, and rejecting the null hypothesis.

Table 3 Independent samples test showing improvement in awareness level of each soft skills.

Soft Skills	Independent sample groups	N	Mean	Std. Deviation	Std. Error Mean	t	P-value Sig.Level (2-tailed).
1.Professional Communication	Control Group	40	5.925	1.22762	0.1941	-30.008	0
	Exp.Group	40	13.475	1.01242	0.16008	-30.008	0
2.Time Management	Control Group	40	6.575	1.08338	0.1713	-32.442	0
	Exp. Group	40	13.425	0.78078	0.12345	-32.442	0
3.Creativity	Control Group	40	6.2	1.28502	0.20318	-26.404	0
	Exp. Group	40	13.3	1.11401	0.17614	-26.404	0
4.Problem Solving	Control Group	40	6.05	1.50128	0.23737	-25.251	0
	Exp. Group	40	13.375	1.0546	0.16675	-25.251	0
5.Motivation	Control Group	40	6.45	1.28002	0.20239	-27.519	0
	Exp. Group	40	13.4	0.95542	0.15106	-27.519	0
6.Team work	Control Group	40	6.3	1.06699	0.16871	-32.09	0
	Exp. Group	40	13.575	0.95776	0.15144	-32.09	0
7.Goal Setting	Control Group	40	6	1.37747	0.2178	-25.561	0
	Exp. Group	40	13.25	1.14914	0.18169	-25.561	0
8.Flexibility & adaptability	Control Group	40	6.375	1.12518	0.17791	-26.515	0
	Exp. Group	40	13.25	1.19293	0.18862	-26.515	0
9.Decision making	Control Group	40	6.425	1.29867	0.20534	-29.216	0
	Exp. Group	40	13.425	0.78078	0.12345	-29.216	0
10.Emotional Intelligence	Control Group	40	6.325	1.3085	0.20689	-25.029	0
	Exp. Group	40	13.125	1.11373	0.1761	-25.029	0

XII. Discussion

The inference from this research study positively affirms the effect and impact of that the soft skills training program on the enhanced soft skills perception of the undergraduate students. The soft skills training program enhances the leadership dimension of the undergraduates, helping them to improve their employability to a higher level as required in the context of globalisation. The study of Pereira and Costa (2017), addresses the need and importance of Soft skills required to adapt to the changing demands of the labour market that also equips the graduates with more integration in various aspects of life, while Mahesh Kumar; Santhosh Kumar (2015) founds that majority of the students accepted that acquisition of Soft skills plays an important role in today's job context. The purpose of the study of Anju Shukla and Gopika Kumar (2017), spells out clearly the importance soft skills that the employers are looking for in their employees. This would help the employees know

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what they should equip themselves before approaching for a job in the corporate world. Ibrahim, Rosli & Boerhannoeddin, Ali & Kazeem Kayode, Bakare (2017), study makes a research study on the effects of soft skill and its training methodology to make the employee more effective and productive. The result of the research study show that there is statistically significant difference between mean scores of experimental group from the mean scores of the control group relating to the perception of leadership dimension enhancing soft skills. Therefore based on the result the null hypothesis is rejected.

The research study also suggests the leadership oriented soft skills training to the undergraduate students.

**** Significant at 0.05 level***

The **Table (no.03)** above, evidently displays that undergraduate students in experimental group were found to be significantly higher with respect to Professional Communication, Time Management, Creativity, Problem Solving, Motivating, Team work, Goal Setting, Flexibility and adaptability, Decision making, Emotional Intelligence, in all the three dimensions. The significant difference between the control group students and experimental group students in relation to these soft skills items were found to be at 0.05 levels. Since there was homogeneity of students belonging to control group and experimental group with respect to the extraneous factors, the results showing significant difference, can be attributed only to the leadership oriented soft skills training intervention undergone by the experimental group. This research study, clearly show that the soft skills training program can bring forth significant improvements in the undergraduate students with regard to all the important soft skills items, and developing their leadership dimensions assuring employable opportunities in the globalised job market scenario.

XIII. Major Findings

i. The defining increase in the in post-test scores of the experimental group students in comparison to the control group students is proved through the effective intervention of soft skills training program.

ii. The significant difference between the post-test mean scores of control group students and experimental group students in respect to the awareness level of soft skills perception due to soft skills training program for the development of leadership dimensions of the undergraduate student.

iii. The comparison and significant difference in relation to the post-test scores of control group and experimental group attributes the positive improvements in the awareness level of soft skills perception of the undergraduate students of experimental group indicating the significant effect of the soft skills training program.

The major findings, suggest and recommends soft skills training program for the undergraduate students along with their regular curriculum so that their leadership qualities will be enhanced enabling them to be more competitive and eligible in the globalised job market.

XIV. Educational Implications and conclusion of the study

The increasing demands of the employers in the globalised scenario are expecting the undergraduate students from different various streams, to blend their academic/technical skills with leadership enhancing soft skills. The awareness level of soft skills perception of the undergraduate students can be refined and improved with proper soft skills training program provided along with the regular curriculum. Since the soft skills are changing and increasing with the changing world scenario the higher educational institutions should organise

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regularly workshops, seminars, conferences to the undergraduate students at the institution level. The undergraduate students exposed to the soft skills training programs will have greater edge over others in relation to employability opportunities as well as in their personality development, empowered to face the challenges of job interviews, placements and career performance throughout their lives.

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PERCEPTION OF TEACHERS IN THE PARTICIPATION OF STUDENTS IN TALENT EXAMINATION SCHOLARSHIP SCHEME AT SECONDARY LEVEL

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Abstract

In the present day educational system has changed the dimension of the development aspect in students in various segments. Talent search examination is a National Means-cum-Merit Scolarship(NMMS) conducted by Ministry of Human Resource and Development (MHRD) to give the scholarship to the worthy candidates at eighth level. This paper aims to investigate perception of teachers in the participation of students in talent search examination at secondary level. Next, using survey data collected on 170 teachers in 36 secondary schools. Purposive sampling technique selected for the present study.The data collected were analyzed using appropriate statistical methods i.e., descriptive statistics. The result inticate that there was significant difference exists in the perception of teacher in secondary school students' in talent search examination with respect to their kinds of school and educational qualification. Moreover, co-ed school teachers have received more perception of teachers than boys and girls teachers and M.Phil qualification teachers has received more perception of teachers than other teachers. The curriculum has changed based on societal needs and students' abilities.The students have knowledge but correcting them and training them in a proper way to a better knowledge future.

Keywords: Talent Search Examination; Teachers Perception; Secondary school students.

INTRODUCTION

Education of man does not begin at school, it begin our birth. Hence Education is a lifelong process.The concept of education is still in the process of evaluation and this process will never come to an end. Education is the most important invention of mankind; it is more important than student's invention of tools, machines, spacecraft, medichine, weapons and even of language too was the product of our education.

Educational aims are correlated to ideals of life. Education is also to mould children into human persons committed to operating for the creation of human communities of affection, freedom, justice, and harmony. Students are to be moulded only by make them knowledge and talent importance of these standards in the school itself. Teachers could manage this only by the lived of their lives manifested in hundreds of little and big communication with students in word and action. **(Aggarwal, 2005)**

Conventional beliefs about intelligence have too long been oppressors of the human spirit and antagonists of self-esteem and human potential **(Rajkumar & Hema, 2018).** E ducation in a knowledge society should be to reach out to the learners at all levels of education in the manner that they derive meaning and substance from the educational process and communicate them to creating a sustainable society. The challenges of mathematics learning for today's education are required self-controlled study, concentration, and motivation. Reliable with previous studies, they found that for a higher level of mastery, motivation was related to higher mathematics grades **(Broussard & Garrison, 2004; Rajkumar & Hema, 2019).**

ROLE OF TEACHERS

Teachers play significant role in pleasing quality education and in determining the future and assembly of a nation. Teachers teach the ways of life, channelize early stages power and die their character. In a real sense, the teachers are the backbone of the nation. A teacher should act as a motivational force and should be able to create a learning environment in which students are encouraged to think carefully, rationally and express their thoughts and decide on the situations and difficulties **(Nagoba and Mantri, 2015)**.

COMPETITIVE EXAMINATION

Competitive exams are like a positive drive for students towards their excellence. Academics should not be the only focus of students. The main aim of competitive exam is to improve intellectual, logical skills and reasoning capabilities among students. Most of these competitive exams are combination of talent and subject knowledge. **Kumar, N. (2015)** was reported that useful for the policy makers as well as students writing for IIT-JEE examination and like other competitive examinations. The analysis might be able to high light the issues of talented leaning of private coaching for competitive examination. This can be relevant as the issue is frequently discussed that such practices are not in favour of fair chances of success to all the aspirants to get admission in various entrance examinations such as IITs which are comparable premier institutions globally.

All parent spend s money on their children's education, we must not forget that academic performance is an academic achievement and a daydream for students. The National Means cum Merit Scholarship Examination (NMMS) is sponsored by the dentral government for class 8^{th}. This examination would consist of two tests: Mental Aptitude Test (MAT) and Scholastic Aptitude Test(SAT). Successful Candidates will get a scholarship of amount Rs.6000/- per annum till class 12^{th}.

REVIEW OF RELATED STUDIES

Kwesi & Lloyd (2016) was focused on teachers teaching styles and students study habits on academic achievement in mathematics among junior high schools in upper east region of Ghana. To support learning habit and scholastic achievement, children need to know away from book knowledge. Self-concept in all forms of student life aids or influences academic performance of a student in mathematics. It is one of the attempts at improving study habit and locus of organize among junior school student, to aid academic performance and success of student. **Onaiba, A. E (2015**) reported that Impact of a public examination change on teachers' perceptions and attitudes towards their classroom teaching practices. Highstakes public examinations, thus, are often used as tools of control in the school system. Though, teachers welcomed the policy concerning exam format and style. Thus findings indicated that exams did exert washback on teachers' attitudes and values in their classroom teaching. Finding of this study revealed that questionnaires and interviews, classroom observations would have provided more tangible proof on teachers' real classroom teaching practices as a result of exam change. **O'Neill, M (2014)** have analyzed perceptions of leaders, teachers, students and parents in high performing West Australian Catholic secondary schools within the context of tertiary entrance examinations. Identify characteristics of leaders in schools, teaching that has resulted in high achievement, student contribution to their schools' success and perceptions of parents in the selected high performing effective schools. Teacher focus group interviews explored questions around the influence of content knowledge, teaching strategies, planning, assessment, feedback and affective qualities of expert teachers on student achievement. **Etuk N. et al. (2013)** are studied on students' perception of teachers' characteristics and their attitude towards mathematics in or on education zone. The result make clear that the way students' recognize their teachers' in terms of communication ability, knowledge of mathematics contents, classroom management skills and teaching methods has a significant rapport with students' attitude towards mathematics.

Once the students' perception of their teachers' characteristics is low down, students' attitude towards mathematics tends to be negative. **Halima Khan et al.(2012)** was studied that the role of teachers in providing educational and career counseling to the secondary school students in Gilgit- Baltistan of Pakistan. Students also see their teachers as role models and attach high value to their guidance and suggestion related to the subjects and occupation selection. Though, the findings reflect that the NGO-run private schools have better quality career services for students than the Government Education Department-run schools. There is less awareness and sense of significance in the Government Education Department on the need of career counseling in schools. The findings also showed that in both the education systems some parents play their roles in guiding their children for their careers.

OBJECTIVES OF THE STUDY

- To find out the level of perception of teachers in the participation of secondary school students towards talent search examination.
- To find out the role of teachers in the participation of secondary school students towards talent search examination based on this demographic variable:Gender (Male/Female),Locality of School (Rural /Urban),Kinds of school(Boys/Girls/Co-Ed),Major Subject (Tamil /English/ Mathematics / Science/ Social Science), Teachers Qualification (P.G B.Ed / P.G M.Ed / P.G ,B.Ed with M.Phil/P.G,M.Ed with M.Phil), Teachers Teaching Experience (Below 10 Years/ 10-20 Years/ Above 20 Years)

HYPOTHESES OF THE STUDY

- The level of the role of teachers in the participation of secondary school students towards talent search examination is high.

- There is no significant difference in the role of teachers in the participation of secondary school students among talent search examination with respect to their demographic variables such as: Gender (Male/Female),Locality of School (Rural /Urban),Kinds of school(Boys/Girls/Co-Ed),Major Subject (Tamil /English/ Mathematics / Science/ Social Science), Teachers Qualification (P.G B.Ed / P.G M.Ed / P.G ,B.Ed with M.Phil/P.G,M.Ed with M.Phil), Teaching Experience (Below 10 Years/ 10-20 Years/ Above 20 Years)

RESEARCH DESIGN

The investigators have adopted survey method and purposive sampling technique. The investigators have developed a perception of teachers in the participation of students in talent search examination at secondary level. For these study 170 samples (teachers) has been selected from 40 government schools located in Salem district. Perception of teacher questionnaire consisted of 30 items in to selected 4 point scale that lead them to select a government schools by the class 8^{th} secondary school teachers. The statistical treatment means, standard deviations, "t' test and F test are used to analyses the data.

HYPOTHESES TESTING

$H_0$1: The level of the perception of teachers in the participation of secondary school students towards talent search examination is high.

Table-1

Mean score of the role of teachers in the participation of secondary school students towards talent search examination.

Maximum Score=120

S.No	Demographic Variable	Category	Mean	SD
1.	Gender	Male	90.77	15.15
		Female	89.21	15.24
2.	Kinds of school	Boys	87.98	14.19
		Girls	86.10	17.66
		Co-Ed	92.63	13.63
3.	Major Subject of Teacher	Tamil	87.65	14.38
		English	89.12	18.57
		Mathematics	91.24	15.19
		Science	91.11	14.31
		Social Science	90.27	13.67
4.	Locality of Teacher	Rural	89.76	15.89
		Urban	90.28	12.98
5.	Qualification Teachers'	P.G with B.Ed.	88.34	15.69
		P.G with M.Ed.	89.56	14.83
		PG with M.Phil	94.35	13.49
6.	Teaching Experience	Below 10 years	90.72	14.55
		10-20 years	91.19	15.32
		Above 20 years	87.73	16.16
Average			**89.89**	**15.05**

From the table-1 it in incidental that the secondary level teachers have above average perception of teachers in participation of students towards talent search examination at Salem district of Tamil Nadu.

H_0 2: There is no significant difference in the perception of teachers in the participation of students in talent search examination with respect to their gender.

Table-2

Significant difference in the perception of teachers of secondary school students' in talent search examination with respect to their gender

Variable	**Gender**	**N**	**Mean**	**SD**	**'t' Value**
Perception of teachers	Male	76	15.17	15.15	0.65
	Female	94	14.96	15.24	

* Significant at 5% level

From the above table-2 reveals that the calculated t value is (0.65) lower than the tabulated value 1.96. It is inferred that the null hypothesis is accepted at 5% level of significance. Hence, it can be concluded that there is a no significant difference exists in the perception of teachers' secondary school students' talent search examination with respect to their gender.

H_0 3: There is no significant difference in the perception of teachers in the participation of students in talent search examination with respect to their kinds of school.

Table-3

Significant difference in the perception of teachers of secondary school students' in talent search examination with respect to their kinds of school

Variable	Kinds of school	N	Mean	SD	F Value
Perception of teachers	Boys	41	87.98	14.19	3.14*
	Girls	42	86.10	17.66	
	Co-Ed	87	92.63	13.63	

* Significant at 5% level

From the above table-3 reveals that the calculated t value is (3.14) higher than the tabulated value 1.96. It is inferred that the null hypothesis is rejected at 5% level of significance. Hence, it can be concluded that there is a significant difference exists in the perception of teachers' of secondary school students' talent search examination with respect to their kinds of school.

$H_0$4: There is no significant difference in the Perception of teachers in the participation of students in talent search examination with respect to their locality.

Table-4

Significant difference in the perception of teachers of secondary school students' in talent search examination with respect to their locality

Variable	Locality	N	Mean	SD	't' Value
Perception of teachers	Rural	127	89.76	15.89	0.21
	Urban	43	90.28	12.98	

* Significant at 5% level

From the above table-4 reveals that the calculated t value is (0.21) lower than the tabulated value 1.96. It is inferred that the null hypothesis is accepted at 5% level of significance. Hence, it can be concluded that there is a no significant difference exists in the perception of teachers' of secondary school students' talent search examination with respect to their locality.

$H_0$5: There is no significant difference in the Perception of teachers in the participation of students in talent search examination with respect to their major subject.

Table-5

Significant difference in the perception of teachers of secondary school students' in talent search examination) with respect to their major subject

Variable	Major subject	N	Mean	SD	F Value
Perception of teachers	Tamil	34	87.64	14.38	0.33
	English	33	89.12	18.57	
	Maths	34	91.24	15.19	
	Science	36	91.11	14.31	
	Social Science	33	90.27	13.67	

* Significant at 5% level

From the above table-5 reveals that the calculated't' value is (0.33) lower than the tabulated value 1.96. It is inferred that the null hypothesis is acepted at 5% level of significance. Hence, it can be concluded that there is a no significant difference exists in the perception of teachers' of secondary school students' in talent search examination with respect to their major subject.

$H_0$6: There is no significant difference in the perception of teachers in the participation of students in talent search examination with respect to their educational qualification.

Table-6

Significant difference in the perception of teachers of secondary school students' in talent search examination with respect to their educational qualification

Variable	Educational Qualification	N	Mean	SD	F Value
Perception of teachers	PG with B.Ed	34	88.34	15.69	2.15*
	PG with M.Ed	37	89.56	14.83	
	PG, B.Ed/M.Ed with M.Phil	99	94.35	13.49	

* Significant at 5% level

From the above table-6 reveals that the calculated't' value is (0.33) lower than the tabulated value 1.96. It is inferred that the null hypothesis is rejected at 5% level of significance. Hence, it can be concluded that there is a significant difference exists in the perception of teachers' of secondary school students' talent search examination with respect to their educational qualification.

$H_0$7: There is no significant difference in the perception of teachers in the participation of students in talent search examination with respect to their teaching experience.

Table-7

Significant difference in the perception of teachers of secondary school students' in national talent search examination with respect to their teaching experience

Variable	Teaching Experience	N	Mean	SD	F Value
Perception of teachers	Below 10 years	52	90.72	14.55	0.77
	10-20 years	87	91.19	15.32	
	Above 20 years	31	87.73	16.16	

* Significant at 5% level

From the above table-7 reveals that the calculated t value is (0.77) lower than the tabulated value 1.96. It is inferred that the null hypothesis is rejected at 5% level of significance. Hence, it can be concluded that there is a significant difference exists in the perception of teachers' of secondary school students' talent search examination with respect to their teaching experience.

FINDINGS OF THE STUDY

- H_0 1: The level of the perception of teachers in the participation of secondary school students towards talent search examination is high. Moreover, secondary level teachers have above average (89.89) perception of teachers in participation of students in talent search examination.
- H_0 2: There is no significant difference in the perception of teachers in the participation of students in talent search examination with respect to their gender. Moreover, male teachers (15.17) have received more perception of teachers than the female teachers (14.96) in talent search examination.
- H_0 3: There is significant difference in the perception of teachers in the participation of students in talent search examination with respect to their kinds of school. Moreover, co-ed school teachers (92.63) have received more perception of teachers than boys (87.98) and girls (86.10) school teachers in talent search examination.
- H_0 4: There is no significant difference in the perception of teachers in the participation of students in talent search examination with respect to their locality. Moreover, urban area school teachers have received more perception of teachers than the rural area school teachers in talent search examination.
- H_0 5: There is no significant difference in the perception of teachers in the participation of students in talent search examination with respect to their major subject. Moreover, maths major teacher have received more perception of teachers than other major teachers in talent search examination.

- H_0 6: There is significant difference in the perception of teachers in the participation of students in talent search examination with respect to their educational qualification. Moreover, PG,B.Ed/M.Ed with M.Phil qualification teachers has received more perception of teachers than PG with B.Ed and PG with B.Ed qualification teachers in talent search examination.
- H_0 7: There is no significant difference in the perception of teachers in the participation of students in talent search examination with respect to their teaching experience. Moreover, 10-20 years (91.19) teaching experience teachers (91.19) has received more perception than below 10 years(90.72) and above 20 years (87.73) teaching experience teachers in talent search examination.

CONCLUSION

Secondary schools, study has to be encouraged by parents, teachers, headmasters and the environment at large, at the right time and place.Teachers play a central role in the students' developments. The curriculum has changed based on societal needs and students abilities. The class test above is not enough to make students cognitively skilled. The students have knowledge but correcting them and training them in a proper way to a better knowledge future. They must adopt technology and teaching which are modern and useful to students. By doing so, the teachers will be in their favourite schedule of their students. The students should be motivated. They can train them self and prepare for the exam with teachers help.

The main finding of the study revealed that there was a significant difference exists in the perception of teacher in secondary school students' in talent search examination with respect to their kinds of school and educational qualification. There was no significant difference exists in the perception of teacher in secondary school students' in talent search examination with respect to their gender, locality, major subject, teachimg experience.

The student's proper involvement in learning school subjects in the class and home help they get high marks because they understand the importance of education. Teachers teaching and student's interest on education at the secondary level increase academic achievement.

Awareness of talent search examination and educational programs by national and household income levels were addressed with a need for more financial support and such as Parent Teacher Association (PTA), teachers meeting, advertisement in radio, television, and newspaper, talents searches centers and local schools for more students to benefit from the talent search examination scholarship scheme **(Selvi & Vakkil, 2016)**. (**Selvi & Vakkil, 2017)** was suggested that the result, the secondary school teachers must have to more concentrate this examination for students' high achievement. Literacy proves to be a factor that demarcates the literate parents can guide their son and daughter study well to learn at home. It improves their children qualities of education and academic achievement.(**Selvi & Vakkil, 2019)**.

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Impact of Parental Involvement in Training Personal Skills among Children with Multiple Disabilities

K.K. Dhanavendan*,
Dr. Vakkil M**

Abstract

The present study aims to identify impact of parental involvement in training personal skills in children with multiple disabilities. Thirty parents within the age range of 25 to 54 years and 30 male and female children with multiple disabilities within the age range of 6 to 19 years participated in the present study. Adapted functional assessment checklist was used to assess the children's present level of personal skills before and after the training of parents. Parental Involvement Questionnaire (PIQ) was used to rate the parental involvement before and after the training. The results revealed that the parental involvement and the performance of children significantly differed after the training of parents. The study motivated the investigator to develop a training manual for parents so that they could train the personal skills of their children.

Key words: Multiple Disabilities, Personal Skills, Parental Involvement

Introduction

Multiple disabilities refer to two or more than two types of disabilities which require more attention and support in education programming. Children with multiple disabilities have difficulty in mobility from one place to another and perform activities of daily living. Also, their socialisation, communication of their needs, ability to solve problems, ability to play and participation in recreational activities are minimized. This leads to severe educational needs that cannot be accommodated in a special education programme solely meant for one of the impairments. As a result, they generally need extensive support across any number of skill areas. And, because of their difficulty to do personal needs , impairment in speech and communication, poor socialization due to cognitive dysfunction, these children pose a serious challenge to their parents.

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The parents of children with multiple disabilities need a great deal of information about diagnosis, management and support services. Parents can assist in the identification, assessment, intervention and implementation of the programmes intended for their children. A child's mastery of daily living skills contributes strongly to prognosis (Gillham et al. 2000) and it has been noted as "essential" to an individual's ability to function successfully and independently in the world (Liss et al. 2001). Personal skills are developmentally appropriate practical skills that are necessary to care for oneself and meet daily challenges.

There are six basic Activities of Daily Living skills (ADL): Eating, Drinking, Toileting, Brushing, Bathing, Dressing, and Grooming. To perform these activities other skills such as gross motor, fine motor and language and communication skills are also required. Needless to add that to support and educate a child with multiple disabilities in personal skills parental involvement is essential.

Parental involvement refers to the commitment of parents related to the school or schooling that can be observed as manifestations of their commitment to the educational needs of their children. This means that a parent who shows these behaviours in a larger extent can be regarded as more highly involved than a parent who shows these behaviours in a lesser degree. Parental involvement has been described in earlier literature and widely recognized (Epstein, 1992).

The author developed six levels of school-related involvement opportunities for parents. These are efforts to assist parents with child-rearing skills such as communicating with families, providing school volunteer opportunities, involving in home-based learning, involving in school decision-making, involving in school-community collaborations. The requirement of including parents in the special education decisions of their children has been shown to have positive effects across multiple studies (Christenson & Reschly, 2010; Elbaum, 2014; Epstein, 1995; Fish, 2008). However, there is a very limited study done in multiple disabilities and parental involvement in training personal skills in children in the Indian context. Therefore, the present study aims to identify the impact of parental involvement in training personal skills in children with multiple disabilities.

Method

Sample

Thirty children with multiple disabilities (cerebral palsy with intellectual disabilities) and their 30 mothers selected for this study using purposive sampling technique. Both males and females within the range of 6 years to19 years and mothers within the range of 25 to 50 years. These children were selected from pre-primary, primary, secondary and pre-vocational level special schools in Chennai.

Tool

The adapted functional assessment checklist was used to measure the child's functional level of personal skills. Parent's involvement was assessed with self-constructed parental involvement questionnaire (PIQ). The questionnaire consisted of general background about the child, the family members and level of training in personal skills like eating, drinking, toileting, brushing, bathing, dressing and grooming.

The questionnaire was constructed in both English and Tamil. Parental involvement was rated with a four-point rating scale coded by 0,1,2,3 as no, low, moderate and high involvements in extending regularity of training, spending time for training, concentration on training and training of their children professionally. Adapted functional assessment checklist was used to assess the present level of functioning of the children before and after the training of parents. The personal skills checklist was constructed based on the developmental milestones to measure the child's corresponding level from zero age to nineteen years. The present checklist was developed and validated with the inter-rated reliability score 84.6 with split half method.

Development of training module for training of parents

The investigator developed a training module for training parents on how to use the manual and home training methods for their children. The training module contended with objective components of target skills, principles of teaching, strategies of teaching, skills with pictorial illustration and task analysis, method, materials, instructions and evaluation methods. The investigator used lecture method for training the parents with power point presentation, demonstration, modelling and videos. The manual was developed bilingually (in Tamil and English) with instruction and material adaptation.

Procedure

Prior to data collection written consent was elicited from parents. All the parents were interviewed in a quiet room with the help of a prepared questionnaire. Parental involvement was assessed with the help of a parental-involvement-questionnaire. Parents were asked to rate their involvement on training their children in personal skills like eating, drinking, toileting, brushing, bathing, dressing and grooming. Further, all the children were assessed with the help of an adapted functional assessment checklist. Pilot study was conducted to see content and duration of the assessment. Based on the initial assessment, training was given to all parents thrice a week for a period of three months through lecture method with power point presentation and demonstration using different prompts and teaching methods. after three months of training, the investigator reassessed the involvement of parents and the performance of children.

Results and Discussion

It is revealed from the pre- and post-test scores that the parental involvement in the personal skills related to training their children on a regular basis, concentration on training, spending time with them, and training them professionally had improved significantly. The data were analysed qualitatively and quantitatively with SPSS 20 version.

Table 1. Pre and Post Test Frequency & Percentage of Functional Assessment of Personal Skills of Children with Multiple Disabilities

Domains	Pre test		Post test	
	Frequency	**Percentage**	**Frequency**	**Percentage**
Emerging	13	43.3%	5	16.7%
Dependent	3	10%	7	23.3%
Independent	14	46.7%	18	60%

The Table above shows the pre- and post-test frequency and percentage score of personal skill deficit among children with multiple disabilities. The pre-test result shows that 43.3% children are in emerging level, 10% are in dependent level and 46.7% are in independent level respectively. The post-test scores obtained from the adapted functional assessment checklist shows that among children with multiple disabilities 16.7% are in emerging level, 23.3% are in dependent level and 60% are in independent level respectively. The results reveal that the pre- and post-test scores significantly differ and so it is concluded

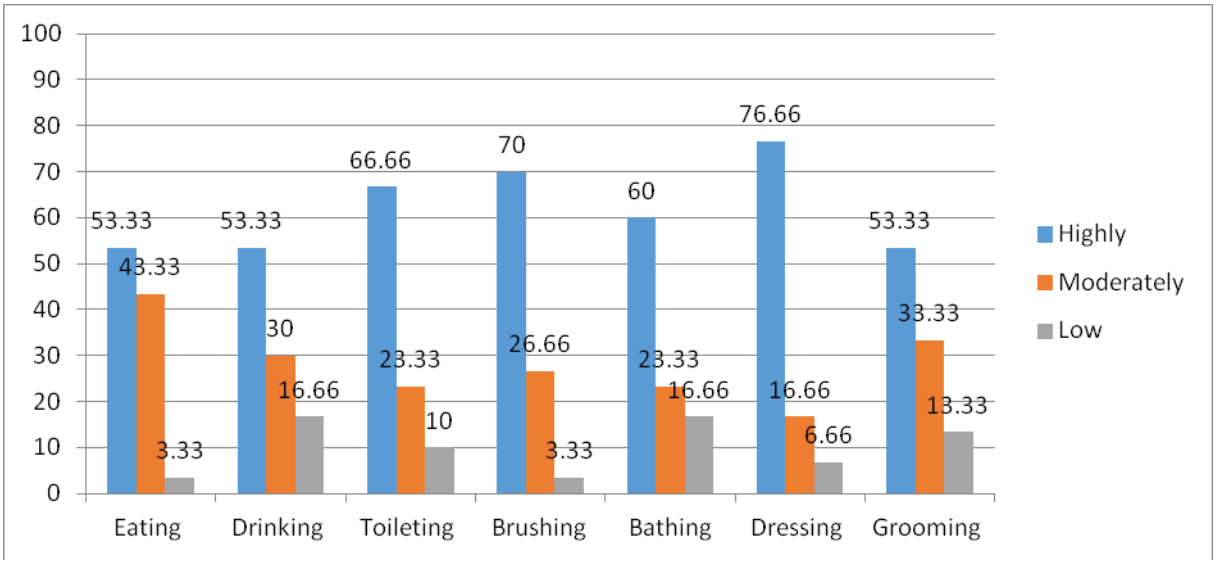
that the parental training increased the involvement of parents in training the personal skills of their children.

Table 2. The Mean, Standard Deviation and t-value of Functional Adapted Assessment of Children with Multiple Disabilities

Variables	N	Mean	SD	T	df	Significance
Pre personal	30	40.03	29.476	7.439	29	0.000
Post personal		55.23	32.119	9.419		0.000

The Table above shows the performance of children before and after training. The mean and t' value of pre- and post-test scores are statistically significant at 0.000 levels.

Figure 1. Percentage of Parental Involvement in training Personal Skills of their children



The figure above indicates the different levels of parental involvement in training personal skills of their children. Regarding high involvement 76.6% are in training dressing skills, 70 % are in training brushing, 66.6% are in training toileting, 60% are in training bathing, and 53.3% are in training eating, 53.3% are in training drinking and 53.3% are in training grooming. Regarding moderate involvement, 43.3% are in training eating, 33.3% are in training grooming, 30% are in training drinking, 26.6% are in training brushing, 23.3 % are in training both toileting and bathing and 16.6% are in training dressing. Regarding low involvement, 16.6 % are in training drinking and bathing, 13.3% are in training grooming, 10% are in training toileting, 6.6% are in training dressing, and 3.3% are in training eating and brushing.

Table 3. Parental Involvement on Personal Skills of Children with Multiple Disabilities.

Variables	Tests	Score		t	df	Significance
		Mean	SD			
Regularity	Pre	23.71	2.812	2.731	6	.034
	Post	26.00	1.000			
Concentration	Pre	26.14	2.854	4.260	6	.005
	Post	27.71	1.976			
Time spend	Pre	24.14	2.116	4.804	6	.003
	Post	27.00	1.826			
Professionally helping	Pre	20.00	2.517	7.249	6	.000
	Post	24.86	1.773			

The Table above shows a significant difference between parents in their regularity in training, concentration, spending time with their children and helping them professionally because there is a significant difference between pre- and post- test scores. Overall involvement of parents shows an increase after training the parents. The present finding agrees with the findings of Entwisle (1990), Hobbs et al.(1984) and Lareau (1989) who had found that the family status variables and related factors such as time, energy, community contacts were significantly related to the involvement of parents in their decision-making and influence.

Conclusion

Children with loco motor and cognitive disabilities need lots of training for all the components. As for their personal skills, they pose a greater challenge to their parents. These latter have obtained adequate experience and knowledge in handling their children effectively even though they might fail to address their needs appropriately. Hence, during the counselling sessions, the parents must be counselled properly on the actual conditions as well as the importance of all the activities of their children. Here the support of the teachers support is very important because the children spend more time in the special education classroom. Teachers could prepare a manual for training in pictorial form and in the regional language with simple steps. This will serve as a valuable guide and be a welcome support for parents to provide appropriate training in helping their children in a professional manner.

Consequently the stress level of parents will also be considerably reduced in training children with multiple disabilities.

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A STUDY ON USE OF FACEBOOK BY PG STUDENTS OF SELECTED DEPARTMENTS IN SRI RAMAKRISNA COLLEGE OF ARTS AND SCIENCE, COIMBATORE

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A STUDY ON USE OF FACEBOOK BY PG STUDENTS OF SELECTED DEPARTMENTS IN SRI RAMAKRISNA COLLEGE OF ARTS AND SCIENCE, COIMBATORE

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ABSTRACT

The study on use of face book by students is a paper that represents a evaluation of more than one hundred studies on the social networking website face book. The paper focuses on face book use, which is currently the most researched theme the main studies for each group are presented, with an emphasis on the most influential ones in the field. The focus of this fictional examination is on the commonalities and difference that start from the results. As a result, one could notice that face book is mainly used to keep in touch with other people, but not in a conventional way as uses tend to spy on other users profiles this phenomenon leads to a growing exhibitionism, which is in turn related to individuals personality teats .use of face book is also influenced by peers and experience with the website.

Keywords: Facebook , Internet, Program,Networking

1.INTRODUCTION

Facebook was started in the dorm room of Harvard student Mark Zuckerberg in 2003. Mark Zuckerberg started the site as an online edition of the popular ‘Facebook’ profiles that colleges distribute to freshmen students before the start of the fall semester. “The answer to

Facebook was enormous and direct at Harvard" and three weeks following the create of the website primarily named that face book.com it had 10,000 registered users at Harvard. The Facebook website was shaped originally only for Harvard college students, but quickly other Ivy association schools such as Yale, Columbia, and Dartmouth requested that Zuckerberg has a Facebook at their school as well. Later it includes any University student, then high school students and finally to anyone aged 13 and over. The website at present have further than 120 million lively user worldwide.

2.REVIEW OF LITERATURE

Al Mamun, M.A. & Griffiths, M.D. (2018) Social media addiction has become an area of increasing research interest over the past few years. However,there has been no previous research on social media addiction in Bangladesh. The present pilot study is the first ever in Bangladesh to examine the relationship between one specific form of social media addiction (i.e., 'Facebook addiction') and its associated predictors. This present study comprised 300 students from the University of Dhaka (Bangladesh) who participated in a survey that included questions relating to sociodemographics, health and behavioral measures, and the Bergen Facebook Addiction Scale (BFAS), and the nine-item Patient Health Questionnaire (PHQ9). The prevalence of FA was 39.7% (cutoff score was ≥18 on the BFAS). Using a regression analysis, the risk of being addicted to Facebook was predicted by being single, having less involvement in physical activities, sleep disturbance (more or less than 6 to 7 hours of sleep), time spent on Facebook (≥5 hours per day), and depression symptoms. Based on the sample in the present study, the risk of Facebook addiction (as assessed using the BFAS) appears to be a significant issue among Bangladeshi students, and depression appears to be one of the main comorbid factors.

Ali, F. H., & Qazi, A. A. (2018) The motivation behind the examination is to observationally evaluate the effect of Social Networking Sites (SNS) on the educational results as seen by the

understudies with regards to post-graduate understudies. Thisaction investigate utilized triangulation way to deal with survey 80 understudies of a post-graduate class. Information were gathered in six stages. At first, an adjusted survey was directed prior and then afterward making formalFacebook (FB). The gathering was checked for three weeks. At last, 18 understudies were chosen for semi-organized meetings dependent on their collaboration with the FB gathering. Information were broke down utilizing SPSS 16, PLS-SEM 3.2, and NVIVO 11. The outcomes uncovered a striking effect of SNS-FB on different educational components. This examination can give the premise to scholastic policymakers to present such formal SNS channels for educating purposes. The examination gives a base to address the new patterns of learning through activity explore that is underexplored in the past writing.

Giade, M. Y. U., Aspura, M. Y. I., & Noorhidawati, A. (2018). The paper gives an explanation of components that drive understudies' apparent self-adequacy in data chasing rehearses through Facebook. The quantitative examination utilized irregular testing of postgraduate understudies in a higher learning foundation. An aggregate of 354 reactions were accumulated through a self-detailed review. The discoveries demonstrated four components, in particular, past execution, other's understanding, verbal influence and mental state, have measurably huge connections with understudies' apparent self-adequacy in data looking for practices through Facebook. Past execution was observed to be the most powerful factor pursued by other's understanding. Verbal influence and mental states were the least persuasive factor. The result of the investigation adds to the current writing especially on the self-adequacy point of view in interpersonal interaction destinations (SNS) stage. Moreover, the discoveries are important to the field of data looking for conduct particularly in giving proof that individuals are seeking data utilizing Facebook.

Jafarkarimi, H., Sim, A. T. H., Saadatdoost, R., & Hee, J. M. (2016). As of late, Social Networking Sites (SNSs) have turned into a noteworthy correspondence vehicle in all social orders. Facebook has turned into the most famous person to person communication site with more than 2.2 billion clients. The delight that Facebook has conveyed has prompted some addictive conduct among its clients. This contemplate utilized the Bergen Facebook Addiction Scale to examine Facebook compulsion among understudies. In this investigation, we chose an example of 441 understudies in Universiti Teknologi Malaysia as respondents. Results demonstrate that 47% of the members were dependent on Facebook. This proportion is nearly the same among postgraduate and college understudies, and strikingly, among Malaysian and non-Malaysian. Much conjectured factors, for example, religion, dimension of pay, inner self quality what's more, locus of control don't demonstrate critical impact on the hazard of Facebook compulsion. Ultimately, the outcomes propose that as individuals invest more energy in Facebook, there is a more noteworthy shot of compulsion

3.OBJECTIVES OF THE STUDY

- To trace out the frequency of use of Facebook
- To find out the user perception about the Facebook
- To know the access purpose and most used Facebook
- To examine the preferred format of using Facebook
- To find out the search preferences of respondents
- To evaluate the user satisfaction with the use of Facebook.

4.HYPOTHESIS

- Based on the above mentioned objectives, the following hypotheses have been formulated and tested in the present study.
- User differs in the level of satisfaction about the Facebook
- Frequency of use of Facebook
- Purpose of the use of Facebook
- Use of Facebook
- Respondents do not differ in their level of satisfaction regarding the use of Facebook

- User differ in their opinion about Facebook

5.METHODOLOGY AND SCOPE OF THE STUDY

The study is confined to the PG Student of the Sri Ramakrishna college of arts and science, regarding the usability of Facebook provided by social network. Under the purview of the academic community, only the students were considered as the sample population. A study is mainly based on the primary data collected from the Sri Ramakrishna college of arts and science in selected three departments

1. MBA 2. COMPUTER SCIENCE 3. COMMERCE

Through a well designed questionnaire. Besides, the secondary data have been collected from sources like the Internet, reference books, National and International journals and magazines. Totally 145 questionnaires distributed to the students of the Sri Ramakrishna college of arts and science, 105 questionnaires received back with a response rate of 70 percent. Simple random sampling methods were used to collect the data. The data were collected through the questionnaires and it was analyzed with simple percentages and ANOVA.

6.ANALYSIS AND INTERPRETATION

Table 6.1 Department wise distribution of questionnaire by the respondents

S. No	Departments	No of respondents	Percentage
1.	MBA	54	51.4
2.	Computer Science	29	28.00
3.	Commrece	22	21
Total		105	100

Table 6.1 shows that the department wise distribution of the questionnaire by the respondents. The majority 54 (51.4%) of the respondents belong to the MBA department followed by Computer Science 29 (28.00%), 22 (21%) of respondents belong to Commerce. The study reveals that the majority of the respondents belong to the MBA Department compared to other departments.

Table 6.2 Gender wise distribution of the respondents

S. No	Gender	No of respondents	Percentage
1.	Male	52	49.52
2.	Female	53	50.48
Total		105	100

Table 6.2 gives the gender wise breakup of respondents. It is observed that 52 (49.52%) respondents are male and 53 (50.48%) are female. This is a glaring example of male-female imbalance in academic community.

Table 6.3 User perceptions about Social Networks

S. No	Social Networks	No of respondents	Percentage
1.	Facebook	39	37.14
2.	Whatsapp	23	21.92
3.	Twitter	16	15.23
4.	Google+	13	12.38
5.	You Tube	8	7.62
6.	Any others	6	5.71
Total		105	100

Table 6.3 indicates that user perception about the social network. Most of the students prefer to use Facebook 39 (37.14%), followed by Whatsapp 23 (21.92%), Twitter 16 (15.23%), Google+ 13 (12.38%), you tube 8 (7.62%), meager percentage 6 (5.71%). So the majority of the respondents prefers Facebook 39 (37.14%).

Figure 5.1 User perceptions about Social Networks

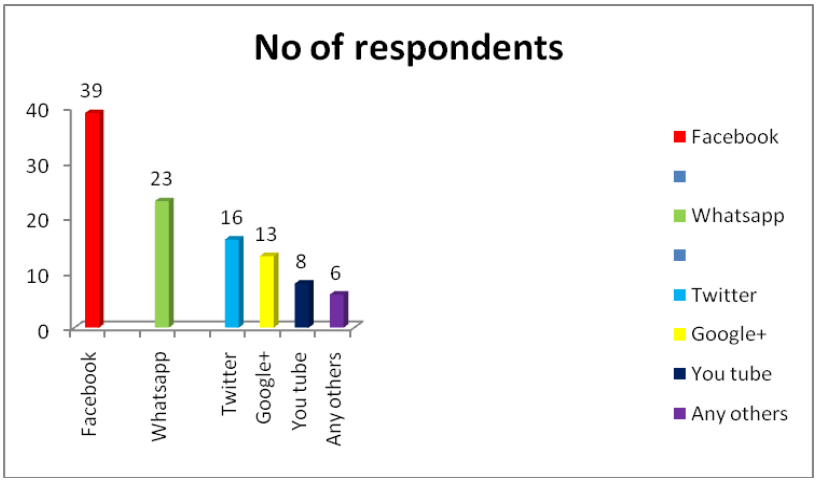


Table 6.4 Frequency of using Facebook

S. No	Frequency	No of respondents	Percentage
1.	1-5 months	13	12.4
2.	6-12 months	20	19.1
3.	1-2 years	15	14.3
4.	More than 2 years	57	54.2
Total		105	100

Table 6.4 indicates the frequency wise use of Facebook. The majority of the respondents used Facebook for more than three years 57 (54.2%) followed by 6-12 months 20 (19.1%), 1-2 years 15 (14.3%) meager percentage 13 (12.4%) of the respondents 1-5 months. So the majority of the respondents using Facebook for more than three years 57 (54.2%).

Table 6.5 Quantum of time spends in Facebook for each day

S. No	Time	No of respondents	Percentage
1.	1 hr	24	23.00
2.	2 hrs	55	52.4
3.	3 hrs	12	11.4

4.	More than 3hrs	14	13.2
Total		105	100

Table 6.5 reveals the quantum of time spends on usage of Facebook. Majority 55 (52.4%) of the respondents spent 2 hours per day followed by 24 (23.00%) respondents spent 1 hour per day. 14 (13.2%) of the respondents spent more than 3 hours on using Facebook per day, 12 (11.4%) of the respondents spent 3 hours per day. The majority of the respondents spent 2 hours on using Facebook per day.

Figure 5.2 Quantum of time spends on Facebook each day

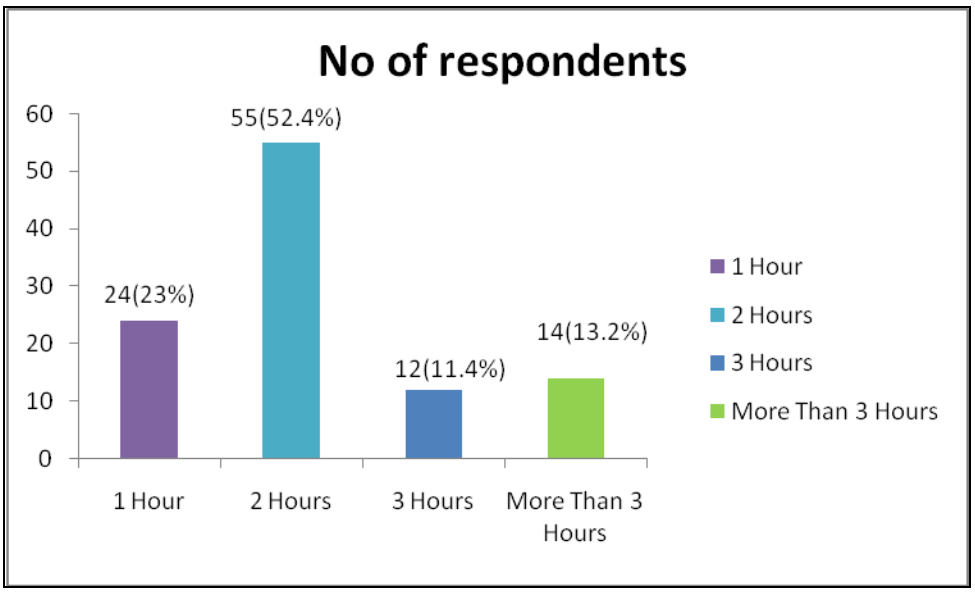


Table 6.6 Number of Facebook Friends by the Respondents

S. No	Number of Facebook friends	No of respondents	Percentage
1.	1-50	63	60.00
2.	51-100	17	16.2
3.	101-150	14	13.4
4.	More than 150	11	10.4
Total		105	100

Table 6.6 reveals that the friends on Facebook. The majority of the respondents 63 (60.00%) are having 1-50 friends on Facebook followed by 17 (16.2%) respondents having 51-100 friends on Facebook, 14 (13.4%) respondents having 101-150 friends on Facebook, 11 (10.4%) respondents having more than150 friends on Facebook. The majority of the respondents have 1-50 friends on Facebook 63(60.00%).

Table 6.7 Number of Facebook groups by the Respondents

S. No	Facebook groups	No of respondents	Percentage
1.	One	17	16.19
2.	Two	19	18.09
3.	Three	22	20.95
4.	More than three	47	44.77
Total		105	100

Table 6.7 explains the Facebook groups. The majority of the respondents 47 (44.77%) were more than three groups in Facebook, 22 (20.95%) respondents having three groups in Facebook, 19 (18.09%) respondents having two groups in Facebook, only 17 (16.19%) respondents having only one group in Facebook. The majority of the respondents have more than three groups in Facebook 47 (44.77%).

Figure 5.3 Number of Facebook groups by the Respondents

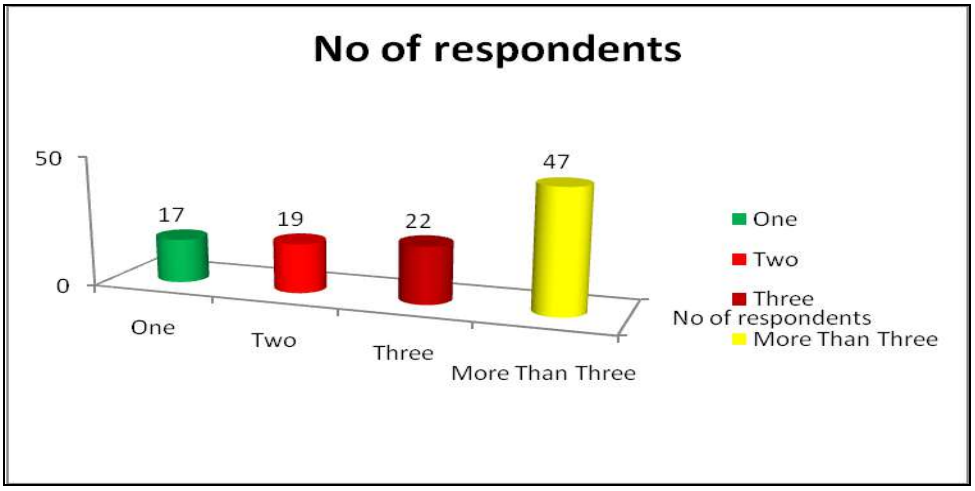


Table 6.8 Post updates on Facebook

S. No	Post status updates on Facebook	No of respondents	Percentage
1.	Daily	48	45.72
2.	Weekly once	33	31.43
3.	Fort nightly	15	14.28
4.	Monthly	9	8.57
Total		105	100

Table 6.8 explains the post status updates on Facebook. The majority of the respondent's post status on Facebook for daily 48 (45.72%) followed by weekly once 33 (31.43%), fortnightly 15 (14.28%). Only meager percentage 9 (8.57%) of the respondents for monthly. The majority of the respondent's post status on Facebook Daily 48 (45.72%).

Table 6.9 Facebook posts by public or private

S. No	Facebook posts	No of respondents	Percentage
1.	Public	51	48.57
2.	Private	29	27.61
3.	Both Public and Private	15	14.29
4.	None of the above	10	9.53
Total		105	100

Table 6.9 examined the Facebook posts. The majority of the respondents 51 (48.57%) Facebook post are public followed by private 29 (27.61%), 15 (14.29%) of the respondents used Facebook posts on both public and private, only meager percentage 10 (9.53%) of the respondents none of the above used this Facebook post. The majority of the respondents Facebook posts publicly 51 (48.57%).

Table 5.10 Profile on Facebook is truly safe

S. No	Opinions	No of respondents	Percentage
1.	Safe	49	46.67
2.	Unsafe	23	21.90
3.	Strongly disagree	19	18.09
4.	No opinion	14	13.34
Total		105	100

Table 6.10 explains the level of Satisfaction of using Facebook. The majority of the respondents are safe with having a profile on Facebook 49 (46.67%), followed by unsafe 23 (21.90%), strongly disagree 19 (18.09%) and finally 14 (13.34%) of the respondents are not given their opinion. The result reveals that more than 50 percent of the respondents are said to have a profile on Facebook is strongly agree.

Figure 5.4 A Profile on Facebook is truly safe

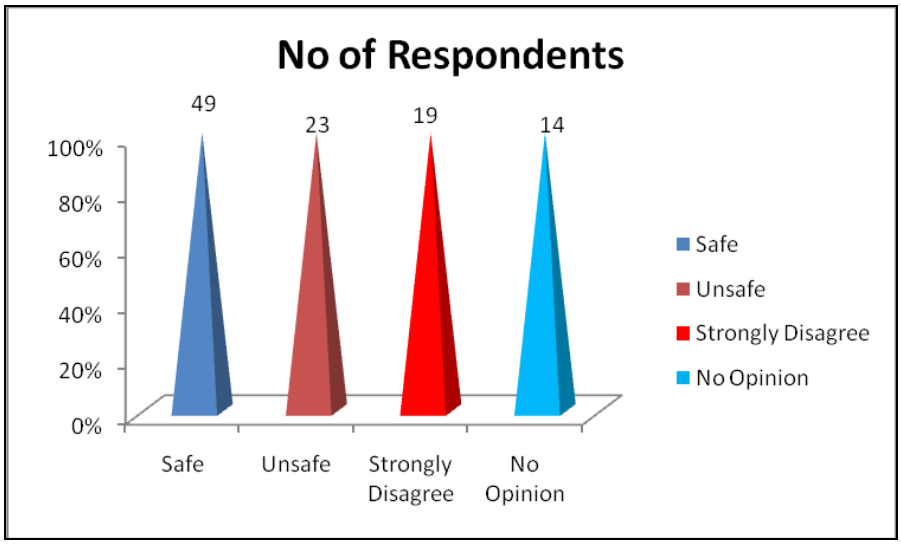


Table 6.11 Facebook Drawbacks

S. No	Major drawbacks	No of respondents	Percentage
1.	Addict	39	37.14
2.	Waste of money	21	20.00
3.	Waste of time	32	30.48
4.	All the above	13	12.38
Total		105	100

Table 6.11 presents that the major drawbacks on using Facebook. The majority of the respondents is said addiction is the major drawbacks on using Facebook 39 (37.14%), followed by waste of time 32 (30.48%), waste of money 21 (20.00%). Only a few of the respondents said all the above 13 (12.38%). The study reveals that the majority of the respondents is said addict 39 (37.14%).

Table 6.12 Facebook Identity

S. No	Facebook identity	No of respondents	Percentage
1.	Yes	49	46.67
2.	No	14	13.34
3.	No opinion	11	10.47
4.	Undecided	31	29.52
Total		105	100

Table 6.12 shows that the majority of the respondents 49 (46.67%) saying yes, followed by 31 (29.52%) respondents are saying undecided, 14 (13.34%) respondents are saying no and at last least number of respondents are saying no opinion 11 (10.47%). The study reveals that majority of the respondents saying yes 49 (46.67%).

Table 6.13 Post responses on Facebook

S. No	Responses	No of respondents	Percentage
1.	Frequently	44	41.90
2.	Rarely	23	21.90
3.	Sometimes	20	19.05
4.	Not at all	18	17.15
	Total	105	100

From table 6.13 it is clear that most of the students frequently responding to the post on Facebook 44 (41.90%), followed by rarely 23 (21.90%), sometimes 20 (19.05%) and finally 18 (17.15%) respondents are saying not at all respond to the post on Facebook. The study examines that the most of the students frequently responding to the Facebook post.

Figure 5.5 Post responses on Facebook

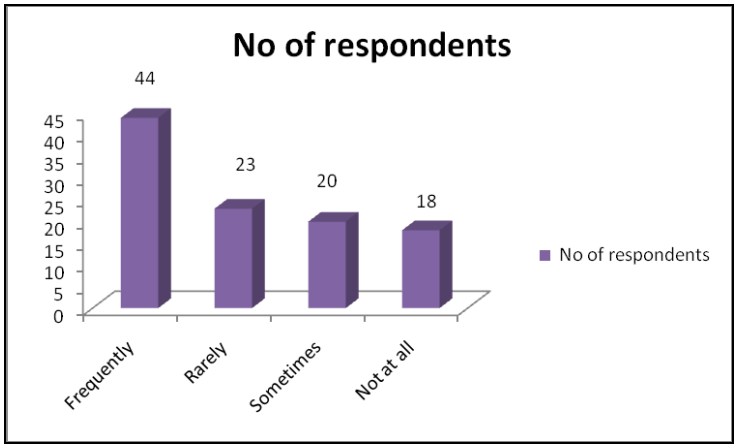


Table 6.14 Feel about Facebook

S. No	Feelings	No of respondents	Percentage
1.	Great	62	59.05
2.	Very great	13	12.38
3.	Satisfied	19	18.10

4.	Unsatisfied	11	10.47
	Total	105	100

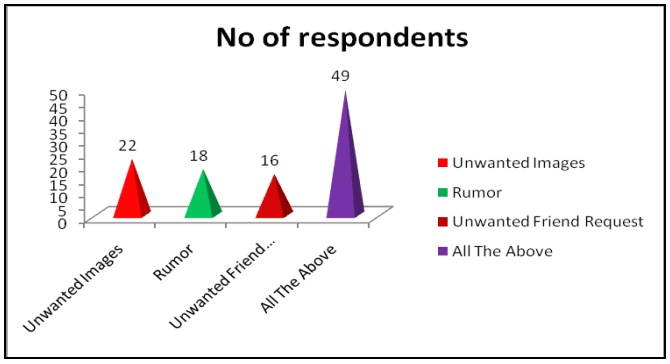
Table 6.14 explains about the Facebook become more commercialized. The majority of the respondents 62 (59.05%) was saying great, followed by 19 (18.10%) are satisfied with the advance of Facebook,13 (12.38%) are saying very great and finally few of them are feelings unsatisfied on Facebook11 (10.47%). So most of the students are saying Facebook is great 62 (59.05%).

Table 6.15 Barriers about the Facebook user

S. No	Facebook barriers	No of respondents	Percentage
1.	Unwanted images	22	20.95
2.	Rumor	18	17.14
3.	Unwanted friend request	16	15.24
4.	All the above	49	46.67
	Total	105	100

Table 6.15 examines that the majority of the respondents are saying 49 (46.67%) all the above are the barriers to use of Facebook, followed by unwanted images 22 (20.95%), rumor18 (17.14%) and finally the least number of the respondents are unwanted friend request 16 (15.24%). The majority of the students are saying all the above are barriers in using Facebook.

Figure 5.6 Barriers about the Facebook user



7.CONCLUSION

Facebook is used by over 8 million college students, but no academic study has been done on its effect on end-users. As with any emerging technology, the common sense regarding its proper use has lagged behind what technology has made possible. Although the Internet has made it possible to publish personal information online for a decade, social networking sites are unique in that they standardize, centralize, and encourage the publication of personal data to an unprecedented extent. The consequences of excessive disclosure of personal information and false senses of security are just beginning to emerge. Although no national attention has been devoted to the issue, more stories of students being disciplined because of Facebook appear in college newspapers every week. As information retrieval and analysis tools become more powerful, the public needs to develop common sense about accepting the practices of these sites. Much as it is now common sense to not meet people online without taking significant precautions, a body of common knowledge about disclosing information online would protect the public. This research aims to begin that dialogue. From a technological perspective, there has been little dialogue about investigating the protections put in place at one of the most-visited sites on the internet, which contains detailed files on more than 8 million young adults. Security by obscurity is not the best practice for any system, let alone one used by so many. The user community on this site and future sites will benefit from increased attention to these issues.

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RESEARCH OUTPUT ON ACUPUNCTURE RESEARCH ACROSS THE GLOBE: A SCIENTOMETRIC ASSESSMENT ON WEB OF SCIENCE DATABASE

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RESEARCH OUTPUT ON ACUPUNCTURE RESEARCH ACROSS THE GLOBE: A SCIENTOMETRIC ASSESSMENT ON WEB OF SCIENCE DATABASE

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Abstract

The present study explores the Scientometric analysis of the Keyword Research on "Acupuncture Research". This study covered 6257 records worldwide from 2014 to 2018. The data were collected from the web of science database. In this study discussed the Keyword Research on "Acupuncture Research" year by year in this study. The study was undertaken to examine the year wise distribution of contributions, authorship pattern, and degree of collaboration, relative growth rate and doubling time, Document wise distribution of records. A Number of publications published in the year of 2017 with 1406(22.4%) records. China ranked first in the Acupuncture Research with 2202 (35%) records followed by USA (1368), and South Korea (620), with second, and third position. A number of records published through the article 4305. Only 11% of the total publications were contributed by the single authors and rest of the 89% research publications were contributed by multi-authors in this study. The study revealed that the average Degree of Collaboration was 0.88. The study analyzed the relative growth rates (RGR) has Increased from 2015(0.68) to 2018 (1.97) in the span of 2014-2018. The doubling time (DT) has rapidly decreased while calculated year wise i.e.2013 (1.01) to 2017(0.35).

Keywords: Scientometric, Relative Growth Rate, Doubling Time, Acupuncture, Authorship Pattern, Activity Index.

INTRODUCTION TO SCIENTOMETRICS

Scientometric is a quantitative measurement of publication patterns of all micro and macro communications along with their authorship by statistical and mathematical analysis." Scientometric is "the measurement of scientific output and the impact of scientific findings on public policy". Some of the areas of Scientometrics application are To identify research trends and growth of information. To estimate comprehensiveness of secondary periodicals. To identify authorship and its trends in documents on various science subjects. To identify users of different subjects, The term Scientometrics were introduced by Nalimov and Mulchenko in 1969. Nalimov and Mulchenko defined

Scientometrics as “the application of those quantitative methods which are dealing with the analysis of science viewed as an information process”. Scientometrics is a wide-ranging field with vague boundaries. It is generic term for a system of knowledge, which endeavors to study the Scientific and Technological system, using a variety of approaches within the areas of Science and Technology Studies (STS). Scientometrics is a “Science of Science’.

INTRODUCTION TO ACUPUNTURE

Acupuncture is a technique in which practitionars stimulate specific points on the body most often by inserting thin needled through the skin. It is one of the practices used in Traditional Chinese Medicine. Acupuncture is a method of inserting fine needle through the skin at specific point especially to cure diseases or to relive pain. The origin of Chinese medicine is a attractive story and acupuncture represents only one facet of their medical system. The first recorded attempt at conceptualizing and treating disease dates back to about 1500 BC during the Shang dynasty. The word “Acupuncture” derived from two words ‘accus’ meaning of needle and ‘puncture’ means insert it. The origin of this therapy can be traced as back as the Stone Age, when stone knives were used to relieve many diseases. The acupuncture is originated approximately 100 BC in china, around the time the yellow 6 emperor’s classic of medicine. The technique of acupuncture rapidly developed during the period of 475 to 221 B.C. acupuncture treatment is first reached to Korea in the 6th century AD, then following reached to Japan through the medical missionaries and then to Europe. In 20th century, as acupuncture spread to the United States and western countries. Acupuncture does not produce long time benefits. Acupuncture is generally safe when using the clean needle technique and single use needles. Acupuncture, along with moxibustion, is one of the oldest practices of traditional Chinese medicine. Most historians believe the practice began in China, though there are some conflicting narratives on when it originated. Academics David Ramey and Paul Buell said the exact date acupuncture was founded depends on the extent dating of ancient texts can be trusted and the interpretation of what constitutes acupuncture.

REVIEW

Zhou, L, et al (2018) have described a Scientometrics study and analyzed publication trends in articles on “disaster medicine”. Data were collected from the Web of Science Core Collection of Thomson Reuters. A total of 564 publications on disaster medicine were identified from 2008 to 2016. There was a mild increase in the number of articles on disaster medicine from 2008 (55) to 2016 (83). Disaster Medicine was published in the majority of articles in the United States, and the leading institute was Tohoku University. F. Della Corte, M. D. Christian, and P. L. Ingrassia were the most prolific authors on the topic, and the field of public health generated the most publications. It was pointed out emergency medicine, public health, disaster preparedness, natural disasters, medicine, and management as the major research hotspots. Hurricane Katrina researched on mechanical ventilation, occupational medicine and intensive care. European journals

deal with the frontiers of disaster medicine research. Overall analysis revealed that disaster medicine studies are closely related to other medical fields and provides researchers and policy-makers in this area with new insight into the hotspots and dynamic directions.

Zacca-Gonzalez, G., et al (2018) the main focus of the this study is to classify the scientific output of the most productive Latin American countries with a aim on the international collaboration and impact. The period of 2003-2013 was taken for the descriptive study based on the SCImago Institutions Ranking (SIR) portal in the medicinal field. The indicator's application was based on documents, citation, and collaboration. End of the study show about the world wide, surgery, cardiology, oncology, neurology and public health as the most productive subjects in medicine; in Latin America is the most profilic title are Public Health, Infectious Diseases, Surgery, Neurology, and Cardiology and Cardiovascular Medicine. The most prolific countries are Brazil,Mexico and Argentina,though the ones having greater impact and more collaboration are Peru, Puerto Rico, and Argentina. The most prolific and evident fields, such as Oncology, Cardiology, and Infectious Disease, are major global health problem involving chronic and emerging diseases. This information could be useful to design pragmatic policies to encourage 9 research in key fields in order to respond better to the health needs of a given populatio.

Krauskopf, E., Garcia, F., & Funk, R.(2017) the purpose of this study was to investigate the association between language and total number of citations found among documents in journals written in English and other languages. They selected all the Under the subject category" Veterinary Sciences" journals were clustered together in the Journal citation Reports 2014 has downloaded all the data registered between 1994-2013 by Web of science for the journals that stated publishing documents in languages other than English they classified each of these journals by quartile and extracted information concerning their impact factor, language, country, published documents, total number of reviews published, percentage of documents published in English. Almost of the journals are multi-lingual. The results of this study suggest that journals considers in using English as the major languages 6 and it will automatically increase citation counts and the impact factor of the journal.

Takahashi, R., & Kajikawa, y.(2017) this study determined CAD research which has been classified and categorized according to disease type and imaging modality in Bibliometric analysis. This classification starts with the CAD of mammograms and eventually progressed to that of brain disease. Moreover, based on this result, it recommended future directions and opportunities for CAD research. Primarily, in contrast to the typical hypothetical approach, the data-driven approach has shown promise. And flowingly, the normalization of the best datasets and an evaluation method is necessary when adopting an algorithm and a system. Third, it discusses opportunities for the co-evolution of CAD research and imaging instruments-for example, the CAD of bones and pancreatic cancer. Fourth, the potential of synergy with computer-aided and clinical support systems is also discussed.

Objectives

The following are objectives of the study:

- To analysis the year-wise publication of Acupuncture Research,
- To know the Country wise Records,
- To analysis the document wise Distribution,
- To analyze the Authorship pattern,
- To determine the degree of collaboration,
- To measure the relative growth rate and doubling time,
- To find out the most productive Keywords,
- To find out the Time Series Analysis
- To determine the Activity Index,

Methodology

The data were collected from the Web of science database by using the topic provision. The research was conducted for the term "Acupuncture", research field selected was Web of Science core journals. The study evaluates the overall literature output over a period of 2014 - 2018. The papers published from 2014 to 2018 by the Medical scientists are accounted as 6257. We arranged in different ways with a view to identify the scientists of Medical Science

DATA ANALYSIS AND INTERPRETATION

Table: 1. Year wise Publication

S.No	Publication year	Records	Percentage
1.	2018	1,349	21.560 %
2.	2017	1,406	22.471 %
3.	2016	1,258	20.105 %
4.	2015	1,314	21.000 %
5.	2014	930	14.863 %

To analyses the yearly output on acupuncture research at world level from 2014 to 2018. There are about 6257 total output on acupuncture research in the year 2014-2018. In the year 2017, the output measured is 1406(22.47%); this is the highest records out of 6257 records. In the year 2014 the output measured is 980(14.86%); this is the lowest records out of 6257 records. The output performance rate is to below 15 Percentage, on 2014. Onwards the output performance is to more than 15 percentages on 2015 to 2018.

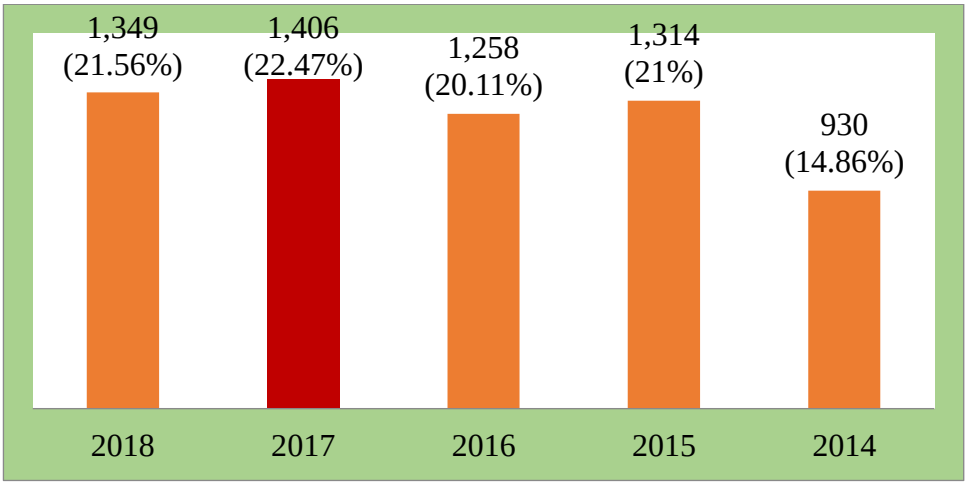


Figure: 1. Year wise Publication of Acupuncture Research

Table: 2. Country wise distribution

S.No	Country	Records	Percentage
1.	China	2,202	35.193 %
2.	USA	1,368	21.864 %
3.	South Korea	620	9.909 %
4.	Germany	327	5.226 %
5.	England	314	5.018 %
6.	Australia	301	4.811 %
7.	Taiwan	250	3.996 %
8.	Brazil	213	3.404 %
9.	Canada	169	2.701 %
10.	Japan	148	2.365 %

The table shows countries wise publication output China is the top ranked with highest records of 2202 and Japan is the last in the list with 148 records of publications. United States America (USA) is the second in the list of countries with 1368 publication output, sharing 21.864% followed by South Korea in third position is having 620 records (9.909%). Germany is the fourth position, and its publication share is 5.226% with 327 publication output, followed by England, Australia, and Taiwan has fifth, sixth and seventh position respectively. And India is in nineteenth place with 62 records in research publication.

Table: 3. Documents with Citation and H-Index

h-index	Documents	Citation sum within h-core	All citations	All articles
32	Article	1916	14543	4305
27	Review	2164	6251	981
7	Editorial Material	135	364	304
6	Letter	57	203	207
5	Proceedings Paper	60	89	27
3	Book Chapter	8	10	8
2	News Item	5	6	96
1	Retraction	1	1	6
1	Meeting Abstract	1	10	250
1	Early Access	1	1	10
1	Correction	2	10	39
0	Data Paper	0	0	1
0	Book Review	0	0	19
0	Biographical-Item	0	0	3
0	Retracted Publication	0	0	1
				6257

Above the table shows the citation and h-index of documentation in the subject of acupuncture medicine. It is found that fifteen types of documents are there. Out of fifteen types of documents, review has the most number of citing papers with 2164 with 27 h-

index. Followed by article 1916 citation and 32 citation, and editorial material has 135 citations with 7 h-index, then another documents are followed below 60 citations with below six h-index. Data Paper, Book Review, Retracted Publication and Biographical-Item are having zero citations and zero h-index.

Table: 4. Authorship pattern

S.No	No. of authors	Frequency	percentage	Cumulative percentage
1	Single author	730	11%	11%
2	Two author	638	10%	21%
3	Three author	745	12%	33%
4	Four author	796	13%	46%
5	Five author	737	12%	58%
6	Above five author	2611	42%	100%
Total		**6257**	**100%**	

The authorship pattern in the acupuncture research publications ranged from single author to above five authors. The category of above five authors has published 2611 records in during the study period, followed by four authored papers published 796 records, three authored papers published 745 records, five authored papers published 737 records, single authored papers published 730 publications and two authored papers published 638 publications.

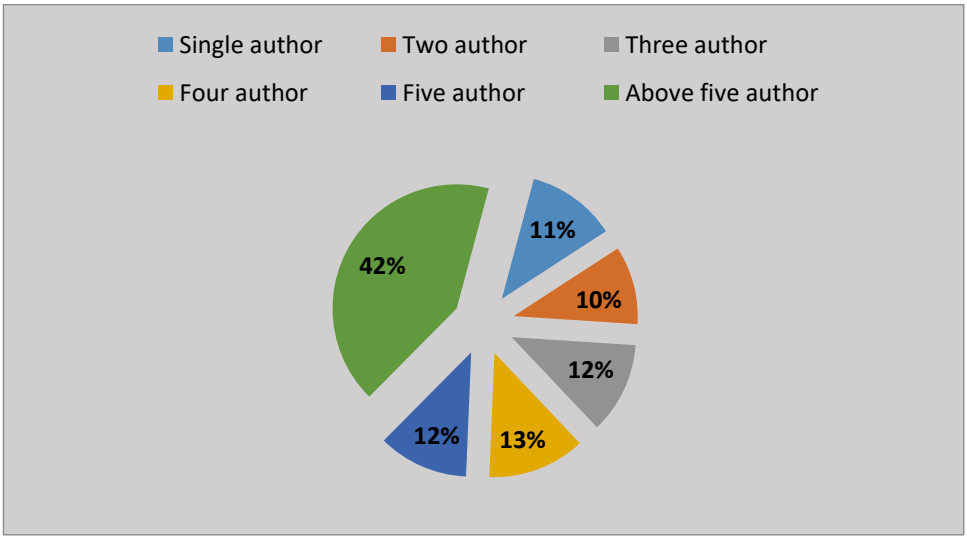


Figure 2 Authorship pattern

Table: 5. Degree of Collaboration

S.No	Year	Single Authors (NS)	Multiple Authors (NM)	Total Authors (NS+NM)	Degree of collaboration (NM/NM+NS)
1	2014	56	874	930	0.94
2	2015	176	1138	1314	0.87
3	2016	153	1104	1257	0.88
4	2017	182	1224	1406	0.87
5	2018	163	1187	1350	0.88
Total		**730**	**5527**	**6257**	**AVRG 0.88**

The table shows the details about the degree of collaboration which indicate tend in single and multiple authors during 2014 – 2018 as shown in Table. The degree of collaboration ranges from 0.88 to 0.94 and the average degree of collaboration is 0.88. The DC is calculated by using the formula K. Subramanian, 1982:

The formula is where

DC = Degree of Collaboration

NM = Number of Multi Authors

NS = Number of Single Authors

DC= NM/NM+NS

DC= 5527/6257

DC = 0.88

In the present study the value of DC is 0.88.

As the result, the degree of collaboration in the study Acupuncture Research is 0.88 which shows the collaboration of multiple authors

Table: 6. Relative Growth Rate (RGR) and Doubling time (Dt)

Year	No. of publications	Cumulative Tot. of publications	Log w1	Log w2	RGR(W2-W1) R(a)	Mean	Doubling time	Mean
2014	1349	1349	-	7.20	-			0.48
2015	1406	2755	7.24	7.92	0.68		1.01	
2016	1258	4013	7.13	8.29	1.16	1.03	0.59	
2017	1314	5327	7.18	8.58	1.40		0.49	
2018	930	6257	6.83	8.74	1.97		0.35	
Total	**6257**					**1.03**		**0.48**

It has been analyzed the growth of publication in acupuncture medicine by Relative Growth (RGR) and Doubling Time (DT). The span of time during the period 2014-2018 has represented 1.03 as mean RGR. Doubling time of this study period is observed as 0.48 for the during the study period 2014-2018. RGR increased from the rate 0f 0.68 in 2015 to 1.97 in 2018. The mean RGR for the 2014-2018 is 1.03. As the doubling same time doubling time decreased from 2015(1.01)-2018(0.35). The mean DT for the 2014-2018 is 0.48. Thus as the rate of growth of research publications was increased and doubling time was decreased.

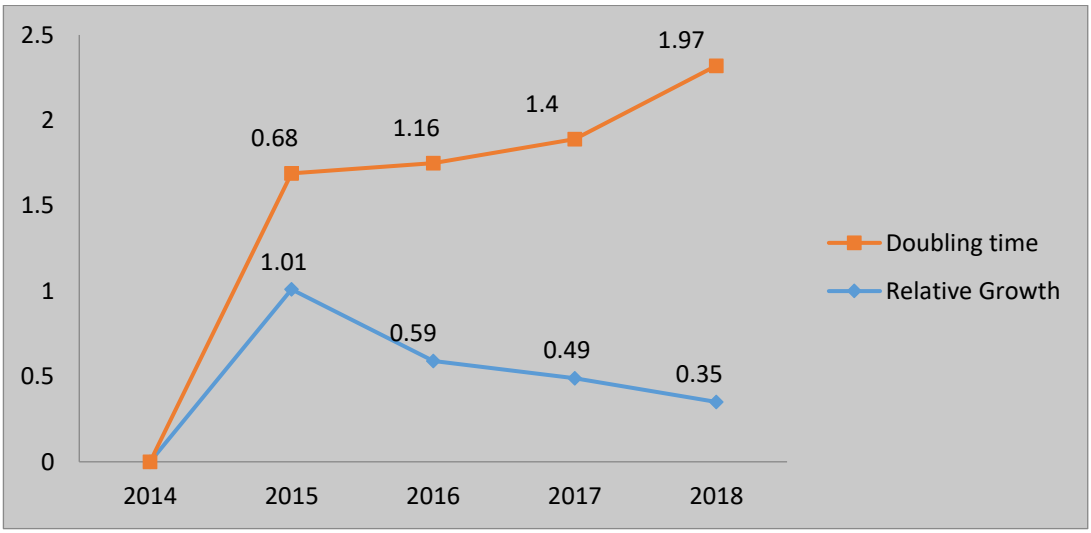
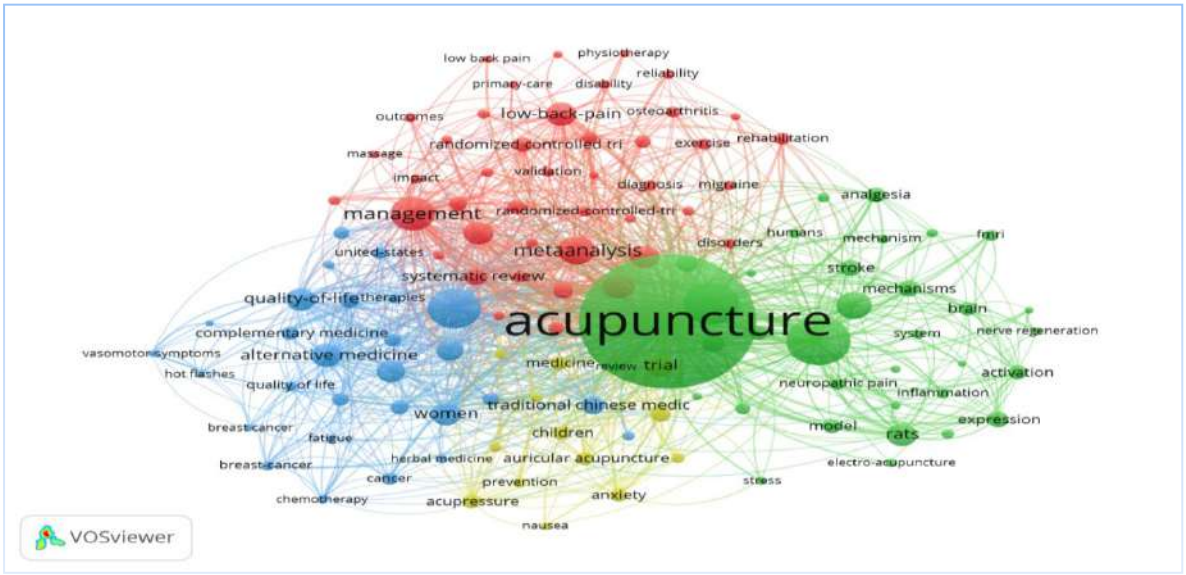


Figure 3 Relative Growth and doubling time

Table: 7. Keyword based classification (Top 10 Only)

S.No	Keyword	Records	Percentage
1	Acupuncture	1375	22%
2	Randomized Controlled-Trial	561	9%
3	Pain	462	7%
4	Electro acupuncture	457	7%
5	Management	441	7%
6	Meta analysis	351	6%
7	Stimulation	329	5%
8	Therapy	270	4%
9	Low-Back-Pain	266	4%
10	Prevalence	253	4%

A few words were repeatedly used by the acupuncture scientists. For this analysis the research has taken top 10 frequently occurring words. The word "Acupuncture" has been repeatedly used 1375 times by the acupuncture research scientists during the study period, Followed by "Randomized Controlled-Trial" used 561 times. The word "Pain" occupies the third position being used 462 times.



Visualization map 1. Keyword based classification

Table: 8. Time Serious Analysis

Year	No. of Publications	X	X^2	XY
2014	930	-2	4	-1860
2015	1314	-1	1	-1314
2016	1257	0	0	0
2017	1406	1	1	1406
2018	1350	2	4	2700
Total	**6257**		**10**	**932**

Straight line equation:

$Yc = a+bX$

Since $\sum X=0$

$a= \sum Y/N= 6257/5 = 1251.4$

$b= \sum XY/\sum X^2 = 932/10 = 93.2$

Estimated literature in 2028 is when X = 2029 – 2019 =10

= 1251.4 + (93.2 x 10) = 2183.4

Estimated literature in 2033 is when X = 2034 – 2019 =15

= 1251.4 + (93.2 x 15) = 2649.4

= 1251.4 + (93.2 x 20) = 3115.4

On the application of the formula of time series analysis and subsequently, from the results obtained separately for the years 2029 and 2034, it is found that the future trend of growth in the study acupuncture research output may take increasing trend during the years to come. The inference is that there is a positive growth at the global level in research output in the acupuncture medicine.

Table: 9. Activity Index

S. No.	Year	Global output	Indian output	Activity Index
1	2014	930	06	153.67
2	2015	1314	08	162.79
3	2016	1257	21	59.28
4	2017	1406	17	81.97
5	2018	1350	10	133.80
Total		**6257**	**62**	**118.30**

Activity Index is the ratio of the country's share in the worlds publication output in the given field to the country's share in world's publication output in all fields.

Mathematically, activity index has identified by the following formula as

$$\textbf{ActivityIndex} = \left[\frac{\frac{Ci}{Co}}{\frac{Wi}{Wo}}\right] * \textbf{100}$$

If the Activity index is =100 indicates that a country's research effort in the given field corresponds precisely to the world average,

If the activity index is > 100 reflects higher than average activity

If the activity index is < 100 indicates lower than average activity.

For Example: 0.1486/0.0967*100 = 153.67

0.2100/0.1290*100 = 162.79

It has been identified the activity index of India during the period 2014-2018. In India most number of publications published in the year 2016 with 21 records and the highest activity index value is 162.79 in the year 2015 and the lowest activity index contributed in the year of 2016 (59.28) in India.

Findings

- It was computed the year wise distribution of contributions and out of 6257 articles, the highest 22.47% of papers were published in 2017 and The lowest number 930 (14.86%) papers were published in 2014.
- The contributions of countries with acupuncture research output, China contributed more number of articles (2202) published.
- As far as citation and H-index are concerned, article is the most cited (14543) documents with having 32 H-index in acupuncture research output during the period 2014-2018.
- Out of the 6257 articles, the major proportion of 42% was contributed by above five authors, and followed by four authors 13%, minimum number of authors contributed by two authors 10% were contributed during 2014-2018.
- The degree of collaboration (DC) among the authors was determined in Acupuncture research. It was very clear that ssingle authored is more than that of multi- authored papers. The degree of collaboration ranges from 0.87 to 0.94 and the average degree of collaboration is 0.88.
- The findings of relative growth and doubling time for research publications of scientists reveal the following facts, the relative growth rate of publications has shown an increasing trend from the started value is 0.68 to 1.97and the average value is 1.03, the doubling time of publications have decreased value started from 1.01 to 0.35 and the average value is 0.48.
- It was observed keyword analysis literature output on acupuncture research during the period of study. In this regard, the prime keyword observed in the study is “Acupuncture” (1375) which reflects 22 percentages of research papers. It is occupied in the first position.
- The results found that the estimated future growth increased as 1251.4 (2018), 2183.4 (2029) and 2649.4 (2034), it clearly explains the progressive trend continued up to estimated year. It is inferred that the rate of growth is relation by the year wise publications of acupuncture research.
- During the study period of five years, the activity index of India value is more than 100 during the period of 2014, 2015 and 2018 with the activity index values of 153.67, 162.79 and 133.80 respectively. The remaining two years had the lower level of productivity in acupuncture publications.

CONCLUSION

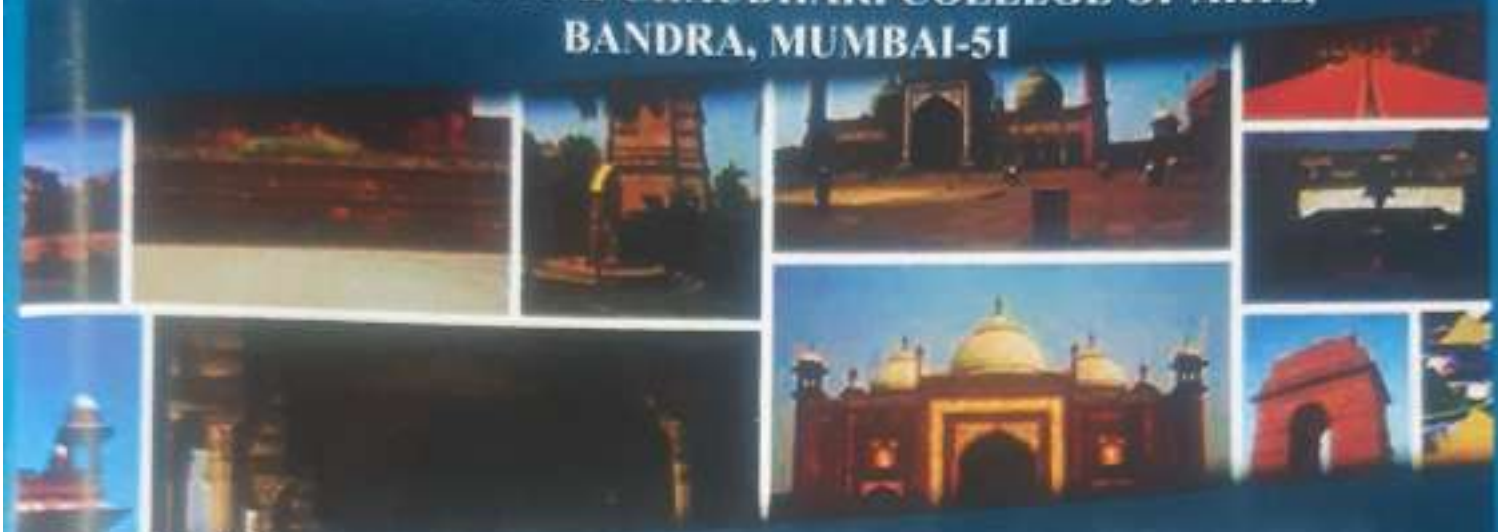
The application of Scientometrics analysis computes to scientific publications has highlighted the contribution of institutions, journals, authors, countries and individual researchers. This study deals with the Research productivity on acupuncture research from 2014 to 2018. This data collected from web of science database by using the keyword “ACUPUNCTURE” search provision in science citation index and analyzed from HistCite and Bibexcel software. For mapping the data, VOS viewer software has been used. In the research analysis, it was measured that the highest 22.47% of papers were published in 2017 and the collaborative research has also measured in the field of acupuncture research in terms of literature output. China has maximum number of literature output i.e. 35.19% and it is ranked in the first position. The degree of collaboration (DC) was determined among the authors productivity, the analysis shows the percentage of multi- authored is more than that of single-authored papers and the average degree of collaboration was 0.88. It is concluded that the research of acupuncture medicine has been increasing year by year at substantial rate.

150 YEARS OF CELEBRATING THE MAHATMA

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ON

"TOURISM AND HOSPITALITY SECTOR: DYNAMICS AND FUTURE PERSPECTIVE"

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21. TOURISM AND PILGRIMAGE TOURISM IN TAMIL NADU AN OVERVIEW

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Abstract

Tourism is one of the fastest growing economic sectors in India and it is expanding very fast in various parts of the country including hill stations, deserts, mountains and coastal area. India has rich cultural heritage, ancient monuments, world famous temples, architecture masterpieces, wild animal's sanctuaries and scenic sports; country holds a great attraction for the international as well as national tourists. Travel for pilgrimage is mental peace and to gain knowledge about rich heritage or religious places in the country is an integral part of Indian culture and tradition. The state of Tamil Nadu is one of the major pilgrimage destinations in Indian states and it is attract more foreign and domestic tourist. pilgrimage tourism in state provide more direct and indirect employment opportunity for local residents, earn foreign exchange earnings, develop the infrastructure and provides unique platform to sell traditional handicrafts etc. The present paper is study the pilgrimage tourism in Tamil Nadu and studies the tourism and pilgrimage tourism connections. This research paper is based on secondary data which comes mainly from state and central government reports, Journals and other literary sources have been used.

Key Words: Tourism, pilgrimage Tourism, Development, Economic Development

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Scientometric analysis on scholarly communications of National Institute of Mental Health and Neurosciences (NIMHANS), India

RADHAKRISHNAN NATARAJAN

Prabahar Ponniah Mr.

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Scientometric analysis on scholarly communications of National Institute of Mental Health and Neurosciences (NIMHANS), India

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Abstract:

The study investigated the research publications of the National Institute of Mental Health and Neurosciences (NIMHANS) during the period 2009-2018 as reflected in Web of Science database. The results show that 1694 papers were published and gained 20158 citations. The average number of citations per paper identified is 11.89%. Neuroscience Neurology, Psychiatry, and Surgery are the most preferred domains to publish the articles. The global collaboration of NIMHANS is mostly with the USA, England, and Australia. The degree of collaboration is 0.99. The researchers of NIMHANS prefer to publish their papers in Indian journals. Lotka's law was tested to measure the scientific productivity of authors. Further, the study analyzed the author's productivity, predominant authors, institutional collaboration, impact factor and highly cited papers.

Keywords: NIMHANS, Scientometrics, Authorship Pattern, Citations, Lotka's Law

Introduction:

Neuroscience is the scientific study of the nervous system and a multidisciplinary subject in science, categorized into the branches of cellular, molecular biology, anatomy and physiology. A few macro and micro levels of quantitative studies of neuroscience research literature in India has been carried out in the past. This study confined to analyze the micro-level of the research performance of NIMHANS. Scientometrics is the tool to study the quantitative and qualitative aspects of research productivity.

The National Institute of Mental Health and Neuro Sciences (NIMHANS) is a multidisciplinary institute for patient care and academic pursuit in the field of mental health and neurosciences which is situated in Bangalore, India. The institute was originated in 1847 when Bangalore Lunatic Asylum was founded. The institute has become "Deemed University" in 1994 by UGC. NIMHANS has been conferred as "Institute of National Importance" in 2012[1].

The research domains have been divided into three major categories namely, Basic Science Research, Behavioral Science and Neuro Science Research. The institute gets funds from national agencies such as DBT, DST, ICMR, CSIR, NIH, (USA) and MRC (UK). It has separate publication division and publishes books, teaching materials, technical reports for academic purposes. Since the institute had originated in the 18th century, it has heritage museum to highlight the history of NIMHANS. The institute has a modernized library and information center, which holds a vast collection of print and online resources in the field of mental health and neurosciences.

Related Work:

Anilkumar, Nishtha[2] (2014), analyzed the research trends of PRL for the period 1997-2006. The data has been taken from their annual reports of the institute. The research studied 1318 papers published in journals. The author studied the publication by division wise of the institute which has six divisions in PRL. The study summarized that the thrust area of PRL research was atmospheric dynamic and meteorology with 114 papers followed by Solar Physics with 82 articles, hydrology and glaciology with 70 papers, and so on. A very less number of documents were published in the area of Condensed Matter with 12 papers during the period. Theoretical Physics division has scored more number of papers; the reason could be more number of faculty and students. Further, high number of publications was directly correlated with more number of journals subscribed by the institute.

Hasan, N. and Singh, M.,[3] (2015) studied the Research output of the top five IITs during the period 2009-2013. The study analyzed the publications of India with a global level, and the Indian share is of 215,019 (2.72%) out of 7,894,639 publications as recorded in the Web of Science database. The IITs' share was 9.32% out of 215,019 papers of Indian contribution. IIT Kharagpur with 5271 papers, is the highest among five IIT's followed by IIT Madras, IIT Bombay, IIT Delhi and IIT Kanpur. IIT Bombay has received more number of citations i.e. 6.7 per article and IIT Bombay and IIT Madras got highest H-Index i.e. 45. USA was the top country collaborating with all the IIT's. IIT Bombay with BARC was the first and IIT Delhi, Kanpur, Kharagpur and Madras with CSIR were the first.

Visakhi, P., and Gupta, R.,[4] (2013) carried out a scientometric study of IISER, Mohali for the period 2008-2012. The study used the Scopus database to collect the data. IISER, Mohali has published 186 papers and confined that annual average growth rate of publications was 44.98%. They calculated the average citation per article for a three-year citation window, and it was 3.40 during the period. The country's collaboration was high with the USA (20.43%) study followed by Germany and Spain. The institute has mostly collaborated with Max Planck Institute of Chemistry, Mainz, Germany etc. IISER, Mohali has also worked with Punjab University, Chandigarh (21papers) IIT, Kanpur (19) papers, and Guru Nanak Dev University, Amritsar (12papers) in India.

Noruzi, A., Abdekhoda, M.,[5] (2013) studied the research output of Iraqi-Kurdistan universities using the Scopus database for the period 1970-2012. The study analyzed 459 papers published by the universities. Their results show that the most favored journals were Eastern Mediterranean

Health Journal and Journal of Chinese Clinical Medicine, etc. The study found that 237 (52%) publications out of 459 have international collaboration and 60% of publications were not cited. Finally, the study suggested that Iraqi-Kurdistan universities should establish repositories at the regional and institutional levels so as to increase the impact of the research.

Suresh, N., and Thauskodi, S.,[6] (2019) explored the research productivity of ICAR-IIHR, Bangalore for the period 1989-2018 using the Web of Science database for collecting the data. The study identified 1095 research publications. Document type "Journal article" is the highest with 90.13%. IIHR researchers mostly preferred to publish their work in Indian journals. USA has gained top position for collaboration with IIHR.

Senthil Kumar, N., Radhakrishnan, N., Hadimani, Nagesh, Prabahar, P.,[7] (2018) have investigated the research performance of CSIR-CECRI, Karaikudi for the period 2010-2015 and retrieved 650 articles using Web of Science database. The highest number of publications was noticed in the year of 2011 with 131 papers. South Korea was the top country to have collaborated with CECRI by its contribution with 36 (5.5%) followed by the USA with 17 (2.62%) and Japan with 16 (2.46%). The study analyzed year-wise publications, document type, subject-wise distributions, highly cited articles and most favored authors as well.

Kumar, Satish[8](2018) evaluated the research productivity of ARIES, Nainital. The study focused on 574 research papers which were published during 2001-2015 using the Web of Science data. 510 research publications were found to be refereed papers out of 574 and the remaining were conferences, symposiums and bulletins etc. Further, the study analyzed active authors, citations, H-index and collaborating institutions.

Priya, Saravanan and Radhakrishnan, Natarajan.,[10] (2018) explored the study of global research trends in entomology. A total of 1671 records were downloaded from the web of science database. The study analyzed the relative growth rate, doubling time, authorship pattern, keyword distribution, etc. The authors' collaboration is 0.97. The output of the study shows that highest number of articles published in the year 2016 with 394 (23.6%) and the lowest articles was published in the year 2012 with 270 (16.2%). USA was the top country to publish articles in the field of entomology followed by South Korea, Peoples R China. India stands in the sixth position with 90 (5.4%) during the period 2012-2016.

Objectives of the Study:

- To describe the authorship pattern and degree of collaboration
- To figure out the most preferred journals for publications

- To visualize co-authorship network using VOSviewer
- To test the Lotka's Law of Scientific Productivity

Methodology:

The study was carried out using the database Web of Science and the data were downloaded for the period 2009-2018. Advanced search as "Organization Enhanced OG=National Institute of Mental Health & Neurosciences-India AND PY=2009-2018" was used to download the records. The results found that totally 2984 publications were retrieved and further refined with "Article" only option with the records 1694 articles taken into the study and other document types like "Editorial material, proceedings paper, biographical item, meeting abstract, review, correction, book chapter, and the letter" were not taken for analysis. The data were downloaded from the database on 26th June. 2019. MS-Excel was also used to analyze the data.

In addition, National and International level assessment with the neuroscience research literature published during the period was considered. To get the national level data, Advance search as "TS=Neuro* AND CU=INDIA and the year range 2009-2018 was applied. For International level data were Advance search as "TS=Neuro* and the period 2009-2018" was given to retrieve suitable records. Further, the data were refined with the document type "Article" only option for the study.

Analysis and Discussion:

Neuroscience Research in India and Abroad:

The study analyzed the literature of neuroscience research at the National and International levels. India stands in the 15th position during the period. Table 1. displays the top 15 countries in the neuroscience research publications. It is evident that the USA is the leading country in the neuroscience research with 36.087%, followed by Peoples R China with 11.395%, Germany with 9.017% so on. Table.2.shows the year-wise publications of the National and international levels.

Table.1. Top 15 Countries in Neuroscience Research

Rank	Countries/Regions	Records	% of 627158
1	USA	226320	36.087%
2	PEOPLES R CHINA	71466	11.395%
3	GERMANY	56551	9.017%
4	ENGLAND	44926	7.163%
5	JAPAN	41636	6.639%
6	ITALY	36714	5.854%
7	CANADA	33894	5.404%
8	FRANCE	31615	5.041%

9	SPAIN	23734	3.784%
10	AUSTRALIA	23251	3.707%
11	SOUTH KOREA	20655	3.293%
12	NETHERLANDS	19255	3.07%
13	BRAZIL	17109	2.728%
14	SWITZERLAND	15151	2.416%
15	INDIA	14153	2.257%

Table.2.Year-wise publications of National and International levels

Year	National	%	International	%
2009	921	6.51%	51888	8.27%
2010	1048	7.41%	54735	8.73%
2011	1140	8.06%	56543	9.01%
2012	1198	4.47%	60836	9.70%
2013	1326	9.37%	63233	10.08%
2014	1546	10.92%	64160	10.23%
2015	1487	10.51%	66348	10.58%
2016	1716	12.13%	67726	10.80%
2017	1821	12.87%	69665	11.11%
2018	1950	13.78%	72024	11.49%
Total	14153	100%	627158	100%

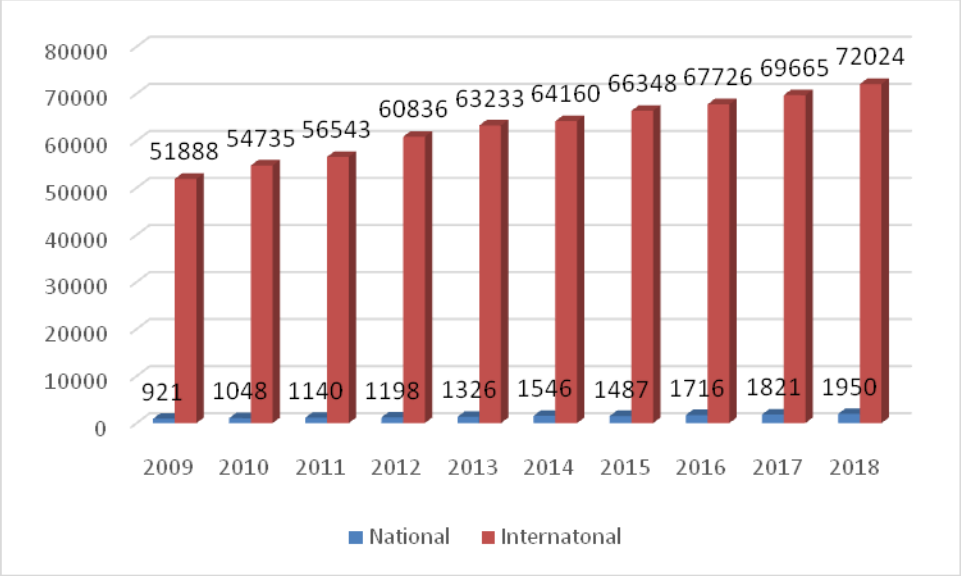


Fig.1.The graph shows Year-wise publications of National and International level on Neuroscience.

Document Type:

The study has analyzed the document-wise publications of NIMHANS during the period 2009-2018. The table 3 proves that out of 2985 publications, the maximum number of publications i.e. 1694 (56.73%) which are research papers and 192(6.43%) publications are "Editorial material, 12 (0.40%) are Proceedings paper, 466 (15.61%) are Meeting abstract, 186 are (6.23%) are Review, and 429 (14.37%) are Letters.

Table.3: Document-wise Distribution

Document Type	No. of document	Percentage
Article	1694	56.73%
Editorial Material	192	6.43%
Proceedings Paper	12	0.40%
Biographical Item	8	0.26%
Meeting Abstract	466	15.61%
Review	186	6.23%
Correction	10	0.33%
Book Chapter	2	0.06%
Letter	429	14.37%
Total	2985	100%

Table 4 shows the year-wise publications of NIMHANS from 2009-2018 and it is proved that 1694 articles were published and received 20158 citations. TLCS (Total Local Citation Score) is 1026, and TGCS (Total Global Citation Score) is 19312. The highest number of articles i.e. 241(14.235%) appeared in the year 2017 and the lowest articles i.e. 114(6.734%) appeared in the year 2011. The average number of articles published per year is 169.3.

Table.4 Year-wise Publications of NIMHANS

Year	Total Publications	%	TLCS	TGCS
2009	117	6.911%	163	2280
2010	138	8.151%	166	2167
2011	114	6.734%	111	2839
2012	126	7.442%	118	1979
2013	159	9.392%	85	1960
2014	180	10.632%	112	3381
2015	174	10.278%	97	1424
2016	206	12.109%	87	1335

2017	241	14.235%	78	1244
2018	239	14.117%	9	523
Total	1694	100%	1026	19132

Year-wise Publications and Citations:

Fig.2.indicates the year-wise publications and citations received on NIMHANS publications. The academics of NIMHANS published 1694 articles during the period 2009-2018 and received 20158 citations. The highest numbers of citations i.e. 3493 were received in the year 2014 and the lowest number of citations 532 was received in the year 2018. The average number of citations per article is 11.89.

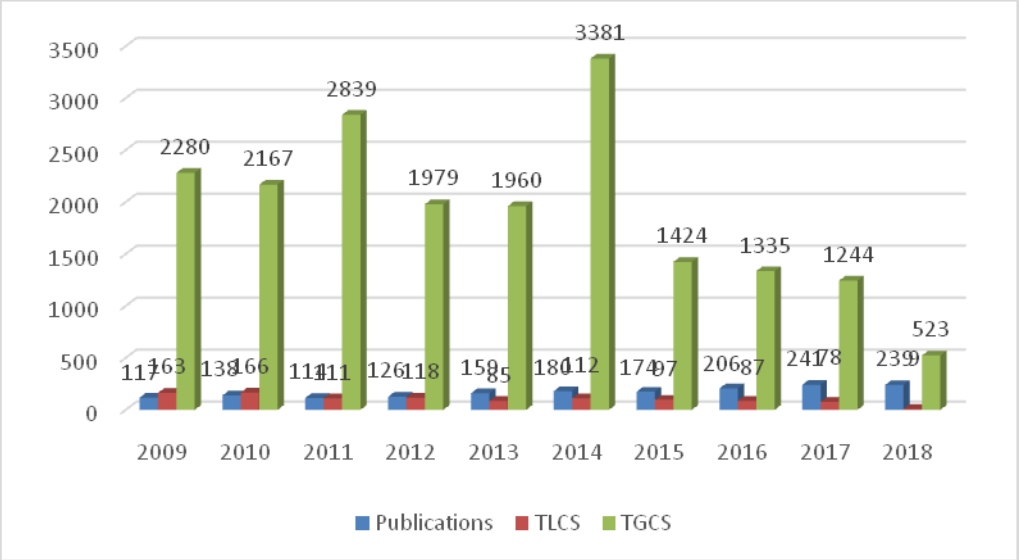


Table 5: Authorship Pattern

S.No.	Authorship Pattern	Number
1	Single Authored Article	72
2	Multi Authored Article	19782
3	Total Publications	1694
4	Total Authors	19854

Subramanyam, K.,[11](1983) defined a formula to calculate the Degree of Collaboration and it is expressed as:

Degree of Collaboration (DC) = Nm
Nm+Ns
Where,
Nm = No. of Multi-authored publications.
Ns = No. of single-authored publications.

(DC) = 19782/19782+72
(DC)=0.99

Hence, the Degree of Collaboration for the period 2009-2018 is 0.99.

Author Productivity:

Yoshikane, F.,[et al.][12] (2009) given a formula to calculate Average Author Per Paper (AAPP) and Productivity Per Author (PPA), which is defined as below:

Average Author Per Paper = No. of Authors/No. of Papers

Productivity Per Author=No. of Papers/No. of Authors

In all 19854 authors (each author is given one count for each published paper) have contributed 1694 articles during the study period. The average author per paper is 11.72 for 1694 articles. The average productivity per author is 0.08.

Most preferred journals for publication:

It has been identified that 1694 articles published by NIMHANS were scattered in various national and international journals. Table.6 describes the top 15 journals in which NIMHANS researchers mostly preferred to publish their work. The highest numbers of articles were published in the journal "Neurology India" with 90(5.316%) is in 1st position, followed by "Annals of Indian Academy of Neurology" with 81(4.784%) is in 2nd position, "Asian Journal of Psychiatry" with 77(4.371%) is in 3rd position. "Journal of Affective Disorders" with 13(0.768%) is in 15th position. Neurology India has got IF (Impact Factor) of 2.708 (2018) and received the highest number of citation i.e. 646 (35 TLCS and 611 TGSC) amongst the top 15 journals. Out of 15 journals, four journals which published 6.025% papers has highest IF of above 4. Hence, the study proves that NIMHANS researchers mostly prefer to publish their work in national level journals.

Table.6 Most preferred journals

Position	Journal Name	Total	%	IF2018	TLCS	TGCS
1	NEUROLOGY INDIA	90	5.316%	2.708	35	611
2	ANNALS OF INDIAN ACADEMY OF NEUROLOGY	81	4.784%	0.898	22	389
3	ASIAN JOURNAL OF PSYCHIATRY	77	4.371%	1.932	16	184
4	INDIAN JOURNAL OF PSYCHIATRY	74	1.93%	1.122	30	446
5	JOURNAL OF CLINICAL PSYCHIATRY	58	3.426%	4.023	64	390
6	JOURNAL OF THE NEUROLOGICAL	27	1.536%	2.651	16	311

	SCIENCES					
7	JOURNAL OF ECT	26	1.76%	2.280	19	233
8	BRITISH JOURNAL OF NEUROSURGERY	24	1.418%	1.481	0	110
9	PEDIATRIC NEUROSURGERY	20	1.181%	0.783	2	76
10	PSYCHIATRY RESEARCH	18	1.004%	2.208	15	181
11	JOURNAL OF CLINICAL NEUROSCIENCE	17	1.31%	1.593	3	157
12	INDIAN JOURNAL OF MEDICAL RESEARCH	16	0.945%	1.251	16	145
12	PARKINSONISM &RELATEDDISORDERS	16	0.945%	4.360	14	235
12	PLOS ONE	16	0.945%	2.776	0	251
13	SCHIZOPHRENIA RESEARCH	15	0.886%	4.569	9	176
14	EPILEPSY RESEARCH	14	0.827%	2.178	18	157
15	JOURNAL OF AFFECTIVE DISORDERS	13	0.768%	4.084	13	182

Highly Prolific Authors of NIMHANS:

Table 7 identified the list of top 15 prolific authors who have contributed papers for NIMHANS. A. Mahadevan has registered for 141 (8.328%) papers which received 2659 citations (TLCS 132 and TGCS 2527) stood in 1st rank followed by S.Sinha who published 133 (7.856%) papers which received 1128 citations (TLCS 85 and TGCS 1043) held in 2nd rank. A.B.Taly has published 116 (6.852%) papers received 1095 citations (TLCS 54 and TGCS 1041) (3rd rank). S.K.Shankar has published 98 (5.789%) papers and received 2589 citations (TLCS 125 and TGCS 2464) (4th rank) and C.Andrade has published 94 (5.552%) papers which received 798 citations (TLCS 86 and TGCS 712) reached 5th rank.

Table 7. Top 15 prolific authors

Rank	Author	Number of Papers	%	TLCS	TGCS
1	MAHADEVAN A	141	8.328%	132	2527
2	SINHA S	133	7.856%	85	1043
3	TALY AB	116	6.852%	54	1041
4	SHANKAR SK	98	5.789%	125	2464
5	ANDRADE C	94	5.552%	86	712
6	PAL PK	90	5.316%	51	828
7	SATISHCHANDRA P	86	5.080%	90	1794
8	SAINI J	79	4.666%	27	542
9	GANGADHAR BN	78	4.607%	49	952
10	NALINI A	77	4.548%	99	693
11	VENKATASUBRAMANIAN G	76	4.489%	41	851
12	SANTOSH V	72	4.253%	60	1105

13	DEVI BI	71	4.194%	14	170
14	THENNARASU K	69	4.076%	58	699
15	THIRTHALLI J	65	3.839%	43	704

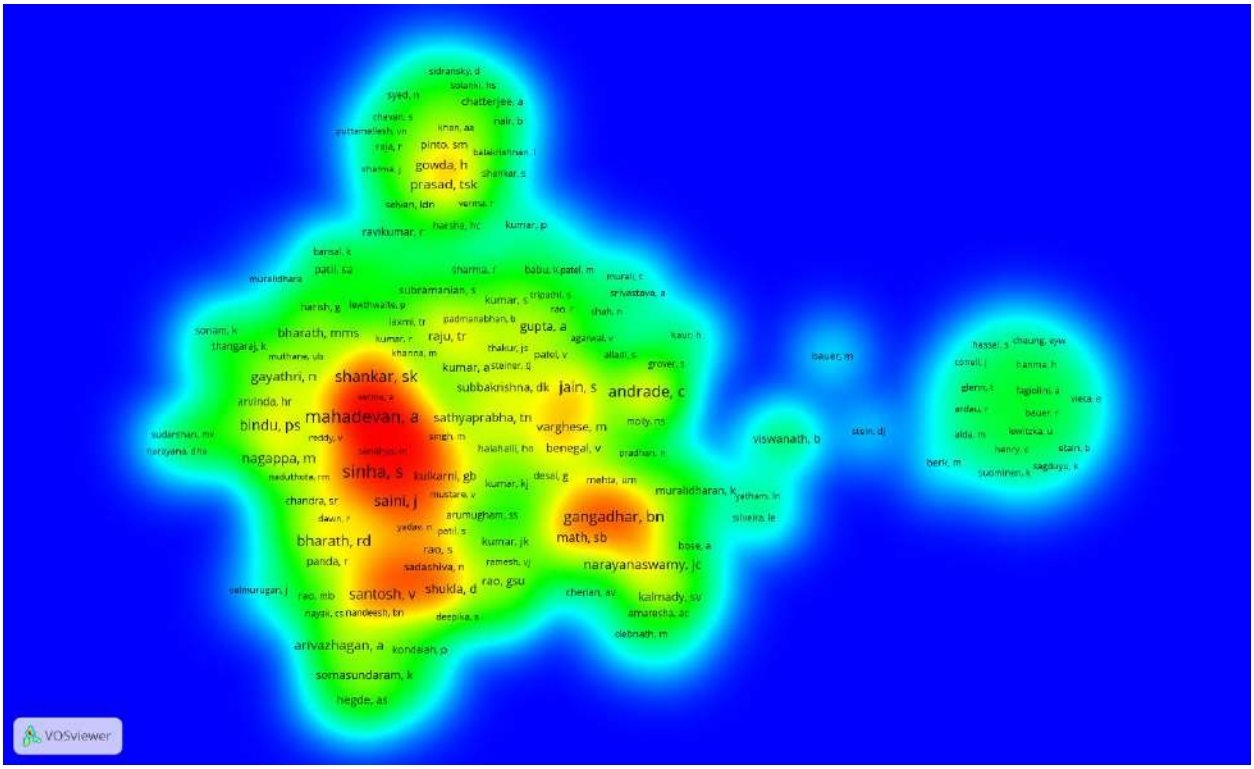


Fig.3.VOSviewer Co-authorship Network Visualization

Subject wise distribution of publications:

Table 8 shows the top 20 subject wise publications of NIMHANS. As per the subject area classified by Web of Science, the academics of NIMHANS mostly preferred to publish their papers in the field of "Neuroscience Neurology" (43.414%) followed by "Psychiatry" (25.340%).

Other prolific subject areas are such as Surgery (7.856%), Biochemistry Molecular Biology (6.143%), Psychology (5.198%), Immunology (4.312%) and similar.

Table 8. Top 20 Subject Areas

Rank	Subject	Records	Percentage
1	NEUROSCIENCES NEUROLOGY	735	43.414 %
2	PSYCHIATRY	429	25.340 %
3	SURGERY	133	7.856 %
4	BIOCHEMISTRY MOLECULAR BIOLOGY	104	6.143 %
5	PSYCHOLOGY	88	5.198 %

6	IMMUNOLOGY	73	4.312 %
7	PEDIATRICS	64	3.780 %
8	GENERAL INTERNAL MEDICINE	55	3.249 %
9	GENETICS HEREDITY	51	3.012 %
9	PHARMACOLOGY PHARMACY	51	3.012 %
10	CELL BIOLOGY	49	2.894 %
11	BEHAVIORAL SCIENCES	47	2.776 %
11	PATHOLOGY	47	2.776 %
12	RADIOLOGY NUCLEAR MEDICINE MEDICAL IMAGING	45	2.658 %
13	BIOTECHNOLOGY APPLIED MICROBIOLOGY	44	2.599 %
14	ONCOLOGY	43	2.540 %
15	RESEARCH EXPERIMENTAL MEDICINE	36	2.126 %
16	INFECTIOUS DISEASES	32	1.890 %
16	SCIENCE TECHNOLOGY OTHER TOPICS	32	1.890 %
17	PUBLIC ENVIRONMENTAL OCCUPATIONAL HEALTH	29	1.713 %
18	ANESTHESIOLOGY	25	1.477 %
19	GERIATRICS GERONTOLOGY	24	1.418 %
20	MEDICAL LABORATORY TECHNOLOGY	20	1.181%

Highly cited publications:

Table 9 depicts the list of the top 10 articles, which are highly cited by other researchers. It is evident from table 9 that the article title “A draft map of the human proteome” written by Kim, Min-Sik.; Pinto, Sneha M.; Getnet, Derese; et al. published in the journal “Nature” in the year 2014 got first position with 915 citations followed by the article entitled “Global Mental Health 2 Child and adolescent mental health worldwide: evidence for action” written by Kieling, Christian; Baker-Henningham, Helen; Belfer, Myron; et al. published in the journal “LANCET” in the year 2011 got 2nd position with 450 citations and the article “Exome Sequencing Links Corticospinal Motor Neuron Disease to Common Neurodegenerative Disorders” published by Novarino, Gaia; Fenstermaker, Ali G.; Zaki, Maha S.; et al. in the journal “Science” in the year 2014 got 3rd position with 222 citations.

Table 9. Top 10 highly cited publications

Rank	Title	Authors	Source	Impact factor (2018)	Total citations
1	A draft map of the human	Kim, Min-Sik.; Pinto, Sneha	NATURE, Volume: 509	43.070	915

	proteome	M.; Getnet, Derese; et al.	Issue: 7502 pp.575, 2014.		
2	Global Mental Health 2 Child and adolescent mental health worldwide: evidence for action	Kieling, Christian; Baker-Henningham, Helen; Belfer, Myron; et al.	LANCET Volume: 378 Issue: 9801 Pages: 1515-1525, 2011.	59.102	450
3	Exome Sequencing Links Corticospinal Motor Neuron Disease to Common Neurodegenerative Disorders	Novarino, Gaia; Fenstermaker, Ali G.; Zaki, Maha S.; et al.	SCIENCE Volume: 343 Issue: 6170 Pages: 506-511, 2014.	41.037	222
4	Targeted therapy for high-grade glioma with the TGF-beta 2 inhibitor trabedersen: results of a randomized and controlled phase IIb study	Bogdahn, U.; Hau, P.; Stockhammer, G.; et al.	NEURO-ONCOLOGY Volume: 13 Issue: 1 Pages: 132-142, 2011.	10.091	184
5	Suicide mortality in India: a nationally representative survey	Patel, Vikram; Ramasundarahettige, Chinthanie; Vijayakumar, Lakshmi; et al.	LANCET Volume: 379 Issue: 9834 Pages: 2343-2351, 2012.	59.102	173
6	India: Towards Universal Health Coverage 3 Chronic diseases and injuries in India	Patel, Vikram; Chatterji, Somnath; Chisholm, Dan; et al.	LANCET Volume: 377 Issue: 9763 Pages: 413-428, 2011	59.102	161
7	Mutations in STIL, Encoding a Pericentriolarand Centrosomal Protein, Cause Primary Microcephaly	Kumar, Arun; Girimaji, Satish C.; Duvvari, Mahesh R.; et al.	AMERICAN JOURNAL OF HUMAN GENETICS Volume: 84 Issue: 2 Pages: 286-290, 2009	9.924	145
8	Plasma Proteome Database as a resource for proteomics research: 2014 update	Nanjappa, Vishalakshi; Thomas, Joji Kurian; Marimuthu, Arivusudar; et al.	NUCLEIC ACIDS RESEARCH Volume: 42 Issue: D1 Pages: D959-D965, 2014	11.147	123
9	Genome-wide expression profiling identifies deregulated miRNAs in malignant astrocytoma	Rao, Soumya A. M.; Santosh, Vani; Somasundaram, Kumaravel	MODERN PATHOLOGY Volume: 23 Issue: 10 Pages: 1404-1417, 2010	6.365	117
10	Rescue of fragile X syndrome phenotypes in Fmr1 KO mice by the small-molecule PAK inhibitor FRAX486	Dolan, Bridget M.; Duron, Sergio G.; Campbell, David A.; et al.	PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA Volume: 110 Issue: 14 Pages: 5671-5676, 2013	9.58	105

Institutions wise distributions:

The publication records of NIMHANS were indexed in Web of Science database during the period 2009-2018. Institution collaboration shows that the Indian Institute of Science (IISC) Bangalore has more articles with 75 (4.430%) and got 1st position followed by Manipal

University with 71 (4.194%) articles in 2nd position. Department of Science and Technology, India gained 3rd position with 53 (3.131%) articles.

Table 10. Collaboration with other institutions

Rank	Institute Name	Records	%
1	INDIAN INSTITUTE OF SCIENCE IISC BANGALORE	75	4.430%
2	MANIPAL UNIVERSITY	71	4.194%
3	DEPARTMENT OF SCIENCE TECHNOLOGY INDIA	53	3.131%
4	JOHNS HOPKINS UNIVERSITY	48	2.835%
5	INST BIOINFORMAT	42	2.481%
6	COUNCIL OF SCIENTIFIC INDUSTRIAL RESEARCH CSIR INDIA	41	2.422%
7	UNIVERSITY OF LONDON	36	2.126%
8	ALL INDIA INSTITUTE OF MEDICAL SCIENCES	32	1.986%
9	AMRITA VISHWA VIDYAPEETHAM UNIVERSITY	31	1.831%
9	PONDICHERRY UNIVERSITY	31	1.831%
10	HARVARD UNIVERSITY	28	1.654%
10	PGIMER CHANDIGARH	28	1.654%
10	ST JOHN S NATIONAL ACADEMY OF HEALTH SCIENCES	28	1.654%
10	YENEPOYA UNIV	28	1.654%
11	JAWAHARLAL NEHRU CENTER FOR ADVANCED SCIENTIFIC RESEARCH	27	1.595%
12	SREE CHITRA TIRUNAL INSTITUTE FOR MEDICAL SCIENCES TECHNOLOGY	25	1.477%
12	ST JOHN S MEDICAL COLLEGE	25	1.477%
13	GOVT MED COLL	24	1.418%
14	DEPARTMENT OF BIOTECHNOLOGY DBT INDIA	23	1.359%
15	UNIVERSITY OF CALIFORNIA SYSTEM	20	1.181%

Country collaboration:

Collaboration with other countries becomes an important indicator. Table 11 reveals that the NIMHANS' researchers have collaborated with USA 209 (12.345%) followed by England with 90 (5.316%), Australia with 54 (3.190%) and Canada with 48 (2.835%).

Table 11. Top 10 collaboration with other countries

Rank	Country	Records	%	TLCS	TGCS
1	USA	209	12.345%	120	5116
2	England	90	5.316%	75	3895
3	Australia	54	3.190%	35	1007

4	Canada	48	2.835%	38	1843
5	Brazil	35	2.067%	14	1166
5	Peoples R China	35	2.067%	28	1788
6	Germany	33	1.949%	20	986
7	Switzerland	28	1.654%	21	891
8	Italy	26	1.536	20	584
9	Netherlands	25	1.477%	26	412
10	France	24	1.418%	15	754

Testing of Lotka's law of scientific productivity:

Alfred J Lotka[13] (1926) developed a law which deals with the author's productivity pattern. It states that the number of authors making 'n' contributions is approximately equal to $1/n^2$ of the number of authors that produce only one contribution. i.e., in a given field, about 60% of authors out of One Hundred will have one article each, 15% will have two articles each, 7% will have3 articles each, and so on. Lotka's Law is mathematically expressed as:

$$Y_x = C/X^n$$

Where, Y is the number of authors credited with X (1, 2, 3, 4, 5, 6, 7, 8, 9……) papers C is the number of authors contributing one paper and n is a rate

$X^n * Yx = C$ **(Where X = 1)**

i.e., 1 * 2934 = C (C = 2934, number of authors contributing one article)

When X= 2

$2^n * 641 = C$ (C=2934)

$2^n * 641 = 2934$

$2^n = 2934/641 = 4.5772$ (by applying log)

n log 2 = log (4.5772)

n= log (4.5772) / log2

n= 0.6606/0.3010

n= 2.195

Where, Y is the number of authors credited with X (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 22, 23, 24, 25, 26, 28, 29, 30, 31, 32, 34, 36, 37, 38, 39, 41, etc.) papers, C are the number of authors contributing one article.

Table 8: Lotka's Law of Scientific Productivity

No of Articles	No. of Authors (Observed)	Observed %	No. of Authors (Expected)	Expected %
X	**7009**		**4359**	
1	2934	41.86	2934	67.31
2	641	9.15	641	14.70
3	2752	39.26	263	6.04
4	200	2.85	140	3.21
5	91	1.30	86	1.97
6	137	1.95	57	1.32
7	33	0.47	41	0.94
8	31	0.44	31	0.70
9	30	0.43	24	0.54
10	15	0.21	19	0.43
11	10	0.14	15	0.35
12	18	0.26	14	0.32
13	2	0.03	11	0.24
14	13	0.19	9	0.21
15	7	0.10	8	0.18
16	3	0.04	7	0.15
17	9	0.13	6	0.13
18	2	0.03	5	0.12
19	6	0.09	5	0.11
20	2	0.03	4	0.09
22	4	0.06	3	0.08
23	4	0.06	3	0.07
24	2	0.03	3	0.06
25	3	0.04	3	0.06
26	2	0.03	2	0.05
28	2	0.03	2	0.04
29	5	0.07	2	0.04
30	6	0.09	2	0.04
31	3	0.04	2	0.04
32	1	0.01	1	0.03
34	2	0.03	1	0.03
36	2	0.03	1	0.03
37	1	0.01	1	0.02
38	3	0.04	1	0.02

39	2	0.03	1	0.02
41	1	0.01	1	0.02
43	1	0.01	1	0.02
45	1	0.01	1	0.02
47	1	0.01	1	0.01
50	1	0.01	1	0.01
51	1	0.01	1	0.01
53	2	0.03	0	0.01
54	2	0.03	0	0.01
59	1	0.01	0	0.01
61	1	0.01	0	0.01
62	1	0.01	0	0.01
63	2	0.03	0	0.01
65	1	0.01	0	0.01
69	1	0.01	0	0.01
71	1	0.01	0	0.01
72	1	0.01	0	0.01
76	1	0.01	0	0.01
77	2	0.03	0	0.01
79	1	0.01	0	0.01
87	1	0.01	0	0.01
90	1	0.01	0	0.01
94	1	0.01	0	0.01
99	1	0.01	0	0.01
116	1	0.01	0	0.01
133	1	0.01	0	0.01
142	1	0.01	0	0.01

There were 1694 articles published by 19852 authors during the period 2009-2018.Table.8 indicates that the number of authors observed is 2934 (41.86%) authors who produced one article, 641 (9.15%) authors produced two articles, 2752 (39.26%) authors who produced three articles, 200 (2.85%) authors contributed four articles and so on. According to Lotka's Law, there will be 641 (14.70%) authors who produce two articles, 263 (6.04%) authors contribute three articles, 140 (3.21%) authors produce four articles. At this point, the present study non-confirms the Lotka's law of scientific productivity.

Findings and Conclusion:

The study has been conducted to analyze the publications' output of NIMHANS. 2984 papers were published during the period 2009-2018. The study is restricted to "Articles" only i.e. 1694 papers. The highest number of articles published in the year 2017 was 241(14.235%), followed by the year 2018 with 239(14.117%). Ten years publications lead to 1694 papers which received

20158 citations. Mahadevan, A., Sinha, S., and Taly, A.B. are the top three authors who contributed the papers. The degree of collaboration is 0.99. The multi-authored publications are very high. The average author per paper is 11.72 and the average productivity per author is 0.08. The academics of NIMHANS mostly preferred to publish their research in the subject area of "Neurosciences Neurology" with 735 (43.41%) followed by "Psychiatry" with 429 with (25.34%) and "Surgery" with 133 (7.856.%). Indian Institute of Science, followed by Manipal University and the Department of Science and Technology has highly collaborated with NIMHANS. As far as Global wise collaboration is concerned, the USA, England, Australia, Canada, Brazil and China have extended. NIMHANS' researchers mostly prefer to publish the work in Indian journals like "Neurology India, Annals of Indian Academy of Neurology, Asian Journal of Psychiatry, and Indian Journal of Psychiatry. The study will benefit policymakers and higher authorities of NIMHANS. On par with international research, the institution and nation should adopt new policies and guidelines to enhance the research.

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NOVEL TRENDS AND TECHNIQUES IN LITERATURE AND LANGUAGE RESEARCH

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Unveiling the Anonymous Conditions of Female to Male (FTM) Transgenders through A.Revathi's Memoir A Life in Trans Activism

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ABSTRACT:

In the 'incredible' India, the transgenders who were anonymous are now finding ways to voice out effectively and make themselves visible through the writing space. Transwomen or the male to female (MTF) transgender writers like Living Smile Vidya, A.Revathi, Manobi Bandyopadhyay and Laxminarayan Tripathi through their heart agonizing memoirs are unveiling their community's identity and deciphering the inbuilt mystery. But the female to male (FTM) transgeders in India are scarcely found and are rarely popular. The anonymity that surrounds FTM remains dense. This condition of FTMs should change; recognition of MTF should be equalised with the recognition of FTM for a liberated gender friendly climate.

The aim of the paper is to uncover the reasons for the anonymity that surrounds the FTM community. The paper through Revathi's memoir *A Life in Trans Activism* primarily brings out the factors that entrench the anonymous conditions of the FTM transgenders.

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Keywords: Anonymity, Transgenderism, Transmen, Discrimination, Caste, Family, Gender Dysphoria, Deindividaution

INTRODUCTION:

The paper attempts to broadly classify the 'reasons' that label the FTM transgenders of India, anonymous. Therefore the reasons for the anonymity of FTM transgenders of India investigated by the paper are found to correlate with the case studies enlisted in the memoir, taken for study. The memoir *A Life in Trans Activism* by A.Revathi presents an account of seven case studies of FTM transgender across India. The story of Mookan is the first case study recorded in the text. The second case study covers the life instances of Charu. The rest five includes the testimonies of Kiran, Sonu Niranjan, Christy Raj, Gee Imaan Semmalar and Satya Rai Nagpaul respectively. When compared to the first two, the last five FTM transgenders have cut a niche through their striking achievements. Through these case studies the paper enlists 'discrimination' and 'lack of family support and family' as the primary factors for the anonymity of FTMs. This mission of encrypting the reasons for the anonymous state of FTM transgenders of India serves to be the objective of the paper.

REASONS FOR THE ANONYMOUS CONDITIONS OF FTM TRANSGENDERS

FTM transgenders who are women before their gender transition, experience discrimination in three ways. Firstly for their 'female gender' assigned at the time of birth, secondly for the 'caste' they belong to and thirdly for the 'gender differences' they possess.

GENDER DISCRIMINATION

Firstly, FTM transgenders are discriminated for being born female. Being born female and changing to the gender their body and mind earns for, exasperates the suppressing

Effectiveness of activity based training programme in enhancing elementary level student-teachers' map reading skills

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Abstract

The study was designed as a single group experimental design aimed at studying the effectiveness of activity based training programme in enhancing map reading skills of elementary level student-teachers. 67 student-teachers were selected as sample using convenience sampling technique. The self-developed test was used to assess the map reading skills of the student-teachers. The researchers also prepared a module on map reading skills to implement the activity based training programme. After developing the research tool and module, the activity based training programme on map reading skills was imparted to the student-teachers using the prepared module. The map reading skills test was administered to the student-teachers at two different phases as pre-test and post-test. The data were analysed using the gain scores, gain ratios, and percentages. The results indicated that the imparted activity based training programme using the developed module was effective in enhancing map reading skills of the student-teachers.

Keywords: *1.Activity based training, 2.Geography, 3.Map reading skills, 4.Student-teachers.*

Introduction

Social Science taught as a subject of study at school level in India. The social sciences encompass diverse concerns of society and include a wide range of content drawn from the disciplines of history, geography, political science, economics, and sociology (National Focus Group Position Paper on Teaching of Social Sciences, 2006). Geography is an integral component of Social Science and introduced as one of the components under the umbrella of Social Sciences.

Geography deals with many components. Among the different components of geography, map work stands out very significantly. Bednarz (2011) claims that, "one of the key differences between expert and novice geographers is the ability to think spatially."Maps are very efficient means of communication and exploration of geographical information. A well-prepared map is worth hundreds of pages of a book in many respects. Moreover, maps are regarded as indispensable aids in the teaching and learning of social sciences, particularly geography.

Hartshorne (1939) states that, "So important is the use of maps in geographic work that… it seems fair to suggest that if a problem cannot be studied fundamentally by maps… then it is questionable whether or not it is within the field of geography." Haggett (1989) expressed the same feeling even more directly and concisely: "Geography is art of the mappable." According to Bednarz (2006) "maps are not the whole of geography, but there

can be no geography without them". From the words of above geographers, it is clear that the well-known geographers often define geography around maps and their use.

Map reading can be defined as the ability of a person to identify, collect, record, organise and interpret geographical information from a map. Map reading is highly valuable not only in the field of geography, but also in our daily lives. Though map reading is primarily taught in geography, but map is a tool which is used by other disciplines as well. Sufficient maps have been used in textbooks, but unless the students know how to read a map, they will not be able to understand what is being taught to them. Better a student is able to read a map, better he or she will be able to interpret the spatial information.

The attainment of map skills is one of the main objectives of geography curricula in school education across the globe. The map reading skills enhance the ability of the students to understand and explore events related to the spaces around them. It provides students with the knowledge of the places and the socio-economic processes taking place or having taken place at a particular location. In addition, the knowledge, skills and competencies acquired in map related teaching-learning activities facilitate effective teaching and learning of other aspects of geography curriculum.

Need for the study

Maps are vital part of teaching and learning of geography at all stages from primary education to higher education. In addition, maps are very much important in students' daily life for different purposes and at their different life stages, whether it is in tourism, for research, in a planning, or as part of a job. Unfortunately, in India, people do not use maps efficiently because the map reading skills are not sufficiently developed among the students in the elementary and secondary schools.

This revealed a weakness in the existing methodology in teaching map reading skills to the students at school level. So, there is a strong need to devise a new strategy to teach map reading skills. In this context, the researcher has decided to prepare a module on map reading skills to impart activity based training for elementary level student-teachers to enhance their map reading skills.

Objectives of the study

The objectives of the study are listed below:

- To prepare and validate a module on map reading skills to impart activity based training to the elementary level student-teachers.
- To prepare and validate an achievement test to assess elementary level student-teachers' map reading skills.
- To impart activity based training on map reading skills using the prepared module for elementary level student teachers.
- To study the effectiveness of activity based training on map reading skills among the elementary level student-teachers in terms of the mastery levels fixed for the study.
- To find out the differences, if any, in the gain ratios of map reading skills among elementary level student-teachers with regard to four population variables involved in this study.

Hypotheses of the study

The hypotheses formulated for verification in this study are as follows:

- A minimum of 75% of elementary level student-teachers have attained mastery level IV (60% to 69% gain ratio) when they are given activity based training on map reading skills using the prepared module.
- Elementary level student-teachers' mastery level attainment in map reading skills is dependent upon all the four population variables involved in this study.

Methodology

Method

Considering the nature and objectives of the study, the present study has been designed as single-group, pre-test and post-test experimental design.

Participants

For the experimentation, 67 student-teachers pursuing first year 'Diploma in Elementary Education' from two District Institutes of Education and Training (DIET) were selected as sample using convenience sampling technique. Out of 67 student-teachers, 32 student-teachers were selected from the District Institute of Education and Training, Perundurai, Erode district and 35 student-teachers were selected from the District Institute of Education and Training, Oddanchathiram, Dindigul district in Tamil Nadu State, India. The participants include 10 male and 57 female student-teachers.

Instrumentation

The researcher has constructed a "Map Reading Skills Test" to assess the map reading skills of elementary level student-teachers. The map skills tests developed by Kamath (1998) and Felix (2012) were consulted for the types of questions to be drafted. But, no items were taken from the above mentioned map skills tests for the preparation of initial draft of the test. In order to prepare the test suited for elementary level student-teachers, the curriculum prescribed for Social Science at elementary school education level was kept in mind. In addition, the summary of skills needed for map reading suggested by different scholars (Wilson, 1980) was also consulted.

Seven map reading skills namely, directions, grid reference, scale, symbols, colours, distribution, and inference were considered for inclusion in the test. The test contains 15 test items for a total of 60 marks. The test contains the items ranging from one mark to five marks. The content validity of the test was ensured through expert review. Further, a pilot study was conducted with 16 student-teachers. The expert review and pilot study provided a scope for slight modification of the test. The test had reliability coefficient of 0.96, when tested for inter-rater reliability.

The details about locality of residence, academic group studied in higher secondary course, use of atlas in learning geography during teacher education programme, and the details about the District Institute of Education and Training (DIET) where they have studied their teacher education programme were also collected from the student-teachers using the 'Personal Information Profile'.

Preparation of the module

The researchers prepared a module on map reading skills to implement activity based training programme to improve the map reading skills of elementary level student-teachers. The module is in the form of 'teacher support material'.

The skills that are required to read the maps given in the Geography lessons of the Social Science textbooks at elementary school education level formed the basis for the selection of map reading skills. The list of 17 essential skills required for map reading suggested by different scholars (Wilson, 1980) was also consulted. Given the purpose of the present study, only seven skills were chosen as essential for inclusion in the module namely, directions, grid reference, scale, symbols, colours, distribution, and inference.

After finalisation of map reading skills, they were sequenced and task analysis was done by identifying learning objectives and writing activities for each of them. The initial draft of the module was edited and tried on a small group of elementary level student-teachers. It was also referred to subject experts. The final draft of the module was prepared by incorporating the changes suggested by the experts.

Experimentation procedure

The experimentation was carried out in three stages. In the first stage, the prepared map reading skills test was administered to the student-teachers of the selected District Institutes of Education and Training (DIET) as pre-test to find out the previous knowledge and skills of student-teachers with regard to map reading.

In the second stage, activity based training programme on map reading skills, as an intervention strategy, was imparted to the student-teachers using the prepared module for five consecutive days (25 hours, 5 hours per day).The training was fully activity-based which mandates the student-teachers to perform activities for each of the map reading skills using atlas maps under the monitoring of the researcher. Before asking the student-teachers to perform the activities, the researcher, first, taught them the basic concepts involved in each of the map reading skills and make them to understand the importance of all the map reading skills.

In the last stage, the prepared map reading skills test was again administered to the student-teachers as post-test.

Statistical treatment of the data

The gain scores and gain ratios were derived from the pre-test and post-test scores to study the effectiveness of activity based training in enhancing map reading skills of the student-teachers.Further, percentage analysis of the mastery levels in map reading skills was carried out for the sample as a whole as well as in terms of the sub-samples of the five population variables of the study.

Results and discussion

Student-teachers' mastery of map reading skills

The details of pre-test and post-test scores obtained by the student-teachers with regard to map reading skills were presented in the table - 1. Further, the gain scores and gain ratios also worked out for the whole sample.

Table 1: Mean scores of map reading skills test (Maximum score: 60)

Variable	*N*	Mean Pre-test score	Mean Post-test score	Mean Gain score	Mean Gain ratio
Mastery of Map Reading Skill	67	11.97	46.16	34.19	71.25

The table - 1 shows the mean map reading skill scores obtained by the student teachers in the pre-test and post-test. The mean gain scores and gain ratios were also worked out for all the student-teachers.

A look at the table reveals that there was a considerable increase in the mean map reading skill scores of the student-teachers before (M = 11.97) and after (M = 46.16) imparting the activity based training programme using the developed module.

Further, the analysis of mean gain scores (M = 34.19) and gain ratios (M = 71.25) revealed that activity based training programme imparted using the prepared module was effective in enhancing student-teachers' map reading skills.

The details of frequencies and percentages of student-teachers at different mastery levels fixed in terms of gain ratios of map reading skills are presented in the table - 2.

Table 2: Frequencies and percentages of student-teachers' mastery levels in map reading skills

Mastery level	Gain ratio	Frequency	Percentage
I	90% to 100%	0	0
II	80% to 89%	9	13
III	70% to 79%	26	39
IV	60% to 69%	32	48
Total		**67**	**100**

It is evident from the table - 2 that 48% of student-teachers have attained mastery level IV by securing 60% to 69% gain ratio in map reading skills.

It is also observed that 39% of student-teachers have acquired mastery level III by securing 70% to 79% gain ratio and 13% of student-teachers have acquired mastery level II by securing 80% to 89% gain ratio in map reading skills.

The above table also reflects that no student-teacher have attained mastery level I which means that none of the student-teachers have secured 90% and above gain ratio in map reading skills.

The finding that 100% of student-teachers have attained at least mastery level IV (60% to 69% gain ratio and above) indicates that the imparted activity based training programme was effective in enhancing map reading skills of the student -teachers. Further, the attainment of mastery levels III and II by 39% and 13% of student-teachers reflects that the activity based training programme on map reading skills have facilitated the student-teachers to attain higher mastery levels also.

Hence, the formulated hypothesis that a minimum of 75% of student -teachers have attained mastery level IV in map reading skills through activity based training programme is accepted. From the above findings, it is concluded that the activity based training programme on map reading skills was effective in enhancing map reading skills of the student-teachers.

Student-teachers' map reading skills and population variables

The details of frequencies and percentages of student-teachers' attainment of mastery in map reading skills in terms of four population variables, viz. locality of residence, academic group studied in higher secondary course, possession of atlas during teacher

education programme, and the District Institute of Education and Training where they have studied their teacher education programme are presented in tables 3 to 7.

Mastery level and locality of residence

The following table shows the locality of residence wise mastery level of student-teachers in map reading skills.

Table 3: Mastery level and locality of residence

Mastery level	Gain ratio	Rural		Urban		Total	
		f	%	f	%	f	%
I	90% to 100%	0	0	0	0	0	0
II	80% to 89%	6	9	3	5	9	13
III	70% to 79%	18	27	8	12	26	39
IV	60% to 69%	19	28	13	19	32	48
Total		**43**	**64**	**24**	**36**	**67**	**100**

It is evident from table - 3 that 28% of student-teachers from rural areas have attained mastery level IV by securing 60% to 69% gain ratio, whereas only 19% of student-teachers from urban areas have attained mastery level IV.

It is also noticed that 27% of student-teachers belong to rural areas have attained mastery level III by securing 70% to 79% gain ratio while just 12% of their urban counterparts have attained mastery level III.

Further, it was observed that 9% of student-teachers from rural areas have attained mastery level II by securing 80% to 89% gain ratio. But, at the same time, only 5% of student-teachers from urban background have attained the mastery level II.

It is noteworthy to mention that none of the student-teachers belong to both rural and urban areas have attained mastery level I.

From the above results, it is inferred that the rural student-teachers have benefited more from the activity based training programme on map reading skills than urban student-teachers. In other words, though the training programme was generally found effective in enhancing map reading skills among the student-teachers, it is found to be highly effective for the student- teachers from rural areas.

Mastery level and academic group studied in higher secondary course

The following table shows the mastery level of the student-teachers in map reading skills with regard to academic group they have studied in higher secondary course.

Table 4: Mastery level and academic group studied in higher secondary course

Mastery level	Gain ratio	Science		Arts		Vocational		Total	
		f	%	f	%	f	%	f	%
I	90 % to 100 %	0	0	0	0	0	0	0	0
II	80 % to 89 %	2	3	5	8	2	3	9	13
III	70 % to 79 %	8	12	15	22	3	5	26	39
IV	60 % to 69 %	15	22	13	19	4	6	32	48
Total		**25**	**37**	**33**	**49**	**9**	**14**	**67**	**100**

It is evident from table - 4 that comparatively higher percent of the student-teachers who studied arts group in their higher secondary course have attained mastery levels II (8%) and III (22%) than their science group and vocational group counterparts.

However, the student-teachers who have studied science group in their higher secondary course have dominated arts group and vocational group students in attaining mastery level IV (22%).

It was also observed that none of the student-teachers have attained mastery level I irrespective of the group they have studied in their higher secondary course.

Though the activity based training programme was effective in enhancing map reading skills of the student-teachers in general, it is found to be highly effective for the student-teachers who have studied arts group in their higher secondary course.

Mastery level and possession of atlas during teacher education programme

The following table shows the mastery level of student-teachers in map reading skills with regard to possession of atlas during their teacher education programme.

Table 5: Mastery level and possession of atlas during teacher education programme

Mastery level	Gain ratio	Possessed		Not possessed		Total	
		f	%	f	%	f	%
I	90 % to 100 %	0	0	0	0	0	0
II	80 % to 89 %	2	3	7	10	9	13
III	70 % to 79 %	14	21	12	18	26	39
IV	60 % to 69 %	18	27	14	21	32	48
Total		**34**	**51**	**33**	**49**	**67**	**100**

It is evident from table - 5 that the student-teachers who have possessed atlas during their teacher education programme have attained mastery levels III (21%) and IV (27%) in a better way as compared to the student-teachers who did not possessed atlas during their teacher education programme.

But, the reverse is noticed in attaining mastery level II, where the percentage of student-teachers who did not possess atlas during their teacher education programme (10%) is higher than the student-teachers who have possessed atlas.

It was also observed that none of the student-teachers have attained mastery level I irrespective of the possession of atlas during their teacher education programme.

Though the attainment of mastery in map reading skills among the student -teachers who did not possessed atlas during their teacher education programme is found to be high, it is found to be lower than that of the student-teachers who have possessed atlas.

Mastery level and institute of study

The following table shows the student-teachers' mastery level in map reading skills with regard to the District Institute of Education and Training (DIET) where they have studied their teacher education programme.

Table 6: Mastery level and institute of study

Mastery level	Gain ratio	DIET, Oddanchathiram		DIET, Perundurai		Total	
		f	%	f	%	f	%
I	90% to 100%	0	0	0	0	0	0
II	80% to 89%	6	9	3	5	9	13
III	70% to 79%	12	18	14	21	26	39
IV	60% to 69%	17	25	15	22	32	48
Total		**35**	**52**	**32**	**48**	**67**	**100**

It is evident from table - 6 that the student-teachers those studied at the District Institute of Education and Training, Oddanchathiram have attained mastery levels II (9%) and IV (25%) in a better way than the student-teachers studied at District Institute of Education and Training, Perundurai.

However, the reverse is observed in attaining mastery level III. In this case, 21% of student-teachers studied at the District Institute of Education and Training, Perundurai have attained mastery level III while only 18% of the student-teachers studied at the District Institute of Education and Training, Oddanchathiram have attained the same.

Further, none of the student-teachers have attained mastery level I irrespective of the District Institution of Education and Training where they have studied their teacher education programme.

So, it is inferred that the activity based training programme was found to be highly effective for the student-teachers those studied at the District Institute of Education and Training, Oddanchathiram than the student-teachers studied at the District Institute of Education and Training, Perunduraiin enhancing their map reading skills.

The overall results shows that map reading skills of the student-teachers were dependent upon all the four population variables involved in this study viz. locality of residence, academic group studied in higher secondary course, use of atlas in learning geography during teacher education programme, and the District Institute of Education and Training (DIET) where they have studied their teacher education programme. Consequently, the stated hypothesis that the student-teachers' mastery level attainment in map reading skills is dependent upon all the population variables involved in this study is accepted.

Conclusion and implications

The present study has been conceived keeping in mind the principle of activity based teaching-learning process and the need for enhancing map reading skills among elementary level student-teachers. The study concerns itself with the designing and validation of activity based training module on map reading skills to train elementary level student-teachers in the selected map reading skills namely, directions, grid reference, scale, symbols, colours, distribution, and inference.

The results revealed that activity based training programme imparted using the prepared module was effective in enhancing map reading skills of elementary level student-teachers. Further, the results also shows that map reading skills of elementary level student-teachers were dependent upon all the four population variables involved in this study in acquiring mastery level in map reading skills.

The results of this study are significant to the students, student-teachers, Social Science teachers, Social Science teacher educators, Social Science textbook writers and curriculum planners. The prepared 'Map Reading Skills Test' will helps the teachers working in elementary level schools to find out their students' map reading skills. Furthermore, the prepared activity based training module will be supportive for the in-service teachers at elementary school education level in enhancing their students' map reading skills. It will further develop their knowledge and understandings in Social Science in general and Geography in particular.

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