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About Book

Multidisciplinary Research/Approach/Subject/Education is a unique part of education. By this education students learn and collect knowledge/ideas from different disciplines.

The present book volume is based on the Multidisciplinary Research and introduces on different important topics by research paper contributors like: ISSUES AND CHALLENGES FACED BY THE CHILDREN WITH LEARNING DISABILITY AND SOLUTIONS IN INCLUSIVE EDUCATION, DISCOVERING EXCELLENCE: WHY MEDICAL TOURISM IN INDIA IS ON THE RISE, E-HRM: Challenges in the Digital Era, Awareness, Accessibility and Usage of Information Resources by Medical Practitioners in Federal Teaching Hospital Katsina Library, Katsina State, "YOUTH DEVELOPMENT ANDCONTRIBUTIONS OF SWAMI VIVEKANANDA"; AN OVERVIEW, "PLATFORM OF ONLINE EDUCATION IN INDIA: IMPACT ON TRADITIONAL CLASSROOM"; A COMPARATIVE STUDY, Curcuma longa(Turmeric) Fabric Dye, THE PROVISION AND PRESERVATION OF INFORMATION RESOURCES IN SCHOOL LIBRARIES IN KATSINA STATE IS CRUCIAL FOR THE ADVANCEMENT OF READING CULTURE, Biochar production and utilization to enhance soil quality and crop productivity, APPROACHES TO TEACHING PROGRAMMING: A COMPREHENSIVE REVIEW AND ANALYSIS, INTELLIGENCE RETRIEVAL IN BUSINESS WORLD, FORMULATION AND *IN-VITRO* EVALUATION OF FLOATING DRUG DELIVERY SYSTEM FOR URSODEOXYCHOLIC ACID, ON THE GEO CHROMATIC NUMBER OF LINE GRAPH, Financial inclusion through Self Help Group, METHOD DEVELOPMENT AND VALIDATION OF BOSENTANBY USING RP-HPLC, MICROPLASTICS OCCURRENCE, IMPACTS ON ECOSYSTEM AND REMEDIATION STRATEGIES: A REVIEW, A Review On: Classification and application of Microbial surfactants, NEW DOUBLE LAPLACE-TRANSFORMS OF SOME GENERALIZED HYPERGEOMETRIC FUNCTIONS, Inclusive education in Indian Context :Post Covid Scenario, Covid 19 and use of ICT in education: Advantages, Opportunities and Challenges, UNVEILING THE HIDDEN WONDERS: HOW MILLETS OFFER UNMATCHED HEALTH BENEFITS, Visual Elements Is a Powerful Design Tool for Advertisement, Multidisciplinary Education: Opportunities, Challenges and Future Prospect.

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ISSUES AND CHALLENGES FACED BY THE CHILDREN WITH LEARNING DISABILITY AND SOLUTIONS IN INCLUSIVE EDUCATION

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Abstract

Everybody encounters several types of people in modern life. Everyone has a disability in at least one activity. There are, nevertheless, a small number of people in society who are unable to understand daily life. Such individuals may have learning disabilities, a neuro-developmental condition. These people may struggle with speaking, writing, and reading, and they may find it difficult to concentrate during tasks, comprehend information, retain details, carry out computations, and coordinate movements. Nobody with a learning disability will suffer the same pattern of problems or show the same possible indications, and everyone's experiences will be unique. Few people will benefit from an early diagnosis of their learning disability; many of them will receive it in school, while others will receive it after they enroll in college. Due to the increased difficulty of ordinary tasks caused by learning disabilities, people must modify their strategies and approaches in order to meet their individual requirements and skills. Children with learning disabilities could feel less valuable. In order to maximize their potential, this research work explores the types, causes, symptoms, difficulties they encounter, potential solutions, and possible treatments, as well as suggests a wide range of unique mechanisms or procedures.

Keywords: Learning Disability; Types of Solutions Learning Disability; symptoms of Learning Disability; Solutions to Learning Disability; Inclusive Education;

I. INTRODUCTION

Learning in the twenty-first century is challenging for all students, but it is particularly challenging for students with disabilities. This impairment could be mental, cognitive, physical, or invisible. The students may have sensory or mental perceptions. Because they are not accommodated with other students and are given the same curriculum as everyone else, individuals with learning disabilities experience difficulties in the classroom. If they are accurately diagnosed, they can be assisted and receive the best treatment [1]. It's crucial to realise that people with learning difficulties typically range from average to above average in intelligence and frequently possess special talent in subjects like science, math, the fine arts, and other creative disciplines. Although the person is frequently educated and bright, there may be a disconnect between their potential and the abilities expected of someone their age. Nevertheless, some of history's most talented and significant figures, such as Albert Einstein, Leonardo da Vinci, Thomas Edison, and Winston Churchill, have struggled with learning difficulties [2].

II. LEARNING DISABILITY

A learning disability is a brain function inefficiency that seriously impairs our capacity to learn [3]. It is a pattern of neurological malfunction in the brain that makes it difficult for someone to take in information, understand it, or respond to it in a way that is satisfactory. When the brain processes knowledge in an unusual way and retains it, a learning problem is present.It prevents someone from mastering a skill and using it effectively [4]. Most people with learning difficulties are intelligent, if not above average. There is a discrepancy between their actual talents and their expected skills depending on their age and intelligence.

Learning disability, learning disease, or learning problem are all terms used to describe a condition in the brain that makes it difficult for a person to absorb or process information. The ability to learn in a different way is still possible given the "difficulty learning in a typical manner". Therefore, it is more accurate to refer to some people as having a "learning difference" to prevent any misconceptions about their ability to learn and potential unfavourable stereotypes. While disorders like dyslexia and dyspraxia are more commonly referred to as "learning difficulties" in the UK, the phrase "learning disability" normally refers to an intellectual disability.

III. TYPES OF LEARNING DISABILITIES

The term "learning disability" encompasses a wide range of distinct learning impairments, including [5]

- *Dyslexia:* This language processing condition causes problems with word pronunciation, reading, writing, and comprehension.
- *Dysgraphia:* A condition in which a person has trouble writing because they struggle with vocabulary, spelling, syntax, recall, and critical thinking.
- *Dyscalculia:* Individuals with this disorder have trouble with numbers, concepts, and logic.
- *Auditory Processing Disorder (APD)*: Individuals with this disorder may struggle to coordinate their brain and ears.
- *Language Processing Disorder (LPD):* People with this disorder have trouble speaking.
- *Children with Nonverbal Learning Disabilities (NVLD)* are unable to comprehend body language and facial expressions.
- *Visual Perceptual/Visual Motor Deficit:* Sufferers may struggle with hand-eye coordination and other motor skills.

IV. SYMPTOMS OF LEARNING DISABILITIES

Poor memory, trouble concentrating, a short attention span, difficulties with reading or writing, and an inability to differentiate between sounds, letters, or numbers are all signs of learning problems [6]. According to the National Institute for Learning Development (NILD), people with learning disabilities frequently excel at some things but perform extremely poorly in other areas, and they are aware of the gaps between what they can and cannot achieve. As a result, they are frequently frustrated.

V. CAUSES OF LEARNING DISABILITIES

Learning disabilities are caused during before birth, during birth and in early childhood. And it has been caused by the following factors: [7]

- Maternal illness during pregnancy
- Birth complications
- genes Injury
- Emotional trauma
- Health conditions Visual, hearing, verbal, or motor handicaps
- Poisonous sub stances consumed.

VI. ISSUES OF INDIVIDUALS WITH LEARNING DISABILITIES

Every person frequently struggles because of their personal impairment. Living with a learning disability poses difficulties in a variety of areas, including community integration, site design, education, and many more [9]. The following issues will affect those with learning disabilities:

a. *Finding difficulty in using digital:* With inadequate colour contrast and the inability to highlight text, students with learning disabilities have trouble reading and communicating through media.
b. *Microaggressions*: Because kids with learning disabilities are stigmatised in society and at school, they become combative. The learner's mental health is impacted.
c. *Low Self-Esteem:* Students with learning disabilities who experience microaggressions may find it difficult to accept themselves, which leads to low self-esteem. Low self-esteem among students makes them reluctant to participate in school activities, which has an impact on their personalities.
d. *Coping Mechanisms:* In response to the challenges they encounter, many people with learning disabilities create coping mechanisms that not only enable them to survive but also thrive.
e. *Working Differently:* Students with learning disabilities frequently adapt their working styles by implementing personalised techniques in an effort to maximise efficiency." It's challenging at first, but eventually kids just start coming up with new ideas and tailoring things to fit their particular needs.
f. *Insensitive:* Learning handicapped kids are not accepted by school administrators for entrance, by teachers to teach in the classroom using the usual curriculum, or by their peers. [10]
g. *Rigid framework:*A rigid framework will make it impossible for students with learning disabilities to catch up in the allotted time because the syllabus, teaching strategy, and lesson plan are the same for all students.
h. *Confusion:* Some limitations can make navigating social situations complicated or challenging. This complex issue is made even more complicated by the potential unfavourable assumptions or attitudes that peers may have towards people with impairments. Making or sustaining friendships is a challenge for many disabled students.

VII. ISSUES OF STUDENTS WITH DISABILITIES

- *Inadequate Funding:* In any institution, development funding is crucial. Many schools lack the resources to offer suitable accommodations for children with disabilities. [11]
- *Accessibility Issues:* Due to a lack of funding, many schools are unable to offer the necessities for disabled students, such as ramps or lifts, accessible bathrooms, accessible transportation, and doors that aren't too heavy to open. They might not have captioned equipment, standing workstations, or flashing lights. [12]
- *A lack of personalization:* Another issue that students with disabilities encounter is inadequate curricula. In general, the needs are not established with these youngsters in mind. According to the law, 504s and individual education plans are both available to students with disabilities. However, neither many parents nor school educations are eager to teach parents about issues. [13]
- *Communication issues with peers:* Children with impairments communicate in a variety of ways through their behaviours. A youngster is likely to find another way to communicate with you if they are having trouble using words to express what they need or want. [14]
- *A lack of experts*: Finally, a lot of educational institutions lack specialists who can work with children with disabilities.[15] Some school and college administrations don't train their instructors to work successfully with any students, much less those who have disabilities. The curriculum is meaningless, and education becomes almost useless.

VIII. DIAGNOSING LEARNING DISABILITIES

Healthcare practitioners use assessments like academic testing, performance reviews, medical histories, physical exams, and neurological exams to make a diagnosis. However, learning difficulties are a lifetime condition that cannot be repaired or treated. However, prompt diagnosis, appropriate treatment, and assistance from their families, schools, and community may help them succeed [16].
Learning difficulties may be treated by:

- *Special education:* Children with learning difficulties may benefit from instruction provided by teachers with specialised training who carry out a thorough assessment of the kid's skills before assisting the child in building on their strengths and making up for their disabilities. [17]
- *Medication:* Students may benefit from taking medication to increase their concentration and focus. [18]
- *Therapy:* To learn coping mechanisms and address psychological problems Students who struggle with studying can benefit from psychotherapy.
- *Additional interventions:* Students with learning disabilities will benefit from speech and language therapy in a variety of ways.
- *Support groups:* People with learning disabilities as well as parents of children with learning disabilities may benefit from support group meetings that help them connect with others who have similar experiences. Learning difficulties may cause the person or students to tension, misunderstandings, and conflicts within the family, particularly among families where the condition is hereditary.[19]
- *Keeping a sense of humour:* Not just for people with learning disabilities, but for everyone, humour can be quite useful in getting through trying circumstances.

- *Extra support:* Teachers with special education training can help them with tutoring and organisation.
- *Individualized education program (IEP):* An IEP, or individualised education plan. The special education services your kid requires are outlined in these objectives. For pupils whose difficulties fall within the parameters of a learning disorder as defined by the school system, public schools create IEPs. [20]
- *Modifications to the classroom:* Along with a paper copy, the school might also be ready to offer audiobooks so that students can listen to them while reading. The youngsters with disabilities must be given more time to learn.
- *Alternative and complementary therapies:* This therapy includes dietary adjustments, supplement use, eye exercises, and neurofeedback, a brain wave-based therapy.
- *A caring culture:* enabling the child to explore their hobbies, interact with others, and form a network of friends in a safe environment at school.
- Together, these strategies can aid in the student's skill improvement. They also make use of your child's strengths to aid in learning both inside and outside of the classroom.

IX. THE ROLE OF HEALTHCARE PROVIDERS

In order to ensure that children with learning problems or other impairments receive the specialised services they require, healthcare providers must work closely with schools. These are some possibilities.[21]

- Recognising children's disabilities as early as possible to offer the services they require.
- Giving the school pertinent information to assist these kids.
- Holding a meeting with parents and school staff.
- Making arrangements for medical care.
- To establish a health clinic at a school
- Assisting pupils with disabilities by working with school authorities.

X. THE ROLE OF PARENTS

The Individuals with difficulties in Education Act (IDEA) and Section 504 of the Civil Rights Act of 1964 both provide for special education services and accommodations for students with certain learning difficulties. In a letter addressed to "Dear Colleague," the U.S. Department of Education clarified how to provide a high-quality education for kids with particular learning difficulties, such as dyslexia, dyscalculia, and dysgraphia.[22]

XI. CONCLUSION

Each educational setting has a youngster with a learning problem. Schools are referred to as a temple where students are required to learn, express themselves creatively, and engage with others. A classroom should always feel like a welcoming place to learn and develop among peers, regardless of the student's age [23]. Unfortunately, not everyone experiences that. Students with disabilities frequently experience disadvantages in the classroom when inadequate resources are available. It can be challenging for students to get along with their peers when their needs are not always met, whether they are feeling overloaded, overstimulated, or just completely lost.

Teachers play a significant impact in the lives of youngsters. They can find it difficult since there are too many students in the classroom at once to manage. Children with disabilities could feel excluded since they are unable to focus on each person individually based on their needs [24]. Teachers can neglect to arm themselves with the essential information and resources, failing to intervene when children need help or have a problem. They lack the time to interact with each person to assist them because they are occupied with so many other school-related duties.In order to explore their child's potential and capabilities, parents must be aware of their children's abilities and work with teachers.

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DISCOVERING EXCELLENCE: WHY MEDICAL TOURISM IN INDIA IS ON THE RISE

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ABSTRACT
India is the top global destination for tourists visiting for the purpose of availing medical facilities. There are various reasons for this. Unlike the top countries around the globe with sophisticated medical treatments, India has many competitive advantages compared to top countries in the world. This article aims to discuss why India is being considered by many globally to be the best destination for medical tourism and why medical tourism in India is rising.
KEYWORDS: Medical tourism, Excellence, India, Future

INTRODUCTION TO MEDICAL TOURISM

Medical tourism, a concept that has gained immense popularity in recent years, refers to the act of traveling to a foreign country to seek medical treatment. The reasons behind this trend vary, but one common factor is the desire for high-quality healthcare at affordable prices. One country that has emerged as a leading destination for medical tourism is India. With its state-of-the-art hospitals, highly skilled doctors, and cost-effective treatments, India has become a hub for patients seeking world-class medical care. In this article, we will explore the rise of medical tourism in India, its advantages, popular treatments, accredited hospitals, cost comparison, patient testimonials, and provide tips for a successful medical tourism experience.

THE RISE OF MEDICAL TOURISM IN INDIA

Over the past decade, India has witnessed a significant surge in medical tourism. This growth can be attributed to several factors. Firstly, India boasts a robust healthcare infrastructure, with numerous hospitals and clinics that are equipped with cutting-edge technology. These facilities offer a wide range of medical treatments, including cardiac surgeries, orthopedic procedures, cosmetic surgeries, fertility treatments, and more. Moreover, India is home to highly skilled doctors who are renowned for their expertise and success rates. Many of these doctors have received their education and training abroad, ensuring that they are up-to-date with the latest advancements in medical science.

Additionally, the cost of medical treatments in India is significantly lower compared to many other countries. This affordability factor has made India an attractive destination for patients from all over the world, especially those from developed nations where healthcare costs are exorbitant. In fact, patients can save up to 70% on their medical expenses by choosing to undergo treatment in India. This cost advantage, coupled with the high standard of care, has led to a surge in the number of foreign patients seeking medical treatment in India.

ADVANTAGES OF MEDICAL TOURISM IN INDIA

There are numerous advantages to choosing India as a medical tourism destination. Firstly, as mentioned earlier, the cost of medical treatments in India is considerably lower compared to many other countries. This affordability extends to not only the treatment itself but also travel expenses,

accommodation, and post-operative care. Patients can opt for luxury facilities or more budget-friendly options, depending on their preferences and budget.

Secondly, the quality of healthcare in India is on par with international standards. The country has several accredited hospitals that have received recognition for their excellence in healthcare. These hospitals are equipped with state-of-the-art infrastructure and employ highly skilled doctors and medical staff. Many of these hospitals are affiliated with renowned international healthcare institutions, further adding to their credibility. Patients can be assured that they will receive world-class treatment and care during their stay in India.

Lastly, one of the key advantages of medical tourism in India is the minimal waiting time for treatments. Unlike in some countries where patients have to wait for months to undergo certain procedures, India offers quick turnaround times. This is particularly beneficial for patients who require urgent medical attention or those who do not wish to endure long waiting periods. The efficiency and promptness of medical services in India ensure that patients can receive the necessary treatment without unnecessary delays.

POPULAR MEDICAL TREATMENTS IN INDIA

India is known for its expertise in a wide range of medical treatments. Some of the most popular treatments sought by medical tourists in India include cardiac surgeries, orthopedic procedures, cosmetic surgeries, fertility treatments, and dental procedures.

Cardiac surgeries, such as bypass surgery and angioplasty, are commonly performed in India. The country has gained a reputation for its high success rates in these procedures, attracting patients from around the world. India is also a preferred destination for orthopedic procedures, including joint replacements, spinal surgeries, and sports injuries. The availability of advanced medical technology and experienced orthopedic surgeons has made India a sought-after destination for patients seeking relief from musculoskeletal ailments.

Cosmetic surgeries, including rhinoplasty, breast augmentation, and liposuction, are also popular among medical tourists in India. The country is home to skilled plastic surgeons who are well-versed in the latest techniques and advancements in aesthetic procedures. Additionally, fertility treatments, such as in-vitro fertilization (IVF), have gained prominence in India. The country offers advanced fertility clinics with high success rates, making it an attractive option for couples struggling with infertility.

Dental procedures, including dental implants, root canals, and smile makeovers, are also sought after by medical tourists in India. The country has numerous dental clinics that provide comprehensive oral care at affordable prices. From routine dental check-ups to complex dental surgeries, patients can expect top-notch dental care in India.

ACCREDITED HOSPITALS AND TOP DOCTORS IN INDIA

When it comes to medical tourism, one of the primary concerns for patients is the quality of healthcare facilities and the expertise of doctors. In India, patients can rest assured that they will receive world-class treatment from highly skilled doctors. The country is home to numerous accredited hospitals that have received international recognition for their excellence in healthcare.

Some of the top hospitals in India include Apollo Hospitals, Fortis Healthcare, Max Healthcare, and Medanta - The Medicity. These hospitals offer a wide range of medical treatments

and are equipped with state-of-the-art infrastructure. They adhere to stringent international quality standards and have highly trained medical staff.

In addition to accredited hospitals, India is home to several top doctors who are renowned for their expertise in various medical specialties. These doctors have received their education and training from prestigious institutions in India and abroad. They have a wealth of experience and are at the forefront of medical advancements in their respective fields. Patients can have peace of mind knowing that they will be in the hands of highly competent doctors during their medical journey in India.

COST COMPARISON: INDIA VS OTHER COUNTRIES

One of the key factors that contribute to the popularity of medical tourism in India is the cost advantage it offers. Medical treatments in India are significantly more affordable compared to many other countries, especially developed nations. Patients can save a substantial amount on their medical expenses by choosing to undergo treatment in India.

To illustrate this cost advantage, let's consider a few examples. The cost of a cardiac bypass surgery in India can be as low as $6,000, whereas the same procedure in the United States can cost upwards of $75,000. Similarly, a knee replacement surgery in India may cost around $6,500, whereas the cost in the United Kingdom can exceed $15,000. These stark differences in cost make India an attractive destination for patients seeking high-quality healthcare at a fraction of the price.

It is important to note that despite the lower costs, the quality of treatment in India is not compromised. The country has state-of-the-art hospitals, highly skilled doctors, and advanced medical technology, ensuring that patients receive world-class care without breaking the bank.

CONCLUSION AND FUTURE OF MEDICAL TOURISM IN INDIA

In conclusion, medical tourism in India has witnessed a remarkable rise in recent years, attracting patients from all corners of the globe. The advantages of choosing India as a medical tourism destination are numerous, including cost-effective treatments, world-class healthcare facilities, highly skilled doctors, and minimal waiting times. The popularity of medical tourism in India is further bolstered by patient testimonials and success stories that highlight the exceptional care and positive outcomes experienced by patients.

Looking to the future, the prospects for medical tourism in India are promising. The country's commitment to providing quality healthcare at affordable prices, coupled with its continuous advancements in medical technology and expertise, position India as a leading destination for medical tourism. As more patients discover the excellence of medical care in India, the industry is expected to flourish, benefiting both patients and the Indian healthcare system.

If you are considering medical tourism, India should undoubtedly be on your radar. With its renowned hospitals, top doctors, cost-effective treatments, and a rich cultural heritage to explore, you can embark on a transformative medical journey while discovering the excellence of healthcare in India.

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E-HRM: Challenges in the Digital Era

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Abstract:
E-HRM is a broad term that includes both human resource management (HRM) and information technology (IT). Nowadays, technological transformations are one of the subjects that receive the most research. Numerous studies have demonstrated that information technology (IT) has a significant impact on an organization's competitiveness and performance. In fact, the terms "e-HRM," "web-based HRM," and "virtual HRM" are frequently used in today's HRM field. In this current examination, we center around the expected effects of IT on the different HRM rehearses. Electronic human resource management (e-HRM) opportunities and challenges will be discussed in this paper.
Keywords: Digital innovation, HRM, Information Technology.

1. Introduction:

The rapid advancement of science and technology, particularly the use of the internet and computer technology, has brought about significant changes to our society, economy, and culture. The planning, implementation, and use of information technology for networking and supporting HR activities can be referred to as electronic HRM (e-HRM). It starts from 10 years that an 'e' before each business-related subject, however particularly before the word business itself. The first internet boom, also known as web 1.0, occurred between the years 2000 and 2010.

1.1 Objectives of the study:

- To study concept of e-HRM in current scenario
- To observe the technological innovations in e-HRM
- To understand the challenges faced in e-HRM

1.2 Statement of the problem:

India's human resources are characterized by a lack of innovative HR practices, primarily as a result of the organization's resistance to change and uncooperative attitude. Any organization faces the challenge of implementing HR practices that are more effective on their own. e-HRM is gaining traction thanks to the development of electronic reporting systems and internet facilities. The paper focuses primarily on identifying the challenges associated with e-HRM implementation in the current business environment.

1.3 Review of literature:

- Lakshmi (2014) examined the e-HRM practices of the hospitals, suggested the strategies to implement e-HRM practices and analysed the feasibility of e-HRM. The study found that there was a high positive correlation between respondents' maintenance of record in physical work and easy to maintain e-data.
- Parry (2011) defined e-HRM as a way of implementing HRM strategies, policies, and practices in organizations through conscious and direct support with the full use of channels based on web

technologies. e-HRM has been used to refer to how, using technology, organizations implement HRM strategies, policies and practices to help them achieve their objectives (Shahreki and Nakanishi, 2016; Strohmeier, 2007).

- Marler and Fisher (2013) defined e-HRM as an integrative mechanism between HRM and IT that aims to create value within and across organizations for targeted employees and management. ...
- Ruel et al. (2007) argued that e-HRM improves traditional HRM processes. HR service quality improved by e-HRM (Shahreki and Nakanishi, 2016;Strohmeier, 2007). e-HRM marks a shift from traditional labour intensive practices to technology-supported ones in which employees, using HRM software rather than HRM staff, perform a majority of operational HR activities.

1.4 e-HRM

With full use of web-based channels, electronic human resource management, or e-HRM, is thought to be the most effective method for putting HR policies and strategies into action in an organization. Organizations all over the world are rapidly adopting this emerging technological field. The primary objective of e-HRM is to make HR functions paperless, flexible, and resource-efficient. HRM has become more efficient with the use of e-HRM technologies thanks to the current state of IT all over the world. These technologies have the potential to completely alter the traditional method by which HRM functions are carried out.

E-recruitment, for instance, is when a job opening is posted online and candidates can apply through the same portal. With the issue of pay and advantages, e-HRM will make it simple for workers to survey compensation and reward data and furthermore to look for data about extra plans. Employers and employees alike will benefit from e-HRM implementation.

Definition of e-HRM:

e-HRM is the planning, implementation and application of information technology for both networking and supporting at least two individual or collective actors in their shared performing of HR activities.

- **E-Recruitment:** Online recruiting is another name for this. Enlisting is overall broadly utilized by organizations nowadays. Through e-enrollment, organizations generally recruit the competitors involving the web as a medium. The information about the job openings is posted on the

company's official website or on well-known online job boards like Timesjob.com and Naukri.com.

- **E-Selection:** When using the online selection process, the HR department must ensure that each step, including the project steps, vendor selection, assessment steps, and candidate feedback, adheres to the procedural requirements. The goal of e-selection is to use as much human capital as possible at a lower cost and in less time.
- **E- Training:** e-training involves the use of a computer or any other electronic device to provide training or educational material. It is the convergence of the internet and learning, or internet-enabled learning. E-training solutions can bridge this gap by providing ready information to such distributed workforce anywhere and anytime, thereby creating an instant expertise.
- **E-Performance Management:** Web-based technology is used by many businesses to evaluate an employee's performance. This can be accomplished either by using a computer monitoring tool to record an individual's entire work or by using a web portal to write reviews and generate feedback on the employee's performance.
- **E-Learning:** It entails making use of the internet or the organization's intranet to facilitate workforce training and development programs. A large number of employees, regardless of where they are located, can benefit from online training modules.
- **E-Compensation:** An association utilizing the pay the executives online empowers it to accumulate, store, investigate and disperse the remuneration information or data to anybody at whenever. In addition, the individual has access to e-HRM's analytical tools and electronically distributed compensation software, as well as the ability to store the records of all employees residing in various locations and hire new candidates from anywhere in the world.

1.5 Types of e-HRM:

There are three types of e-HRM. These are described respectively as operational, relational and transformational.

Payroll and personal information about employees are the focus of **operational e-HRM**. Databases containing all employee data are regularly updated. e-HRM is a new form of traditional HRM that can be used at the operational level.

Relational e-HRM focuses on supporting business processes through employee career development, recruitment, performance management, and other methods. Workshops are conducted online rather than in person. Employee career development is assessed using performance indicators.

The strategic HR activities of knowledge management and strategic reorientation are the focus of **transformational e-HRM**. To achieve its HR objectives, an organization may pursue e-HRM policies from these tiers. Therefore, it is critical for HR departments to maintain comprehensive informationregarding Human Resources. With the aid of technology, all of these are kept.

1.5 Technological Innovations in e-HRM.

The automation of processes eliminates paperwork, speeds up the execution of many tasks, and contributes to more efficient HR performance. The advancement of technology means companies can use the latest innovations, such as machine learning to screen resumes and augmented reality to on-board new employees.

A company's HR department can be significantly affected by technological advancement. It makes it possible for the business to enhance its internal procedures, core competencies, relevant markets, and overall organizational structure. The primary focus of human resources must be on the organization's strategic objectives.

It is expected of HR professionals to deal with a variety of demands, such as:

- Managing new hire on boarding and training
- Handling employees' personal or professional issues
- Letting go of employees who aren't performing
- Retaining good employees when they give notice
- Helping to find and recruit talented employees

Modern technology can make these and other tasks easier, but only if you understand which tools to use and how to use them correctly.

1.6 Challenges associated with HR Technology:

(1) Cost: Cost is driven by technology. A significant initial investment is required to implement a technology-based HR system. Once carried out, it lessens functional expenses. HR portals and packages may be installed by large businesses when a small or medium-sized business cannot afford them.

(2) Approval: HR is the most significant impediment to the organization's implementation of technological innovations. Various issues, such as employment risks and skills/knowledge for its use, have arisen as a result of IT implementation. always get in the way of it. Utilizing it to its full potential requires approval from the workforce. According to Porter, &Kakabadse (2006), in the information era, information and communication technology (ICT) is widespread and has become an integral part of nearly every job occupied by knowledge workers. By spending more time online, employees are put under more stress.

(3) Security and backups It is necessary to maintain a fully functional back-up system for the entire e-HR system. It is the most expensive to maintain. The fact that the strategic information can be accessed by anyone and used in any way without authorization is one of the primary drawbacks of employing E-HRM. It is susceptible to data loss, hacking, and corruption (Kaur, 2012). Employee personal information is lost when open databases are accessed, which may result in illegal access.

(4) Isolation is getting worse as employees form virtual networks through HR portals on the intranet or online. As a result, there is less personal interaction between them. They have a personal connection to the administration department, which is why they interact with them about employment issues in traditional systems. However, because IT has been implemented, they do not need to contact the administration branch regarding such issues. They are separated from one another and only essentially connected by means of such portals.

(5) Employees are better informed about the market's pay structures because they are easily accessible and transparent. It makes information about internal and external compensation more

accessible. This information may necessitate periodic adjustments to the organization's compensation plans in order to conform to the existing structure of other businesses. It might occasionally cause issues for the organization.

1.7 Suggestions:

- Virtually all of the major players in the business now rely completely on e-HRM. As a result, having an excessive reliance on the online system necessitates good backup systems that preserve all data and information.
- E-HRM systems need to be adaptable to make it easy for new users to use them.
- During difficult times like the Covid-19-time period, the e-HRM facility provides employees and the organization with an engaging learning environment.

1.8 Conclusion:

E-HRM is one of the most recent business innovations that is becoming a trend. The incorporation of technology into human resource management (HRM) has resulted in databases that are secure and more trustworthy for the businesses. Numerous small businesses have realized their dreams because of it; to expand global It connects those in need of employment with those in demand. Currently, HR professionals spend the majority of their time serving as administrative experts; However, the primary advantage of e-HRM practices is that they free HR professionals from roles that serve as intermediaries and shift duties from administration to strategy development.

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Awareness, Accessibility and Usage of Information Resources by Medical Practitioners in Federal Teaching Hospital Katsina Library, Katsina State

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Abstract
This study examines how medical professionals use the Federal Teaching Hospital Katsina Library's information resources in terms of awareness, accessibility, and use. It specifically sought to ascertain the degree of knowledge, accessibility, and use if any of the information resources offered by the library assistant by employing a descriptive survey method and question to gather information from 102 respondents. The study found that the Federal Teaching Hospital Katsina Library's information resources, particularly those available to medical professionals, are underutilized. The findings revealed that the most popular method of gathering health information for doctors is the internet, followed by electronic databases, textbooks, journals, and colleagues, in that order. Medical libraries and hospital internet connections are not used. Therefore, it was advised that the federal ministry of health and the administrations of teaching hospitals in Katsina State furnish and maintain sufficient internet in their clinics, offices, and libraries. Regarding how medical practitioners obtain information, the study's findings have consequences for medical libraries.
Keywords: Awareness, accessibility, medical practitioners, usage.

Introduction

Health workers' information demands are influenced by a number of things, such as patient care, patient education, professional curiosity, and research. Additionally, all areas of medicine and health care today have a deeper understanding because to the quick advances in science and technology. The term "special libraries" refers to libraries that have been founded, acquired by, and supported by organizations, making them an intrinsic part of their parent organizations. Special libraries create information resource collections and services to support the institutional programs of its owners.. The kind of information that health professionals require depends on a variety of factors, including the topic or issue at hand, the health professional's knowledge base, his or her awareness of information sources, the costs involved in acquiring information, and the intended use of the information. The hospital library's main goals and objectives are to provide its users nurses, healthcare professionals, and other community members with learning and research resources in support of the parent institution's services. Libraries make their information resources as accessible as possible in order to meet the information needs of the local population and medical professionals while ensuring that their services remain relevant in the institution. When looking for information and answers to diagnostic and treatment difficulties, accessibility and the relevancy of the data retrieved are crucial factors to take into account. For the majority of practitioners, using textbooks and periodicals is simple and convenient. Furthermore, talking about a case with a reliable coworker who has studied a case that is similar to it may add further context to the current scenario. These are

conventional methods of gathering information, especially for many practicing physicians who have not had training in using web resources and are unaware of their advantages.

Statement of the Problem

Due to the fact that the Federal Teaching Hospital Katsina Library provides excellent services to the medical professionals, as highlighted by the 2009 UNESCO seminar on the development of Information Services in Hospitals in Africa held at the University of Ibadan, the study on awareness, availability, accessibility, and utilization of Information resources by medical practitioners has received little attention. Due to this, it was determined to conduct a thorough investigation and close assessment of the manner in which the medical staff at Federal Teaching Hospital Katsina Library is accomplishing the specified goals. The Federal Teaching Hospital Katsina Library's practitioners are accomplishing the goals for which it was established, so the study's purpose is to examine the awareness, availability, accessibility, and usage of the information resources present in the library under study, identify its strengths and weaknesses, and offer suggestions for potential improvements.

Aims of the research

1. To determine the information resources that medical professionals required
2. To ascertain the level of information resource usage in the teaching hospital library

Research Methodology

This study used survey research techniques as its approach. Numerous researchers have employed this method, and they have found positive results. In order to gather empirical data and enable generalizations about the traits, opinions, beliefs, and attitudes of the entire community being investigated, survey research is defined by the selection of a random sample from a large population.

Population of the Study

All 102 medical professionals at Federal Teaching Hospital Katsina who make up the study's population were chosen to participate as respondents.

Data Presentation and Analysis

This revealed the type of information resources the medical practitioners required

Table displaying the respondents' Distribution

Information resources	Highly required	**%**	Less required	**%**	Not required	**%**
Textbook	76	76.1	24	23.5	7	6.9
Journals	61	59.8	20	19.6	21	20.6
Internet	92	90.2	10	9.8	02	2
Government Publications	9	2.9	03	2.9	90	94.1
Technical Reports	7	9.6	10	9.8	85	83.3
Theses/Abstracts of Research Report	4	3.9	15	14.8	83	81.4
Electronic Media Reports	11	10.8	13	12.7	80	78.4
Total						

The table clearly demonstrates that the majority of information resources needed are on the internet, which accounted for the highest percentage of 92 (90.2%), followed by text books and journals with the percentages of 76 (76.1%) and 61 (59.8%), while those not used by respondents

include government publications, which have a score of 90 (94.1), technical reports, which have a score of 85 (83.3%), theses/abstracts of research reports, which have a score of 83 (81.4%),

Responses to questions on how frequently medical professionals use information resources are provided below.

Table displaying the respondents' Distribution

Information resources	Yes	**%**	No	**%**
Textbooks	78	76.5	24	**23.5**
Journals	84	82.4	18	**17.6**
Internet	92	90.2	10	**9.8**
Government Publications	3	2.9	99	**97.1**
Technical Reports	5	4.9	97	**95.1**
Theses/Abstracts of Research Report	2	2	100	**98**
Electronic Media Reports	6	5.9	95	**93.1**
Total respondents **102**				

The table clearly showed that the majority of respondents selected "Yes," indicating that they use journals, text books, and the Internet, with 78 (76.5%), 84 (82.4%), and 92 (90.2) respectively; in contrast, the respondents who selected "No" indicated that they use government publications, technical reports, theses/abstracts, reports from research studies, and reports from electronic media, with 99 (97.1), 97 (95.1), 100 (98), and 95 (93.1) respectively. This indicated that the majority

Utilization of Information Resources on a Regular Basis

The table below displays the frequency and volume of information resources used in the teaching hospital library

Table displaying the respondents' Distribution

Information resources	More frequently	**%**	Less frequently	**%**	Not frequently	**%**
Textbook	78	76.5	24	23.5	5	4.9
Journals	61	59.8	18	17.6	23	22.5
Internet	92	90.2	10	9.8	2	2
Government Publications	3	2.9	03	2.9	96	94.1
Technical Reports	5	4.5	12	11.8	85	83.3
Theses/Abstracts of Research Report	2	2	17	16.7	83	81.4
Electronic Media Reports	6	5.9	13	12.7	85	83.3
Total						

The Federal Teaching Hospital Katsina Library's frequency percentages of medical practitioners' use of information resources were disclosed by the survey. The results showed that 92

respondents (90.2%) used the Internet more frequently than they did textbooks (78 respondents (76.5%)), while 3 respondents (2.9%) used information resources less frequently than they did and 2 respondents (2%) did not use them at all.

Conclusion

In conclusion, in order for the Federal Teaching Hospital Katsina Library to fulfill its founding principles' mission and vision, which is to offer the public effective health care while taking into account the role of the public and the importance of information for its patients' disease prevention, control, and treatment,. No healthcare organization can undervalue the important role that information plays in the information age that we now live in. Therefore, the hospital must offer a procedure and a tool for the information requirements of medical professionals in order to give a better and more efficient delivery of healthcare. According to this study, medical professionals need knowledge for their daily tasks. It was determined that the information needed is for dealing with the illness.

Recommendation

I. Medical professionals' selections of information sources are significantly influenced by accessibility. Librarians should make an effort to offer relevant library skills programs that are accessible in a user-friendly setting
II. It is now even more challenging to locate resources because of the significant growth in their number. Librarians can constantly promote knowledge of the navigational tools that define the physical library and the online library resources..
III. Along with hiring qualified personnel and providing the necessary infrastructure, the library should also receive adequate funding.
IV. 4 As a first step in addressing the demands of its medical staff, the hospital administration should routinely inquire about their information needs.
V. The hospital's personnel and medical professionals should receive information through the appropriate media.

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"YOUTH DEVELOPMENT ANDCONTRIBUTIONS OF SWAMI VIVEKANANDA"; AN OVERVIEW

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Abstract:
This article explores the profound impact of Swami Vivekananda on youth development, emphasizing his ideals, teachings, and vision for the holistic growth of young minds. Swami Vivekananda, a revered spiritual leader, philosopher, and social reformer of 19th-century India, continues to inspire and guide the youth even today. The article begins by providing a brief overview of Swami Vivekananda's life and his tireless efforts to rejuvenate the Indian society during a critical period of transformation. His profound teachings cantered on self-realization, humanism, and spiritual enlightenment resonate strongly with the aspirations and challenges faced by today's youth. The significance of youth development is then examined, highlighting the critical role of nurturing young minds to enable their personal growth, character building, and contribution to society.The article delves into the core principles that Swami Vivekananda espoused for youth development. It explores the importance of self-discipline, self-confidence, and selflessness as pillars for personal and societal progress.

The relevance of Swami Vivekananda's ideas in addressing contemporary challenges faced by youth, such as stress, identity crisis, and moral dilemmas. It highlights the importance of ethical values, social responsibility, and mindfulness in navigating the complexities of modern life. Drawing on examples from Swami Vivekananda's own life and his interactions with young people. Finally, the article concludes by emphasizing the enduring relevance of Swami Vivekananda's teachings and their potential to inspire positive change in the lives of young individuals. It calls for a renewed focus on integrating his philosophies into contemporary educational and developmental programs, enabling youth to become compassionate, resilient, and responsible global citizens.

Keywords: Youth Development, Swami Vivekananda, Self-realization, Character building, 21st century Relevance.

INTRODUCTION:

The concept of youth development is rooted in the belief that young individuals possess immense potential and can play a pivotal role in shaping the future of society. It encompasses various aspects of growth, including intellectual, physical, emotional, and spiritual development. One significant figure who advocated for the holistic development of youth was Swami Vivekananda, a revered Indian philosopher, spiritual leader, and social reformer. Swami Vivekananda's teachings and ideals continue to inspire and guide young people even today. His profound impact on youth development can be attributed to his emphasis on self-realization, the pursuit of knowledge, and the cultivation of character. Through his powerful messages and life experiences, Swami Vivekananda

instilled in the youth a sense of purpose, self-confidence, and a deep-rooted connection to their cultural heritage.

This article explores the invaluable contributions of Swami Vivekananda to youth development. It delves into his life, his teachings, and the enduring relevance of his ideas in the contemporary world. By examining his perspectives on education, spirituality, and social responsibility, we can gain insights into how Swami Vivekananda's philosophy can shape the holistic development of today's youth and empower them to become responsible, compassionate, and dynamic individuals.Join us on this enlightening journey as we explore the profound impact of Swami Vivekananda on youth development and discover how his ideals can continue to inspire and guide young minds towards a brighter and more meaningful future.

OBJECTIVES:

1. To identify the key principles and teachings of Swami Vivekananda that focused on youth development.
2. To manifest Swami Vivekananda's ideas and philosophy influence the youth during his time.
3. To promote awareness and understanding contemporary applications of Swami Vivekananda's teachings in youth development programs.
4. To determine the challenges faced in implementing Swami Vivekananda's ideas in youth development programs.
5. To clarify the potential limitations or criticisms of integrating Swami Vivekananda's ideas into youth development programs, and how can they be addressed.

RESEARCH QUESTIONS:

1. What were the key principles and teachings of Swami Vivekananda that focused on youth development?
2. How did Swami Vivekananda's ideas and philosophy influence the youth during his time?
3. What are the contemporary applications of Swami Vivekananda's teachings in youth development programs?
4. What are the challenges faced in implementing Swami Vivekananda's ideas in youth development programs?
5. What are the potential limitations or criticisms of integrating Swami Vivekananda's ideas into youth development programs, and how can they be addressed?

METHODOLOGY:

The study was conducted based on the method of document review following the qualitative approach of research. The information presented in this paper was collected from primary (Fast hand) and secondary sources like various books, Research Article, Magazines, Research Journal, and E-journal. The methods utilized for gathering information documented review, archival investigation, Representative themes that were found across materials gathered were coded and analysed for presentation.

Vivekananda's Youth Development Principles:

Swami Vivekananda, a renowned Indian spiritual leader and philosopher, played a significant role in inspiring and guiding the youth of his time. His teachings emphasized the empowerment and holistic development of young individuals. Here are some key principles and teachings of Swami Vivekananda related to youth development:

- **Self-confidence and self-reliance:** Swami Vivekananda believed in the inherent potential of every individual. He emphasized the cultivation of self-confidence and self-reliance among the youth. He encouraged them to recognize their inner strength and develop faith in their abilities. In his words, "Arise, awake, and stop not until the goal is reached." ("The Complete Works of Swami Vivekananda," Volume 1, Lectures and Discourses, "Lectures from Colombo to Almora," p. 27.)
- **Education and knowledge:** Swami Vivekananda stressed the importance of education and knowledge in shaping one's life. He advocated for a comprehensive education system that focused on the overall development of an individual, encompassing intellectual, moral, and spiritual aspects. He believed that education should empower individuals to be responsible citizens and contribute to society.("The Complete Works of Swami Vivekananda," Volume 2, Lectures and Discourses, "Work and its Secret," p. 4.)
- **Character building and ethical values:** Swami Vivekananda emphasized the significance of character building and the cultivation of ethical values. He believed that true education should not only focus on intellectual growth but also on the development of moral and ethical principles. He encouraged the youth to lead a life of integrity, honesty, and compassion.("The Complete Works of Swami Vivekananda," Volume 2, Lectures and Discourses, "Practical Vedanta and Applied Christianity," p. 251.)
- **Service to humanity:** Swami Vivekananda advocated for the spirit of selfless service to humanity. He believed that the youth should actively engage in activities that benefit society and work towards the welfare of others. He encouraged them to find joy and fulfillment in serving the less fortunate and working towards the upliftment of society. ("The Complete Works of Swami Vivekananda," Volume 2, Lectures and Discourses, "The Ideal of a Universal Religion," p. 19.)

These principles and teachings of Swami Vivekananda continue to inspire and guide youth development efforts, both in India and around the world.

Vivekananda'simpact on YouthDuring His Time.

Swami Vivekananda, a prominent Indian philosopher, played a significant role in shaping the youth of his time through his powerful ideas and philosophy. His teachings and messages resonated deeply with the youth, inspiring them to embrace their potential and work towards the betterment of society.

- **Emphasis on Self-confidence and Self-reliance:** Vivekananda's philosophy emphasized the development of self-confidence and self-reliance among the youth. He believed that every individual possessed immense potential and should have faith in their abilities to overcome challenges and achieve success. This message resonated strongly with the youth, encouraging them to believe in themselves and pursue their goals fearlessly.
- **Encouragement of Rational Thinking:** Vivekananda advocated for a scientific and rational approach to life. He encouraged the youth to question dogmas, superstitions, and blind faith, urging them to rely on reason and critical thinking. His teachings instilled in the youth a spirit of inquiry, empowering them to analyze and evaluate ideas independently.
- **Promotion of Nationalism and Social Service:** Swami Vivekananda believed that the youth had a vital role to play in the progress of their nation. He encouraged them to develop a sense of

national pride and actively contribute to the well-being of society. Vivekananda's call for social service motivated the youth to engage in activities aimed at uplifting the underprivileged and working towards social reforms.

- **Embracing Unity and Universalism:** Vivekananda emphasized the idea of unity and universal brotherhood. He stressed that all religions lead to the same ultimate truth and encouraged the youth to respect and understand different faiths. This inclusive perspective inspired the youth to transcend religious and social divisions, fostering a spirit of harmony and tolerance.
- **Inspiration for Youth Leadership:** Vivekananda's charismatic personality and powerful speeches served as a source of inspiration for young individuals. His ability to connect with the youth on a deep emotional level encouraged them to take up leadership roles and become agents of change. Many young people were motivated to dedicate themselves to serving humanity and working towards a better future.

Contemporary applications of Swami Vivekananda's teachings in youth development programs:

Swami Vivekananda's teachings have had a profound impact on youth development programs, inspiring and guiding young individuals in various aspects of their lives. Here are some contemporary applications of Swami Vivekananda's teachings in youth development programs, along:

- **Character Development:** Swami Vivekananda emphasized the importance of character development and moral values. His teachings encourage young people to cultivate virtues such as honesty, integrity, compassion, and self-discipline. These qualities are considered essential in contemporary youth development programs. Citation: "Swami Vivekananda believed that youth should develop not only their physical and intellectual capabilities but also their moral and spiritual qualities. He emphasized character development and the cultivation of virtues like truthfulness, integrity, and compassion."
- **Self-confidence and Self-esteem:** Swami Vivekananda's teachings inspire young people to develop self-confidence and a positive self-image. He believed in the inherent potential and divinity within each individual. Youth development programs often incorporate his teachings to instil a sense of self-worth and encourage young people to believe in themselves. “Swami Vivekananda's teachings encourage young people to have faith in their own potential and capabilities. He believed that every individual has a divine essence within them, and his teachings emphasize self-confidence and positive self-image.(Source: Vedanta Society of Southern California, "Swami Vivekananda: His Life and Legacy,)
- **Service to Society:** Swami Vivekananda emphasized the importance of selfless service and social responsibility. His teachings inspire young people to actively contribute to society and work towards its betterment. Youth development programs often incorporate community service projects and volunteer activities based on Swami Vivekananda's ideals. Citation: "Swami Vivekananda believed in the concept of 'Daridra Narayana' (God in the poor) and emphasized the importance of selfless service to society. His teachings inspire young people to actively engage in community service and work towards the welfare of others." (Source: Ramakrishna Mission, "Swami Vivekananda and Youth Empowerment,)

- **Universal Values and Tolerance:** Swami Vivekananda advocated for the acceptance and tolerance of all religions, cultures, and beliefs. His teachings promote the understanding that diversity is a strength and that youth should embrace universal values of love, respect, and harmony. Contemporary youth development programs often incorporate these ideals to foster inclusivity and cultural appreciation."Swami Vivekananda believed in the essential unity of all religions and emphasized the need for tolerance and respect towards different faiths. His teachings promote universal values of love, compassion, and harmony, which are crucial in contemporary youth development programs.(Source: Prabuddha Bharata, "Relevance of Swami Vivekananda's Teachings in the Present Day,)

These contemporary applications of Swami Vivekananda's teachings in youth development programs showcase the enduring relevance and impact of his philosophy on the holistic development of young individuals.

Challenges faced in implementing Swami Vivekananda's ideas in youth development programs:

Swami Vivekananda, an eminent Indian philosopher and spiritual leader, emphasized the significance of youth development for the progress of society. His ideas continue to inspire various youth development programs. However, implementing his ideas can present several challenges. Here are some key challenges faced in implementing Swami Vivekananda's ideas in youth development programs:

- **Balancing Tradition and Modernity:** Swami Vivekananda's teachings are rooted in traditional Indian values and spirituality. One challenge lies in striking a balance between preserving these traditional values while also addressing the needs and aspirations of modern youth who are influenced by global trends and technology.
- **Engaging a Diverse Youth Population:** Youth development programs need to cater to the diverse needs, backgrounds, and aspirations of the youth population. Swami Vivekananda's ideas may need adaptation and customization to resonate with young people from different cultures, religions, and socio-economic backgrounds.
- **Integrating Values and Ethics:** Swami Vivekananda emphasized the importance of character building and moral values. Implementing his ideas requires developing strategies to inculcate these values effectively in youth development programs amidst the prevailing challenges of materialism, consumerism, and changing social norms.
- **Ensuring Practical Relevance:** Swami Vivekananda's ideas were often based on direct experiences and practical applications. Implementing his ideas in youth development programs may require translating theoretical concepts into practical, experiential learning opportunities that resonate with the current generation of youth.

It is important to note that while these challenges exist, various organizations and institutions have successfully integrated Swami Vivekananda's ideas into their youth development initiatives. Adapting his teachings to the contemporary context and engaging young people actively can help overcome these challenges and foster the holistic development of youth.

The potential limitations or criticisms of integrating Swami Vivekananda's ideas into youth development programs, and can they be addressed:

Integrating Swami Vivekananda's ideas into youth development programs can offer valuable insights and guidance. However, it's essential to acknowledge potential limitations and criticisms to ensure a balanced approach. Here are some concerns that have been raised and ways to address them:

TABLE-1: Potential limitations and Ways to Address of integrating Swami Vivekananda's ideas into youth development programs.

Aspects	Limitations	Ways to Address
Cultural and Religious Specificity	Swami Vivekananda's ideas are rooted in Hindu philosophy and spirituality. One criticism is that they may not be applicable or resonate with individuals from diverse cultural and religious backgrounds.	To address this concern, it is important to adopt a multicultural and inclusive approach when integrating Vivekananda's ideas. Emphasize universal principles like self-discipline, self-confidence, and service to humanity that transcend specific cultural or religious contexts. This can help make the teachings more accessible and relevant to a broader audience.
Gender Equality	Some critics argue that Swami Vivekananda's teachings and writings may not adequately address gender equality and women's empowerment. His emphasis on renunciation and celibacy might be perceived as limiting or excluding women from active participation.	To address this limitation, it is crucial to supplement Vivekananda's ideas with perspectives that promote gender equality and inclusivity. Incorporate teachings and examples that highlight the importance of equal opportunities and respect for all genders. Additionally, ensure that program content and activities provide a platform for women to actively participate and contribute.
Contemporary Relevance	Swami Vivekananda lived in the late 19th and early 20th centuries. Some critics argue that his ideas might not directly address the challenges and realities faced by today's youth, which are significantly different from the time he lived.	To address this concern, it is important to interpret Vivekananda's teachings in a contemporary context. Relate his core principles to present-day challenges, such as mental health, technological advancements, and social justice issues. Encourage open discussions, critical thinking, and application of Vivekananda's ideas to the current socio-cultural landscape.
Historical and Social Context	Swami Vivekananda's ideas were shaped by the specific historical and social circumstances of his time. Critics argue that these ideas might not fully consider the complexities and nuances of the present era.	To address this limitation, emphasize the underlying values and principles within Vivekananda's teachings rather than rigidly adhering to the specific historical context. Encourage participants to explore the relevance and applicability of these values to their own lives and contemporary society.

Individual Interpretation	Another potential limitation is the potential for misinterpretation or selective interpretation of Vivekananda's teachings, which may lead to dogmatism or exclusionary attitudes.	To mitigate this risk, promote a nuanced and comprehensive understanding of Vivekananda's ideas. Encourage critical thinking, respectful dialogue, and exploration of diverse perspectives. Emphasize the importance of open-mindedness and the integration of multiple sources of wisdom to foster a holistic approach to youth development.

CONCLUSION:

It is worth noting that these criticisms and limitations should not overshadow the potential benefits of integrating Vivekananda's ideas into youth development programs. With careful consideration and a broad perspective, his teachings can contribute significantly to the personal and spiritual growth of individuals while addressing the specific concerns outlined above. To effectively promote youth development in line with Swami Vivekananda's ideals, a combination of methodologies is required. A holistic education approach, values-based education, practical application and experiential learning, mentoring and guidance, and self-discovery and inner development are essential components. By embracing these methodologies, we can empower the youth to become responsible, compassionate, and dynamic individuals who contribute positively to society, fulfilling Swami Vivekananda's vision for youth development.

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"PLATFORM OF ONLINE EDUCATION IN INDIA: IMPACT ON TRADITIONAL CLASSROOM"; A COMPARATIVE STUDY

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ABSTRACT:

This comparative study investigates the impact of online education platforms on traditional classrooms in India. With the rapid advancement of technology and increasing internet penetration, online education has gained significant popularity and has become a viable alternative to traditional classroom learning. This study aims to examine the implications of this shift on various aspects of the educational landscape. The study employs a comparative approach, analyzing the benefits and challenges posed by online education platforms in contrast to traditional classroom settings. The study also investigates the role of teachers in adapting to online teaching methods and their perception of the transition from traditional classrooms. It explores the advantages of online education, such as increased accessibility, flexibility in scheduling, and personalized learning experiences. Additionally, it delves into the potential drawbacks, including the lack of physical interaction, reduced socialization, and the need for technological infrastructure. The findings of this comparative study contribute to the existing body of research on online education by providing insights into the Indian context. The results shed light on the transformative potential of online education platforms and their ability to augment or challenge traditional classroom practices. The findings of this study offer valuable insights for stakeholders seeking to navigate the evolving educational landscape and adapt their practices to meet the needs of 21st-century learners.

KEYWORDS: Online Education, Traditional Classrooms,21st-century learners, Online platforms.

INTRODUCTION:

This comparative study aims to shed light on these questions, offering a comprehensive analysis of the impact of online education on the traditional classroom in the Indian context. By examining the experiences, perspectives, and outcomes of students, teachers, and educational institutions, we can better understand the opportunities and challenges presented by the advent of online education. Ultimately, this research aims to inform policymakers, educators, and stakeholders about the evolving landscape of education and contribute to the ongoing discourse on educational transformation in India.

OBJECTIVES:

1. To identify the Popular online education platforms in India and Abroad.
2. To explore the challenges faced by teachers and students in adapting to online education platforms in India, and do these compare to challenges in traditional classrooms.
3. To bring out online education platforms in India impact the interaction and collaboration among students, compared to traditional classroom settings.

4. To determine the use of online education platforms impact the cost and accessibility of education for students in India, compared to traditional classrooms.

RESEARCH QUESTIONS:

1. What are the Popular online education platforms in India and Abroad?
2. What are the challenges faced by teachers and students in adapting to online education platforms in India, and how do these compare to challenges in traditional classrooms?
3. How do online education platforms in India impact the interaction and collaboration among students, compared to traditional classroom settings?
4. How does the use of online education platforms impact the cost and accessibility of education for students in India, compared to traditional classrooms?

METHODOLOGY:

The study was conducted based on the method of document review following the qualitative approach of research. The information presented in this paper was collected from primary and secondary sources like various books, Research Article, Magazines, Research Journal, and E- journal. The methods utilized for gathering information documented review, archival investigation, Representative themes that were found across materials gathered were coded, categorization and analysed for presentation. By employing this methodology, the study aims to provide valuable insights into the impact of online education platforms on traditional classroom settings in India, offering a comparative analysis of their strengths, weaknesses, and potential implications for the education system.

Popular online education platforms in India and Abroad:

There are several platforms for online education in India that offer a wide range of courses and learning opportunities. Some of the popular platforms include:

- **Swayam:** is an online platform developed by the Government of India that offers free courses and study materials to promote digital learning and skill development. It was launched in 2017 as part of the government's Digital India initiative. The platform provides access to a wide range of courses in various disciplines, including engineering, humanities, science, management, and more. Swayam aims to bridge the gap between students and quality education by making high-quality educational resources available to all. The courses are designed and prepared by reputed Indian universities and institutions, ensuring the credibility and relevance of the content. Swayam has gained popularity among learners across India, with millions of students enrolling in courses offered on the platform.(Source: Government of India. (2017). Swayam: Study Webs of Active Learning for Young Aspiring Minds. Retrieved from: https://swayam.gov.in/)
- **Unacademy**: Unacademy is one of the largest online learning platforms in India, offering courses for various competitive exams, school curriculum, language learning, and skill development. It has a vast collection of video lectures and live classes conducted by experienced educators. It covers exams like UPSC, SSC, banking, railways, and more. (Source: Unacademy website - www.unacademy.com)
- **BYJU'S**: BYJU'S is a well-known online learning platform that focuses on providing personalized learning experiences for students. It offers courses for school students, competitive exams like JEE and NEET, and various other subjects and skill development. It provides video

lessons, interactive quizzes, and other learning resources. (Source: BYJU'S website - www.byjus.com)

- **Udemy**: Udemy is a global marketplace for online courses that has a significant presence in India. It hosts a wide range of courses on various topics, including programming, business, photography, personal development, and more. Udemy courses are created and taught by experts in their respective fields. (Source: Udemy website - www.udemy.com)
- **Coursera:** Coursera is a popular platform that offers online courses from top universities and educational institutions worldwide. It provides courses on subjects like computer science, data science, business, humanities and many others. Coursera also offers certifications and degree programs in partner ship with universities. (Source: Coursera website - www.coursera.org)
- **edX**: edX is another renowned online learning platform that offers courses from top universities, colleges, and organizations. It covers a wide range of subjects, including computer science, engineering, humanities, and more. edX courses are accessible to learners globally. (Source: edX website - www.edx.org)
- **Vedantu**: Vedantu specializes in providing online live tutoring for K-12 students. It offers interactive classes for subjects like mathematics, science, English, and social studies. Vedantu focuses on personalized learning and provides one-on-one sessions with experienced teachers.(Source: **Vedantu** website - https://www.vedantu.com)
- **Toppr**: Toppr is an online learning app primarily aimed at school students. It offers comprehensive study materials, practice tests, and personalized learning plans for various school boards and competitive exams. Toppr also provides live doubt-solving sessions with (Source: **Toppr** website -https://www.toppr.com)
- **Khan Academy:** Khan Academy provides free educational resources, including video lectures and practice exercises, across a wide range of subjects. It covers topics from math and science to humanities and test preparation. (Source: Khan Academy website - www.khanacademy.org)
- **UpGrad**: UpGrad is an online learning platform that offers courses and programs in collaboration with universities and industry experts. It focuses on providing industry-relevant skills and professional development. (Source: UpGrad website - www.upgrad.com)

These are just a few examples of popular online education platforms in India and Abroad. Each platform has its unique features, course offerings, and teaching methodologies. It's recommended to explore these platforms further to find the one that aligns with your specific learning goals and requirements.

Challenges faced by teachers and students in adapting to online education platforms in India, and do these compare to challenges in traditional classrooms:

Adapting to online education platforms in India presents several challenges for both teachers and students. These challenges can be compared to those encountered in traditional classrooms. Here are some of the key challenges faced by teachers and students in India when transitioning to online education, along with comparisons to traditional classrooms:

TABLE-1: compare between Online Education and Traditional Classroom Challenges faced by teachers and students.

Aspects	Online Education	Traditional Classroom
Access to Technology and Internet Connectivity	Online Education: One of the primary challenges is access to technology and reliable internet connectivity. Many students in India, especially in rural areas or economically disadvantaged backgrounds, may not have access to a stable internet connection or the necessary devices like computers or smartphones.	Traditional Classroom: In a traditional classroom, students are not dependent on personal devices or internet connectivity. They can access educational resources through textbooks, libraries, or classroom materials, ensuring equal access to information for all.
Technical Competence	Online Education: Both teachers and students may face challenges in adapting to the technical aspects of online education platforms. They may require training to use the various tools and features effectively, such as video conferencing, file sharing, or online assessments.	Traditional Classroom: In a traditional classroom, the focus is primarily on pedagogical skills and subject matter expertise, rather than technical competence. Teachers can deliver lessons using traditional teaching methods without relying on complex digital tools.
Engagement and Interaction	Online Education: Maintaining student engagement and facilitating interaction can be challenging in an online environment. Students may find it difficult to actively participate in virtual discussions or ask questions, leading to reduced interaction and a potential impact on their learning experience.	Traditional Classroom: In a traditional classroom, face-to-face interactions and immediate feedback from teachers and peers enhance student engagement. Teachers can employ various strategies like group discussions, hands-on activities, or real-time questioning to encourage active participation.
Personalized Attention	Online Education: Providing personalized attention to individual students can be more challenging in an online setting. Teachers may struggle to address the specific needs, doubts, or learning difficulties of each student due to limited interaction or time constraints.	Traditional Classroom: In a traditional classroom, teachers have the opportunity to observe students' behavior, understand their learning styles, and provide immediate assistance. This enables personalized attention and targeted support for individual students.
	Online Education: Conducting assessments and providing timely	Traditional Classroom: In a traditional classroom, assessments

Assessment and Feedback	feedback can be challenging in online education. Proctoring exams to ensure fairness and prevent cheating becomes more difficult. Additionally, providing detailed feedback on assignments and assessments may take longer due to the digital format.	can be conducted in person, allowing for direct observation and controlled environments. Teachers can provide immediate feedback, discuss mistakes, and guide students on improvement areas.

It is important to note that the challenges mentioned above are not exclusive to online education platforms in India but are also relevant to online education worldwide. The comparisons made highlight the differences between the two modes of education and the unique challenges each presents.

Online education platforms in India impact the interaction and collaboration among students, compared to traditional classroom settings:

Online education platforms in India have had a significant impact on the interaction and collaboration among students, especially when compared to traditional classroom settings. Here are some ways in which online education platforms have influenced student interaction and collaboration, along with relevant citations:

- **Enhanced accessibility and inclusivity:** Online education platforms have made education more accessible to a wider range of students, including those who face geographical or physical limitations. Students from different regions can connect and collaborate, fostering a diverse and inclusive learning environment. According to a study by Reddy and Gupta (2019), online education has provided opportunities for students from rural areas to access quality education that was previously limited to urban areas.
- **Increased student engagement:** Online education platforms often incorporate interactive tools and multimedia resources, which can enhance student engagement. These platforms utilize features such as virtual classrooms, discussion forums, and chat rooms to facilitate active participation and collaboration among students. A research study conducted by Arbaugh and Benbunan-Fich (2007) found that online discussion forums fostered higher levels of student interaction and engagement compared to traditional classroom discussions.
- **Flexible learning opportunities:** Online education platforms provide flexibility in terms of time and location, allowing students to learn at their own pace. This flexibility enables students to engage in learning activities whenever and wherever they are comfortable, encouraging them to take ownership of their education. According to a report by KPMG India (2020), the flexibility of online learning has led to increased student participation and collaboration due to reduced time constraints and the ability to balance work and education commitments.
- **Collaborative learning tools:** Online education platforms offer various collaborative learning tools that promote student interaction. These tools include virtual group projects, shared documents, and collaborative problem-solving activities. A study by Pall off and Pratt (2005) emphasized the effectiveness of online collaborative tools in enhancing student interaction and collaborative skills.

- **Diverse learning communities:** Online education platforms bring together students from various backgrounds, creating diverse learning communities. This diversity fosters a rich exchange of ideas, perspectives, and experiences, encouraging students to collaborate and learn from one another. Research by Duderstadt et al. (2017) highlighted the importance of diverse online learning communities in enhancing student collaboration and the development of critical thinking skills.

Use of online education platforms impact the cost and accessibility of education for students in India, compared to traditional classrooms:

The use of online education platforms has had a significant impact on the cost and accessibility of education for students in India when compared to traditional classrooms. Here are some key points:

- **Cost Reduction:** Online education platforms often offer courses at lower costs compared to traditional classroom-based education. This is primarily due to the elimination of expenses associated with physical infrastructure, such as building maintenance and utilities. Additionally, online platforms allow for scalability, enabling a larger number of students to enroll, further reducing the cost per student. According to a report by KPMG, online courses can be 46% cheaper than traditional courses in India, making education more affordable for a broader range of students. Source: KPMG India, "Online Education in India: 2021"
- **Access to Quality Education:** Online education platforms provide access to quality educational resources to students in remote areas, who may not have access to well-established educational institutions. It helps bridge the geographical divide by providing equal learning opportunities to students across the country. A study by the All India Survey on Higher Education found that online education has played a crucial role in increasing the Gross Enrolment Ratio (GER) in higher education in India. The GER for 2019-20 was 27.1%, with online education contributing significantly to this growth. Source: Ministry of Education, Government of India, "All India Survey on Higher Education 2019-20"
- **Flexibility and Convenience:** Online education platforms offer flexibility in terms of scheduling and pacing, allowing students to learn at their own pace and convenience. This is particularly beneficial for individuals who are working or have other commitments, as they can access course materials and lectures anytime, anywhere.

A study conducted by the Indian Journal of Medical Informatics found that 92% of students enrolled in online education programs in India appreciated the flexibility it offered. Source: Indian Journal of Medical Informatics, "An Online Education Platform in Healthcare: A Cost-Effective Solution for Continuing Medical Education"

It's important to note that while online education platforms have made education more accessible and affordable, there are still challenges, such as the availability of internet connectivity in remote areas and the need for digital literacy among students. However, overall, online education has significantly expanded educational opportunities for students in India.

FINDINGS:

The findings of this study offer valuable insights for stakeholders seeking to navigate the evolving educational landscape and adapt their practices to meet the needs of 21st-century learners.

- Online education offers greater flexibility and convenience compared to traditional classroom settings. Students can access learning materials, lectures, and assignments at their own pace and convenience.
- The cost of online education is often lower compared to traditional classroom-based education, as it eliminates expenses related to infrastructure, travel, and printed materials.
- Online education platforms provide various interactive tools, multimedia resources, and discussion forums, promoting active student participation and engagement.
- Reliable internet connectivity and access to technology remain significant challenges, particularly in rural and economically disadvantaged areas, hindering the widespread adoption of online education.
- Certain subjects and practical skills require hands-on training and physical interaction, which are difficult to replicate in online settings.
- Lack of face-to-face interaction may impact social and emotional development, as well as the development of soft skills among students.

CONCLUSION:

Overall, the platform of online education in India has had a significant impact on the traditional classroom. While it offers several benefits such as accessibility, flexibility, and personalized learning, challenges related to infrastructure, technology, and the need for physical interaction remain. A blended approach that combines online and traditional classroom education may offer a balanced solution to maximize the benefits of both methods and address the limitations.

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Curcuma longa(Turmeric) Fabric Dye

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ABSTRACT

Dyeing is a process of applying coloring matter directly on fiber, yarn or fabric without any additives. Natural dyes were used only for coloring of textiles from ancient times till the nineteenth century. As the name suggests, natural dyes are derived from natural resources. Coloring materials obtained from natural resources of plant, animal, mineral, and microbial origins were used for coloration of various textile materials. Today is the world of most scientific and advanced level of dyeing. There are huge numbers of process to do coloration. Natural and manmade colors are also used. In this paper, the natural dyes are extracted and fabric dyeing is analyzed by applying dye on 100 % pure cotton. At first stage we extract dye from Turmeric Powder. This dye was extracted with the help of boiling method. We find out yellow color from turmeric powder. The fabric dyed with extracted dye without using any mordant. This can be considered as cent percentage organic, especially for baby clothes. The dyed fabric tested for rubbing fastness, washing fastness, indoor and outdoor drying fastness, etc.

Turmeric is highly valued in natural medicine as well as textiles. Its gorgeous colour and healing properties have earned it the nickname “Indian solid gold”- indeed it has quite the reputation. In the context of Ayurveda healing, turmeric is believed to help “purify the blood” and help with a number of ailments in the skin, heart, liver and lungs. This makes it the perfect raw material for Ayurveda dyeing, combining both beauty and function. Turmeric before you may have noticed it can give your hands a bit of a stain with its bright yellow colour. Dyed white singlets and endless swathes of tulle in a big pot of turmeric. Dyeing clothes with Turmeric are great way for beginners to start as it produces vibrant warm yellow color on natural fabrics. Turmeric dye cotton, silk and wool. The colour does fade quickly when washed a lot, so be mindful of this and we suggest washing the turmeric dyed fabric in its own just in case.

Keywords: Natural Fabric such as cotton, linen, silk, Turmeric Powder, Water

REVIEW OF LITERATURE

1. INTRODUCTION

Majorly dyes are of two types – natural and synthetic dyes. The natural dyes are extracted from Natural substances such as plants, animals, or minerals. Synthetic dyes are made in a Laboratory. Chemicals are synthesized for making synthetic dyes. Some of the synthetic dyes Contain metals too. Textiles dyed with natural dyes were found to yield poor colour, have Inadequate fastness properties.

The production and us age of the synthetic dyes is related with carcinogenic, toxic, allergic effects on humans and to our environment. The textile industry consumes a substantial amount of water in manufacturing processes used mainly in the dyeing and finishing operations. The waste water from textile plants is classified as the most pollution of all the industrial sectors. The untreated

Wastewater is one of the biggest threats to the environment. Organic, colored, toxicant, surfactant and chlorinated compounds and salts are the main pollutants in textile effluents. The ingestion of Water contaminated with textile dyes can cause serious damage to the human health and of other Living organisms, due to the toxicity and mutagenicity of its components. These chemicals cause Different diseases like contact dermatitis, allergic dermatoses, respiratory diseases and asthma .Workers in the textile industry have a two- fold increased risk of contracting bladder cancer Compared to workers in other occupations like aviation, agriculture and construction.

The global demand for natural dyed products is increasing in international market due to their less Toxicity and harmful effects. The natural dyes are clinically safer than their synthetic analogues, in Handling and use because of non – carcinogenic and biodegradable nature. Natural dyes possess Lower toxicity and allergic reactions than synthetic dyes however safety of natural dyes needs to Be proved if they are used more widely and in commercial process. The environmental pollution Problems caused due to the harmful chemical dyes requires a dire need for the assessment of the Synthetic dyes, which can be countered with the wide search and usage of thev able cheaper Sources of dye and mordant. There are two main ways to limit the environmental impact of textile Processing. One is to construct sufficiently large and highly effective effluent treatment plants, and the other way is to make use of dyes and chemicals that are environment friendly.

1.1 NATURAL DYES:

Natural dyes are less toxic, less polluting, less health hazardous, noncarc inogenic and non-poisonous. Added to this, they are harmonizing colors, gentle, soft and subtle, and create a restful effect. Above all, they are environment friendly and can be recycled after use. The natural dyes have several advantages, there are some limitations as well. Tedious extraction of coloring component from the raw material, low color value and longer time make the cost of dyeing with natural dyes considerably higher than with synthetic dyes. some of the natural dyes are fugitive and need a mordant for enhancement of their fastness properties. Some of the metallic mordents are hazardous. Also, there are problems like difficulty in the collection of plants,

Lack of standardization, lack of availability of precise technical knowledge of extracting and dyeing techniqes and species availability.

Natural dyes are aesthetically appealing environment friendly, biodegradable, nontoxic, and are cost effective. Recently, some people have been advocating the revival of the hoary practice of natural dyeing against the suitable manacling back drop of impending ecological disaster and toxic diseases, as well as the diminishing proportions of the global wealth of petroleum and coal tar on which synthetic dyes are based. Hence a consideration of Natural dyes is not an innovation it is a revival with revised technique and scientific methodology. Naturally dyed materials have good resistance to most invasion. Some of its constituents are anti-allergens, hence proved to be safe for body contact.

1.2 CLASSIFICATION OF NATURAL DYES:

Natural dyes are sparingly soluble in water and the solubility of dye may be increased in mild alkaline condition. Natural dyes can be classified in various forms, such as sustentative and adjective colors. This classification is replaced by an equivalent subsequent classification namely direct dyes

and mordant dyes. In another classification method they are divided as monogenetic dyes and polygenetic dyes. Monogenetic dyes produce only one color irrespective of the mordant while the color generated on the fiber by polygenetic dye depends on the mordant use. Direct natural are sustentative to untreated cellulosic fibers and are directly applied like direct dyes. Fibers dyed with natural direct dyes are normally treated with metal salts. They are generally fugitive in nature.

Most of the natural dyes belong to mordant dyes. They have affinity for mordant Fibers and forms a complex. Natural mordant dyes are extracted along with the tannin from vegtable matters in which dye is directly taken by the untreated cotton. Natural dyes are aesthetically appealing, environment friendly, biodegradable, nontoxic, and are cost effective. Recently, some people have been advocating the revival of the hoary practice of natural dyeing against the suitable manacling back drop of impending ecological disaster and toxic diseases, as well as the diminishing proportions of the global wealth of petroleum and coal tar on which synthetic dyes are based.

1.3 OBJECTIVES:

- To dye the Cotton fabrics with turmeric powder dye.
- To do comparative study between the original and dyed samples,
- To check the effectiveness of the dyes.

1.4 TURMERIC POWDER

Curcumin is a bright yellow chemical produced by plants of the Curcuma longa species. It is the principal curcuminoid of turmeric (Curcuma longa), a member of the ginger family, Zingiberaceae. It is sold as an herbal supplement, cosmetics ingredient, food flavoring, and food coloring.

2. METHODOLOGY

Turmeric is one of the few natural dyes that doesn't require a mordant, Mordants are chemicals that are used to pre-soak items, and different mordants can change the color of turmeric.

2.1 PREPARATION OF DYE:

- Bring a medium/ large pot of water to simmering heat.
- Add 1/4 to 3/4 cup of turmeric (depending of the density of yellow desired) to the pot and simmer for 20-30 mins.
- Submerge your fabric in solution.
- Bring to boil and let simmer for approximately 1 hour.

2.2 MATERIAL:

We have taken the 100 % cotton fabric as substrate. The powder of turmeric collected for the extraction of dye.This textile has relatively high tensile strength, and its natural coloring is white or slightly yellowish. Cotton is very water absorbent, but it also dries quickly, which makes it highly moisture wicking. washed cotton in high heat, and this fabric drapes well on our body.

2.3 PROCESS PARAMETER:

Temperature - As per required

Time - As per required

2.4 TESTING

Washing Fastness - 10 min

Rubbing - Dry and Wet Rubbing using hand

Indoor Drying, Sunlight Drying

2.5 EXTRACTION OF DYE FROM TURMERIC POWDER

- The powder of turmeric is collected and washed thoroughly with water to remove any impurities.
- They are dried at room temperature.
- Then boil it about 1 hour in a hot water bath for quick extraction of natural dye.
- At the end of 1 hour, grind it with the water and the total color was extracted.
- The solution was double filtered and used to carry out our study. They are shown in the figures below.

3. PROCEDURE OF DYEING

Take the strained dye into a bowl and add required quantity of water and sample is dip into it. This sample is treated for 30 minutes. The fabric is treated in room temperature. After the required time sample is taken out, washed and dried.

4. RESULTS AND DISCUSSION

4.1 WASHING FASTNESS TEST:

Different type of washing is specified as different washing methods. The solution should be pre heated to the required temperature of washing. After soaping treatment, rinse twice in cold water and then in cold running tap water. Then squeezed and dried.

The result of washing fastness was observed. As the naturally obtained dyes does not have too much affinity with the fiber. We did not use any mordants to this dye as a fixative. Even though naturally this dye stays on fabric for certain washes. After 5 washes in soap water, slightly the color changed but in case of normal water, the dye on fabric can sustain.

4.2 DRYING:

5. CONCLUSION

The natural fabrics cotton dyed with turmeric was much eco-friendly. The natural dyes were more bio-degradable and so it would not deplete the ozone layer. Finally cotton dyed with turmeric showed good physical properties using with out any mordants.

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THE PROVISION AND PRESERVATION OF INFORMATION RESOURCES IN SCHOOL LIBRARIES IN KATSINA STATE IS CRUCIAL FOR THE ADVANCEMENT OF READING CULTURE.

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Abstracts
This research, titled "The Provision and Preservation of Information Resources in School Libraries in Katsina State is Crucial for the Advancement of Reading Culture," is important for advancing reading culture. was conducted primarily to determine the degree of preservation of information resources in school libraries, which are essential in promoting reading culture in Katsina State, the strategies used in preservation of the resources, and recommendations were made based on the study's findings to aid future research in the area effective utilization of the resources in school libraries in promoting reading culture and potential solutions to problems. Data collection employed a qualitative approach. The analysis's findings were used to create the study's summary and conclusion.
Keywords: Provision, Preservation, Information Resources, School Libraries, Reading Culture

Introduction

If libraries are to fulfill their role of meeting the information needs of their customers, preservation of information resources in libraries has become a global phenomenon. To satisfy its patrons' requirements for information or entertainment, libraries collect materials. When the items under one's care are allowed to degrade uncontrolled or suffer any kind of harm, it may be challenging and ultimately challenging to make the knowledge they contain usable.. In order for patrons to always have access to these items, it is the duty of the library staff to maintain them in good physical shape. Numerous libraries around the nation continue to hold their collections in subpar conditions (Olatokun, 2018). In current electronic media houses, a significant amount of information captured on audio or videotape regarding significant occasions, persons, etc. is frequently erased (Popoola, 2013). This is a tragic circumstance that may be found in many Nigerian school libraries. When intellectual contents in libraries—whether printed or not—stand the test of time and meet users' requirements, they are at their most beautiful. One of the primary roles of school libraries nowadays is the preservation of library materials around the globe. They regularly purchase these goods and also take safety precautions. The collections held by libraries represent the inestimable heritage of humanity since they preserve information, concepts, ideas, works of art, and other manifestations of human achievement in a variety of fields, eras, and directions.. According to Ezekwe (2001), school libraries are those located in primary and secondary schools for the use of the students and their teachers. They offer a variety of teaching resources and are also referred to as institutional material centers (IMC) for the school. based on Lorenze (2011).On the other hand,

defined school libraries as these long-standing and crucial components of primary and secondary education with a single purpose of offering educational materials to improve the curriculum, supplement classroom activities, and give students the best chances.. These are intended to make children aware of the breadth of knowledge that is available and to inspire them to look for, investigate, and gather data that is pertinent to their general educational needs as well as their own needs. The school libraries primarily encourage a reading culture. Consequently, this work gains interest and significance. As a result, Katsina State in Nigeria serves as the study's geographical focus.

Statement of the Problem

Even though Katsina State has made great strides in the creation, growth, and utilization of school libraries, there is still much to be done to meet the students' expanding information requirements. Proper information resource preservation is one of the issues preventing Katsina State's school libraries from providing their services effectively and encouraging children to read for pleasure. Therefore, the school administration, state government, and local government have disregarded the protection of information resources in the school. The majority of the information resources in school libraries are printed books, which can deteriorate for a variety of reasons and prevent users from having long-term access to them when they are required.. Additionally, it had an impact on learning and information resources in several State post-primary institutions. These issues have persisted for a very long time and don't appear to have a remedy. As a result, it becomes a topic worth researching. Determining the preservation techniques and key components of preservation implemented in a few secondary schools in Katsina State is the goal of this study..

Aims of the research

1. To assess the materials made available by Katsina State's public school libraries.
2. to identify the methods used in the public school libraries under study for information resource preservation
3. To identify the Challenges Affecting Information Resource Preservation in the Under Study School Libraries

Research Methodology

This study used a qualitative research design with the intention of understanding some facets of social life by using words rather than numbers to generate data for analysis. Investigating the complicated, genuine, and within a particular context, shared subjective experience of the researcher and research participants is the method's main objective.

Population of the Study

Three librarians from the chosen public secondary schools in Katsina State were chosen by the researcher to participate in the study as responders. Government Girls College Katsina, Government Girls College Funtua, and Government Secondary School Daura

Data Presentation and Analysis

Types of Information Resources Available in school libraries in Katsina State

PARTICIPANT A:

The books and other resources in our library collections are essential to its efficient operation. They are tools that aid in achieving the school's objectives and aims. Print, non-print, and a wide range of information-bearing elements are all included in the definition of information resources.

PARCIPANT B:

The three (3) broad categories listed below can be used to group the knowledge resources in this library. Resources that have been printed technically are known as print resources. Reference and non-reference information resources are subdivided into them. Additionally, there are non-print and electronic materials. Resources that cannot be printed rely on the senses of sight, hearing, or both to transmit meaning.. Additionally, they are separated into audio and audio visual. The audio resources, such as audio tapes and recordings, convey information through listening. The visual resources use visual materials like posters, charts, images, etc. to convey information. In the case of audio-visual resources, information is presented by combining both senses (senses of sight and sound), such as in movies, home videos, and television. They are all audio-visual.

PARTICIPANT C:

The library's collection of information resources includes serials (newspapers, journals, newsletters, and magazines). Reference books (dictionaries, atlases, yearbooks, encyclopedias, and so forth). Books on many disciplines based on the subjects taught in schools, there are also computers, audiovisual materials, and other things.

Strategies that are employed to preserve Information Resources in school libraries in Katsina State

PARTICIPANT A:

In this library, the most often employed preservation measures for both print and non-print resources were cleaning, dusting, and shelving with open air between the shelves..

PARTICIPANT B:

Along with regular cleaning and dusting, this library has adequate security measures in place to guard against vandalism and other forms of mutilation. The de-acidification approach used at the library is another preservation method.

PARTICIPANT C:

Insecticides and pesticides, the installation of air conditioners, photocopying, laminating, and binding are all used in the preservation process.

Obstacles affecting Preservation of Information Resources in the school libraries under study

PARTICIPANT A:

The main issue is money; without money, there is nothing you can do; the money released to libraries is insufficient and affects other things since it is too tiny. Equipment is a problem, particularly for non-print materials and the digitization process; we are not yet fully equipped, while effort is being done to get the necessary machinery. There are no organizational plans for managing records, no understanding of how records management supports organizational responsibility and efficiency, little

stewardship and coordination in handling records, and no policies or procedures to direct resource management. PARTICIPANT B:

Money is always a constraint. In some libraries, money is allocated at the start of each year to be used by the library or librarian, but in our organization, the management decides what resources we acquire and can approve or refuse our requests. Additionally, there are instances when we go without power for an extended period of time, and using generating sets is expensive, so the problem still comes down to money. Everyone also mentions financial considerations, but preservation extends beyond using simple machines. As a result, being able to afford the equipment and machinery required for preservation is another difficulty resource.

PARTICIPANT C:

According to the respondent, the problem is the absence of clearly established policies that can give preservation a full unit of its own so that it is treated more seriously. There is no set protocol, but all of the library's departments collaborate, and no one individual is assigned a specific task. Even if there is a written policy that is not followed, the policy no longer needs to be followed; as long as everyone works together and knows what they are doing, everything will be OK.

Solutions to the Challenges of Preservation of Information Resources in the Libraries

PARTICIPANT A:

the regular availability of money and the capacity to obtain the tools required for preservation. Leadership commitment, or how management feels about preservation, is another consideration. Do they have the willpower to implement these practices in the library since doing so would also have an impact on the amount of money allocated for material preservation? To prevent unlawful removal of books marked with magnetized strips, libraries should, whenever possible, utilize an electronic detecting system at the exit. Libraries should have a procedure in place for checking the condition of books for circulation if that is not possible.

PARTICIPANT B:

Just as there is a circulation unit and bindery section, a whole unit should take care of preservation so that it would be more meaningful and it would bring awareness to the importance of preservation. The technical know-how, technical manpower, and training needs for the staff to be able to handle preservation. Ideally, a secured door that can only be accessed by an electric keypad should divide the user's areas from the closed collection area.

PARTICIPANT C:

Because there are guidelines for the management of materials and you need to inform and train your clients on usage, preservation is a full spectrum, all-inclusive process that encompasses usage. Staff members must occasionally watch patrons to deter intentional destruction or vandalism of library items, whether a library has open stacks (which let readers access the book shelves) or closed stacks (which force readers to search a book in the catalog and rely on staff to obtain it). The most effective security measures are electronic security systems; just installing the equipment would cut theft by more than half.

Conclusion

In line with the library function of safeguarding and preserving what has already been acquired for future generations in the school, the study on provision and preservation of information resources in school libraries in promoting reading culture in Katsina State, Nigeria, has been deemed important. This study has demonstrated that preservation strategies are understood in libraries, but they are not always fully applied because of several restrictions, most notably low funding. It is envisaged that these results would provide the study's target libraries with the strategic guidance they need to start any preservation efforts for the preservation of their holdings.

Recommendation

1. All schools shall be provided with sufficient textbooks and other reading materials, which should be current and pertinent to the curriculum, by the Katsina State Ministry of Education.
2. To ensure that library materials continue to serve users' information needs for a longer period of time, the libraries under investigation must embrace the digital technique of preservation. The issue of library information preservation has received a lot of attention, and one proposed answer is digitalization.
3. Every school should have a dedicated library, which the ministry of education should supply for efficient use and upkeep of reading materials.
4. The school libraries should provide reading desks for kids, courtesy of the ministry of education. In order to provide effective organization and student access to the learning resources, the school libraries should also have shelving.
5. The libraries' operating hours should be extended to include evening hours so that pupils can access the reading resources after school.
6. Similar to preservation, which is the protection of cultural property through activities that minimize chemical and physical deterioration and damage and that prevent loss of informational content, library management in the libraries under study should also be emphasized in various strategies to ensure that library materials are put under good conditions. Keeping cultural property alive longer is the main objective of preservation.

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Biochar production and utilization to enhance soil quality and crop productivity

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Abstract
Biochar is a carbon-rich product derived from various biomass sources such as kitchen waste, wood biomass, agricultural residue, sewage sludge, and algae. It is produced through pyrolysis that involves heating the biomass under limited oxygen conditions. Biochar offers innumerableuses owing to its ability to remain stable in soil, offers large surface area, with negative charge that improves cation exchange capacity of soil and help to retain essential nutrients for plant utilization. Biochar production minimizes waste and embraces the concept of treating waste with waste, making it an environmentally friendly solution. By converting crop residues into biochar, it sequesters carbon while also improving soil physical properties, such as water holding capacity and soil temperature moderation. It assists to retain organic matter, enhances crop resistance to disease, and supports the proliferation of soil microorganisms. Furthermore, biochar application is gaining popularity in environmental remediation as it plays a crucial role in the sustainable decontamination of toxic substances. Research and development efforts continue to explore the potential of biochar in various fields, including agriculture and environmental remediation but it is essential to carefully consider factors such as feedstock selection, production methods, and appropriate application rates to ensure optimal outcomes and minimize potential drawbacks.
Key words: Biochar, carbon sequestration, soil health, environment remediation

Introduction:

Agricultural waste in India is often viewed as a burden due to the lack of means to transform it into a valuable resource. The country produces approximately 435.98 million tons of agro-residues annually, with 93 million tons of crop residues being burned each year. This practice leads to the loss of valuable biomass and nutrients, as well as the release of harmful gases that pollute environment (1). In this context, biochar produced through the pyrolysis of plant biomass, presents a significant opportunity to convert large-scale agricultural waste from a financial and environmental liability into a valuable asset. It is a carbon-rich material that is created by heating organic matter, such as wood chips, agricultural waste, aquatic biomass, biosolids in a low-oxygen or oxygen-free environment. Utilizing biochar in agricultural systems is a viable option that can enhance the natural rates of carbon sequestration in soil, reduce farm waste, and improve soil quality. Its ability to increase yields without relying on synthetic fertilizers or soil additives presents a boost to modern sustainable agricultural practices (2).

In recent years, many research institutes and agricultural universities in India, such as ICAR institutes and SAUs, have begun exploring biochar production from various bio-residues and its application as a soil amendment. Initial findings indicate that biochar application improves soil health and crop productivity (3).However, in order to promote the widespread use of biochar as a soil amendment and a climate change mitigation option, it is crucial to prioritize research, development, and demonstration of biochar production and application. This includes the development of affordable biochar kilns to make the technology accessible to small and marginal farmers.

Additionally, interdisciplinary and location-specific research should be conducted to assess the long-term effects of biochar application on soil physical properties, nutrient availability, soil microbial activities, carbon sequestration potential, crop productivity, and greenhouse gas mitigation.

Production of Biochar

Biochar is a type of charcoal that is produced through the pyrolysis process that involves heating the biomass at temperatures typically between 400 to 700^{o}C. There are several methods of biochar production, each with its own advantages and disadvantages and properties of biochar produced also depend on types of feedstocks used (4,5).

1. Traditional Kilns: Traditional kilns have been used for centuries to produce biochar. They are simple, low-cost structures made of bricks or stones. Traditional kilns are labour-intensive and have limited control over the pyrolysis process, resulting in inconsistent biochar quality.
2. Retorts: Retorts are enclosed chambers designed to optimize the pyrolysis process. They allow better control of temperature, heating rate, and gas flow. Volatile gases and vapours can be collected and used as a source of energy. Retorts provide better efficiency and consistency in biochar production compared to traditional kilns, but they can be more complex and expensive to build.
3. Gasification: Gasification is a more advanced method that involves the partial combustion of biomass in the presence of limited oxygen. The process produces a mixture of gases known as syngas, which can be further processed for various applications. However, they require more advanced equipment and expertise.
4. Torrefaction: Torrefaction is a thermal treatment process that involves heating biomass at temperatures between 200 to 300 degrees Celsius (392 to 572 degrees Fahrenheit) in the absence of oxygen. This process removes moisture and volatile components from the biomass, resulting in a more stable and energy-dense product known as torrefied biomass. While the primary goal of torrefaction is to produce biomass fuel, biochar is also a byproduct.

Table 1: Properties of biochar produced from various feedstock's

Feedstock	Carbon Content	Porosity	Nutrient Content	Ash Content	Stability
Woody Biomass	High	High	Moderate	Low	High
Agricultural Residues	Moderate	High	Variable	Moderate	Moderate
Shell Waste	Moderate	High	Low to Moderate	High	Moderate
Biosolids	Variable	High	High	Moderate to High	Moderate
Aquatic Biomass	Variable	High	Moderate	Variable	Moderate

Physio-chemical properties of Biochar

Specific properties of biochar can vary depending on factors such as the feedstock, pyrolysis conditions, and post-treatment processes. Physicochemical properties of biochar make it a versatile material with applications in agriculture, environmental remediation, carbon sequestration, and sustainable resource management (6, 7).

1. Porosity: Biochar exhibits a highly porous structure, characterized by a network of pores and cavities. The presence of pores contributes to the large surface area of biochar with excellent water-holding capacity, nutrient retention, and adsorption capabilities.
2. Surface Area: Biochar's porous structure leads to a substantial surface area, which provides a large number of sites for chemical reactions and adsorption of substances. The increased surface area allows biochar to interact with various molecules and ions, making it an effective adsorbent for contaminants and a habitat for beneficial microorganisms.
3. pH and Cation Exchange Capacity (CEC): Biochar has a neutral to slightly alkaline pH, typically ranging from 7 to 9. This pH range can vary depending on the feedstock and production conditions. The alkaline nature of biochar can help buffer soil acidity and promote nutrient availability. Additionally, biochar possesses a cation exchange capacity (CEC), which refers to its ability to adsorb and exchange cations (positively charged ions) with the surrounding environment.
4. Stability and Carbon Sequestration: Biochar is a chemically stable form of carbon that has a longer residence time in the soil compared to other organic matter. Due to its resistance to decomposition, biochar can sequester carbon in the soil for hundreds to thousands of years, contributing to climate change mitigation.
5. Adsorption Capacity: Biochar has the ability to adsorb and retain various substances such as organic compounds, heavy metals, and nutrients. This adsorption capacity is attributed to its porous structure, large surface area, and presence of functional groups on the surface. Biochar can act as a filter and adsorb contaminants, making it useful for water and air filtration, soil remediation, and waste management applications.

Applications of biochar

A. Remediation of pollutants using Biochar

Biochar has shown promise in the remediation of pollutants due to its excellent adsorption and immobilization properties (8,9).

1. Heavy Metal Remediation: Biochar has a high affinity for heavy metals, such as lead, cadmium, copper, and zinc. Its porous structure and large surface area provide ample sites for heavy metal adsorption. Biochar can be applied to contaminated soils, sediments, or water bodies to effectively bind and immobilize heavy metals, reducing their mobility and bioavailability.
2. Organic Pollutant Removal: Biochar's adsorption capabilities extend to a wide range of organic pollutants, including pesticides, polycyclic aromatic hydrocarbons (PAHs), pharmaceuticals, and industrial contaminants. The porous structure and presence of functional groups on biochar's surface allow it to effectively capture and retain these pollutants.
3. Nutrient Runoff Mitigation: Agricultural runoff can contribute to water pollution by carrying excess nutrients, such as nitrogen and phosphorus, into water bodies, causing eutrophication.

Biochar can be utilized to mitigate nutrient runoff by adsorbing and retaining these nutrients, preventing their leaching into water systems.

4. Soil Remediation: Biochar has the potential to remediate contaminated soils by adsorbing and immobilizing a range of pollutants. It can be used for the remediation of petroleum hydrocarbons, volatile organic compounds (VOCs), and other organic contaminants. Biochar amendments can enhance the degradation and immobilization of these pollutants through adsorption, providing a more sustainable and cost-effective alternative to traditional soil remediation techniques.
5. Phytoremediation Enhancement: Biochar can be combined with phytoremediation, a process that uses plants to remove pollutants from the environment. Biochar-amended soils can improve phytoremediation efficiency by increasing nutrient availability, enhancing microbial activity, and reducing contaminant leaching.

B. Improvement of soil chemical and biological properties using biochar

Biochar can significantly improve soil chemical and biological properties, leading to enhanced soil fertility, nutrient cycling, and microbial activity(10,11,12).

1. Nutrient Retention and Availability: Biochar has a high cation exchange capacity (CEC), which allows it to retain and release nutrients slowly over time. When applied to soils, biochar adsorbs and holds nutrients such as nitrogen, phosphorus, and potassium, preventing their leaching and making them available for plant uptake.
2. pH Regulation: Biochar can act as a pH buffer in soils. Depending on the feedstock and production conditions, biochar can have a neutral to slightly alkaline pH. Incorporating biochar into acidic soils can help raise the pH and alleviate soil acidity, creating a more favorable environment for nutrient availability and microbial activity.
3. Microbial Habitat and Diversity: The porous structure and large surface area of biochar provide a habitat for beneficial microorganisms in the soil. Biochar acts as a refuge for soil microbes, supporting their growth, activity, and diversity. This enhanced microbial habitat can improve nutrient cycling, organic matter decomposition, and overall soil health.
4. Carbon Sequestration: Biochar is a stable form of carbon that persists in the soil for an extended period. When applied to soils, biochar sequesters carbon, contributing to long-term carbon storage. The presence of biochar in the soil promotes the accumulation of soil organic carbon, which improves soil structure, water-holding capacity, and nutrient availability.
5. Water Retention and Drainage: The porous structure of biochar enhances soil water-holding capacity by providing spaces for water storage. Biochar helps retain moisture in the soil, reducing water stress on plants during dry periods. Moreover, biochar can also improve soil drainage in heavy clay soils, preventing waterlogging and enhancing root growth.
6. Suppression of Soil-borne Diseases: Biochar has been shown to suppress soil-borne pathogens and pests. It can inhibit the growth and activity of certain soil-borne pathogens, reducing the incidence and severity of plant diseases. Biochar's antimicrobial properties and its ability to enhance beneficial microbial communities contribute to disease suppression.
7. Temperature Regulation: Biochar can help regulate soil temperature. Its high heat capacity allows it to absorb and release heat slowly, providing a thermal buffer to the soil. In hot climates, biochar can help cool the soil by reducing temperature fluctuations, while in cooler climates, it can provide some insulation, protecting against frost damage.

8. Enhanced Root Development: Biochar improves soil structure, leading to increased root growth and development. This promotes better root-soil interactions, allowing plants to access nitrogen more effectively. With a larger and more extensive root system, plants have improved access to soil nutrients, including nitrogen, resulting in enhanced nitrogen uptake efficiency.

Table 2: Various studies depicting effects of biochar on plant growth and yield

Study	Findings	References
Atkinson et al. (2010)	Biochar application increased plant biomass, nutrient availability, and improved soil properties such as pH, cation exchange capacity, and water holding capacity.	(13)
Lehmann et al. (2011)	Biochar application significantly increased plant growth, nutrient availability, and water-holding capacity, leading to improved drought tolerance.	(14)
Xie et al. (2013)	Biochar amendment enhanced soil fertility and rice production, particularly in soils with low nutrients.	(15)
Agegnehu et al. (2016)	Biochar application significantly increased maize yield, nutrient availability, nutrient use efficiency, and improved soil properties related to fertility.	(16)
Yeboah etal, (2020)	In cowpea application of biochar increased growth, yield and nutrient uptake	(17)
Ohtsuka et al, (2021)	Biochar significantly increased the relative growth rate of canopy oak trees and production of reproductive organs (mainly oak acorns)	(18)
Simiele etal, (2022)	Biochar enhances root, stem, leaf biomass, flower and fruit numbers, and antioxidant content of cherry Tomato	(19)

Disadvantages of biochar

While biochar offers numerous benefits, it is important to consider its potential disadvantages, drawbacks, and limitations (20,21).

1. Production Energy Requirements: The production of biochar requires energy input, typically in the form of heat for pyrolysis. This energy requirement can contribute to greenhouse gas emissions and environmental impacts if not sourced from renewable or low-carbon energy sources.
2. Feedstock Availability and Sourcing: The availability of suitable feedstock for biochar production can be a challenge, especially on a large scale. Competing demands for biomass resources, such as food production and other industrial uses, can limit the availability and sustainability of feedstocks.
3. Emissions during Production: While biochar production itself can sequester carbon and reduce emissions, there is a potential for emissions of volatile organic compounds (VOCs) and

greenhouse gases during the pyrolysis process if not properly controlled. This can occur due to incomplete combustion or the release of stored carbon dioxide from the feedstock.

4. Lack of Standardization and Quality Control: The quality and properties of biochar can vary significantly depending on the feedstock, production conditions, and post-treatment processes. The lack of standardized protocols and quality control measures can make it challenging to ensure consistent and reliable biochar products with desired characteristics for specific applications.
5. Long-Term Stability and Persistence: While biochar can be stable and resistant to decomposition in the soil, its long-term behavior and effects are still being studied. Factors such as aging, microbial activity, and interactions with soil components can influence its persistence and potential environmental impacts over extended periods.

Conclusion

In conclusion, biochar is a versatile and promising material with numerous applications and benefits. Its production involves the pyrolysis of biomass, resulting in a carbon-rich material that can improve soil fertility, sequester carbon, remediate pollutants, and enhance environmental sustainability. Biochar exhibits a range of physicochemical properties, including high porosity, large surface area, nutrient retention, and adsorption capabilities. It can enhance soil chemical, physical, and biological properties, such as nutrient availability, water holding capacity, soil structure, and microbial activity. Biochar's potential drawbacks include energy requirements for production, feedstock availability, emissions during production, and the need for standardized quality control. However, ongoing research and development efforts aim to address these challenges and optimize biochar production and application techniques. By considering site-specific factors, proper management practices, and sustainable feedstock sourcing, biochar has the potential to contribute to sustainable agriculture, waste management, carbon sequestration, and climate change mitigation. Continued exploration and implementation of biochar technologies can unlock its full potential and help foster a more sustainable and resilient future.

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APPROACHES TO TEACHING PROGRAMMING: A COMPREHENSIVE REVIEW AND ANALYSIS

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ABSTRACT

In this article, an initial framework on programming pedagogy is suggested which attempts to conceptualise pedagogy along the two dimensions, namely, programming knowledge and programming representation. For the dimension of programming knowledge, the two poles are programming syntax and programming concept, which correspond to the developmental change in learning programming. For the dimension of programming representation, the two poles are textual representation and visual representation, which reflects the advancement of technology in programming presentation. Structured programming is traditionally learned with focus on programming syntax in textual representation. As a result, it is considered as a more syntax-oriented and textual-based (i.e., syntax-textual pedagogy). Problem Solving, Software Development, Language Learning, and Learning Theory approaches are regarded as more concept-oriented and textual-based (i.e., concept-textual pedagogy) since they emphasise the mastery of problem solving skills. Mini-language and Sub-language approaches usually make use of visual metaphor to help beginners to start programming. In this sense, they focus more on concepts building through a visual programming representation (i.e., concept-visual pedagogy). However, we could not find any approach which is under syntax-visual pedagogy. With a trend towards user-friendliness and technology development, it is anticipated that there will be a gradual shift from the concept-textual pedagogy to concept-visual pedagogy in the future.

Keywords: Adaptive Learning, Inquiry-Based Learning, Collaborative Learning, Online and Interactive Learning, Flipped Classroom.

1. Introduction

Teaching programming is a challenging task that requires educators to employ effective approaches to facilitate optimal learning outcomes. This research article provides a comprehensive review and analysis of various approaches to teaching programming. By examining different pedagogical strategies, instructional methodologies, and learning environments, this article aims to offer insights and guidance to educators seeking to enhance their programming education practices. The analysis encompasses both traditional and innovative approaches, taking into account their strengths, limitations, and suitability for different learner profiles and educational contexts. The introduction presents the significance of teaching programming, the growing demand for programming skills in various industries, and the need for effective teaching approaches to meet this demand. It also outlines the research objectives and the structure of the article.

2. Traditional Approaches

This section explores traditional approaches to teaching programming, including lectures, textbooks, and guided exercises. It discusses the strengths and limitations of these approaches,

emphasizing their effectiveness in conveying foundational programming concepts and syntax but noting their potential limitations in promoting problem-solving skills and hands-on application.

3. Inquiry-Based Learning

Inquiry-based learning is an approach that promotes active engagement, critical thinking, and problem-solving skills. This section explores how this approach can be applied in teaching programming, incorporating open-ended projects, student-led investigations, and problem-based scenarios. The benefits and challenges of implementing inquiry-based learning in programming education are discussed.

4. Project-Based Learning

Project-based learning involves students working on real-world projects, applying programming concepts and skills to create meaningful and practical solutions. This section examines the benefits of project-based learning in teaching programming, including increased motivation, collaboration, and the development of problem-solving abilities. It also addresses potential challenges and provides guidance on implementing effective project-based learning experiences.

5. Collaborative Learning

Collaborative learning emphasizes peer interaction, teamwork, and knowledge sharing. This section discusses the benefits of collaborative learning in programming education, such as improved communication skills, diverse perspectives, and enhanced problem-solving capabilities. Strategies for implementing effective collaborative learning activities, including pair programming and group projects, are explored.

6. Online and Interactive Learning

The rise of online platforms and interactive learning tools has transformed programming education. This section investigates the benefits and challenges of online programming courses, interactive coding environments, and gamified learning approaches. It also discusses the importance of providing personalized feedback and support in online learning environments.

7. Flipped Classroom

The flipped classroom approach involves students learning theoretical concepts independently outside the classroom, with in-class time dedicated to hands-on activities and problem-solving. This section explores the potential of the flipped classroom model in programming education, highlighting the advantages of active learning and individualized instruction.

8. Adaptive Learning

Adaptive learning leverages technology to provide personalized learning experiences based on individual learner needs and progress. This section investigates how adaptive learning platforms and intelligent tutoring systems can be utilized in programming education to enhance student engagement, tailor instruction, and provide timely feedback.

9. Key Components of Computer Programming Education:

9.1 Curriculum Development

Designing a comprehensive and structured curriculum is essential in computer programming education. This involves determining the learning objectives, sequencing topics, and selecting appropriate programming languages and tools. The curriculum should cater to learners of different levels, from introductory courses to advanced programming concepts.

9.2 Instructional Strategies

Effective instructional strategies play a crucial role in engaging learners and promoting active learning in computer programming education. These strategies can include a combination of lectures,

hands-on coding exercises, group projects, pair programming, code reviews, and problem-solving sessions. Providing real-world examples and encouraging practical application of concepts helps students understand the relevance of programming skills.

9.3 Pedagogical Approaches

Different pedagogical approaches can be employed to facilitate effective learning experiences in computer programming education. These approaches include inquiry-based learning, project-based learning, flipped classrooms, and peer learning. Each approach promotes student engagement, collaboration, and problem-solving skills, enabling students to apply theoretical concepts to practical scenarios.

9.4 Assessment Methods

Assessment is an integral part of computer programming education to evaluate students' understanding and progress. Assessments can include written exams, coding assignments, project evaluations, and code reviews. Constructive feedback is provided to guide students in improving their programming skills and identifying areas for further development.

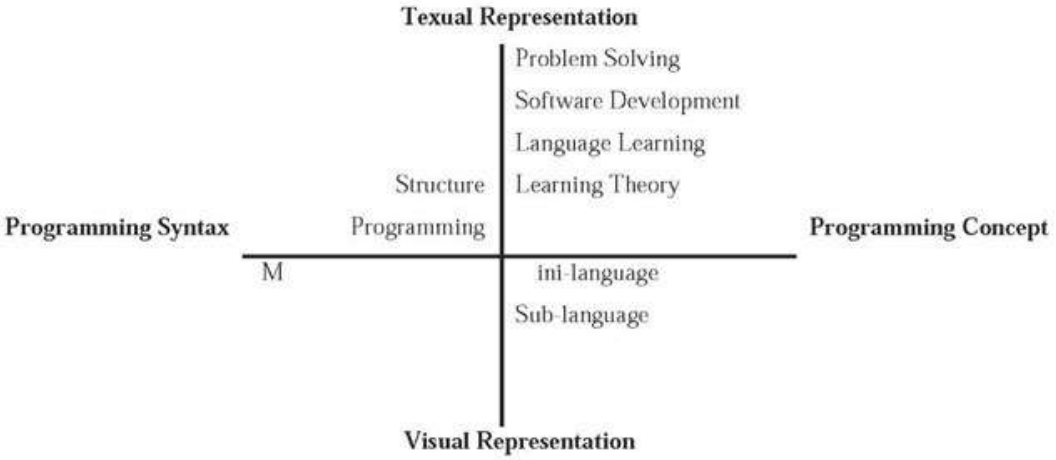

Figure 1. Classification of Programming Pedagogy

9.5 Inclusive Teaching

Computer programming education should be inclusive, accommodating learners from diverse backgrounds and with varying levels of prior knowledge. Inclusive teaching practices involve creating a supportive and accessible learning environment, providing resources and support for students with different learning styles, and promoting diversity and equity in the classroom.

9.6 Professional Development

Continuous professional development is vital for educators in computer programming education to stay updated with evolving programming languages, tools, and teaching methodologies. Attending workshops, conferences, and online courses, collaborating with fellow educators, and staying connected with industry trends and best practices contribute to enhancing teaching skills and keeping the curriculum relevant.

10. Conclusion

The conclusion summarizes the key findings of the research and highlights the importance of adopting a flexible and learner-centric approach to teaching programming. It emphasizes the need for educators to combine various approaches, adapt to diverse learner profiles, and continuously evaluate and improve their teaching practices to meet the evolving demands of programming education.Computer Programming Education focuses on the study and theory of teaching and

learning methods specific to computer programming. By developing comprehensive curricula, employing effective instructional strategies, embracing pedagogical approaches, utilizing appropriate assessment methods, promoting inclusivity, and engaging in continuous professional development, educators can create a conducive learning environment and empower learners to become proficient programmers. The field of computer programming education continues to evolve as technology advances, and new methodologies and tools emerge, ensuring that students are well-prepared to tackle the challenges of the digital age.

11. Future Directions

The article concludes with suggestions for future research directions, such as investigating the effectiveness of hybrid approaches that combine different teaching methodologies and exploring emerging technologies like virtual reality and augmented reality in programming education.

Overall, this research article provides educators with a comprehensive overview of approaches to teaching programming. By understanding the strengths, limitations, and suitability of different approaches, educators can make informed decisions in designing and delivering programming courses that foster optimal learning outcomes and prepare students for the challenges and opportunities in the digital age.

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INTELLIGENCE RETRIEVAL IN BUSINESS WORLD

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ABSTRACT

We're all aware of how much of a presence computers now have in our daily lives. The state of technology today is such that machines can perform tasks and even succeed with high rates of success that are comparable to those of people. Because of artificial intelligence, all of this is now achievable. Businesses can no longer rely on traditional business strategies to promote growth because of the massive amounts of data that are now readily available and the constantly changing preferences and complexity of customers. These significant adjustments have created new opportunities for using AI to boost corporate growth through useful insights derived from customer data. Artificial intelligence in business simply refers to the use of intelligent computer software with human-like abilities to raise revenue, enhance customer experience, increase productivity and efficiency, and drive business growth and change. Automation of tasks that would otherwise require human intelligence is made possible by artificial intelligence (AI) in technology. In computer science, artificial intelligence (AI) has a wide range and is created and programmed using machine learning and deep learning. Our lives are made easier by the regular application of AI in numerous fields. Artificial intelligence is employed extensively in the commercial world, for example. Any organization may benefit from using AI to streamline operations, analyze data for insights, and interact with clients and staff. Every company wants to be at the top of its game since there is fierce rivalry among them in the market. Successful MNCs leverage AI's automation, big data analytics, and natural language processing capabilities to acquire insight into their industries and improve their businesses' effectiveness and relevance to their clientele. For their businesses to succeed, even small enterprises use AI.

Keywords: Artificial Intelligence, Machine, Business, Application and Automation

ORIGINATION

MEANING

Artificial intelligence (AI), commonly referred to as machine intelligence, is a subfield of computer science that focuses on creating and overseeing machinery that can learn to make judgments and do actions autonomously on behalf of a human.

The purpose of artificial intelligence (AI), a large field of computer science, is to create intelligent machines that can do jobs that usually require human intelligence. Even though artificial intelligence (AI) is a multidisciplinary field with a wide range of methodologies, advances in machine learning, and particularly deep learning, are driving a paradigm shift in practically all facets of the IT sector. Machines can mimic human mental talents using artificial intelligence, or perhaps outperform them. Additionally, The emergence of self-driving cars and the growth for generation AI tools like Chat GPT and the search engine's Bard are examples of how AI is progressively becoming a part of daily life and an area in which corporations from every industry are investing.

DEFINITION

Artificial intelligence (AI) uses sophisticated analysis and logic-based approaches, such as machine learning, to analyze events, support and automate decisions, and perform actions.

REASONS WHY BUSINESSES SHOULD USE AI

The complexity of business operations in the twenty-first century is considerable and involves laborious and ineffective human labor. The age of data is currently ruling business. With the help of data, businesses can gain important knowledge on tactics that can dramatically accelerate growth. Therefore, in order to succeed and remain relevant amid the intense competition, businesses must have a unique understanding of the demands and preferences of their clients. Businesses may now use artificial intelligence to better understand and interact with their consumers, automate corporate procedures, increase productivity and income, and cut costs associated with running their businesses.

ALLIANCE BETWEEN ARTIFICIAL INTELLIGENCE & BUSINESS

Artificial intelligence is typically considered to be a supportive tool rather than a replacement for human intelligence and ingenuity. The ability of AI to process and analyze vast amounts of data considerably more quickly than a human brain is impressive, despite the fact that it currently struggles to complete tasks that are common sense in the real world. After that, synthetic courses of action can be presented to the human user by artificial intelligence software, which can then return. AI can be used in this way to speed up decision-making by helping us game out the potential effects of each action. It is a type of software that is capable of acting even in circumstances that the creators were unable to foresee. Compared to conventional software, artificial intelligence has a broader range of decision-making capabilities. These characteristics make AI extremely beneficial across a wide range of businesses, whether it's just assisting personnel and tourists in smoothly navigating a corporate site or doing a task as difficult as monitoring a wind turbine to foretell when it will require repairs.

USAGES OF AI THAT ARE COMMON

- Systems that collect a lot of data frequently employ machine learning. Sensing devices attached to various assets, such as smart energy management systems, gather data. Machine learning algorithms contextualize the massive data sets before delivering them to the decision-makers in your firm to help them better comprehend energy usage and maintenance requirements.
- Customer relationship management (CRM) systems are being altered by artificial intelligence. For them to stay accurate and up to date, software like Sales force and Zoho require a lot of human interaction. However, when artificial intelligence (AI) is applied to these platforms, a standard CRM system becomes an auto-updating, self-correcting system that manages your relationships for you.
- Because it enables specialists to more thoroughly comprehend, investigate, and assess crimes, artificial intelligence is effective in cyber security. It helps enterprises safeguard client data while advancing the tools they employ to battle fraudsters. However, artificial intelligence can also be a very comprehensive resource and might not be practically suitable in every application. However, it can also give hackers a new tool with which to hone their skills and advance their cyber - attacks. This is the most significant use of the technology.

DOWN THE LINE

- **You can Become a Customer Maniac Thanks To AI.**

In a hybrid world, many SMBs are attempting to engage with their customers in new ways, but many are reliant on cobbled-together point solutions that do not consistently integrate their customer data in a reliable, streamlined manner. When it comes to comprehending our clients, AI is one of the most persuasive solutions to the challenge of separation. Corporate executives concur. A staggering 63% of business professionals, according to our research, believe that AI has already improved how well their staff members understand their clients.

- **In order to make better decisions, AI will automate data analysis.**

Collecting the appropriate data is one of the most time-consuming tasks that any leader must perform. Hours can be spent by a business executive, analyst, or marketer to study consumer data and find insightful patterns, leaving little time for the decision-maker to actually apply the information. Not to mention that human mistake is always a possibility in a manual data analysis procedure. Fortunately, predictive analytics may assist in streamlining and enhancing your analytics operations. Predictive analytics combines machine learning algorithms, data mining, and statistical approaches to evaluate massive amounts of data and create accurate predictions about future trends or behaviors.

The following three advantages come from using AI for data analysis:

- Patterns that people might not immediately see can be found by AI algorithms.
- Your data can help artificial intelligence (AI) improve its predictions over time.
- You don't need to complete it by yourself.

A more tailored consumer experience is ultimately a result of smarter data. Your ability to interact with each prospect more effectively is aided by having a thorough understanding of your client data.

- **AI will boost productivity and save expenses for businesses.**

Business executives must use their resources more efficiently in the challenging economic environment of today. There are countless ways AI can help your firm save money; in fact, 28% of business leaders have already discovered that AI reduces expenses at their organization. One benefit will be the automation of laborious, manual operations. For instance, a lot of customer service representatives have to put in a lot of effort to address the same questions from clients. You can automate answers to frequently asked queries by using AI, which frees up your support staff to handle more complicated problems. Chat-bots already effectively handle customer service requests, according to 91% of customer support agents who utilize AI. Businesses can save repair costs by planning maintenance before equipment breakdowns by using AI to predict equipment failures.

- **Business executives will spend money on hiring people with specialized AI training.**

AI is more likely to maximize the impact of current roles and make space for new employment prospects.

- **AI is more likely to maximize the impact of current roles and make space for new employment prospects.**

For organizations of all sizes, it will make fraud detection simpler.65% of organizations experienced fraud-related assaults or tries in 2022.Any business that commits fraud risks suffering financially and legally. Detecting fraud gets harder and harder as it gets more complex. Businesses will use AI tools more and more in 2023 to spot and prevent fraud. Your staff can spot

prospective fraudsters by using AI to highlight data abnormalities, such as strange spending patterns.AI can also utilize data to forecast the possibility that a specific transaction is fraudulent. AI systems will improve over time at spotting fraudulent conduct, including shady logins, strange transactions based on consumer behavior, or identity theft.

- **AI will aid companies in producing better goods.**

  In the future, company executives will start to use AI to find new product prospects.

  Software engineers can use AI technologies, for instance, to filter through feedback, engagement, or other product usage data to decide which features they should improve on a current product, or uncover new product ideas based on gaps in their offerings. It extends past that, though. You can develop your product with the aid of AI algorithms.

  You did really hear correctly. In order to give you the critical insights you need to develop more user-friendly, engaging, and efficient solutions for your customers, AI will be able to analyze data on customer usage patterns, feedback, and preferences. Rapid prototyping will also aid in accelerating the entire product development cycle. Your team can swiftly determine the most promising choice and iterate in real-time thanks to AI algorithms' ability to fluidly and instantaneously present many design options.

- **BUSINESS APPLICATIONS OF AI**

  The following technologies are just a few of the ones where AI is now being used in both academic and industrial settings:

  1. An intelligent system can translate spoken words from people into text or computer code using speech recognition.
  2. The ability to converse with computers is provided via natural language generation.
  3. An image can be scanned by a computer using computer vision, and items can be recognized in the image using comparative analysis.
  4. In machine learning, the emphasis is on creating algorithmic models that can find trends and connections in data.
  5. Expert systems may answer problems as precisely as a human expert in a certain field since they acquire information about it.

AI FOR A SPECIFIC INDUSTRY NEED

Other use cases are particular to the requirements of each industry, despite the fact that many AI applications are dispersed throughout many industry sectors.

- The healthcare sector is utilizing artificial intelligence and machine learning tools to examine enormous datasets gathered in recent years in order to detect patterns and insights that people alone are not capable of discovering. Diagnostic tools using algorithms enable clinicians to make more precise diagnosis earlier in the course of a disease. In order to create a customized treatment plan for each individual patient, therapists can also use other intelligence tools.
- Money-related services. The financial services industry employs AI and machine learning for fraud detection, digital and data protection, analyzing historical and real-time data to make prompt judgments regarding the legitimacy of individual transactions. Business choices, loan approval, and money management are just a few of the more specific uses of AI in the financial services industry.

- Commercial upkeep. The industrial sector employs artificial intelligence (AI) to anticipate machine maintenance, identifying the most likely times that equipment will need repair and maximizing the scheduling of maintenance operations. In industries, AI is also utilized to boost productivity.
- An increasing fleet of self-driving cars can learn to navigate better with the help of AI. Better traffic control procedures and logistics for transportation are also being improved with AI

END OF THE LINE

It is a truth that AI will have an impact on your business in the future. Although the negative impact is not immediately apparent, it could have a substantial impact on how your business functions. It requires an open mind and the desire to seize fresh opportunities. Many commercial sectors are being drastically altered by artificial intelligence. AI brings us entirely new possibilities with its capacity to recognize patterns and spot anomalies in massive volumes of digital information in commercial processes. Once trained, it can easily manage a variety of daily chores. The advent of AI frees staff members from mundane, low-complexity activities so they may concentrate on addressing more difficult technical issues or raising customer service standards. It's challenging to transform artificial intelligence in the workplace. Companies need a methodical approach that starts with locating the most promising applications of artificial intelligence in business. Data ecosystems must be built in order for AI algorithms to succeed. Businesses must simultaneously support a variety of abilities and figure out how to integrate AI outcomes into their workflows. It is therefore advised to get the preferred skills of offshore AI developers and Machine Learning & Artificial Intelligence Experts from reputable AI development services providers like Explore Global.

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FORMULATION AND *IN-VITRO* EVALUATION OF FLOATING DRUG DELIVERY SYSTEM FOR URSODEOXYCHOLIC ACID

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Abstract

The aim of the present study was to develop floating matrix formulation of Ursodeoxycholic Acid to maintain constant therapeutic levels of the drug for over 12 hours. Various grades of natural polymers and celluloses were employed as polymers. Ursodeoxycholic Acid dose was fixed as 300 mg. total weight of the tablet was considered as 520 mg. polymers were used in the concentration of 50, 75 and 100 mg concentration. All the formulations were passed various physicochemical evaluation parameters and they were found to be within limits. Whereas from the dissolution studies it was evident that the formulation (F6) showed better and desired drug release pattern i.e., 97.33 % in 12 hours. It followed zero order release kinetics mechanism.

Keyword: Ursodeoxycholic Acid, Guar gum, Sodium CMC, HPMC K4M, HPMC K100 M, Sustained Release Tablets.

Introduction:

Oral controlled release drug delivery has recently been of increasing interest in pharmaceutical field to achieve improved therapeutic advantages, such as ease of dosing administration, patient compliance and flexibility in formulation, Gastro retentive drug delivery is an approach to prolong gastric residence time, thereby targeting site-specific drug release in the upper gastrointestinal tract (GIT) for local or systemic effects. The floating drug delivery system (FDDS) also called Hydro dynamically Balanced Drug Delivery System (HBS). FDDS is an oral dosage forms (capsule or tablet) designed to prolong the residence time of the dosage form within the GIT. It is a formulation of a drug with gel forming hydrocolloids meant to remain buoyant on stomach contents. Drug dissolution and release from dosage retained in the stomach fluids occur at the pH of the stomach under fairly controlled condition. Piretanide is a sulfamoylbenzoic acid belonging to the class of loop diuretics. Piretanide is structurally related to furosemide and bumetanide

Materials and Methods:

Ursodeoxycholic Acid, Microcrystalline cellulose, Chitosan, Guar gum, Sodium CMC, HPMC K4M, HPMC K15M, HPMC K100M, Magnesium stearate, Sodium bicarbonate, Talc all the chemicals were laboratory grade.

Formulation Development of Tablets:

All the formulations were prepared by direct compression. The compressions of different formulations are given in Table. The tablets were prepared as per the procedure given below and aim is to prolong the release of Ursodeoxycholic Acid. Total weight of the tablet was considered as 520mg.

Procedure:

- Ursodeoxycholic Acid and all other ingredients were individually passed through sieve no≠ 60.
- All the ingredients were mixed thoroughly by triturating up to 15 min.
- The powder mixture was lubricated with talc.
- The tablets were prepared by using direct compression method.

Optimizations of Di Sodium Glycine Carbonate Concentration:

Di sodium glycine carbonate was employed as effervescent gas generating agent. It helps the formulation to float. Various concentrations of Di sodium glycine carbonate were employed; floating lag time and floating duration were observed. Based on that the concentration of Di sodium glycine carbonate wasfinalized and preceded for further formulations.

Table 1: Optimization Di Sodium Glycines Carbonate Concentration

S.No	Excipient Name	EF1	EF2	EF3
1	Ursodeoxycholic acid	300	300	300
2	Guar gum	125	105	85
4	$NaHCO_3$	80	100	120
5	Mg. Stearate	5	5	5
6	Talc	10	10	10
7	MCC pH 102	Q. S	Q. S	Q. S
	Total weight	520	520	520

All the quantities were in 520mg.

Based on the floating lag time and floating duration the concentration of sodium bicarbonate was optimised.

Table 2: Formulation Composition for Floating Tablets

Formulation No.	Ursodeoxycholic acid	Sodium CMC	Chitosan	Guar gum	$NaHCO_3$	Mag. Stearate	Talc	MCC pH 102
F1	300	50	-----	-----	100	5	10	QS
F2	300	75	-----	-----	100	5	10	QS
F3	300	100	-----	-----	100	5	10	QS
F4	300	-----	50	-----	100	5	10	QS
F5	300	-----	75	-----	100	5	10	QS

F6	300	-----	100	-----	100	5	10	QS
F7	300	-----	-----	50	100	5	10	QS
F8	300	-----	-----	75	100	5	10	QS
F9	300	-----	-----	100	100	5	10	QS

All the quantities were in mg, Total weight is 520 mg.

Table 3: Formulation Composition for Floating Tablets

Formulation No.	Ursodeoxycholic acid	HPMC K4M	HPMC K15M	HPMC K100M	$NaHCO_3$ + Citric acid	Mag. Stearate	Talc	MCC pH 102
F10	300	75	-----	-----	50	5	10	QS
F11	300	100	-----	-----	50	5	10	QS
F12	300	125	----	-----	50	5	10	QS
F13	300	-----	75	-----	50	5	10	QS
F14	300	-----	100	----	50	5	10	QS
F15	300	-----	125	-----	50	5	10	QS
F16	300	-----	-----	75	50	5	10	QS
F17	300	-----	-----	100	50	5	10	QS
F18	300	-----	-----	125	50	5	10	QS

All the quantities were in mg, total weight is 520 mg.

Evaluation of post compression parameters for prepared Tablets:

The designed formulation tablets were studied for their physicochemical properties like weight variation, hardness, thickness, friability and drug content.

Results And Discussion:

Present study was aimed to developing gastro retentive floating tablets of Ursodeoxycholic Acidusing various polymers. All the formulations were evaluated for physicochemical properties and invitro drug release studies.

Analytical Method: Graphs of Ursodeoxycholic Acid were taken in Simulated Gastric fluid(pH 1.2) at 252 nm.

Table 4:Observations for Graph of Ursodeoxycholic Acid in 0.1N HCl (252 nm)

Conc [µg/l]	Abs
0	0

1	0.131
2	0.232
3	0.347
4	0.459
5	0.629

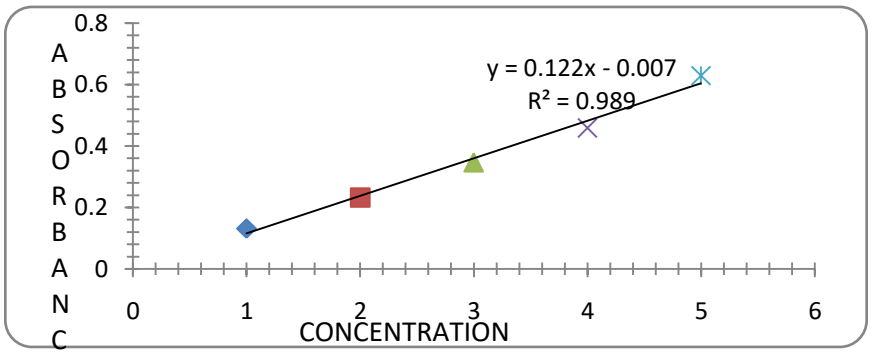

Figure 1: Standard Graph of Ursodeoxycholic Acidin 0.1N HCl

Preformulation parameters of powder blend:

Table 5: Pre-formulation parameters of blend

Formulation Code	Angle of Repose	Bulk density (gm/ml)	Tapped density (gm/ml)	Carr's index (%)	Hausner's Ratio
F1	37.01±0.4	0.49±0.07	0.57±0.01	16.21±0.06	0.86±0.06
F2	35.8±0.4	0.56±0.06	0.62±0.05	16.87±0.05	0.98±0.05
F3	22.74±0.6	0.52±0.03	0.68±0.07	17.11±0.01	0.64±0.03
F4	25.33±0.5	0.54±0.04	0.64±0.08	17.67±0.08	1.12±0.04
F5	37.24±0.3	0.53±0.06	0.67±0.03	16.92±0.04	1.2±0.08
F6	26.12±0.2	0.56±0.05	0.66±0.06	17.65±0.09	1.06±0.09
F7	38.08±0.4	0.58±0.06	0.69±0.04	16.43±0.05	0.76±0.03
F8	25.12±0.5	0.48±0.05	0.57±0.02	17.97±0.02	1.15±0.09
F9	25.45±0.6	0.54±0.08	0.62±0.03	17.54±0.09	1.17±0.02
F10	36.01±0.5	0.55±0.2	0.645±0.3	14.72±0.1	0.85±0.3
F11	34.8±0.2	0.57±0.5	0.66±0.2	13.63±0.3	0.86±0.1
F12	32.74±0.1	0.53±0.2	0.606±0.5	14.19±0.2	0.858±0.3

F13	35.33±0.3	0.531±0.1	0.613±0.2	13.37±0.5	0.866±0.2
F14	36.24±0.3	0.549±0.1	0.641±0.1	14.35±0.2	0.856±0.5
F15	36.12±0.1	0.564±0.3	0.666±0.2	15.31±0.5	0.846±0.2
F16	37.08±0.7	0.581±0.2	0.671±0.5	13.41±0.2	0.865±0.1
F17	35.12±0.2	0.567±0.5	0.654±0.2	13.12±0.1	0.845±0.7
F18	35.45±0.5	0.571±0.2	0.689±0.1	13.28±0.7	0.855±0.3

Tablet powder blend was subjected to various pre-formulation parameters. The angle of repose values indicates that the powder blend has good flow properties. The bulk density of all the formulations was found to be in the range of0.43±0.07 to 0.58±0.06 (gm/cm3) showing that the powder has good flow properties. The tapped density of all the formulations was found to be in the range of0.57 to 0.69 showing the powder has good flow properties. The compressibility index of all the formulations was found to be ranging between16 to 18 which show that the powder has good flow properties.All the formulations have shown the Hausner's ratio ranging between0 to 1.2 indicating the powder has good flow properties.Ursodeoxycholic Acid blend was subjected to various pre-formulation parameters. The apparent bulk density and tapped bulk density values ranged from 0.52 to 0.581 and 0.606 to 0.671 respectively. According to Tables 5 the results of angle of repose and compressibility index (%) ranged from 32.74±0.12 to 37.08±0.96 and 13.37±0.38 to 14.72±0.62 respectively. The results of angle of repose (<35) and compressibility index (<23) indicates fair to passable flow properties of the powder mixture. These results show that the powder mixture has good flow properties. The formulation blend was directly compressed to tablets and *in-vitro* drug release studies were performed.

Optimization of Sodium Bicarbonate Concentration:

Three formulations were prepared with varying concentrations of sodium bicarbonate. The formulation containing sodium bicarbonate in 50mg concentration showed less floating lag time of 4 min and the tablet was in floating condition for more than 12 hours.

Quality Control Parameters For tablets:

Tablet quality control tests such as weight variation, hardness, and friability, thickness, and drug release studies in different media were performed on the tablets.

Table 6: Invitro quality control parameters for tablets

Formulation code	Weight variation (mg)	Hardness(kg/cm2)	Friability (%loss)	Thickness (mm)	Drug content (%)	Floating lag time (min)
F1	300.5±0.7	4.5±0.8	0.52±0.8	4.8±0.8	99.76±0.7	4.0±0.4
F2	300.4±0.4	4.2±0.7	0.54±0.8	4.9±0.5	99.45±0.4	4.2±0.7
F3	300.6±0.5	4.4±0.4	0.51±0.7	4.9±0.4	99.34±0.7	4.5±0.8

F4	300.6±0.8	4.5±0.5	0.55±0.4	4.9±0.7	99.87±0.8	4.1±0.8
F5	300.4±0.5	4.4±0.4	0.56±0.7	4.7±0.4	99.14±0.7	4.0±0.7
F6	300.7±0.4	4.2±0.7	0.45±0.8	4.5±0.5	98.56±0.4	4.4±0.7
F7	300.3±0.7	4.1±0.4	0.51±0.5	4.4±0.8	98.42±0.7	4.5±0.4
F8	300.2±0.3	4.3±0.7	0.49±0.4	4.7±0.7	99.65±0.4	4.6±0.5
F9	300.3±0.8	4.5±0.8	0.55±0.7	4.6±0.4	99.12±0.5	4.7±0.8
F10	301.4±0.4	4.2±0.8	0.56±0.5	4.9±0.8	99.56±0.4	4.1±0.3
F11	302.4±0.5	4.3±0.4	0.52±0.8	4.9±0.4	99.55±0.8	4.2±0.4
F12	301.5±0.3	4.5±0.8	0.50±0.4	4.9±0.8	99.54±0.3	4.1±0.8
F13	302.3±0.8	4.2±0.4	0.50±0.3	4.9±0.4	99.85±0.8	4.1±0.3
F14	301.4±	4.3±0.3	0.51±0.4	4.8±0.8	99.54±0.4	4.2±0.8
F15	303.8±0.3	4.3±0.4	0.54±0.8	4.8±0.3	98.55±0.8	4.1±0.4
F16	301.2±0.4	4.2±0.8	0.53±0.3	4.9±0.8	98.45±0.4	4.2±0.5
F17	300.2±0.8	4.2±0.4	0.57±0.8	4.8±0.4	99.55±0.3	4.1±0.5
F18	300.5±0.3	4.3±0.8	0.59±0.4	4.9±0.3	99.15±0.5	4.2±0.3

All the parameters such as weight variation, friability, hardness, thickness and drug content were found to be within limits.

In-Vitro Drug Release Studies

Table 7: Dissolution Data of Ursodeoxycholic Acid Tablets Prepared withSodium CMC in Different Concentrations

TIME(hr)	F1	F2	F3
0.5	21.73±0.5	18.52±0.4	19.53±0.7
1	59.23±0.4	37.47±0.6	28.97±0.4
2	84.9±0.6	59.93±0.5	35.89±0.6
3	94.873±0.4	65.85±0.6	45.7±0.7
4	94.873±0.5	77.54±0.4	54.38±0.5
5		89.55±0.7	61.2±0.4
6		96.6±0.5	67.06±0.6

7	72.52±0.7
8	77.88±0.4
9	86.6±0.6
10	89.09±0.4
11	94.52±0.6

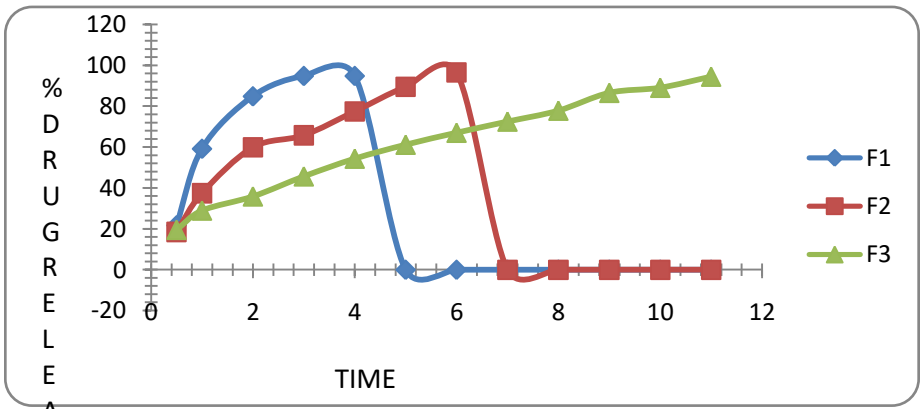

Fig 2: Dissolution profile of Ursodeoxycholic Acid floating tablet (F1, F2, F3 formulations)

Table 8: Dissolution Data of Ursodeoxycholic Acid Tablets Prepared withChitosan in Different Concentrations

TIME(hr)	F4	F5	F6
0.5	18.45±0.7	18.42±0.3	19.62±0.1
1	36.26±0.2	27.73±0.7	27.86±0.3
2	52.16±0.1	35.63±0.2	36.35±0.7
3	70.01±0.3	42.04±0.7	41.45±0.2
4	87.26±0.7	57.25±0.2	47.80±0.1
5	93.10±0.2	64.33±0.7	55.25±0.3
6		75.41±0.2	60.24±0.7
7		83.84±0.7	66.73±0.2
8		92.80±0.2	71.34±0.7
9			78.52±0.2
10			80.17±0.7
11			88.75±0.2

12	96.33±0.7

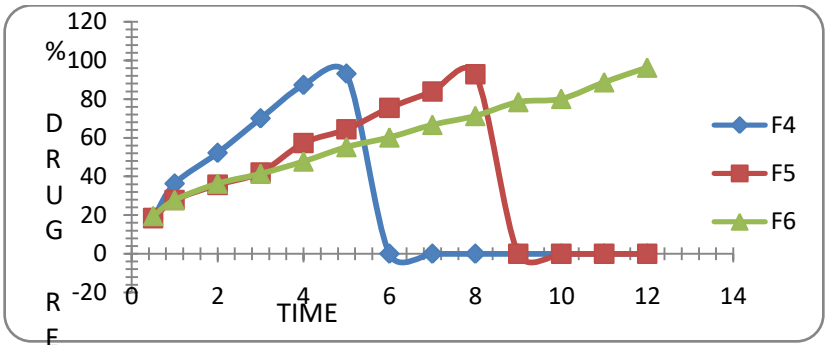

Fig 3: Dissolution profile of Ursodeoxycholic Acidfloating tablet(F4, F5, F6 formulations).

Table 9: Dissolution Data of Ursodeoxycholic AcidTablets Prepared withGuar gum In Different Concentrations

TIME(hr)	F7	F8	F9
0.5	18.81±0.2	19.89±0.3	14.21±0.6
1	29.02±0.6	28.04±0.2	18.87±0.3
2	35.70±0.3	35.43±0.6	27.19±0.2
3	43.32±0.3	41.65±0.2	35.66±0.6
4	49.25±0.2	47.18±0.6	43.32±0.3
5	55.28±0.6	53.81±0.2	51.06±0.3
6	60.92±0.8	58.89±0.6	57.13±0.2
7	66.08±0.8	64.53±0.2	63.63±0.6
8	70.44±0.2	69.43±0.6	69.71±0.6
9	77.22±0.6	72.83±0.2	73.34±0.3
10	80.90±0.8	79.98±0.6	79.27±0.2
11	87.83±0.6	83.52±0.2	82.86±0.6
12	91.90±0.2	88.65±0.6	85.97±0.8

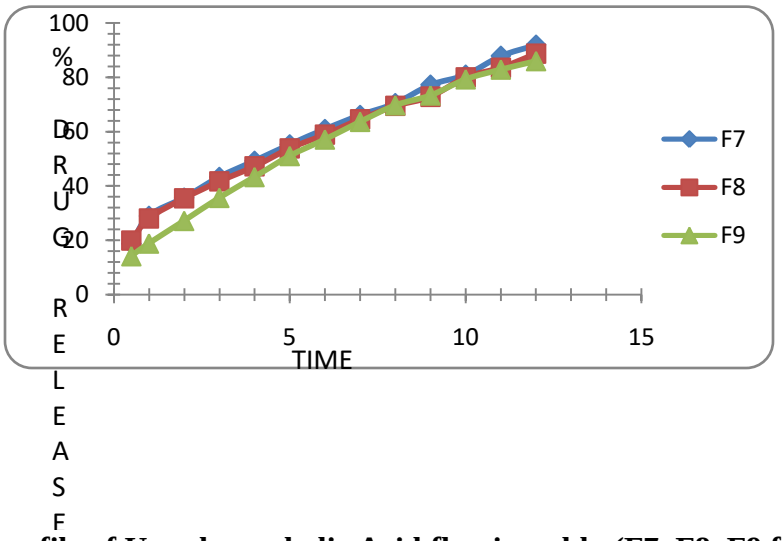

Fig 4: Dissolution profile of Ursodeoxycholic Acid floatingtablet(F7, F8, F9 formulations)

From the dissolution data it was evident that the formulations prepared with Sodium CMC as polymer were unable to retard the drug release up to desired time period i.e., 12 hours.

Whereas the formulations prepared with Chitosan retarded the drug release in the concentration of 75 mg showed required release pattern i.e., retarded the drug release up to 12 hours and showed maximum of 96.33 % in 12 hours (Formulation F6) with good floating lag time and floating buoyancy time. The formulations prepared with Guar gum showed more retardation even after 12 hours they were not shown total drug release. Hence, they were not considered.

Table 10: Dissolution Data of Ursodeoxycholic Acid Tablets Prepared withHPMC K 4 M in Different Concentrations

TIME(hr)	F10	F11	F12
1	18.8±0.1	28.94±0.3	16.1±0.9
2	24.87±0.3	37.88±0.1	29.74±0.3
3	36.12±0.5	48.2±0.7	30.56±0.1
4	45.25±0.7	55.45±0.5	48.29±0.2
5	51.24±0.5	69.52±0.7	57.1±0.10.5
6	57.35±0.2	71.53±0.1	68.25±0.3
7	62.17±0.1	77.56±0.3	79.32±0.5
8	65.65±0.3	81.45±0.1	86.25±0.3
9	66.98±0.9	82.35±0.3	87.65±0.1
10	68.89±0.3	84.65±0.1	90.23±0.3
11	71.26±0.1	86.27±0.7	92.23±0.5
12	76.25±0.2	89.75±0.5	98.69±0.7

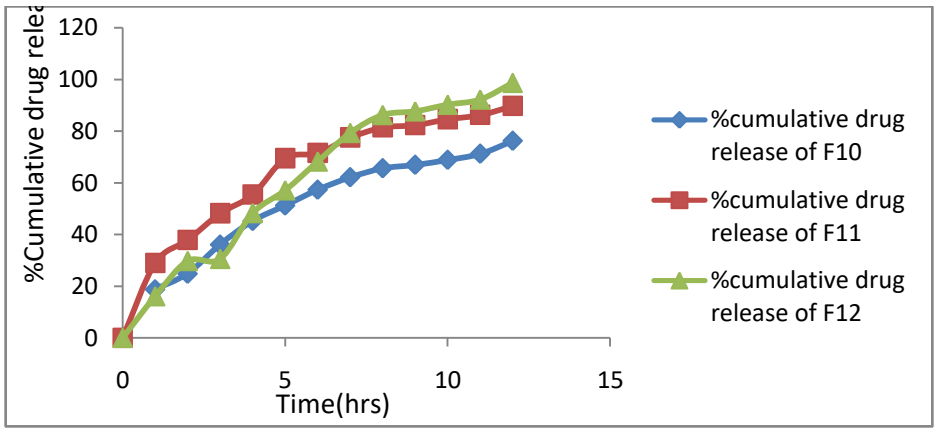

Fig 5: Dissolution profile of Ursodeoxycholic Acid floating tablets (F10, F11, F12 formulations).

Table 11: Dissolution Data of Ursodeoxycholic Acid Tablets Prepared withHPMC K15 Min Different Concentrations

TIME(hr)	F13	F14	F15
1	14.47±0.7	29.42±0.5	26.56±0.2
2	24.89±0.5	32.05±0.7	34.92±0.1
3	32.11±0.3	44.1±0.1	44.52±0.3
4	41.82±0.1	51.25±0.3	54.85±0.9
5	56.01±0.3	63.33±0.1	67.21±0.3
6	67.35±0.5	69.24±0.3	70.05±0.1
7	76.25±0.3	70.01±0.1	74.16±0.2
8	80.24±0.1	76.45±0.7	79.61±0.5
9	81.25±0.2	78.54±0.5	80.35±0.7
10	83.54±0.1	81.26±0.7	81.87±0.5
11	85.16±0.3	84.29±0.1	82.83±0.3
12	90.98±0.9	91.25±0.3	89.21±0.1

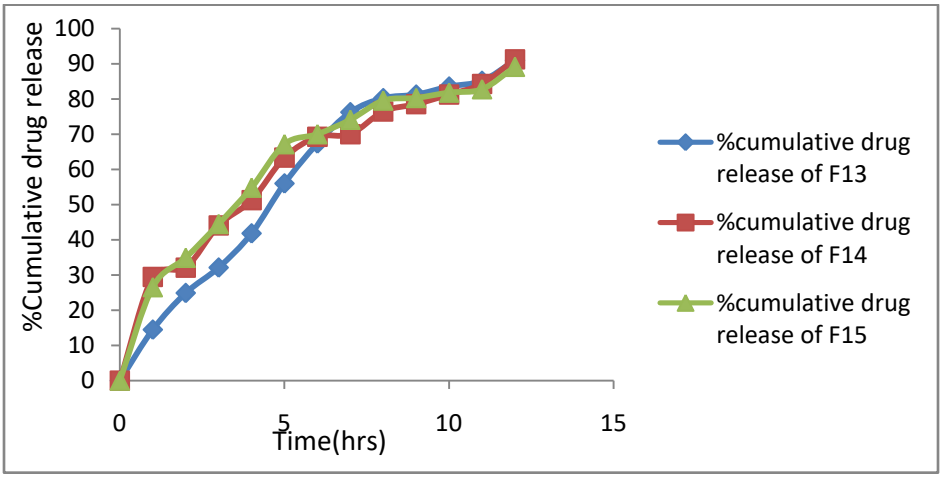

Fig 6: Dissolution profile of Ursodeoxycholic Acid floating tablet (F13, F14, F15 formulations).

Table 12: Dissolution Data of Ursodeoxycholic AcidTablets Prepared withHPMC K 100 M In Different Concentrations

TIME(hr)	F16	F17	F18
1	16.14±0.1	11.12±0.3	11.52±0.9
2	27.35±0.3	33.45±0.1	29.36±0.3
3	30.73±0.5	45.62±0.3	35.2±0.1
4	45.24±0.3	58.73±0.1	49.65±0.2
5	51.27±0.1	62.64±0.2	61.1±0.5
6	57.83±0.3	70.43±0.5	68.99±0.7
7	62.19±0.1	76.21±0.3	72.58±0.9
8	67.02±0.7	81.26±0.1	79.56±0.3
9	68.25±0.5	83.64±0.3	80.36±0.1
10	70.34±0.3	87.94±0.1	81.12±0.9
11	72.01±0.1	89.75±0.7	82.95±0.5
12	79.58±0.9	92.89±0.5	86.25±0.7

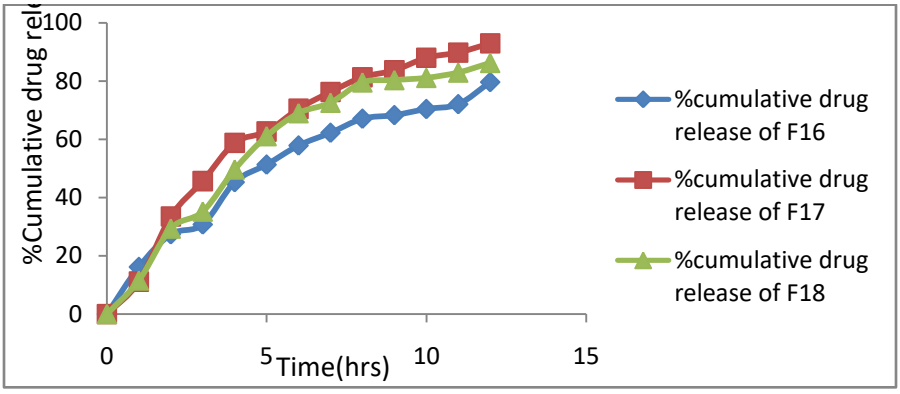

Fig 7: Dissolution profile of Ursodeoxycholic Acid Floating tablets (F16, F17, F18 formulations)

From the dissolution values it was evident that the formulations F13 & F18 were retarded the drug release up to 12 hours, they shown drug release of 98.69 and 86.45 % respectively. Formulations F11 –F13 contains HPMC K4M alone. As the concentration of HPMC K4M increases retardation nature was increased. F13 formulation containing 100 mg of HPMC K4M was show almost negligible amount of drug release in first 3 hours from the 5th hour onwards it shown drug release as the time proceeds slowly the polymer was undergone erosion and allowed the drug to come out from the dosage form. The formulation was retarded drug release up to 12 hours and it showed maximum drug release in 12 hours.

Application of Release Rate Kinetics to Dissolution Data:

Various models were tested for explaining the kinetics of drug release. To analyse the mechanism of the drug release rate kinetics of the dosage form, the obtained data were fitted into zero-order, first order, Higuchi, and Korsmeyer-Peppas release model.

Table 13: Release kinetics data for optimised formulation (F6)

CUMULATIVE (%) RELEASE Q	TIME (T)	LOG (%) RELEASE	LOG (T)	LOG (%) REMAIN	RELEASERATE(CUMULATIVE% RELEASE / t)	1/CUM% RELEASE	PEPPAS log Q/100	% Drug Remaining
0	0			2.000				100
19.62	0.5	1.293	0.301	1.905	39.240	0.0510	-0.707	80.38
27.86	1	1.445	0.000	1.858	27.860	0.0359	-0.555	72.14
36.35	2	1.561	0.301	1.804	18.175	0.0275	-0.439	63.65
41.45	3	1.618	0.477	1.768	13.817	0.0241	-0.382	58.55
47.8	4	1.679	0.602	1.718	11.950	0.0209	-0.321	52.2
55.25	5	1.742	0.699	1.651	11.050	0.0181	-0.258	44.75
60.24	6	1.780	0.778	1.599	10.040	0.0166	-0.220	39.76

66.73	7	1.824	0.845	1.522	9.533	0.0150	-0.176	33.27
71.34	8	1.853	0.903	1.457	8.918	0.0140	-0.147	28.66
78.52	9	1.895	0.954	1.332	8.724	0.0127	-0.105	21.48
80.17	10	1.904	1.000	1.297	8.017	0.0125	-0.096	19.83
88.75	11	1.948	1.041	1.051	8.068	0.0113	-0.052	11.25
96.33	12	1.984	1.079	0.565	8.028	0.0104	-0.016	3.67

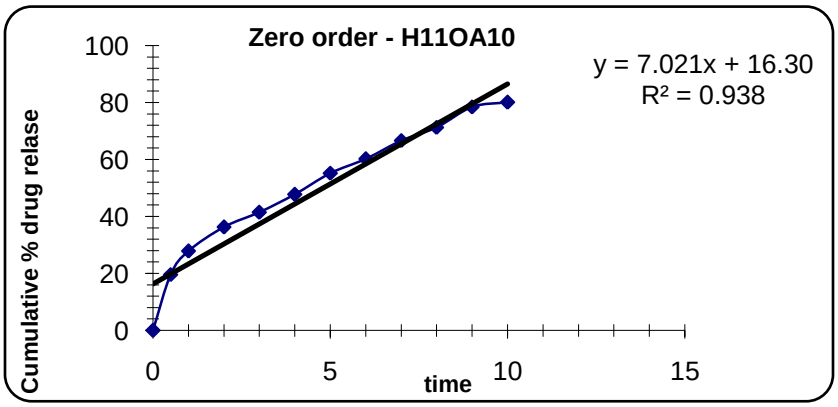

Fig 8 : Zero order release kinetics graph

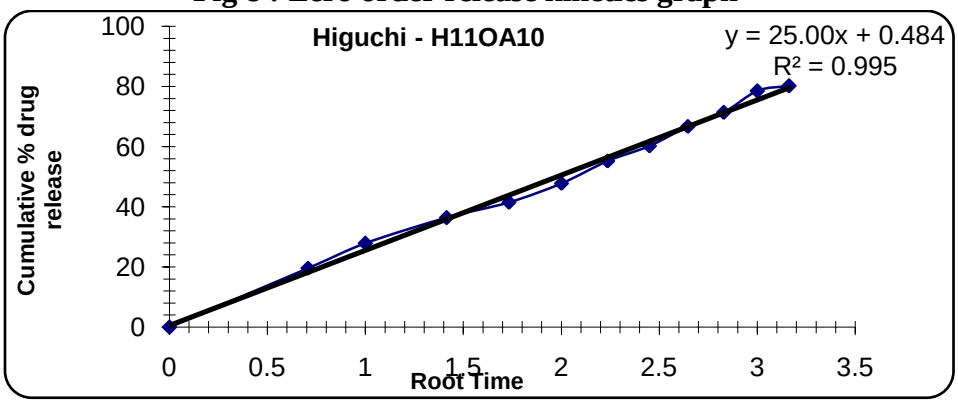

Fig 9 : Higuchi release kinetics graph

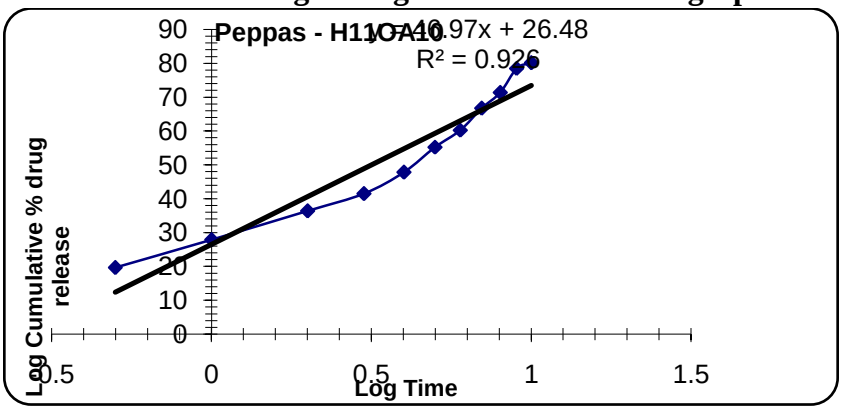

Fig 10: Kars mayer peppas graph

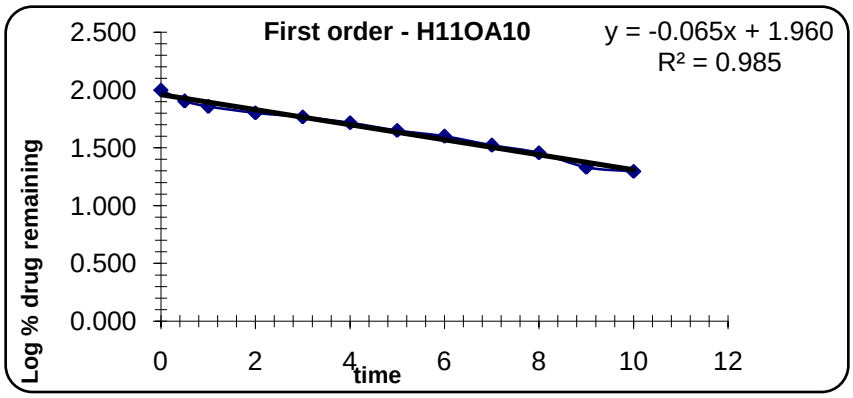

Fig 11: First order release kinetics graph

From the above graphs it was evident that the formulation F6 was followed Higuchi mechanism.

Table 14: Release kinetics Data for Optimised Formulation(F12)

CUMULATIVE (%) RELEASE Q	TIME (T)	ROOT (T)	LOG (%) RELEASE	LOG (T)	LOG (%) REMAIN
0	0	0	0	0	2.000
16.1	1	0	1.207	0	1.924
29.74	2	1.000	1.473	0.000	1.847
30.56	3	1.414	1.485	0.301	1.842
48.29	4	1.732	1.684	0.477	1.714
57.1	5	2.000	1.757	0.602	1.632
68.25	6	2.236	1.834	0.699	1.502
79.32	7	2.449	1.899	0.778	1.316
86.25	8	2.646	1.936	0.845	1.138
87.65	9	2.828	1.943	0.903	1.092
90.23	10	3.000	1.955	0.954	0.990
92.23	11	3.162	1.965	1.000	0.890
98.69	12	3.317	1.994	1.041	0.117

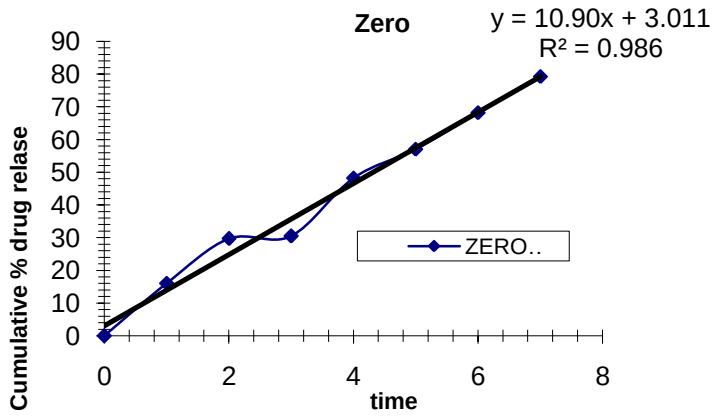

Fig 12 : Zero order release kinetics graph

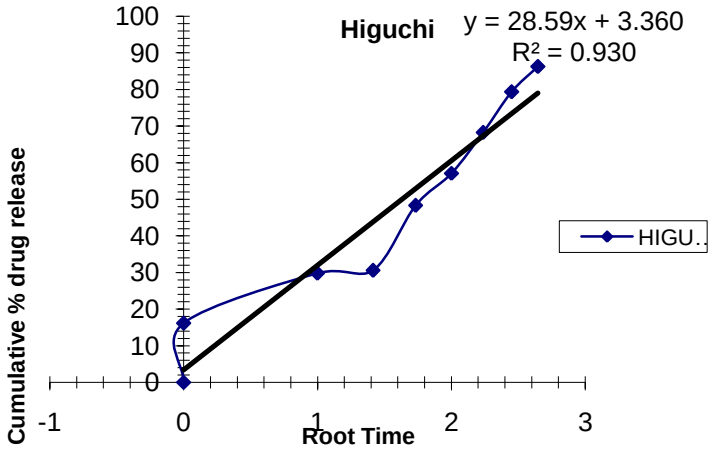

Fig 13 : Higuchi release kinetics graph

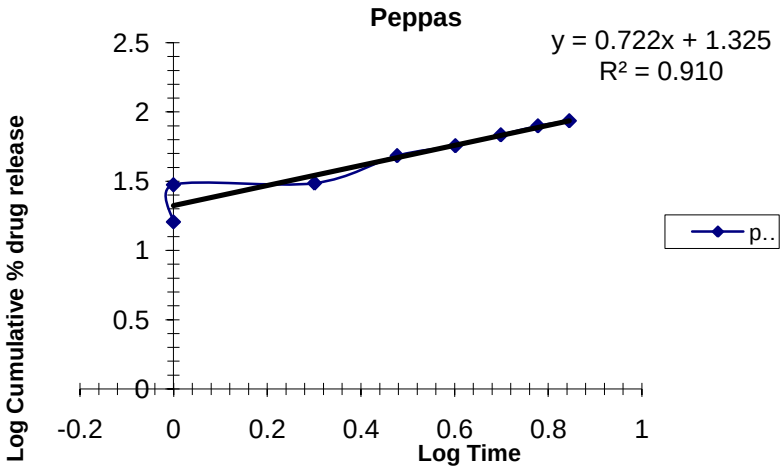

Fig 14: Kars mayer peppas graph

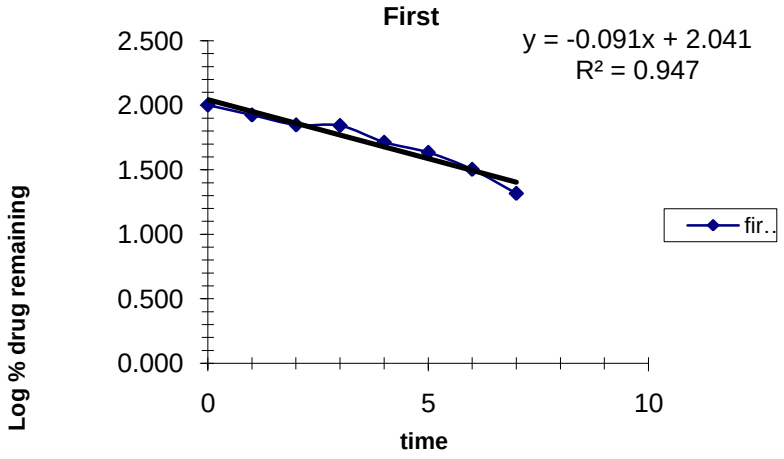

Fig 15: First order release kinetics graph

Conclusion:

In the present research work gastro retentive floating matrix formulation of Piretanide by using various hydrophilic polymers. Initially analytical method development was done for the drug molecule. Absorption maxima was determined based on that calibration curve was developed by using different concentrations. Gas generating agent sodium bicarbonate concentration was optimized. Then the formulation was developed by using different concentrations of polymers of various natural polymers. The formulation blend was subjected to various preformulation studies, flow properties and all the formulations were found to be good indicating that the powder blend has good flow properties. Among all the formulations the formulations prepared with HPMC K 4M retarded the drug release up to 12 hours in the concentration of 100 mg (F12). Hence, they were not considered. The optimized formulation dissolution data was subjected to release kinetics; from the release kinetics data it was evident that the formulation followed Higuchimechanism of drug release.

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ON THE GEO CHROMATIC NUMBER OF LINE GRAPH

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Abstract
The Geo Chromatic Number (GCN) of line graph $L\lfloor\chi_{gc}(G)\rfloor$ for cross product and also for a few known graphs are focused.
Keywords: Distance, Geodetic, Geodetic number, Line graph, Cross product

1. Introduction

Beulah Samli et al., developed the concepts of the graph GCN [7]. We define a graph to be connected, finite, and simple in this work, where V(G) is the vertex set and E(G) is the edge set [1, 3, 4]. The distance between two vertices x_1, x_2 contained in V(G) is the minimum size of x_1–x_2 paths in G. An x_1–x_2 path of the size $d_G(x_1, x_2)$ is known as geodesic. We indicate $I_G(x_1, x_2)$ as the set of Vertices which are lies inside some x_1–x_2 geodesics of G. A Vertex is said to be lie on x_1–x_2 geodetic if c is an inner Vertex of P. All Vertices occur on some x_1–x_2 geodesic of G, and the bounded interval $I(x_1, x_2)$ encompasses x_1, x_2. Consider a non- empty set S ⊆ V (G). For a set I(S) = I (S) = $\bigcup_{x_1, x_2 \in S} I(x_1, x_2)$. If G is connected graph, thus S is a geodetic set g(S) such that I(S) = V (G) [9, 10].

The cardinality minimum S of G is a well-known geodetic number that is defined by g(G). A j – Vertex coloring of G is an allotment of j colors to the Vertices of G. The coloring is proper if no two joining Vertices accept same color such that χ(G) = j is said to be j – chromatic, where j ≤ k a minimum cardinality of a chromatic number of G is known as chromatic set. [2, 5] came up with some useful conclusion. As part of our discussion, we looked at Geo Chromatic Number (GCN). [5, 6, 8] defined results on cross product and for some known graph

2. Preliminary results

Using results [3], the following results are derived

1. Theorem: For any Path graph of G, with m > 2, the Geo chromatic number of a line graph of path graph P_m is $\chi_{gc}[L(P_m)] = \begin{cases} 2 \ , \ if\ m\ is\ even \\ 3 \ , \ if\ m\ is\ odd \end{cases}$.

Proof: The Line graph L (P_m) of a path graph P_m is again a path graph. For the path L (P_m), m > 2 has m – 1 vertices and m – 2 edges, two vertices of degree one and m – 3 vertices of degree 2. Thus the L (P_m) = P_{m-1}. Let line graph L (P_m) be a vertex set {u_1, u_2, u_3, ….., u_m). Let us consider two cases.

Case (i): For P_{2m}, Since the vertices of degree one, say u_1 and u_m is geodetic set of P_{2m} , which is minimum. Also the set S is a minimum chromatic set C of P_{2m}. Then g(G) = $|S|$ and $\chi(G)=|C|=|S|$. Hence $\chi_{gc}[L(P_{2m})]=2.$

Case(ii): For P_{2m+1}, Since the vertices of degree one, say u_1 and u_m is geodetic set of P_{2m+1}, but not a chromatic set and so $\chi_{gc}(P_{2m+1})>|S|=2.$ If the neighbor of $N(u_1)$ and $N(u_m) \subseteq S$ has vertices with distinct colors, that is u_1 and u_m receives same color. Then $S_c = N(u_1) \cup N(u_m) \cup S$ is a geo chromatic set of G not a minimum set, and $\chi_{gc}(P_{2m+1}) < 4=|S|$ having a minimum geo chromatic set either $N(u_1)$ or $N(u_m)$ is in S. Thus it's clearly shows that $\chi_{gc}[L(P_{2m+1})]=3.$

2. Theorem: For any Cycle graph of G, with m > 2, the Geo chromatic number of a line graph of cycle graph C_m is $\chi_{gc}[L(C_m)]=\begin{cases}2 \ , \ if \ m\equiv 2 \pmod 4 \\ 3 \ , \ otherwise\end{cases}$.

Proof: The Line graph L (C_m) of a cycle graph C_m is again a cycle graph. For the cycle L(C_m), m > 2 has m vertices and m edges, each vertex is of degree 2. Thus the Line graph L (C_m) be a vertex set {u_1, u_2, u_3, ….., u_m) with m vertices , $m \geq 3$. Since the set S = $\left\{u_1 , u_{\frac{m+2}{2}}\right\}$ or S = $\left\{u_1 , u_{\frac{m+1}{2}} , u_{\frac{m+3}{2}}\right\}$ is a minimum geodetic set of G. Let us consider two cases,

Case (i): Let S= $\left\{u_1 , u_{\frac{m+2}{2}}\right\}$ is a geodetic set of G, by allotting a proper color of G, then vertices in S belongs to the similar color class or different color classes, thus we have two sub cases.

Sub case (i): Let us assume that the vertices in S have a various color classes in G, the it is also a chromatic set of G. Then both geodetic set and chromatic set of G are minimum, clearly it follows that S_c = $\left\{u_1 , u_{\frac{m+2}{2}}\right\}$ is a minimum geo chromatic set of G. Thus $\chi_{gc}[L(C_m)]=2.$

Sub case (ii): Let us assume that the vertices in S have a similar color classes in G, say c_1, then S is not a chromatic set of G. That is $\chi_{gc}[L(C_m)]=2$, taking another vertex from G which belongs to the various color classes. Let $u_i \in c_j$, $j \neq 1$. If $u_i \in S$, then the set becomes S_c = $\left\{u_1 , u_{\frac{m+2}{2}}\right\} \cup \{u_i\}$ is a geodetic set as well as chromatic set of G. Thus $\chi_{gc}[L(C_m)]\leq 3$, where $\chi_{gc}[L(C_m)]<3$ is not possible. Therefore $\chi_{gc}[L(C_m)]=3.$

Case (ii): Let us take S = $\left\{u_1 , u_{\frac{m+1}{2}} , u_{\frac{m+3}{2}}\right\}$ is a minimum geodetic set of G, clearly S is a chromatic set which is minimum. Thus $\chi_{gc}[L(C_m)]=3.$

Observation 1:

For the cycle graph, n > 2 the Geo chromatic number and the line Geo chromatic number is $\chi_{gc}[L(C_m)] = \chi_{gc}(C_m) = \begin{cases} 2 & , if\ m \equiv 2 \pmod 4 \\ 3 & , otherwise \end{cases}$.

3. Theorem: For any Star graph of G, with m > 1, the geo chromatic number of a line graph of $K_{1,m}$ is $\chi_{gc}[L(K_{1,m})] = m$

Proof: The Line Graph $L(K_{1,m})$ of a star graph $K_{1,m}$ is a complete graph K_m. For the star graph $L(K_{1,m})$, m > 1 each vertex has degree m – 1. Let $L(K_{1,m}) = K_m$ be a complete graph with n vertices each vertices in K_m is the minimum geodetic set S. Thus every vertex in K_m will receive distinct colors. Then the set S_c is both geodetic set as well as chromatic set of G. Clearly its follows that $\chi_{gc}[L(K_{1,m})] = m$

Observation 2:

The Geo chromatic number of a complete graph K_m, m > 2 and the line Geo chromatic number of star graph of $K_{1,m}$ is $\chi_{gc}(K_m) = \chi_{gc}[L(K_{1,m})] = m$

4. Theorem: For any Double star graph of G, with m, n > 1, the geo chromatic number of a line graph of $S_{m,n}$ is $\chi_{gc}[L(S_{m,n})] = m + n + 1, \quad for\ m, n > 1$

Proof: The line graph $L[S_{m,n}]$ of a double start is obtained by two different complete graph connect with any one of the vertices . Let the set of vertices of m be $u_1, u_2, u_3, \ldots, u_m$ such that $|u_i| = m$, where i = 1, 2, 3,…., m and the set of vertices of n be $v_1, v_2, v_3, \ldots, v_n$ such that $|v_j| = n$, where i = 1, 2, 3,…., n. Let C be the proper coloring of G. We have $|C_i| = \max\{m, n\}$. Every vertex of a complete graph is the minimum geodetic set $g(L[S_{m,n}]) = m + n$ of S. We have the minimum geodetic set S receives same color class in G. But S is not a chromatic set of G. Hence, choose another vertex of G which belongs to the different color class. Let $u_i \in C_j$, $j \neq 1$. Let $u_i \in S$, then the set becomes a geodetic set as well as chromatic set of G. Clearly it follows that $\chi_{gc}[L(S_{m,n})] = m + n + 1$.

5. Theorem: For the Wheel graph, $W_n = C_{n-1} + K_1$ (n >3), the Geo chromatic number of a line graph of W_n is $\chi_{gc}[L(W_n)] = \begin{cases} 4 & , when\ n = 4 \\ n-1 & , n > 4 \end{cases}$.

Proof: Let $W_n = C_{n-1} + K_1$ (n >3), with u_o be the vertex of K_1 and $V(C_{n-1}) = \{v'_1, v'_2, v'_3, ..., v'_{n-1}\}$, E = $\{e'_1, e'_2, e'_3, ..., e'_{n-1}\}$ be the internal edges of W_n. Now, U = $\{u'_1, u'_2, ..., u'_j\}$ be the vertices formed from the edges of C_{n-1}. That is U $\subseteq$ V[L(W_n)], W = $\{w'_1, w'_2, ..., w'_j\}$ are the vertices of L[W_n] formed from internal edges of W_n ie., W $\subseteq$ V[L(W_n)]. Now U $\cup \{w'_j\}$ or U $\cup \{w'_j, w'_{j-1}\}$ forms a minimum geodetic set of L[W_n]. Let us have the following cases.

Case (i): For n = 4, we have $W_4 = C_3 + K_1$ with u_0 be the vertex of K_1 and $V(C_3) = \{v'_1, v'_2, v'_3\}$, E= $\{e'_1, e'_2, e'_3\}$ be the internal edges of W_4. Now U = $\{u'_1, u'_2, u'_3\}$ be the vertices formed from the edges of C_3 that is U $\subseteq$ V[L(W_4)]and W = $\{w'_1, w'_2, w'_3\}$ be the vertices of L(W_4) formed from the internal edges of W_4 that is W $\subseteq$ V[L(W_4)]. Now S = U $\cup \{w'_3\}$ forms a minimum geodetic set of

L(W_4). Thus S $= \left| U \cup \{w_3'\} \right| = \frac{n}{2}$. That is $g[L(w_n)] = \frac{n}{2}$ is a minimum geodetic set but not minimum chromatic set, Hence, S belongs to the same color class, say C_1. Since, C_3 is an odd cycle, thus $\chi(C_3) = 3$.Thus by choosing another vertices of different color class $v_i \in C_i$, $v_j \in C_j$ where $i \neq j \neq 1$. Then the set $S_c = \frac{n}{2} \cup \{v_i\} \cup \{v_j\}$ is a geodetic set as well as chromatic set of L(W_4). Hence $\chi_{gc}[L(W_4)] = 4$.

Case (ii): For n > 4 , We have $W_n = C_{n-1} + K_1$ with u_o be the vertex of K_1. Now S = U $\cup \{w_j'\}$ or U $\cup \{w_j', w_{j-1}'\}$ forms a minimum geodetic set of L(W_n).It is clear that $\left| U \cup \{w_j'\} \right| = \frac{n}{2}$ or $\left| U \cup \{w_j', w_{j-1}'\} \right| = \frac{n+1}{2}$. That is g[L($W_n$)] = $\frac{n}{2} or \frac{n+1}{2}$ forms a minimum geodetic set of L[W_n] , n > 4. g[L(W_n)] is a minimum geodetic set but not a chromatic set of L(W_n). Thus W_n = $\{w_1', w_2', ..., w_j'\}$ are the vertices of L(W_n) formed from internal edges of W_n which is a complete graph with K_j vertices. Since each vertices in K_j was assigned by different color classes, $\chi(K_j) = j$, Thus by adding of any w_i , $1 \leq i \leq j$ with g[L(W_n)] is a geo chromatic set . $\chi_{gc}(L(W_n)) > n$ is not possible . Hence, $\chi_{gc}(L(W_n)) \leq n-1$ is not possible. Thus it is clear that $\chi_{gc}(L(W_n)) = n-1$.

7. Theorem: For any integer m, n ≥ 2, $\chi_{gc}(L(K_{m,n})) = \begin{cases} 3 & , m = n = 2 \\ m+n-1, & m, n > 2 \end{cases}$.

Proof: Let $K_{m,n}$ be the complete bipartite graph with m + n number of vertices and mn number of edges and d be the diameter. Let S be the minimum geodetic set of L($K_{m,n}$) is g[L($K_{m,n}$)] $\leq$ mn – 1. Hence we have two cases.

Case (i): When m = n = 2, the complete graph $K_{2,2}$ is C_4. Thus the line graph of a cycle is cycle. The geodetic set of C_4 is 2. The set S is a minimum geodetic but not a minimum chromatic set of L($K_{2,2}$) where as g(L($K_{m,n}$). The set S receives the same color class, by adding the different color class to the set S. Thus, S_c result the geo chromatic set. Therefore, $\chi_{gc}(L(K_{m,n})) = 3$.

Case (ii): When m, n > 2, let S be the minimum geodetic set of L($K_{m,n}$) where the vertices in S receive different color which is the minimum cardinality of L($K_{m,n}$). Therefore S_c forms geo chromatic set of L($K_{m,n}$) which is minimum, $\chi_{gc}(L(K_{m,n}))$ = m + n – 1 .

8. Theorem: Let G' be the graph attain by joining a end edge {u, v} to a cycle C_n = G with u $\in$ G and v $\notin$ G then $\chi_{gc}[L(G')] = \begin{cases} 4 & for\ n = 3 \\ 3 & for\ n > 3 \end{cases}$.

Proof: Let G' be the graph obtained from G = C_n by joining an end edge {u, v} = e_k to the vertex u, such that u $\in$ G and v $\notin$ G and let { u_1, u_2, u_3,....,u_{n-1}u} be a cycle with n vertices of G.

Case (i): For n = 3: Let G' be the graph obtained from G = C_n by joining an end edge {u, v} = e_k to the vertex u, such that u $\in$ G and v $\notin$ G and let {u_1u_2, u_1u, u_2u, uv}be the vertices of the graph L(G')

with four vertices which is even. Thus S = {u_1u_2, uv} be the geodetic set which is not a chromatic set where the vertices belongs to same color class in L(G'). By taking an another vertices which belong to the different color classes in L(G'), thus its satisfies the minimum geo chromatic set. Clearly $\chi_{gc}[L(G')]=4$.

Case (ii): For n > 3, let {u_1, u_2, $u_{3,,....,}$ u_{n-1}u, uv} be the n vertices of the cycle C_n by joining the end edge {u,v} with it. Let G' be the graph attained from G = C_n by joining an end edge {u, v} = e_k to the vertex u, such that u $\in$ G and v $\notin$ G. By assigning a proper coloring to the graph L(G') the vertex set in S_c satisfies the minimum geo chromatic set. Hence, we have $\chi_{gc}[L(G')]\leq 3$. Since $\chi_{gc}[L(G')]<3$ is not possible. Hence it result $\chi_{gc}[L(G')]=3$.

9. Theorem: Let G' be the graph attain by joining a end edge (u_i, v_i), i = 1, 2, 3,….,n to each vertex of a cycle C_n = G such that $u_i \in G$ and $v_i \notin G$. Then the geo chromatic number of a Line graph G' is $\chi_{gc}[L(G')]=n$.

Proof: Let us take G = C_n be the cycle with n – vertices where i = 1, 2, 3, ….,n and by adding end edges of v_i to the corresponding end vertex of u_i is denoted as G'. In G' we have 2n number of edges. Now let us consider the line graph L(G') with the vertex set V(G') = {x_1 , $x_{2\ ,.....,}$ x_{2n}}. Since the vertex set whose degree of vertex two is consider as the minimum geodetic set S. Then S_c is the minimum geodetic set as well as chromatic set of L(G'). Hence it is clear that $\chi_{gc}[L(G')]=n$

Remark: G' be the graph attain by joining a end edge {u_i, v_i}, i = 1, 2, 3,…., n to each vertex of a cycle C_n = G such that $u_i \in G$ and $v_i \notin G$. Then the geo chromatic number of a Line graph G' is $\chi_{gc}[L(G')]=n=\chi_{gc}(G)$.

10. Theorem: For any path P_n, then the geo chromatic number of a line graph of P_n x K_2 is $\chi_{gc}[L(P_n\times K_2)]=\begin{cases}3, when\, n=2\\ n, when\, n>2\end{cases}$.

Proof: Let us take P_n x K_2 be the graph obtain from two copies of G and H of P_n and K_2 is a ladder graph. Then by the theorem g(P_n x K_2) = g(P_n). Let us consider V(G) = { u_1, u_2, u_3,…. , u_n}be the vertex of path of P_n and V(H) = {v_1 , v_2}and thus the line graph of G' = L(P_n x K_2) is obtained from two copies of G and H. Here we consider the following cases:

Case (i): If n = 2, We know that by the definition of line graph, L(P_2 x K_2) = P_2 x K_2 which is a cycle graph C_4, by theorem 1.3 it is clearly that the geodetic set of L(P_2 x K_2) is 2. That is the geodetic set of g(G') = 2 which is minimum but not a chromatic set. By taking the neighbor vertex of different color class thus S_c which satisfies the minimum geodetic set and chromatic set. Hence it is clear that $\chi_{gc}[L(P_n\times K_2)]=3$

Case (ii): If n > 2, let S be the geodetic set of L(P_n x K_2) = G'. We consider end vertices of degree two and the remaining vertices of degree four as geodetic set S of the graph G' which is minimum geodetic set S. Thus S_c satisfies the minimum geodetic and chromatic set. Thus G'satisfies the condition I(S) = G'(S), Therefore it is clear that $\chi_{gc}[L(P_n\times K_2)]=n$

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Financial inclusion through Self Help Group

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Abstract:

Financial inclusion may be defined as the process of assuring access to financial services and timely, adequate credit where needed by underprivileged groups such as weaker sections and low-income groups at an affordable cost. Financial inclusion through Self Help Groups (SHGs) has been a popular approach in India to provide access to financial services to the rural population. This has been a successful program that helps the people to access with current financial market facilities.

This study aims to contribute to the existing literature by examining the effectiveness of the SHG Bank Linkage Programme in promoting financial inclusion in rural India. Through an empirical analysis of the programme's impact on access to credit, savings, and income generation, this study seeks to identify the key factors that contribute to the success of SHGs in promoting financial inclusion and empowering rural communities. This study focused on assessing the impact of SHGs financial inclusion. .

Key words: Self Help Groups, Financial Inclusion.

Introduction

Financial inclusion is an important factor of economic development, particularly in rural areas where access to formal financial services is limited. Self-Help Groups (SHGs) have emerged as a promising tool for promoting financial inclusion, enabling access to credit, encouraging savings, and empowering the poor. Several studies have been conducted to explore the role of SHGs in financial inclusion, including their impact on income generation

Financial inclusion, broadly defined, refers to universal access to various financial services at a reasonable cost. These include not only banking products but also other financial services such as insurance and equity products. Financial inclusion enlarges the resource base of the financial system by creating a culture of savings among the rural population and plays its own role in the process of economic development. Further, by fetching low-income groups within the circle of the formal banking sector; financial inclusion protects their financial wealth and other resources in exigent circumstances. Financial inclusion also mitigates the exploitation of vulnerable sections by usurious money lenders by facilitating easy access to formal credit.

Financial inclusion initiatives by SHG bank linkage program

In the last few years, the bank industry has grown tremendously through increasing viability, profitability, and competitiveness; however, banks are not able to reach the rural population, especially the underprivileged community. The efforts through financial inclusion will uplift the standard of life.

1. **RBI POLICY:** The Reserve Bank of India places a lot of emphasis on financial inclusion, which is the process of ensuring that all individuals and businesses have access to financial services and products. This is because banks sometimes neglect certain areas, and regulators must step in to address the situation

2. **Initiatives by NABARD**: The bank linkage program is a major tool for financial inclusion initiatives. The SHG-Bank Linkage Program is the most cost-effective and fastest-growing microfinance initiative in the world, enabling more than 100 million households to access formal financial services.

   All banks initiate the following:

   - Open BSBDs (BASIC SAVING BANK ACCOUNT)
   - Simplified KYC norms
   - Simplified branch authorization policy
   - Open branches in rural areas
   - Better consumer grievance redressal.
   - Implementation of the FIP plan for both public and private sector banks
   - Financial literacy classes.

SELF HELP GROUPS

A Self-Help Group (SHG) is a small group of 10 to 20 poor individuals who voluntarily come together to support each other financially and socially. The group is economically homogeneous, meaning that its members belong to the same community and have similar socioeconomic backgrounds.

The main objectives of an SHG are:

- **Saving regularly**: Members save small amounts of money regularly
- **Contributing to a common fund**: Members agree to contribute to a common fund
- **Meeting emergency needs**: Members can access the common fund to meet their emergency needs
- **Collective decision making**: Members make decisions collectively
- **Resolving conflicts through mutual discussion**: Members resolve conflicts through mutual discussion and collective leadership
- **Providing collateral-free loans**: The group provides collateral-free loans to its members at market-driven rates, with the terms decided by the group.

REVIEWS OF LITERATURE

- Kandpal, V., &Khalaf, O. I. (2020) suggest that to bring the underprivileged people to the mainstream they should be financially independent. This study focuses on the problems of the current banking credit system.
- Gupta, S., &Kanungo, R. P. (2022) .The article discusses the challenges and intricacies of financial inclusion for the BOP segment in developing and frontier economies. It reviews financial services and intermediaries serving the BOP and explains the collaborations between businesses and formal institutions that can create a viable economic channel for serving the BOP segment. The article also highlights the importance of the digitalization of formal financial intermediaries in achieving a higher degree of financial inclusion for the BOP segment.
- Subbarao, D. (2009) financial inclusion is a key enabler of reducing extreme poverty and boosting shared prosperity. It is important for banks to seize this opportunity today and customize offerings strategically, take advantage of innovative channels, and deliver quality financial services that meet customers' needs and capacities.

- Rangappa, K. B., Bai, R., &Sandesh, A. L. (2009) this study analyzed credit facilities for rural Karnadaka and found that financial inclusion is the most effective weapon for eliminating unawareness. As banking services are important public services, accessibility of banking, funds transfer, and payment services to the rural population without discrimination is the prime objective of public policy.
- Bandgar, P. K. (2012) use of Microfinance is a financial service that provides small amounts of money to the poor, including savings, credit, insurance, leasing, money transfer, and equity transactions.
- Pinto, A. R., Arora, A., & Roy, S. (2020) advancement of technology has made a tremendous change in the field of financial systems. Online banking and other facilities have improved the quality of services and access for rural people.
- Roy, S., Singh, R., & Singh, H. R. (2017) this study focused on the impact of financial literacy on financial inclusion. The study found that financial awareness is the major factor that affects financial inclusion.
- Nagayya D. &Rao B. A. (2016). Ensuring various facilities to poor people, especially women, is the major activity of microfinance. This study focused on the SHG bank linkage program in 2018-2016, during 2013-2016 SHGs was the important technique for improving the financial inclusion .moreover it studied about product and services of microfinance rather than the credit and savings.
- Bhanot D., Bapat, V., &Bera, S. (2012).Examinethe unexplored market segment to create awareness for the banks to study geographical remote areas.
- Cnaan, R. A., Scott, M. L., Heist, H. D., &Moodithaya, M. S. (2023) studied about the cashless society and investigate the Indian rural villager's digital inclusion. financial as well as online literacy are the two sides of same coins nevertheless of that they warning the digital banking and innovation of cashless societies . Because the majority of the people were excluded from this.

Objectives

- To understand financial inclusion through SHG s bank linkage programme
- To analyse about various initiatives by banks for financial inclusion.
- To assess the impact of financial inclusion on rural people.

Research methodology

The study used secondary data that has been taken from journal, published articles etc.

Discussion

As per the study financial inclusion can elevate through SHGs .The SHG-Bank Linkage Programme is a strategy aimed at improving financial inclusion. Through this programme, Self-Help Groups (SHGs) are linked to banks, primarily through savings and later through credit.

The impact of financial inclusion follows:

- **Enhanced the access to formal credit**:The SHG bank linkage model helps improve the flow of formal institutional credit to poor people. This allows them to access financial resources for various needs.
- **Promoting for banking or savings habits**:SHGs are promoting people for development of banking habits among individuals. They literate in banking procedures, learn to use new technologies.

- **Encourage financial inclusion:** participation through SHG s bank linkage programme will help to educate people about banking activities and give easy access to the bank through liberalising policies of banks. so it will ensure the financial literacy of people
- **Encourage social inclusion:** financial inclusion also promotes people for socially engage in various activities.

It is recommended to encourage the wide adoption of the SHG-Bank Linkage Programme for rural areas for promoting woman empowerment, eliminating poverty and ensuring social wellbeing.

Conclusion

Self Help Groups (SHGs) had positive impact on financial inclusion, as well as social and economic conditions. Studies shows that SHGs reduce the financial exclusion.it introduce with lots of aims such as access to credit facility, income generation, encouraging savings, and ultimately empowering the poor.

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METHOD DEVELOPMENT AND VALIDATION OF BOSENTANBY USING RP-HPLC

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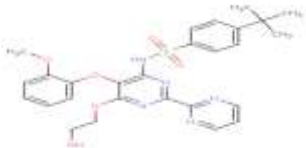
ABSTRACT:

A new method was established for Bosentan by RP-HPLC method by using Biorelevant Dissolution Media (FaSSIF). The chromatographic conditions were successfully developed for the separation of Bosentan by using Xterra C18 column (4.6×150mm)5µ, flow rate was 1ml/min, mobile phase ratio was (70:30 v/v) ACN: phosphatebuffer ($KH_2PO_4$and K_2HPO_4)phosphate pH 3(pH was adjusted with orthophosphoric acid), detection wavelength was 274nm. The instrument used was WATERS HPLC Auto Sampler, Separation module 2695, photo diode array detector 996, Empower-software version-2. The retention times were found to be 2.305 mins. The % purity of Bosentan was found to be 100.27%.The system suitability parameters for Bosentan such as theoretical plates and tailing factor were found to be 4891 and 1.03. The analytical method was validated according to ICH guidelines (ICH, Q2 (R1)). The linearity study of Bosentan was found in concentration range of 5µg-25µg and correlation coefficient (r^2) was found to be 0.999, % recovery was found to be 99.48%, %RSD for repeatability was 0.5, % RSD for intermediate precision was 1.0. The precision study was precision, robustness and repeatabilty.LOD value was 2.17 and LOQ value was6.60.Hence the suggested RP-HPLC method can be used for routine analysis of Bosentan in API and Pharmaceutical dosage form.

KEYWORDS: Xterra C18, Bosentan,RP-HPLC

INTRODUCTION:

Bosentan monohydrate (4-tert-butyl-N-[6-(2-hydroxyethoxy)-5-(2-methoxyphenoxy)-2-(pyrimidin-2-yl) pyrimidin-4-yl] benzene-1-sulfonamide monohydrate), a dual endothelin receptor antagonist (ERA) has molecular formula of $C_{27}H_{29}N_5O_6\,S{\cdot}H_2O$ with relative molecular mass of 569.64. It is the first orally active drug approved by United States Food and Drug Administrative as Tracleer (65 mg and 125 mg) for the successful treatment of pulmonary arterial hypertension (PAH).



Bosentan

MATERIALS AND METHOD:

INSTRUMENTATION:

HPLC-auto sampler –UV detector, Separation module2695, PDA detector,Empower-software version-2,Waters.U.V double beam spectrometer,Digital weighing balance,pH meter,Sonicator.

CHEMICALS:

Bosentan, KH_2PO_4, Water and Methanol for HPLC,Acetonitrile for HPLC,Ortho phosphoric Acid,K_2HPO_4.

(OptimizedMethod):

Chromatographic Conditions:

Column : Agilent (4.6×150mm)5µ
Mobile phase ratio : Methanol: ACN (60:40% v/v)
Detection wavelength : 235 nm
Flow rate : 1.0 ml/min
Injection volume : 10µl
Column temperature : Ambient
Auto sampler temperature : Ambient
Retention time :2.954min

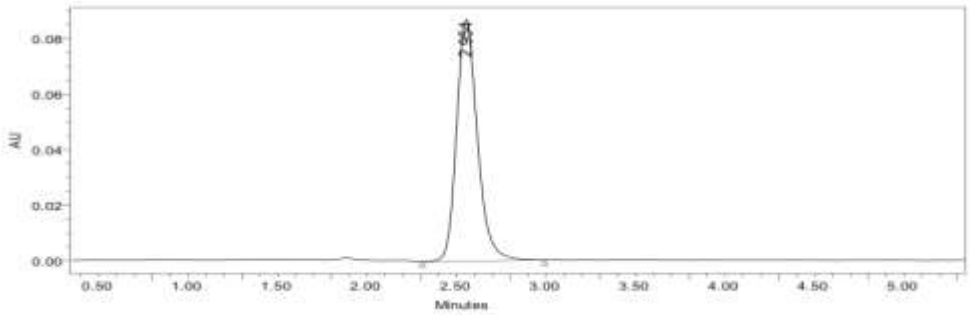


Fig.No.1. Chromatogram Showing Optimized method

Sample Solution Preparation:

10 mg of Bosentan tablet powder was accurately weighed and transferred into a 10 ml clean dry volumetric flask, add about 2ml of diluent and sonicate to dissolve it completely and making volume up to the mark with the same solvent(Stock solution). Further pipette 10ml of the above stock solution into a 100ml volumetric flask and was diluted up to the mark with diluent.

Standard Solution Preparation

10 mg Bosentan working standard was accurately weighed and transferred into a 10ml clean dry volumetric flask and add about 2ml of diluent and sonicate to dissolve it completely and make volume up to the mark with the same solvent (Stock solution).Further pipette out 1ml of the above stock solution into a 10ml volumetric flask and was diluted up to the mark with diluent.

METHOD VALIDATION:

- Specificity
- Linearity
- Range
- Accuracy
- Precision
- Repeatability
- Intermediate Precision
- Detection Limit

- Quantitation Limit
- Robustness

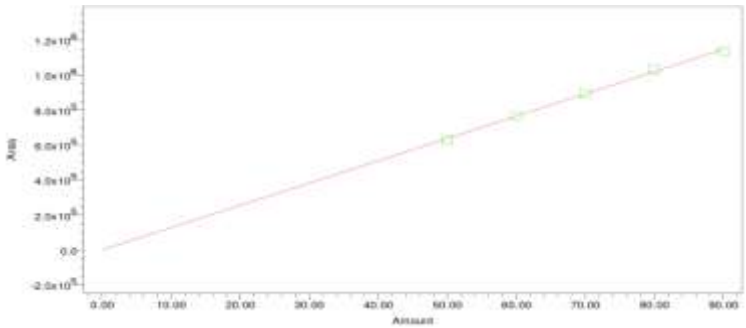
RESULTS AND DISCUSSION:

VALIDATION:

Linearity:

Table No.1. Linearity Results Bosentan

S.No	Linearity Level	Concentration	Area
1	I	20 ppm	804543
2	II	40 ppm	932134
3	III	60 ppm	1092224
4	IV	80 ppm	1254135
5	V	100 ppm	1403793
Correlation Coefficient			0.998



BOSENTAN r^2 = 0.998

Fig.No.2. Showingcalibration graph for Bosentan

Accuracy:

Table.No.2. Showing accuracy results for Bosentan

%Concentration (at specification level)	Average area	Amount added (mg)	Amount found (mg)	% Recovery	Mean recovery
50%	1093514.6	5	4.96	99.91%	100.56%
100%	2246802.7	10	9.98	99.18%	
150%	3407885.8	15	15.02	99.60%	

Precision:

Table.No.3. Showing% RSD results for Bosentan

	Name	RT	Area	Height(µv)
1	Bosentan	2.824	894562	128135
2	Bosentan	2.827	896754	129139
3	Bosentan	2.833	893627	132891
4	Bosentan	2.833	893750	129914
5	Bosentan	2.836	892682	130515
Mean			894275	
Std.Dev.			1537.7	
%RSD			0.17	

Intermediate precision/Ruggedness:

Table.No.4. Showing results for intermediate precision of Bosentan

	Name	RT	Area	Height(µv)
1	Bosentan	2.823	895311	125747
2	Bosentan	2.827	896783	122578
3	Bosentan	2.828	895237	124365
4	Bosentan	2.828	894206	124057
5	Bosentan	2.825	895085	125410
Mean			895324	
Std.Dev.			927.8	
%RSD			0.10	

Detection Limit:

Table.No.5. Showing results for Limit of Detection

Drug name	Standard deviation(σ)	Slope(s)	LOD(µg/ml)
Bosentan	1537.7	15205	0303

QuantitationLimit:

Table.No.6. Showing results for Limit of Quantitation

Drug name	Standard deviation(σ)	Slope(s)	LOQ(µg/ml)
Bosentan	1537.7	15205	1.011

Robustness:

Table.No.7. Showing system suitability results forBosentan

S. No	Flow rate (ml/min)	System suitability results	
		USP Plate Count	USP Tailing
1	0.8	4921	1.4
2	**1**	**4600**	**1.4**
3	1.2	4493	1.4

Table.No.8. ShowingSystemSuitability Results forBosentan

S.No	Change in organic composition in the mobile phase	System Suitability Results	
		USP Plate Count	USP Tailing
1	5 % less	5032	1.3
2	***Actual**	**4522**	**1.3**
3	5 % more	3834	1.3

SUMMARY AND CONCLUSION:

This paper presents a rapid, simple, precise, robust, accurate, and selective RP-HPLC method by using Biorelevent Dissolution Media (FaSSIF).Thus the proposed RP-HPLC method is used for validation of Bosentan from active pharmaceutical ingredient and marketed formulation good resolution. Hence the proposed RP-HPLC method is strongly recommended for the quality control of the raw material, API and pharmaceutical formulation per ICH guidelines.

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MICROPLASTICS OCCURRENCE, IMPACTS ON ECOSYSTEM AND REMEDIATION STRATEGIES: A REVIEW

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Abstract
Microplastics are small plastic particles, measuring less than 5 mm, ubiquitous in various ecosystems, including oceans, rivers, lakes, and even the air we breathe. They originate either from breakdown of larger plastic items or by direct release of microplastics from various products. The presence of microplastics poses significant threats to the environment and living organisms. Ingestion of microplastics by fish, seabirds, turtles, and marine mammals leads to physical damage, nutritional impairment, and biomagnification. Microplastics found in soil, have potential consequences for plant growth, nutrient cycling, and soil health. Transport of microplastics through the atmosphere raises concerns about their potential inhalation and associated health risks for both wildlife and humans. Addressing microplastic pollution requires concerted efforts from individuals, industries, governments, and international collaborations. Strategies include reducing plastic waste, improving waste management systems, bioremediation approaches, promoting sustainable practices, and raising public awareness about the ecological and health impacts of microplastics. Continued research is essential to better understand the extent of microplastic pollution, develop effective mitigation strategies, and foster a transition to a more sustainable and plastic-free future.
Key words: Microplastics, marine environment, bioremediation, biomagnification

Introduction

Microplastic pollution is a pressing environmental issue that has gained significant attention in recent years. Microplastics are minuscule plastic fragments of less than 5mm in diameter generated from breakdown of larger plastic debris or from microbeads used in personal care items, fertilizers, pharmaceutical industries and synthetic textiles. They can be found in every corner of the globe, from the deepest ocean trenches to the highest mountain peaks (1).

The impacts of microplastic pollution are far-reaching and multi-faceted. Marine organisms often mistake microplastics for food, leading to ingestion and subsequent harm. The presence of toxic chemicals adsorbed onto microplastics further exacerbates the risks to marinelife. Microplastics can disrupt ecosystems and biodiversity. They alter habitat structure, affect nutrient cycling, and disrupt the balance of species interactions. The persistence of microplastics in the environment, combined with their potential to bioaccumulate and biomagnify through the food chain, poses risks to wildlife and human health (2).

Addressing microplastic pollution requires collective action from individuals, industries, governments, and international collaborations. Bioremediation measures, reduction of plastic waste, promoting sustainable alternatives, raising awareness about the environmental and health impacts are being adopted by countries. By taking proactive steps to tackle this issue, we can strive to protect our ecosystems, and preserve the well-being of both present and future generations (3).

Types and sources of microplastics (4)

They are classified into Primary microplastics and Secondary microplastics.

- Primary Microplastics: Primary microplastics are intentionally manufactured as small particles for specific purposes. They are directly released into the environment in their microplastic form. Common sources of primary microplastics include:
  I. Microbeads: These are tiny plastic beads used in personal care and cosmetic products like face scrubs, toothpaste, and body washes.
  II. Microfibers: Synthetic fibers shed from textiles like clothing, carpets, and upholstery. Washing synthetic garments is a significant source of microfiber release.
  III. Nurdles: Also known as "pre-production pellets," nurdles are small plastic pellets used as a raw material in the manufacturing of plastic products.
- Secondary Microplastics: Secondary microplastics are the result of the breakdown of larger plastic items through various processes. Sources of secondary microplastics include:
  I. Fragmentation: Over time, larger plastic items, such as bottles, bags, and packaging, break down into smaller pieces due to weathering, UV radiation, and mechanical forces.
  II. Plastic Waste Mismanagement: Improper disposal and inadequate waste management systems contribute significantly to microplastic pollution.
  III. Rubber abrasion: Tire wear on roads and runways is a significant source of microplastic particles, as tires contain synthetic rubber.

Impact of microplastics on Ecosystem

Environmental degradation by microplastics(5, 6)

Microplastics, contribute to environmental degradation across different spheres, including the lithosphere, hydrosphere, and atmosphere.

1. Lithosphere (Soil and Land):Microplastics can accumulate in soil by application of plastic-based mulches, composts, or the breakdown of larger plastic debris. They can alter soil physical properties, reducing water infiltration, affecting soil structure and nutrient cycling. Microplastics in soil can disrupt soil-dwelling organisms and microbial communities.
2. Hydrosphere (Water Bodies): They can enter waterways through various pathways, such as runoff, wastewater discharge, and direct littering. Microplastics in aquatic environments can contaminate surface and drinking water sources, affecting aquatic organisms and potentially human health.
3. Atmosphere (Air):Microplastics can become airborne by breakdown of larger plastic items, the release of microfibers during textile use and laundering, and atmospheric transport from other sources. Airborne microplastics can be transported over long distances and eventually deposited on land or water surfaces. Inhalation of airborne microplastics is a potential route of exposure for humans and terrestrial animals.

Health impacts of microplastics on humans (7)

1. Ingestion and Gastrointestinal Effects: After entering human body through ingestion of contaminated food and water theyaccumulate in the gastrointestinal tract that could interfere with nutrient absorption or disrupt the balance of gut microbiota..High levels of microplastic exposure can cause inflammation, oxidative stress, and cellular damage in the gastrointestinal system.

2. Chemical Transfer: Microplastics have the ability to adsorb and concentrate various toxic chemicals including persistent organic pollutants (POPs) and heavy metals. When ingested, these adsorbed chemicals result in systemic effects, such as endocrine disruption, reproductive issues, and adverse impacts on the immune system.
3. Respiratory Effects: Inhalation of airborne microplastics is a potential pathway for human exposure. Inhaled microplastics can reach the lungs, causing inflammation, tissue damage, and respiratory disorders.
4. Potential for Bioaccumulation: microplastics have the ability to cross biological barriers and accumulate in organs and tissues and have been detected from breast milk, blood, placenta and even from stools.

Hazardous effects of microplastics on plants(8)

1. Root Morphology and Growth: Exposure to microplastics can inhibit root elongation, decrease root biomass, and alter root architecture. These effects can impair nutrient uptake, water absorption, and overall plant growth.
2. Plant Physiology and Metabolism: Exposure to microplastics can affect photosynthesis, chlorophyll content, and antioxidant enzyme activity in plants. These alterations can impair plant metabolism, reduce growth rates, and ultimately affect crop productivity.
3. Seed Germination and Seedling Development: Microplastics in the soil can delay germination, reduce seedling emergence, and inhibit early-stage growth. These effects can have implications for plant establishment and crop productivity.
4. Translocation and Accumulation: Microplastics get accumulated in various plant tissues, including roots, stems, leaves, and fruits. This accumulation may have potential consequences for plant health and the transfer of microplastics through the food chain.
5. Interactions with Soil Microorganisms: Microplastics can disrupt soil microbial communities affecting plant-microbe interactions. This can have cascading effects on plant growth and ecosystem functioning.

Impact on marine life by microplastics(9)

1. Ingestion: Microplastics can be ingested directly or indirectly when they are mistaken for prey items or when they accumulate on the surfaces of natural food sources. Once ingested, microplastics can cause physical damage, blockage of digestive tracts, reduced feeding efficiency, and malnutrition.
2. Accumulation and Bioaccumulation: Microplastics have the potential to accumulate and concentrate in the tissues of marine organisms, potentially resulting in systemic effects and impairing the health and reproductive capacity of marine organisms.
3. Physical Damage and Injury: Sharp or abrasive microplastic particles can damage delicate tissues, such as gills or reproductive organs, leading to injury, inflammation, and impaired organ function.
4. Transfer through the Food Chain: Biomagnification, can result in the accumulation of microplastics and associated contaminants in top predators, such as marine mammals and apex predators like sharks and birds. As a result, these organisms can experience higher exposure levels, increasing the potential for health effects.
5. Disruption of Reproduction and Development: Exposure to microplastics can lead to reduced reproductive success, impaired fertility, and developmental abnormalities in various species.

Effect of microplastics pollution on wildlife (10)

1. Ingestion and Internal Damage:Ingesting microplastics can lead to physical damage, blockage of digestive tracts, and impaired nutrient absorption.Internal injuries caused by sharp or abrasive microplastic particles can result in tissue damage, inflammation, and compromised organ function.
2. Nutritional Impairment and Starvation:Ingesting microplastics can create a false feeling of satiety, leading to reduced appetite and decreased food consumption. As a result, wildlife may suffer from malnutrition, inadequate energy intake, and decreased reproductive success.
3. Toxic Chemical Exposure:Microplastics have the ability to adsorb and concentrate toxic chemicals such as persistent organic pollutants (POPs), heavy metals, and other harmful substances from the surrounding environment. When wildlife ingest microplastics, these chemicals can be released in their digestive systems and transferred into their tissues resulting in reproductive problems, immune system suppression, and developmental abnormalities.
4. Bioaccumulation and Biomagnification:Microplastics can bioaccumulate in wildlife tissues over time, potentially reaching high concentrations. This bioaccumulation can lead to biomagnification due to which top predators can experience the highest levels of microplastic accumulation and associated health risks.

Microplastics pollution problem in different states of India (11, 12)

Microplastics pollution is a growing concern in various states of India, particularly in coastal regions and areas with high population density and industrial activities.

1. Maharashtra:

•Mumbai: The city faces significant microplastics pollution due to its high population, urbanization, and industrial activities. Studies have detected microplastics in the marine environment, sediments, and fish species in Mumbai waters.

•Thane Creek: Thane Creek, a vital mangrove ecosystem near Mumbai, has been found to be heavily polluted with microplastics. The accumulation of microplastics in sediments and the presence of plastic debris pose risks to the region's biodiversity.

2. Tamil Nadu:

•Chennai: Chennai, the capital city of Tamil Nadu, faces microplastics pollution in its coastal areas. Studies have reported the presence of microplastics in beach sediments and fish samples, highlighting the extent of contamination in this region.

3. Kerala:

•Kochi: The city of Kochi, located in the southwestern state of Kerala, has witnessed the impact of microplastics pollution. Studies have identified microplastics in water samples from backwaters, sediments, and fish species, indicating the presence of contamination in this area.

4. Gujarat:

•Gulf of Kutch: The Gulf of Kutch, located in the state of Gujarat, is known for its marine biodiversity. However, studies have found microplastics in the waters, sediments, and biota of this region, raising concerns about the impact on marine life and the ecosystem.

5. West Bengal:

•Sundarbans: The Sundarbans, a UNESCO World Heritage Site shared between India and Bangladesh, faces microplastics pollution. Research has shown the presence of microplastics in the water and sediments, impacting the unique mangrove ecosystem and its associated wildlife.

6. Andaman and Nicobar Islands:

•Coastal areas: The pristine coastal regions of the Andaman and Nicobar Islands are not immune to microplastics pollution. Studies have detected microplastics in seawater, sediments, and marine organisms, highlighting the threat to the region's delicate marine ecosystems.

7. Uttrakhand

- Dehradun: The state capital has microplastics in its environment and the biggest reason is the tourism. During peak tourist season the Dehradun Mussoorie highway is filled with empty plastic bottles, wrappers of chips and biscuits and empty juice bottles contributing not only the land microplastic pollution but are also ending in river Ganga.

Remediation strategies of microplastics (5, 13)

1. Source Reduction: Decreasing the production of single-use plastics and promoting the use of sustainable alternatives can directly reduce the input of microplastics. Enhancing waste management systems by proper waste collection, recycling, and implementing advanced techniques for plastic waste treatment is crucial.
2. Wastewater Treatment: Developing and implementing advanced filtration systems such as membrane filtration, activated carbon adsorption, and ozonation, in wastewater treatment plants can help capture and remove microplastics from wastewater before it is discharged into water bodies.
3. Environmental Remediation: Organizing cleanup campaigns and community-driven initiatives to remove plastic waste from rivers, coastlines, and other affected areas can help prevent the further transport of microplastics into the marine environment.
4. Innovative Technologies:

•Microplastic- Selective Filters: Developing filters and membranes that specifically target microplastics while allowing the passage of other substances can aid in the removal of microplastics from water sources.

•Electro coagulation: Electro coagulation involves the use of electric currents to form aggregates that can capture and remove microplastics from water sources. This technique shows promise for large-scale water treatment applications.

•Bioremediation: Exploring the potential of microorganisms and enzymes to degrade microplastics is an active area of research.

5. Education and Awareness: Increasing public awareness through education campaigns, media, and community engagement can promote responsible plastic use, recycling practices, and proper waste management. Implementing and enforcing regulations and policies at national and international levels such as bans on microbeads in personal care products, promoting extended producer responsibility, and incentivizing the development of sustainable materials can help control and reduce microplastic pollution.

Bioremediation strategies for microplastics

1. Microbial Degradation: Certain bacteria and fungi have the ability to produce enzymes, such as lipases and esterases, that can break down plastic polymers. Microorganisms can form biofilms on microplastic surfaces, leading to colonization and degradation over time.
2. Enzymatic Degradation:Specific enzymes produced by microorganisms, such as cutinases and polyesterases, have shown promise in degrading certain types of microplastics. Scientists are

working on modifying and engineering enzymes to improve their efficiency in breaking down microplastics. This includes enhancing enzyme stability, substrate specificity, and activity under various environmental conditions.

3. Bioreactors: Engineered bioreactors can be designed to create optimal conditions for the growth and activity of microorganisms capable of degrading microplastics. These systems provide controlled environments where microplastics can be introduced, and microbial degradation can be enhanced.
4. Genetic Engineering: Genetic engineering techniques can be used to enhance the plastic-degrading capabilities of microorganisms. This involves introducing genes responsible for plastic-degrading enzymes or modifying existing genes to optimize enzyme activity and effectiveness.

Table 1: Role of microbes in remediating microplastics

Microbes	**Role in Microplastic Remediation**	**References**
Pseudomonas spp.	Production of enzymes capable of degrading plastics like PET and PE	(14)
Bacillus spp.	Production of enzymes (cutinases, esterases) to break down plastic polymers	(15)
Aspergillus spp.	Production of extracellular enzymes (lipases, esterases) for plastic degradation	(16)
Trichoderma spp.	Production of enzymes to degrade polyurethane (PU) and polystyrene (PS).	(17)
Nocardia spp.	Capability to degrade plastics like polyethylene and polypropylene	(18)
Chlorella spp.	They can utilize microplastics as a carbon source and degrade them enzymatically	(19)

Conclusion

Microplastics pollution is a significant and growing environmental concern with far-reaching implications. Microplastics contribute to environmental degradation by contaminating soil, water bodies, and the atmosphere. Microplastics have detrimental effects on wildlife, plants, marine organisms and potentially human health. Addressing microplastic pollution requires collective efforts from individuals, industries, governments, and international collaborations. Source reduction, improving waste management practices, promoting recycling, and adopting sustainable alternatives are key steps in reducing plastic waste and preventing the release of microplastics into the environment. Bioremediation strategies for microplastics are still in the early stages of research and development. Challenges include optimizing degradation efficiency, scaling up processes for real-world application, and ensuring that the byproducts of degradation are not harmful to the environment. Additionally, research is essential to understand the extent of microplastic pollution, its impacts on different ecosystems, and the development of effective mitigation strategies.

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A Review On: Classification and application of Microbial surfactants

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Abstract
In comparison to chemical surfactants, biosurfactants have several advantages, including lower toxicity, higher biodegradability, better environmental compatibility, higher foaming, high selectivity, and specific activity under extreme conditions like temperature, pH, and salinity. Biosurfactants are surface-active biomolecules produced by microbes (bacteria, fungi, and yeast). Nearly majority of the surfactants that are currently on the market were created chemically. Due to the wide range of functional qualities of biosurfactants and the extensive synthetic capacities of microorganisms, interest in them has surged recently.Applications for microbial biosurfactants in environmental protection include improving oil recovery, containing oil spills, biodegradation, and detoxifying of soils and industrial effluents that have been contaminated with oil. The pharmaceutical/medical, food, cosmetic, pesticide, oil, and biodegradation industries may use biosurfactants made by microorganisms. Focused on three key areas in this review article: the many forms of biosurfactants, the group of bacteria engaged in their synthesis, and the use of microbial biosurfactants.

Introduction

A biosurfactant, also known as biological surfactant, is a surface-active compound produced by microorganisms, plants, or animals. It is a type of surfactant that possesses both hydrophilic (water-loving) and hydrophobic (water-repelling) properties.The term "Biosurfactant" refers to microbial substances that exhibit strong surface activity (Maneerat, 2005). Unique amphipathic compounds known as biosurfactants have been studied for use in a range of industrial and bioremediation applications, as well as in the pharmaceutical, food, and oil recovery industries (Desai and Banat, 1997; Makker and Cameotra, 1998). Global surfactant production peaked at almost 2.5 million tons in 2002, hovered around 1,735.5 USD in 2011, and was projected to reach 2,210.5 USD in 2018 (Sekhon*et al.* 2012). This represents an average yearly growth rate of 3.5% from 2011 to 2018. Surfactants reduce the surface tension between two different phases, such as a liquid and a solid or a liquid and a gas, enabling them to mix or disperse more easily.

Structure and classification of Biosurfactants

Biosurfactants are primarily classified based on their compound structure and sources. The hydrophilic top is usually amino acid, peptide, mono-, di- or polysaccharide. The hydrophobic end is usually saturated, unsaturated, linear, branched or hydroxylated fatty acid.

Glycolipids

These are the carbohydrates with the combination of long chain aliphatic acid or hydroxyaliphatic acid that are the most widely used and accessible biosurfactant. Either ether or ester groups are used for the linkage. The most well-known biosurfactants among the glycolipids are rhamnolipids, trihalolipids, and sorpholipids. The best researched glycolipids are those produced by *Pseudomonas* sp. (Jarvis *et al.* 1949), *Pseudozyma Antarctica* (Kitamoto*et al.* 1990), and *Rhodococcus sp., Nocardia sp., Arthrobacter* sp., and *Mycobacterium sp.* (Lang and Wagner, 1987). *Ustilago maydis* produces cellobiolipids (Teichmann*et al*. 2007b), while *Candida sp.* produces sophorolipids (Cooper and Paddock, 1984).

Lipoproteins and lipopeptides

Numerous cyclic lipopetides are created, including decapeptide and lipopeptide antibiotics. These have a polypeptide chain attached to a lipid. a lipopeptide known as *Bacillus sp.* produces surfactin, which are composed of seven amino acids linked to carboxyl and hydroxyl groups in 14-carbon acids. Surfactin's capacity to lyse mammalian erythrocytes and produce spheroplasts is a crucial property (Bernheimer and Avigad, 1970). Cyclic peptides joined to a fatty acid are the main structural component of the molecules in this family of biosurfactants. These antibiotic-like chemicals are known to be produced by a number of bacteria, including *Bacillus subtilis,* which makes the substances surfactin and subtilisin. Bacillus licheniformis and *Bacillus subtilis* peptide-lipid and lichenysin (Yakimov*et al.* 1997; Begley *et al.* 2009).

Neutral lipids, phospholipids, and fatty acids

When growing on n-alkanes, a lot of bacteria and yeast produce a lot of fatty acids and phospholipid surfactants (Cirigliano and Carman, 1985). The length of the hydrocarbon chain in their structures directly relates to the hydrophilic and lipophilic balance (HLB).

In order to facilitate the uptake of the carbon source, a number of fungi, yeasts, and bacteria that can grow on hydrophobic substrates like alkanes release vast quantities of phospholipids, fatty acids, or neutral lipids. *Aspergillus species, Candida lepus, Thiobacillusthiooxidans, Acinetobacter species, Pseudomonas species, Micrococcus species, Mycococcus species, Candida species,* and *Penicillium species* are a few examples (Kappeli and Finnerty, 1979). According to Kappeli and Finnerty (1979), *Acinetobacter sp.* produces phosphatidylethanolamine-rich vesicles that are optically transparent.

Particle biosurfactants

Extracellular membrane vesicles divide up hydrocarbons in a microemulsion, which is crucial for microbial cells to absorb alkanes. Protein, phospholipids, and lipopolysaccharide are the main components of *Acinetobacter sp.* vesicles, which have a diameter of 20–50 nm and a buoyant density of 1.158 cubic g/cm (Kappeli and Finnerty, 1979).

Features of biosurfactants

Biosurfactants are distinct from synthetic surfactants, which are chemically produced. They are naturally occurring and can be derived from various sources, including bacteria, yeasts, fungi, plants, and marine organisms. Biosurfactants exhibit several advantageous properties, making them attractive for various industrial, environmental, and biomedical applications.

Some key features of biosurfactants are:

1. Surface tension reduction: Biosurfactants lower the surface tension of liquids, allowing them to spread more easily and improve wetting. This property finds applications in detergents, cleaning products, and oil recovery processes.
2. Emulsification: Biosurfactants can emulsify immiscible liquids, such as oil and water, forming stable emulsions. This property is useful in industries like food, cosmetics, and pharmaceuticals for emulsion stabilization and formulation.
3. Foaming and defoaming: Biosurfactants can enhance or inhibit the formation of foam depending on their concentration and composition. This property finds applications in detergents, firefighting foams, and wastewater treatment.
4. Environmental applications: Biosurfactants have potential applications in bioremediation, where they aid in the removal of hydrophobic contaminants from soil and water by increasing their solubility and bioavailability.

5. Antimicrobial activity: Some biosurfactants exhibit antimicrobial properties, making them valuable in the development of antimicrobial agents and formulations.
6. Biomedical applications: Biosurfactants have shown potential in drug delivery systems, wound healing, and as antimicrobial agents in medical applications.

Compared to synthetic surfactants, biosurfactants are generally considered more environmentally friendly and sustainable since they are biodegradable, non-toxic, and often produced from renewable resources. Research and development in the field of biosurfactants continue to explore new sources, optimize production processes, and expand their applications in various industries.

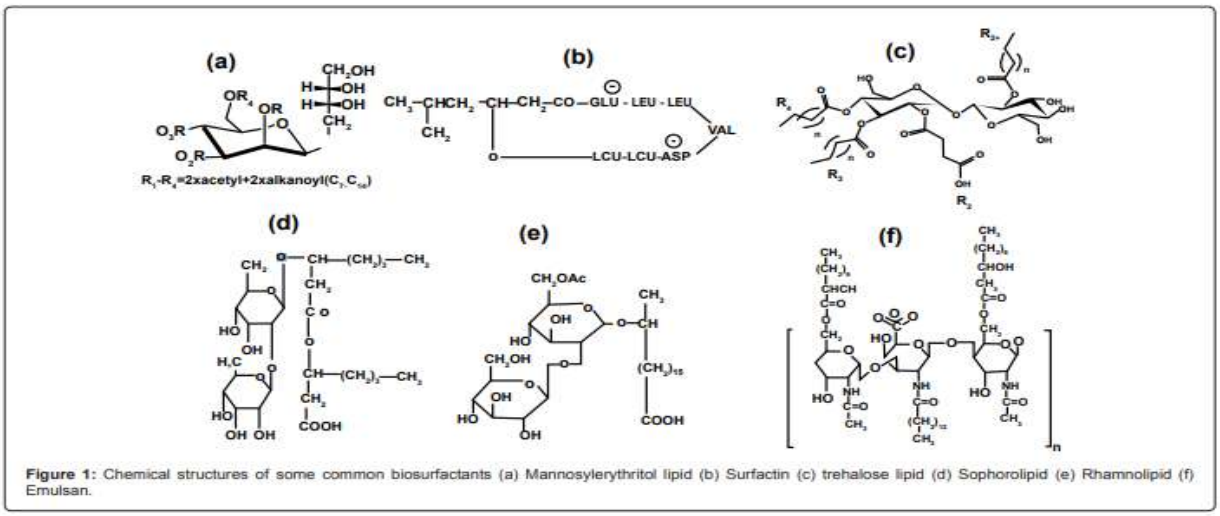

Figure 1: Chemical structures of some common biosurfactants (a) Mannosylerythritol lipid (b) Surfactin (c) trehalose lipid (d) Sophorolipid (e) Rhamnolipid (f) Emulsan.

Various microorganisms are known to produce biosurfactants. Some common examples include:

1. Bacteria: - *Pseudomonas aeruginosa ,Bacillus subtilis , Lactobacillus spp., Rhodococcus spp., Acinetobacter spp.*
2. Yeasts: - *Candida spp., Saccharomyces spp., Rhodotorula spp., Pichia spp.*
3. Fungi: - *Aspergillus spp., Penicillium spp., Trichoderma spp., Fusarium spp*.
4. Actinobacteria:-*Streptomyces spp., Nocardia spp., Mycobacterium spp.*

These microorganisms produce biosurfactants as part of their natural metabolic activities. The specific types of biosurfactants produced and their properties can vary among different strains and species. Additionally, microorganisms from extreme environments such as marine environments or hydrocarbon-contaminated sites are often investigated for biosurfactant production.

It's worth noting that the production of biosurfactants by microorganisms can be influenced by various factors such as growth conditions (temperature, pH, nutrients), carbon sources, and culture media. Therefore, optimization of cultivation conditions is important for maximizing biosurfactant production by these microorganisms.

Application of Biosurfactant

Bacteria that produce biosurfactants have a wide range of uses in many industries and environmental contexts. Several prominent uses for these bacteria and their biosurfactants are listed below:

1. Enhanced Oil Recovery (EOR): In the oil and gas sector, bacteria that produce biosurfactants are utilized to improve the recovery of stranded oil from reservoirs. Biosurfactants help to mobilize and extract oil by lowering the interfacial tension between oil and water.

2. Bioremediation: The bioremediation of contaminated soil and water can be improved by biosurfactants produced by bacteria. They make hydrophobic contaminants more soluble and bioavailable, allowing other bacteria to more easily degrade them.
3. Environmental Cleanup: Biosurfactants can be used to remove petroleum contamination from locations and oil spills. They help to lessen the impact on the environment by facilitating the dispersion and degradation of oil.
4. Agriculture: To improve nutrient uptake by plants, biosurfactant-producing bacteria can be used in agriculture. Biosurfactants' surfactant qualities increase soil wetness and nutrient availability, which promotes greater plant development and higher crop yields.
5. Detergents and cleaning goods: The creation of environmentally friendly detergents and cleaning products uses biosurfactants. They assist in removing oil, grease, and filth from a variety of surfaces while being environmentally friendly and biodegradable.
6. Cosmetics and personal care: Natural substitutes known as biosurfactants are becoming more and more common in the creation of cosmetics, shampoos, soaps, and other personal care items. They have mild foaming, emulsifying, and cleaning abilities and are biocompatible and sustainable.
7. Food business: To stabilize emulsions, create foam, and improve texture, biosurfactants are employed in the food business. They are used as natural food additives, emulsified products, and in food processing.
8. Pharmaceutical and Biomedical Applications: In the pharmaceutical and biomedical industries, biosurfactants may be used as antibacterial agents, wound healing systems, and drug delivery systems. Their special qualities can accelerate the healing of wounds and increase the solubility, stability, and effectiveness of medications.

Biosurfactants are appealing replacements for synthetic surfactants in a variety of industrial and environmental applications due to their adaptability and eco-friendliness. New bacterial strains are being investigated, biosurfactant manufacturing methods are being improved, and their application potential is being further increased.

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NEW DOUBLE LAPLACE-TRANSFORMS OF SOME GENERALIZED HYPERGEOMETRIC FUNCTIONS

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ABSTRACT.

The double Laplace transform Is a powerful mathematical tool that allows the transformation of functions from the time domain to the complex frequency domain. In this research paper, we explore the double Laplace transforms of hyper geometric functions. We derive formulas for the double Laplace transforms of specific hypergeometric functions by using certain hypergeometric summations, which were established by Masjed- JameiandKoepf.

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Keywords and phrases. Generalized hypergeometric function, Gauss' summation theorem, Gauss' second summation theorem, Hypergeometric summations, Double Laplace Transform.

1. Introduction and Preliminaries

The Laplace transform is a well-studied mathematical tool with a wide range of applications. However, there is relatively little work on the double Laplace transform, which is age neralization of the Laplace transform to functions of two variables. The double Laplace transform is a powerful mathematical tool that allowsthetransformationoffunctionsfromthetimedomaintothecomplexfrequencydomain.

The double Laplace transforms of the function of two variables are defined and studied in[1 – 3].

Let $f(x,y)$ be a function of two variables x and y, where $x, y > 0$. The double Laplace transform of $f(x,y)$ is defined by the following double integral:

$$\mathrm{L}\left[\mathrm{L}\left\{f(x,y);x\to p\right\};y\to q\right]=\mathrm{L}\left[f(p,y);y\to q\right]=\int_0^\infty\int_0^\infty e^{-(px+qy)}f(x,y)\,dxdy \qquad (1.1)$$

The double Laplace transform of the hypergeometric function is obtained by applyingtheLaplacetransformtwicetothehypergeometricfunction.Hypergeometricfunctionsareaclassof specialfunctionsthatarisein many areas of mathematics, physics, and engineering. Understanding their double Laplace transforms can provide valuable insights into the behavior and properties of thesefunctions.

The well-known generalized hypergeometric function with r numerator and s de-nominator parameters is defined [4 – 6]as:

$$ {}_rF_s\left[\begin{matrix}u_1,u_2,...,u_r\\ v_1,v_2,...,v_s\end{matrix};w\right]=\sum_{n=0}^{\infty}\frac{(u_1)_n(u_2)_n...(u_r)_n}{(v_1)_n(v_2)_n...(v_s)_n}\frac{w^n}{\mathrm{n!}} \qquad (1.2) $$

Also, no denominator parameter v_j is supposed to be zero or a negative integer. If any parameter u_i is zero or a negative integer, the series terminates. The power series (1.2) could be examined using the elementary ratio test, which confirms that:

(i) If $r \le s$, the series is convergent for all finite w.

(ii) If $r=s+1$, the series is convergent for $|w|<1$ and diverges for $|w|>1$.

(iii) If $r > s+1$, the series diverges for $w \neq 0$.

(iv) If $r = s+1$, the series is absolutely convergent on the circle $|w|=1$ if

$$ \Re\left[\sum_{j=1}^{s}v_j-\sum_{i=1}^{r}u_i\right]>0 $$

Moreover, $(u)_n$ in series (1.2) is widely known as the shifted factorial for any complex number and is defined by:

$$ (u)_n=\frac{\Gamma(u+n)}{\Gamma(u)}=\begin{cases}1 & (n=0,\ u\in \pounds\setminus\{0\})\\ (u)\,(u+1)\,(u+2)....(u+n-1) & (n\in ¥,\ u\in \pounds)\end{cases} \qquad (1.3) $$

It is intriguing to observe that the results are always crucial and extremely pertinent from an application standpoint wherever and whenever a generalized hypergeometric function reduces to a gamma function. As a natural consequence, the classical summation theorems and their numerous generalizations are imperative in the theory of generalized hypergeometric functions. However, in our present investigation, we mention the following theorems due to Gauss viz. [4, 5]:

- Gauss's summation theorem:

$$ {}_2F_1\left[\begin{matrix}a,b\\ c\end{matrix};1\right]=\frac{\Gamma(c)\Gamma(c-a-b)}{\Gamma(c-a)\Gamma(c-b)} \qquad (1.4) $$

provided $\Re(c-a-b)>0$.

- Gauss's second summation theorem:

$$ {}_2F_1\left[\begin{matrix}a,b\\ \frac{1}{2}(1+a+b)\end{matrix};\frac{1}{2}\right]=\frac{\sqrt{\pi}\,\Gamma\left(\frac{1}{2}(a+b+1)\right)}{\Gamma\left(\frac{1}{2}(a+1)\right)\Gamma\left(\frac{1}{2}(b+1)\right)} \qquad (1.5) $$

In 2019, Masjed-Jamei and Koepf [7] established a very interesting identity viz.

$$ {}_pF_q\left[\begin{matrix}a_1,...,a_{p-1},m+1\\ b_1,...,b_{q-1},n+1\end{matrix};\mathrm{z}\right]=n!\binom{n-1}{m}\frac{(-1)^{n(p-q)+m}}{z^n}\frac{(1-b_1)_n...(1-b_{q-1})_n}{(1-a_1)_n...(1-a_{p-1})_n} $$

$$\times\left\{\begin{array}{c}\displaystyle\sum_{k=0}^{m}\frac{(-m)_k(a_1-n)_k\ldots(a_{p-1}-n)_k}{(1-n)_k(b_1-n)_k\ldots(b_{q-1}-n)_k}\,{}_{p-1}F_{q-1}\left[\begin{array}{c}a_1-n+k,\ldots,a_{p-1}-n+k\\ b_1-n+k,\ldots,b_{q-1}-n+k\end{array};z\right]\frac{(-z)^k}{k!}\\ -{}_pF_q\left[\begin{array}{c}a_1-n,\ldots,a_{p-1}-n,-(n-1-m)\\ b_1-n,\ldots,b_{q-1}-n,-(n-1)\end{array};z\right]\end{array}\right\} \quad (1.6)$$

where $m,n\in ¥$ such that $m<n.$

By employing (1.4) and (1.5) in the identity (1.6), they obtained the following twointeresting results viz.

$$ {}_3F_2\left[\begin{array}{c}a,b,m+1\\ c,n+1\end{array};1\right]=(-1)^{n+m}n!\binom{n-1}{m}\frac{(1-c)_n}{(1-a)_n(1-b)_n}$$

$$\times\left\{\begin{array}{c}\displaystyle\sum_{k=0}^{m}\frac{(-m)_k(a-n)_k(b-n)_k}{(1-n)_k(c-n)_k}\frac{\Gamma(c-n+k)\Gamma(c-a-b+n-k)}{\Gamma(c-a)\Gamma(c-b)}\frac{(-1)^k}{k!}\\ -{}_3F_2\left[\begin{array}{c}a-n,b-n,-(n-1-m)\\ c-n,-(n-1)\end{array};1\right]\end{array}\right\}=\Delta_1 \quad (1.7)$$

and

$$ {}_3F_2\left[\begin{array}{c}a,b,m+1\\ c,n+1\end{array};\frac{1}{2}\right]=(-1)^{n+m}2^n n!\binom{n-1}{m}\frac{(1-c)_n}{(1-a)_n(1-b)_n}$$

$$\times\left\{\begin{array}{c}\sqrt{\pi}\displaystyle\sum_{k=0}^{m}\frac{(-m)_k(a-n)_k(b-n)_k}{(1-n)_k(c-n)_k}\frac{\Gamma(-n+k+c)}{\Gamma\left((a-n+k+1)/2\right)\Gamma\left((b-n+k+1)/2\right)}\frac{(-1)^k}{2^k k!}\\ -{}_3F_2\left[\begin{array}{c}a-n,b-n,-(n-1-m)\\ c-n,-(n-1)\end{array};1\right]\end{array}\right\}=\Delta_2$$

with $c=\dfrac{a+b+1}{2}$.

The primary goal of this study is to determine the double Laplace transforms of hypergeometric functions by utilizing the (1.7) and (1.8).We provide an organized methodology for computing these transformations.

2. Double Laplace Transforms

In this section we shall evaluate double Laplace transforms of hypergeometric functions asserted in the following theorems.

Theorem 1. For $m,n\in ¥$ such that $m<n$, $\Re(c-a)>0$ and $\Re(c-b)>0$, the following result holds true when $x,y>0$

$$\int_0^\infty \int_0^\infty e^{-(x+y)} x^{a-1} y^{b-1}\, {}_1F_2 \left[\begin{matrix} m+1 \\ c, n+1 \end{matrix} ; \mathrm{xy} \right] dxdy = \Gamma(a)\Gamma(b)\Delta_1 \qquad (2.1)$$

where Δ_1 is the same as given in (1.7).

The following theorems contend two more instances of (2.1):

Theorem 2. For $m,n \in ¥$ such that $m<n, \Re(c-a)>0$ and $\Re(c-b)>0$, thefollowing result holds true when $x,y>0$

$$\int_0^\infty\int_0^\infty e^{-(x+y)}x^{a-1}y^m {}_1F_2\left[\begin{matrix} b \\ c,n+1 \end{matrix}; \mathrm{xy}\right]dxdy = \Gamma(a)\Gamma(m+1)\Delta_1 \qquad (2.2)$$

where Δ_1 is the same as given in (1.7).

Theorem 3. For $m,n \in ¥$ such that $m<n, \Re(c-a)>0$ and $\Re(c-b)>0$, thefollowing result holds true when $x,y>0$

$$\int_0^\infty\int_0^\infty e^{-(x+y)}x^{b-1}y^m {}_1F_2\left[\begin{matrix} a \\ c,n+1 \end{matrix}; \mathrm{xy}\right]dxdy = \Gamma(b)\Gamma(m+1)\Delta_1 \qquad (2.3)$$

where Δ_1 is the same as given in (1.7).

In an analogous way, we can articulate the Double Laplace Transform of Gauss's second summation theorem as:

Theorem 4. For $m,n \in ¥$ such that, the following result holds true when $x,y>0$

$$\int_0^\infty\int_0^\infty e^{-(x+y)}x^{a-1}y^{b-1} {}_1F_2\left[\begin{matrix} m+1 \\ \frac{1}{2}(a+b+1),n+1 \end{matrix}; \mathrm{xy}\right]dxdy = \Gamma(a)\Gamma(b)\Delta_2 \qquad (2.4)$$

where Δ_2 is the same as given in (1.8).

The following theorems contend two more instances of (2.4):

Theorem 5. For $m,n \in ¥$ such that, the following result holds true when $x,y>0$

$$\int_0^\infty\int_0^\infty e^{-(x+y)}x^{a-1}y^m {}_1F_2\left[\begin{matrix} b \\ \frac{1}{2}(a+b+1),n+1 \end{matrix}; \mathrm{xy}\right]dxdy = \Gamma(a)\Gamma(m+1)\Delta_2 \quad (2.5)$$

where Δ_2 is the same as given in (1.8).

Theorem 6. For $m,n \in ¥$ such that, the following result holds true when $x,y>0$

$$\int_0^\infty\int_0^\infty e^{-(x+y)}x^{b-1}y^m {}_1F_2\left[\begin{matrix} a \\ \frac{1}{2}(a+b+1),n+1 \end{matrix}; \mathrm{xy}\right]dxdy = \Gamma(b)\Gamma(m+1)\Delta_2 \quad (2.6)$$

where Δ_2 is the same as given in (1.8).

Proof: The derivation of our results (2.1), (2.4) and their analogues are quite straight forward. To establish (2.1), we proceed as follows.

Denoting left-hand side of (2.1) as I, expressing ${}_1F_2$ as a series, change the order of integration and summation, we obtain:

$$I = \sum_{k=0}^{\infty}\frac{(m+1)_k}{(c)_k(n+1)_k}\int_0^\infty\int_0^\infty e^{-(x+y)}x^{a+k-1}y^{b+k-1}dxdy$$

After some simplification and summing up the series. Finally, we obtain:

$$I = \Gamma(a)\Gamma(b)_3F_2\left[\begin{matrix}a,b,m+1\\ c,n+1\end{matrix};1\right]$$

Now, we observe that ${}_3F_2$ can be evaluated with the help of the result (1.7) and we simply reach at the right-hand side of (2.1). This completes the proof of the theorem. In exactly same manner (2.2) to (2.6) can be evaluated.

Conclusion

By applying the double Laplace transform to Hypergeometric functions, we have discovered new patterns and relationships that were previously unknown. These findings have shed light on intricate connections between different variables and parameters within these mathematicalframeworks. Moreover, these new results have great practical benefits as well because of the conjunctions of two important objects of applied mathematics. Theimproved understanding of double Laplace transforms can lead to more efficient methods for solving practical problems involving Hyper geometric functions. The exploration of double Laplace transforms applied to Hyper geometric functions is an ongoing journey that holds great promise for advancing knowledge in mathematics and its practical applications. For further significant contributions towards hypergeometric functions, integrals, and their applications, by the First author, we refer [8 – 26].

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Inclusive education in Indian Context : PostCovid Scenario

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Abstract

Lateral thinking is a kind of a skill to solve the problems and take forward the work of the group or a team.According to "Edward de Bono", he was the author, philosopher, and inventor of the lateral thinking. According to him we all are free to think, for imagination for our creativity by use of special experiments together or alone.

There are four techniques of lateral thinking – awareness, random stimulation, alternatives and alternation.

Every student has an equal right for the education. According to act no 35 of 2009 in Indian constitution, students are free to educate themselves especially whose age is between 6- 14 years and all student should aware to this act because this is the compulsory education act for the students. Even teachers should focus on those students who lack support, awareness due to their disabilities.

Role of teacher is basically most important in student life. They should be able to look after their personal needs, they should be able nourish their hidden talent, their skills, creativity as well as their attitude.

Students can face many complexities during learning- inferiority, and may be they are not going to adjust easily with other student, they may be introvert or may lack expression. It depends only on the teacher to create the healthy environment for those students.

Keeping the above observation in mind the current work is putting up the following-

- How can we support the children for the education?
- What kind of techniques teacher can use ?
- How can we aware the student for their skills?
- How teachers make their teaching more interesting

Key Words: Education, children, skill, interesting, support

Inclusive education means all children in the same classrooms, in the same schools. It means real learning opportunities for groups who have traditionally been excluded – not only children with disabilities, but speakers of minority languages too.

According to UNESCO, inclusive education is an ongoing process aimed at offering quality education for all while respecting diversity and the different needs and abilities, characteristics and learning expectations of the students and communities. As, here, we talk about education, need, learning, abilities, it is pertinent to have certain components of this matter; such as the very first and

foremost component of this method is the children from grassroot level from various background for whom another important component of the inclusive education would be prominent and that is options of various programs; These programs obviously need modifications of curriculum as it would cater to the various needs of those needy children. To make all these (so far 4 components) materialised in an effective manner, the involvement of parents is very influent in this context.

Inclusive Education has two types – the first type is called regular inclusion and the other type is full inclusion.

Here, let us mention John Meehan, a poet, author and an educator, whosaid that a teacher without empathy and compassion is as useless as a book without light. Inclusive education may take out the following characteristics in a person and help building up the personality:

Critical thinking: According to Albert Einstein "education is not the learning of acts but the training of mind to think" which means a teacher should analyse as well as evaluate the student for their upgradation.

Again, according to Edward de Bono there is no doubt that creativity is the most important human resource of all without creativity there would be no progress and we would be forever repeating same matter. A teacher should be creative thinking rather than repeating the same pattern.

Responsible Decision Making: decision making involve in giving consideration to the matter, noting up the desirable result secondly selecting the suitable option to achieve the fruitful result.

Effective communication: Effective communication brings out the fruitful result.

" In many ways effective communication begins with mutual respect communication that inspire, encourage, other to do their best " according to Zig Ziglar, an American author and motivational speaker. This characteristic comes as a pivotal point for the very next trait.

Problem solving: In problem solving the very first step goes to the effective communication. If a teacher is communicate well with the student then he/ she can effective communication easily find a path of the light. Problem solving doesn't mean just giving solution to the student. It is rather to make student thinking clear about the problems. Asking questions directly or giving helpful suggestions.

According to Robert J. Meehan "Teacher are unique problem solver by character temperament and resilience. Teacher can not be manufactured.

With this, we can conclude by saying that although inclusive education shapes the interpersonal relationships like excelling in communication, building up a superior understanding quality, developing an optimum listening skill, mastering Non- verbal communication and self confidence, yet

Firstly a teacher should have excellence in communication so that he/she may can effectively communicate the chapters.

Secondly teacher should posses the skill of understanding quality if a teacher is able to understand student then he /she can help study better and build up their career.

Thirdly teacher should posses the effective listening skill to stay attentive and grasp each and every word which is spoken.

Adding more if a teacher have a quality of communicating without actual verbal communication then it can help a lot to understand the student in better way.

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Covid 19 and use of ICT in education: Advantages, Opportunities and Challenges

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ABSTRACT
COVID-19 is a contagious illness caused by a new type of Coronavirus. It was officially declared a worldwide pandemic on March 11, 2020, and has had a significant impact on various aspects of human life. One area greatly affected by the virus is education, as educational systems around the world have been disrupted. According to UNESCO, more than 100 countries have implemented widespread school closures, affecting almost 90% of the global student population. In the 21st century, having knowledge is crucial. Access to information is empowering, and education is the foundation for advancement in all societies, families, and nations. Education plays a critical role in ensuring economic and social development and enhancing income equality. It is also essential for increasing people's productivity and innovation, as well as fostering entrepreneurship and technological advancements. The Covid 19 pandemic has increased the importance of ICT in meeting the educational needs of communities. Educational institutions are now compelled to utilize technology in the field of education. It is now widely recognized that education is no longer limited to physical locations. In previous years, ICT has primarily been employed for information sharing through electronic means such as emails, text messages, and phone calls. However, the advent of the COVID-19 pandemic has brought about a significant shift in education system and ICT is considered as a vehicle for the dissemination of knowledge. This paper aims to elucidate the role of ICT in Education in the context of the COVID-19 pandemic.
Key words: Covid – 19, Pandemic, ICT, Education and communities

INTRODUCTION

The Covid-19 pandemic has caused the biggest ever disruption to the education system, affecting approximately 1.6 billion students in over 190 countries. According to a report by UNICEF, the closure of schools during lockdown has had a negative impact on 247 million children in primary and secondary education, as well as 28 million children in preschools and daycare centers. Additionally, the crisis has led to a faster adoption of digital technologies for educational purposes, resulting in significant changes to curriculum development and ICT enabled teaching methods. ICT improves the learning experience by creating a platform for teachers, students, and other members of the education community to collaborate and enhance the management of education, both at the classroom level and on a national scale. The education system underwent a digital transformation due to the pandemic, with the implementation of online lectures, teleconferencing, digital open books, online exams, and virtual interaction.

The Covid-19 pandemic has had a significant impact on the education sector worldwide. The crisis has sparked innovation in the education sector, particularly in India where various ICT

initiatives have been implemented to ensure access to education for marginalized populations who may lack healthcare and technology resources. This includes the widespread use of online tools like Zoom, Google Classroom, and Blackboard, as well as mobile applications, telephone, television, and radio to reach every learner. The MHRD has introduced online platforms such as DIKSHA, NISHTHA, and e-Pathshala. These platforms aim to offer training opportunities to a wider range of educators. Additionally, the promotion of massive open online courses (MOOC) has been encouraged for further education. This crisis has highlighted the potential of ICT in achieving universal access to quality education.

The Advantages and Disadvantages of ICT in Education

There are numerous justifications for incorporating technology in the classroom, but there are also drawbacks to consider.

Advantages

1. Assist in the acquisition of knowledge in specific subjects.
2. Technology can serve as a means of education rather than just for entertainment.
3. Facilitate the development of students' ICT skills and literacy while also enhancing their understanding of various subjects.
4. ICT promotes higher-order thinking skills
5. Students who require special assistance are now on an equal footing as they can access necessary resources and utilize specialized ICT tools to meet their educational requirements.
6. ICT use motivates learning
7. ICT in education improves engagement and knowledge retention
8. With the assistance of e-journals, e-magazines, and e-library, a teacher can expand their knowledge base.

Disadvantages

1. Not all students have equal opportunities to access technology, which can lead to a digital divide. Economically disadvantaged students are often deprived of access to ICT. There is a disparity in the level of access among students.
2. The use of technology in the classroom has the potential to divert attention.

Limitations of ICT

Here are a few drawbacks of incorporating ICT in any educational environment, which can be seen as significant from both the teacher's and the students' perspectives. When it comes to learning how to effectively use ICT, the teacher needs to invest time and effort. The main obstacles included a shortage of authentic software, insufficient computers in the classroom, slow internet connection, lack of motivation from both teachers and students to use technology, inadequate training, absence of up-to-date technology equipment, shortage of skilled technical staff, lack of administrative support, and an inadequate course curriculum.

REVIEW OF LITERATURE

During the past two years, the education sector experienced a significant transformation due to the global pandemic. The traditional method of classroom teaching and learning was greatly

affected as schools and universities were forced to close by governments in order to prevent the spread of the virus. This led to a major shift in the way education was delivered, with technology playing a crucial role (Ajay Lotheta 2022). In today's digital era, teachers need more than just textbooks and notes for their education. They must have a strong understanding of ICT (Information and Communication Technology) in order to effectively deliver their lessons (Narayan Prasad Niroula 2021). The use of ICT is highly beneficial in the present situation. These tools are very helpful in solving problems and allow us to stay connected and continue with education (Manisha Mohite 2020).

RESEARCH METHODOLOGY

This study aims to examine the impact of the COVID-19 pandemic on ICT enabled learning and the effectiveness of distance learning methods employed by education institutions. To accomplish this objective, a comprehensive review of international and national literature has been conducted. The research relies on secondary data for analysis.

DISCUSSION AND CONCLUSION

One of the biggest obstacles in using ICT in education is finding a balance between educational objectives and financial constraints. Implementing ICT programs in education requires significant financial resources, and developing countries must carefully consider which models of ICT use to adopt while also considering the cost-effectiveness. Ultimately, the question is whether the benefits of using ICT outweigh the costs compared to other alternatives.

The shift from traditional to online education in India has presented numerous difficulties for the government, educational institutions, students, and parents. Teachers have faced difficulties in adapting to online learning because they have had to undergo training in new methods of developing interactive and online educational content. Schools had the freedom to decide how to implement online learning, so there was no specific guideline on which online platform to use. Some teachers used social networks, Edmo, Zoom, or Google Meet for online learning. These tools helped teachers understand how students perceived and evaluated online learning. The government did not have a uniform strategy, but for children, different approaches like scheduled public television broadcasts and sharing photos on social networks were used. Some students also attended online lessons through direct connections on Google platforms or Zoom. Educational Apps such as Byju’s, Unacademy, Upgrad, Vedantu, Toppr, Khabri etc. also helped the students to engage themselves in teaching learning process.

Government of India needs to update education policies and regulations in order to support continuous learning in educational institutions and encourage students to prepare for the future. It is crucial for educational systems to find immediate solutions to address the consequences of the pandemic and to be able to assess the quality of education in the short and long term. Establishing a national framework for cooperation and collaboration is important to reshape and restructure education regulations and policies, as well as to share the skills and lessons learned from dealing with this pandemic. Additionally, it is essential to address the challenges faced by education systems in different states, such as the lack of preparedness in adopting ICT, inequalities in internet access, weak infrastructure, and the unpreparedness of both students and educators.

The Ministry of Education in India is now adopting the strategy of collaborating with the private sector and public sector to implement ICT-based projects. These partnerships can take various forms, such as private sector grants combined with government contributions, corporations donating equipment and educational content to state-run schools, and providing technical assistance for planning, management, and improving human resources at the local level. Additionally, multilateral organizations and international aid agencies have played a significant role in driving ICT initiatives in education in the developing world.

In this research, we initially addressed the topic of incorporating ICT in education, highlighting both the advantages, disadvantages and challenges. Although there may still be some teachers who are hesitant about utilizing ICT, it is undeniable that in today's interconnected world, the significance and value of technology cannot be ignored. Teacher trainers and policy makers need to comprehend the obstacles and cost-effectiveness of various methods of integrating ICT into teacher training. This understanding will enable them to explore training strategies that are feasible and accessible to everyone.

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UNVEILING THE HIDDEN WONDERS: HOW MILLETS OFFER UNMATCHED HEALTH BENEFITS

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ABSTRACT
Millets are a staple food with numerous health benefits, including weight management, preventing chronic diseases, digestive health, and heart health. These gluten-free, fiber-rich grains are rich in vitamins, minerals, antioxidants, and protein, making them ideal for maintaining a healthy weight and reducing heart disease risk. Their low fat and cholesterol content promotes sustainable weight loss, while their complex carbohydrates provide steady energy and prevent blood sugar spikes. Millets' low glycemic index promotes better blood sugar control and heart health. By incorporating millets into meals creatively, individuals can enjoy their health benefits while adding variety and nutrition to their diet. In this article, we will explore the nutritional value of millets and delve into the many ways they can benefit our health.
KEYWORDS: Hidden Wonders, Millets, Health Benefits

INTRODUCTION TO MILLETS

Millets have been a staple food in many parts of the world for centuries. These small-seeded grains are packed with nutrients and offer a wide range of health benefits. Millets are gluten-free, rich in fiber, and have a low glycemic index, making them an excellent choice for those with dietary restrictions or health concerns.

THE NUTRITIONAL VALUE OF MILLETS

Millets are a powerhouse of nutrition, containing essential vitamins, minerals, and antioxidants. They are particularly rich in magnesium, phosphorus, and iron, which are vital for maintaining healthy bones, teeth, and red blood cell production. Millets are also a great source of protein, providing all the essential amino acids our bodies need for optimal growth and repair.
Furthermore, millets are low in fat and cholesterol, making them an ideal choice for those looking to maintain a healthy weight or reduce their risk of heart disease. They are also high in dietary fiber, which aids in digestion and helps prevent constipation. With their impressive nutritional profile, millets offer a holistic approach to maintaining good health.

HEALTH BENEFITS OF CONSUMING MILLETS

1. Millets And Weight Management

In today's world, where obesity has become a global epidemic, millets can play a crucial role in weight management. Due to their high fiber content, millets keep us feeling full for longer, reducing the chances of overeating. Additionally, the complex carbohydrates in millets are slowly digested, providing a steady release of energy and preventing blood sugar spikes, which can lead to weight gain. By incorporating millets into our diet, we can achieve sustainable weight loss and maintain a healthy body mass index.

2. Millets And Their Role In Preventing Chronic Diseases

Chronic diseases such as diabetes, cardiovascular diseases, and certain types of cancer are on the rise. However, a healthy diet that includes millets can help prevent the development of these conditions. The antioxidants present in millets protect our cells from damage caused by free radicals, reducing the risk of chronic diseases. Moreover, millets have a low glycemic index, meaning they have a minimal impact on blood sugar levels. This makes them an excellent choice for individuals with diabetes or those at risk of developing the condition.

3. Millets And Digestive Health

Digestive health is essential for overall well-being, and millets can contribute to a healthy digestive system. The high fiber content in millets promotes regular bowel movements, preventing constipation and maintaining a healthy gut. Additionally, millets contain prebiotics, which act as food for the beneficial bacteria in our gut. These bacteria play a crucial role in digestion, nutrient absorption, and supporting our immune system. By incorporating millets into our diet, we can support a healthy gut microbiome and improve our digestive health.

4. Millets And Their Impact On Blood Sugar Levels

Maintaining stable blood sugar levels is essential for individuals with diabetes or those at risk of developing the condition. Millets have a low glycemic index, meaning they are digested and absorbed slowly, resulting in a gradual rise in blood sugar levels. This slow release of glucose into the bloodstream helps prevent sudden spikes and crashes, promoting better blood sugar control. Incorporating millets into meals can be beneficial for individuals with diabetes or those looking to manage their blood sugar levels effectively.

5. Millets And Their Contribution To Heart Health

Heart disease is a leading cause of death worldwide, but a healthy diet can significantly reduce the risk. Millets are a heart-healthy food choice due to their low fat and cholesterol content. They are also rich in antioxidants and magnesium, both of which have been linked to a lower risk of heart disease. Additionally, the fiber in millets helps reduce levels of LDL cholesterol, commonly known as "bad" cholesterol. By including millets in our diet, we can take a proactive approach to maintaining heart health and reducing the risk of cardiovascular diseases.

CONCLUSION: EMBRACING THE WONDERS OF MILLETS FOR A HEALTHIER LIFESTYLE

Millets are often overlooked, but they offer unparalleled health benefits that can enhance our overall well-being. From weight management to preventing chronic diseases, millets have a significant impact on our health. Their nutrient-dense profile, combined with their versatility in the kitchen, makes them a valuable addition to any diet.

So, let's embrace the wonders of millets and make them a staple in our meals. By doing so, we can nourish our bodies with the nutrients they need, support our digestive health, manage our weight effectively, and protect ourselves against chronic diseases. Let millets become a cornerstone of our healthy lifestyle and experience the hidden wonders. By incorporating millets into our meals creatively, we can enjoy their health benefits while adding variety and nutrition to our diet.

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Visual Elements Is a Powerful Design Tool for Advertisement

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Abstract:

Our day started with the use of products by a product for a product simply surrounded by various products. Products are nothing but a result of a brand for smoothing our lifestyle. Spreading a piece of information each company depends upon a medium or channel. This process of distribution of information is called an Advertisement. The generalized definition of advertisement is the means of communication in which a product, brand, or service is promoted to a viewership in order to attract interest, engagement, and sales. So, in my, understanding concern about advertising is nothing but a transfer of justified information regarding a product or a brand to its targeted audiences through various media options. henceforth, advertisements are nothing but a combination of many visual elements such as "Pictography" and written language "Typography" that use for commercial purposes.

My modest attempt to investigate and explore the customers' temperament and perceptions towards the visual elements and the impact of visual elements on their impulse buying behaviors. The literature review revolves around the consumer's emotional and psychological perception of different visual elements and their role as a communication agent in the advertisement. The main observations and the focus key area of this research paper are understanding the perception of consumers' behavior in terms of recognition, curiosity, consistency, and adaptability of a particular product over visual elements incorporated in the design and packaging of the same product. This paper concluded with the statement that visual elements have the power to create the "Brand Identity" and it is directly associated with brand image. The study also concludes with a discussion of the main implications of the research and with the forwarding of suggestions for further research.

Keywords: Adaptability, Aesthetics, behaviour, Brand Identity, Curiosity, Pictography, Visual Elements.

1. Introduction:

Advertising is a commercial process or a strategy by which a brand or accompanies spreads information to sustain their brands or products. For carrying the message or information the advertisement process consisting numerous advertising components and out of them "Visual Elements" are a major role in impulse buying. Let's discuss what is visual elements and how it impacts consumers buying behaviors. The visual elements are those elements that identify by seeing visually and they directly deal with the overall beauty and aesthetics of a product. So, the major visual elements are Line, Shape, Form, Color, Texture, and Space. To visualize these visual elements and their incorporation in advertisement every advertisement company have a creative studio with a team of designer and artists.

Brand awareness is no doubt dependent on effective advertisement and for creating an effective advertisement the role of visual elements is play a significant role in making sense of novelty, innovation, and competitiveness in most of all segments whether it is commercial or personal business awareness'. The visual elements are basically design tools and design is directly proportionate to the packaging which directly propagates the beauty or the aesthetics of the products.

Numerous research proves that the incorporation of visual elements in advertisement plays a significant role in building a positive business identity or brand image of a particular product and also impacted financial performance in turn to turnover, and revenues. Visual is the right kind of tool that has the power to lead ahead in the competitiveness of a business, brand, or enterprise. Thus, it helps in communicating the message to the audience and spreading awareness through attractive and creative ideas. Henceforth a good brand identity is dependent on visual language. So, fora creative marketing campaign, it is necessary to make a first impression through its innovative visual elements so that it gets instantly noticeable.

Advertisements' prime focus is to catch viewers' attention and transform the massage to its targeted audience. Thus, the successful incorporation of visual language in the form of visual elements helps to notice the maximum audience reach. A well-balanced and harmonious distribution of visual elements may can be communicating the brand's message with consistency in the flow of the message and it reinforces its impact in consumers' minds. On the other hand, if the poorly executing visual elements such as signage, logos, website, brochure, and other marketing tools as a result company's brand image may be sacrificed and people may drive away.

Business analyst and scholar, Buss (2006) expresses that the integration of design with advertising, promotion, or any medium of marketing builds a stronger impact in consumers' minds. According to John Grace, a global branding consultant;"Industry is recognizing that design is strategy, and strategy is design – they're not separated"(Buss, 2006, p. 11). They state that design and aesthetics can add value and equity to a brand. The forms and shapes, the colors and materials, and the visual and auditory communications of an organization express its culture and values (Marcus, Schmitt, & Simonson, 1995). Wheller (2003) believes that design is essential to brand personality. She believes design in advertising should convey the brand's personality, align with the brand's positioning strategy, create a unique look and feel, be viable across all media, demonstrate an understanding of the target customer, and help differentiate a brand from the competition. In addition to differentiation, design can also be used to highlight a brand's unique attributes.

2. Visual Elements:

The prime concern of advertising is simply to successfully transfer the message to the target audiences to create brand awareness, although graphic artists give their creative input and artistic techniques to improvise the aesthetics of advertisement. That would be only possible by incorporating various visual elements into it. Because every visual elementis directly associated with emotions. It stimulated consumers to have respect for the product. Henceforth the visual elements are nothing but those elements that identify by seeing and it responsible for the overall beauty and aesthetics of a product. It has the power to create the "Brand Identity". Let's talk about the various design elements and their significance in advertisements. advertising is a form of artistic expression incorporating the seven visual elements of art.

2.1. Lenier composition:

Graphics are nothing but the enclosed path of lines and they could be expressed in many ways they can suggest express force, solidity, direction, and harmony. So, the line is the very essential part of the drawing and each line has its own expressions and meaning as the horizontal line represented passivity, while vertical lines suggest power and activity. Lines are directly associated with emotional affect. For example, in mechanical or industrial products thick and solid lines are used to reflect boldness but while showing beauty products or feminine products lines are soft and curved.

2.2.Creative Shapes:

The enclosed path of the line form shape, shape is basically a 2d form of representation of drawing without volume. It is an integral part of drawing and it can imply anything. Curved shapes imply feminine characteristics, while straight angles imply masculine or male characteristics features. As per the product requirement, shapes in the advertisement might provide momentum to create images and associations based on these fundamental notions. For eternity and virtue are represented by a circle, but a line, such as a road stretching to the horizon, represents freedom. Triangles, squares, and parallel lines all imply distinct ideas and emotions. Triangles direct the imagination upward, whereas squares frequently represent practicality and use.

2.3.Individualistic Forms:

Volume drawing is nothing but a form, like other visual elements form is also one of the major elements for visually appealing. It is directly associated with design and packaging and can confine a particular product's structure. So, they can easily transform a simple product into a dynamic one. By changing the innovative and creative form the company can make an individual style of brand identity.

2.4.Power of Color:

No doubt colors are the first visual elements that create an opening impression of a distinct object, product, or advertisement. So, color is a significant image builder, and each and every color is directly or directly associated with our emotions whether it relates to our cultural, psychological, or religious beliefs in the other hand it is simply part of our day-to-day life. Every color has its own language and expressions such as Red from the Indian perspective it represents intense love, youthfulness, power, and action at the same time Red is the color of blood so it also predicted danger. Blue is often calm or cool. It is also associated with a luxury color so most of the big brands of furniture and automobile companies used Blue as their brand identity. Green is emitted from nature so it is referred to as fertility, growth, hope, and organic. Orange and Yellow are suggesting speed and power. Henceforth, most automobile companies or energy companies used this color for their brand promotions.

2.5.Intensity of color:

The tone is nothing but the gradations of color so many companies are not executing the direct color they use the tints and shades of the same color for consistency and for brand promotions. Highly tinted or vibrant colors represent speed, youth, and virility. Henceforth, high-speed sports car commonly uses this color palate for their ads. Big fashion brands that design for youth have also used this type of intense color for their targeted audiences and in the other hand in festive ads focus on muted values to grasp the attention of all age groups.

2.6.Innovative Space distribution:

In composition space is one of the most comprehensive artistic visual elements. It is the composite comprehensive of all other elements in the advertisement. Space is the ground for the place for all other artistic visual elements to come together. As per the placement of elements space can be divided into positive space or active space and negative space or dead space. As par the distribution is concerned space is again bifurcated into two categories formal or classical space distribution theory and informal or modern space distribution theory. In between the positive and negative space, there is an empty space, that is not treated as an empty space but rather is a spatial distribution of objects in a defined environment that is called breathing space which is an essential part.

2.7.Power of Texture

The texture is basically two types visual and tactile texture. Visual textures are identified by seeing visually while tactile texture refers to the surface qualities of an object. It is very challenging to imitate the existing texture or create a new texture. The tactile texture is experienced through tactile sensation. Textures may be smooth or rough so according to product requirements it will be applicable suppose that the product deal with feminine then the texture should be smooth and for representation of masculine or male the texture is rough or tactile in nature.

2.8.Balance:

The balance that belongs to the principle of design in the absence of these particular elements one cannot find harmony thou harmony is otherwise justified by the overall balance in terms of Alignment of typefaces, Illustrations, color schemes, etc. The initial layout should be achieved by incorporating all elements in a plane and it is also accountable for the proper distribution of visual elements on a page in order to achieve a pleasing and clear layout. An important component of balance is learning how to group important information together in a logical way" (Graham, 2005, pp. 1112). Stemming from the use of photography and illustrations, layouts also can make use of a certain theme such as modern, fantasy, fun, etc. throughout the ad and campaign.

Newark (2002) believes that style limits choices by creating a related set of design decisions. For example, GAP advertisements usually feature model(s) in GAP clothing and the corporate logo. Its ads completely revolve around a simplistic style based solely on the use of photography and logo recognition. Design also can make a brand's personality come to life which is important because no purchase is devoid of emotion (Cooper & Press, 2003).

2.9.Direction:

The movement or direction of placing the things is another key element of the design principle that directly holds the reader's eye tracks through a page or pages. A page with good flow will visually lead the reader from one element to another element in the layout, carefully presenting the information to the reader" (Graham, 2001, p.131).

2.10. The flow of Rhythm:

A layout or an advertising diagram only can succeed when all the elements are on the ground well distributed and create rhythmic compositions. Then can only the eyes of spectators enjoy the layout and get emotionally attached to the design. So, understanding the rhythm is important for the flow of the massage incorporated in the advertisement.

2.11. Harmony:

It is not an external element or a visible component that is seen by viewing but it is an integral emotion of a viewer that emerges by seeing the output of work. So, if a work incorporated all visual

elements in a proper justified manner along with a good composition, then can only harmony erect. As a result, consumers go for impulse buying.

3. Visual literacy:

visual literacy in advertisement means analyzing or rationalizing both visual language in the form of incorporation of pictures and typefaces with context to how their meaning is conveyed. Synthesize the metalanguage of both elements. With refers to one of the most rational "Classical Rhetoric Theories" that can provide a framework for the visualizer to assess the visual literacy in the advertisement. According to the theories it would be majorly categories into three categories as

3.1.Ethos:

Ethos is a word from the Greek language that means "habit" or "custom." It can be traced back to the great Aristotle, who created the phrase in its current form. He devised the 'ingredients of persuasion,' sometimes known as 'appeals,' which comprised ethos with logos and pathos. In summary, it is a method of persuading your audience of the credibility of a character, and as such, it may be used to persuade readers not only of the author's credibility but also of his or her characters inside a novel.

So, ethos is the distinguishing character, sentiment, and moral beliefs of a person or a group, or an institution and it also is referred to as the perceived credibility of the author/creator/ product. Henceforth the execution of the advertisement is important because ethos can acquire the audience's trust and respect by demonstrating that one is credible and ethical; this creates an appeal to the audience and is known to be one of three different sorts of persuasion. In a modern meaning, ethos is used to instill norms and habits into any one group, such as a community or minority group, through guiding beliefs.

3.2.Logos:

Logos is the method of persuasion used in classical rhetoric that involves logical proof that is either actual or apparent. In the plural, logoi. Also known as logical support, rational appeal, and rhetorical argument. It is an appeal to the audience's sense of reason or logic to use logos, often known as the appeal to logic. Using facts and figures as well as making clear, logical connections between concepts, the author employs logos. Another tactic is to build a logical argument by using literal and historical analogies. There should be no logical fallacies, or ambiguous or incorrect assumptions or links between ideas, which are known as holes in the argument.

3.3.Pathos:

Pathos often known as the appeal to emotion, is a literary device used to persuade readers by deliberately arousing particular feelings in them to produce the desired emotional response. Authors choose their words carefully, employ meaningful terminology, and employ instances and narratives that arouse feelings. A variety of emotions, such as empathy, rage, irritation, or even humor, can be desired by authors. It is the quickest approach to grab your audience's attention is via pathos, which is Latin meaning emotion. People frequently react emotionally before their minds advise them to stop before their brains kick in. But be cautious. Because they are also looking for evidence to back up any emotional claims you may be making so they know they can trust you, your audience may feel emotionally manipulated or even angry if you employ too much pathos.

4. Conclusion:

21st century is otherwise known as the advertising world we are surrounded by numerous products and their overgrazing information. to overcome this destruction of advertising chaos the visual elements only enhance the aesthetical values of the advertisement but it so makes the advertisements more beautiful. So, visual language that is exarate from visual elements is directly associated with us, and the impact of these elements forces us to impulse buying in our day-to-day daily life. Thus, some may not be aware of the power of this visual language while doing daily work. For example, all of us not choosing clothes randomly rather we all know about our body color scheme and what color scheme is suit us. So, we chose clothes accordingly. Henceforth, during maximum shopping, we prefer to buy products from those who deliberate their product information through justify visual representation through their advertisement because the visuals are associated with our emotions. Thus, the visual element incorporated in design and packaging are not the sole condition to buy but it plays a significant role in making successful advertising.

This study helps to find out the co-relationship between emotional psychology based on visuals executed in advertising. So, this might be open-up a new perspective of future quantitative research that can use to understand the positive impacts or the power of visuals in advertisements. Visual elements can help consumers to persuasion art in advertisements and that can help to create a "Brand Image" across the globe.

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Multidisciplinary Education: Opportunities, Challenges and Future Prospect

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Abstract
Multidisciplinary approach in education is comprehensive methodology which integrates the knowledge and skills of multiple domains. It allows the learner to acquire multiple traits which in turn opens the wide range of professional opportunities for the learner. This approach facilitates an individual to design innovative ideas by integrating the acquired knowledge across disciplines and tends to develop a workforce of professional expertise which can effectively resolve the complex issues existing in the society. Furthermore, this approach successfully allows the sharing of knowledge, ideas research and innovations across disciplines ensuring the holistic development of an individual. The implementation and execution of multidisciplinary approach is accompanied with number of challenges, which need to be addressed effectively for developing a better learner centric environment. To obtain the effective and efficient results, we need to completely transform the structure of higher educational institutions. This approach will further widen the carrier perspective for an individual by developing and designing the acquired professional skills. The wide variety ofnovel and vocational courses will open the new doors of opportunities for learners. In this paper, the reported case studies of implemented multidisciplinary approach are discussed which, elaborates the critical analysis comprising the advantages, limitations and the opportunities associated with the effective implementation of this approach. The studies hows that there is crucial demand to restructure the educational institutions and introduce courses with more flexible curriculum delivering approach. The perfect structuring of courses can contribute to develop individuals having 21st century skills in the fields of arts, humanities, languages, sciences, social sciences, and professional, technical and vocational disciplines.
Keywords: Multidisciplinary, trans disciplinary, artificial intelligence, design thinking, innovative ideas.

Introduction

Multidisciplinary approach has gained significant attention in there centers, which has made the education system more pertinent and student oriented. Now students need not to stick themselves to any individual discipline, they have the free do to explore and select courses of their choice and can design their own curriculum by integrating various disciplines. It allows the student to study single topic from the perspective of different disciplines. There is a cross pollination of ideas from different areas for the better understanding of concepts. This flexible way of integration of various subjects helps in combining knowledge from multiple fields and provide at angible way of understanding the world.

The Indian literature is having examples where an individual acquires various skills with the help of this multidisciplinary educational approach. The literary work of Bana Bhatta's "Kadambari" reflects the integrated education as the combination of 64 kala as (arts), which include all the wide variety of 64 disciplines including singing, dancing, theatricals, cooking, playing etc. along with 14 vidyas including science, mathematics, and technology (NationalEducationalPolicy,2020). This approachisassociatedwithnumerousadvantagesandchallengeswhichcanbedealteffectivelyiftheteamfocuseseffectivelyonactiveparticipationcooperation among the faculty, students, mentors, evaluators, administrators, and advisory committees (Doerschuk etal., 2016).

The critical analysis of various case studies in this paper projects the effectiveness ofthis approach along with the associated challenges. The result of this study reflects that if we implement this multidisciplinary approach in the initial years of learning i.e., school stage then till the time the individual enters in higher educational courses the learner tends to develop the adaptability of learning in such a structured framework and acquires the respective traits in an effective way. The restructuring of higher education courses by adopting this integrated learning approach can indeed facilitate the learner in acquiring the respective skills and traits of his interest.

Benefits of multidisciplinary education

Access to numerous opportunities: One of the biggest benefits of multidisciplinary education is that student is not restricted to one specific stream or discipline. Students will be having access to multiple disciplines and further can avail the multiple job opportunities. They will not be confined to use their knowledge as per the defined stream, but they can widen their horizon of thinking and application by this multifaceted educational approach.

Design Thinking and problem solving: This educational approach inculcate the ability to apply self-teaching in the various situations and directs them to the limitless learning in the existing hyper competitive world. It enables to design multiple solutions to certain problem and helps in finding the effective solution by the critical analysis and testing of all the available solutions.

The above diagram shows the first two phases belong to the problem space and the last three to the solution space. The aim of this is to identify and generate multiple solutions to the specific needs and problems which are identified in the previous phase. These solutions are then prototyped and assessed to reach the final ideal solution fitting perfectly to that specific situation (Charosky et

al., 2018). This collaborative approach enhances the thinking abilities and tends to develop skills for ideating the solution of complex problem by using integrated knowledge approach and will direct to find effective solutions.

Develops Pragmatic approach: It allows the students to self-direct them by evaluating the risk and success factors associated with the available opportunities related to the discipline and hence help them in selecting the right profession with enhanced success rate. This further help them in visualising the realistic side of certain problem and they can apply their integrated knowledge approach to resolve the problem in an effective way.

Raising the bar of Education: In traditional education system students were forced to stick to some specific discipline and they confine their thinking capabilities accordingly. In this advance and flexible approach, the learner gets exposure to multiple skills through cross learning between disciplines. The learner has the freedom to choose discipline of his interest and can explore beyond traditionally drawn rigid boundaries. Such integrated educational approach tends to add some realistic value to the acquired knowledge and thus assist in raising the bar of education.

Discover and develop enthusiastic learning culture: Multidisciplinary education helps the enthusiastic learners to adopt subjects of their choice and develop a sense of self-motivation and creation where they can experiment and implement their innovative ideas. This approach facilitates the learner in acquiring different skills and traits by the cross pollination of ideas and Knowledge between different fields. The interaction with experts from different fields develop a learning culture which enables the learner to discover their interest and nurture their passion.

Unique subject combinations: Students earlier used to follow hierarchical structure of education keeping them stick to certain common subjects. This further restricts them to only certain specific carrier options and hence the student's interest and passion sometimes compromises on certain common choices. This limitation is very well compensated and overcome by this multidisciplinary education system. Here the student has completed free do to pick the subject combination of his choice and can adopt the unique subject combinations, which further opens the new doors to various carriers and opportunities.

Connecting brightest minds together: This holistic and multidisciplinary education aims to develop a connection among different streams and the intellects by connecting people automatically through sharing and application of their relevant ideas and concepts to a wide spread problem. Such education's sustainability is for the longer time and will provide wider vocational perspective to an individual.

Acquiring skills in multiple fields: For effective learning, the higher-level institutions should be innovative and flexible in their approach. Students should have the freedom to design their own curriculum by selecting the subjects across curriculum boundaries. This comprehensive curriculum not only tends to emphasize the availability of wide variety of curriculum choices available across disciplines, but also tends to bring proficiencies in the learner by specializing him/her in multiple skills. They acquireskillsassociatedwithdifferentdisciplinesandeventheemployers get attracted to graduate students having competencies associated with multiple fields (Shukla, 2019).

Flexibility in designing Curriculum: The students will be having complete flexibility to choose the subjects of their interest and pursue different courses from various disciplines as per their strengths and weaknesses. Novel and engaging vocational courses will be offered to the students

along with rigorous specialization of subject/ subjects (National Educational Policy 2020). This integrated curriculum approach expands thinking horizon of the students and they tends to understand and acknowledge the involved curriculum integration and its relevancy in a better way (Wickleinand Schell, 1995).

Developing different capacities of human being: Multidisciplinary education aims to develop intellectual, aesthetic, social, emotional, physical, intellectual, creative, innovative capabilities of an individual.

Subject Integrationat school level: Science, Technology, Engineering And Mathematics (STEM) learning helps students to think structurally and incorporate information using different subjects. Students will be competing in the global sector for jobs, so they must possess enough knowledge as per the growing IT industry (Halilia and Sulaimanb, 2021). Integration of science, technology, engineering, and mathematics at school level helps in developing individuals who will be capable to face the challenges of 21st century. It will enhance the critical thinking and problem-solving approach of students and will also make them learn to work in collaboration as a team, inculcating caring and sharing capabilities along with moral and life skills.

Comprehensive learning experience: Multidisciplinary approach in education helps in maintaining a healthy and knowledge-oriented classroom environment. Students in classroom are engaged in solving problems by utilising knowledge acquired from different disciplines (Adeyemi, 2010). Such collaboration of skills, knowledge and understanding helps in better learning experience and outcomes.

Knowledge Transfer by Cross Disciplinary Research: Many times, one mode of discipline is not so useful to understand the complex topic effectively and will not encourage information transfer effectively to each other. The Cross Disciplinary Research makes the effective use of time and fundings along with helping to visualise a topic from different perspectives and encourages knowledge transfer by sharing of innovative ideas across disciplines (Curran et al, 2007).

Challenges in multidisciplinary education

Restructuring the higher education: There are three major changing forces which are impacting the higher education environment. These forces are 1) fiscal and budgetary constraints; 2) the growth of information technology; and 3) market forces with the resulting increased competition for students. As per the NEP 2020 the Higher education institution will be restructured in view of the multidisciplinary education in which the universities will be offering cross disciplinary choice of courses and subjects. The higher education institutions will be redesigning to vibrant multidisciplinary institutes offering the credit courses as per the choice and demand of the students and the prevailing carriers. This will be going to be the big challenge in front of the existing educational institutions.

21st century skills related challenges: As per the literature review report conducted on 21stcentury skills the three major identified challenges are: the curriculum integration of 21stcentury skills, the need for professional development, and the involvement of stake holders from various sectors (public, private, and educational) as a key factor for implementation. Along with this, the complicated and cross curricular nature of 21st century skills are critical to make sure the effective implementation of these skills (Voogt and Roblin, 2010).

Cross Disciplinary Skill Implementation: Technology has driven the world and is taking overall the disciplines. In such a changing world the need of the hour is to prepare a workforce of professionals which can meet all the challenges by implementation of multidisciplinary approaches. The major challenge which rises in this context is the effective understanding and application of skills in another discipline to resolve certain problem. The requirement for the multidisciplinary approach is to understand the application of skills of one discipline to resolve the problems of another discipline. These professionals need to be trained in such a way that they effectively use their training and skills across disciplines to find solution of critical problems. The trained professionals must be capable of understanding the ways in which the two disciplines interact and create new knowledge (Roberts, 2011).

Designing structured courses across disciplines: The Dumus Academy methodology offers one year master's courses which encourages the students to solve complex design problems with the help of versatile world class faculty and students also get opportunity to work with big brands and companies. This type of structured courses tends to create multidisciplinary teams which tend to use the skills of every student in resolving the complex problems (Chiodo et al2018). The challenges in this respect include the designing of courses which creates versatile teams with a workforce of professional's expertise across disciplines and should be capable enough in utilising multidisciplinary skills effectively to resolve complex problems. The biggest challenge is to develop such sustainable projects in which information and Communications Technology (ICT) can be viewed as a toolas a solution for building the knowledge-based societies. In such developed societies the stakeholders can leverage knowledge from collaboration of multiple disciplines for the development of ICT (Parmar, 2009).

*Multidisciplinary approach Challenges in Pharmacy Education:*As per the analogy if wetry to put adult cat and adult mouse together, they will always fight with each other for protecting their respective area. Where as if we put kitten and pups together and nurture them under same conditions, then they will learn to share space and will respect each other's territory. Similarly, if we try to place grown up pharm aceutical professional together, they will not share the space between each other and will result in interpersonal conflicts inhibiting the growth and development. This can be resolved if we tend to put pharmacy student, nursing student and medical student at the early age, they will together constitute a formidable team growing altogether and will respect teach other's interest and are as resulting to contribute as an effective health care team (Yanchick, 2004).

Problems associated with multi disciplinary University-College team partnership: A university was selected to work on university – college partnership for over 18^{th} months and it was noticed that elements involving team growth and team development need the trust and respect which is a time-consuming process. At every step of growth of the team the role of leader transforms from managerial to facilitator addressing the crucial issues at the time of crises. Bridging of the organizational structure by setting its own culture, norms and operating systems and monitoring mechanism is a time – consuming process (Ameyetal.,2002).

Somecase studies

Addressing behavioural issues at school level: A case study conducted at preschool in Chicago mentioned the use of multidisciplinary approach to the study of learning problems of young children. Here multidisciplinary approach to address the behavioural issue was found to be

beneficial for the child, where his interest and emotional challenges can be known by collaborative efforts of an educator, the psychologist, and the psychiatrist who share a common interest in child. Such type of co- operation in the school education system is available in teacher training, curriculum–planning, curriculum implementation, and evaluation (Brottman, 1968).

Effectiveness of cross disciplinary approach: A case study was conducted on group of 23students (15 boys and 8 girls) by teaching them using multiple disciplines like Science &Technology, English, Drawing and Music. This study helped in understanding that interdisciplinary approach positively affects the students' learning ability. It results in the better understanding and improves the learning abilities (Deneme and Ada, 2012).

Developing professional competences: The case study conducted on the graduate students of the State of Oaxaca and the south-southeast Mexican region reflected that integration of disciplines helped the curriculum designers to design such curriculum which is flexible and tends to provide professional competences (Margarita and Argelia, 2016).

*Teaching students about community food security (CFS**):*** Multidisciplinary approach was used to family arise the students with issues related to community food security focussing on sustainable practices used by community residents to obtain safe nutritional diets. Use of multidisciplinary approach to CFS helped in exposing the students to the challenges and complexities surrounding CFS (Ash and Bradley, 2011).

Transitioning to STEM careers: The use of Stair step Research Programme helped in closing the gaps in higher education in Texas and succeeded in increasing the participation in STEM. Stairstep was designed to help the small teams of undergraduates to participate in research and various transitioning activities under the mentorship of the faculty belonging totheirrespectivediscipline.Itwasobservedthattheundergraduateparticipantsofthisprogrammeacquiredtheskillsand knowledge that helped them to transition to STEM careers or advance study. This further helped in attracting other students to STEM and helped in developing skills of these students (Doerschuk etal, 2016).

Assistance in knowledge management: The study at National University of Taiwan suggested the significance of multidisciplinary approach in curriculum development for knowledge development program. They used the Knowledge development programs which were designed as the knowledge development curriculum by collaborating Department of Library and Information Science, Business Administration, Information Management and Computer Science and Information Engineering. This helped in educating and training the knowledge Professionals and impart the desired competencies required for their professional growth and development (Chaudhary and Mann, 2003).

Use of Balanced Scorecard Approach: Results of a study conducted at Turkey University of Applied Sciences shows that the Balanced Scorecard Approach is a tool developed to implement the strategic plans and consistently help in defining the objective so for ganisational change. For articulating the purpose of the change, the balanced mix of all the organizational objectives should be placed. The results further reflected that the multidisciplinary faculties can be effective enough increating innovative research and development and help sin promoting multidisciplinary projects and research (Hautalaetal, 2008).

Delivering Interdisciplinary knowledge: Texas A&M University-Kingsville Citrus Centre developed a new course: Phytochemicals in Fruits and Vegetables for improving Human Health. This course combined the subject expertise from different disciplines like chemistry, plant physiology, horticulture, plant breeding, food science, plant pathology, biochemistry, post harvest physiology, and the medical sciences in the discussion of phytochemicals. This course helped in delivering interdisciplinary knowledge regarding the effect of fruits and vegetables on human health and established an effective understanding of the relationships between research findings and the practical use of phyto chemicals across discipline (Dooleyetal, 2000).

Future prospect of multidisciplinary education

The year 2020 had a turbulent effect on the whole education system. All the educational institutions adapted to the pandemic challenge by moving from realistic classroom to the virtual mode teaching and learning. Teachers adapted themselves to the e-learning resources and transformed all the pedagogies accordingly. ICT has assisted a lot by facilitating teachers and learners to in the virtual mode of teaching and learning. Government has taken numerous initiatives by starting various trainings and programmes to assist in this respect. Few of the online e-learning resources are-Swayam, Diksha, e-Pathshala, Olabs, CBSE Shiksha Vani (podcast), PRAGYATA, Swayam Prabha etc. This has enabled all the learners, even the one residing in remote areas to have access to all the learning resources without coming out of their home.

Indian Institute of Technology (IIT) Bombay has contributed for designing virtual content on the platform PhETcolorado, which has various simulations related to the different subjects. The STEM initiative started by IIT Gandhinagar for training teachers and learners the important concepts in an easy and playful way has accelerated this virtuale-learning. This not only fueled the ICT but also helped in attaining the learning objectives without keeping health at risk. NPTEL is another initiative started by the collaboration of various IIT institutions, which provides open online courses around engineering and core science subjects. These all e-learning platforms have given paceto the learning process even in the absence of real campus teaching and learning. These ICT resources of e-learning proved to be an asset for the learner where he/she got the opportunity to enroll during his/her choice. NEP2020 has brought loton wonderful initiatives out of which the significant emphasis was laid on multidisciplinary education. The NEP 2020 undoubted lyis designed to cater the diverse needs and interest of the 21st century learner. The only need is the structured educational institutions who effectively implement this education policy by delivering education, catering the proficiencies of each learner with flexible curriculum and pedagogies.

We know that coming tomorrow will be going to be the world of artificial intelligence (AI) and we need to prepare the coming generations as per the growing technology. At the same time this has put forward again a big challenge also i.e., the holistic development of the learner. Virtual learning resources can only enhance intellectual abilities of the learner where as it cannot contribute toward sholistic development. So, we need to develop a balanced education system where the learner should be given equal exposure to virtual and realistic classroom learning as per the interest and need to prepare competent professionals for the upcoming multi faceted global challenges.

Conclusion

The multidisciplinary approach is an innovative tool to amalgamate the intellectually driven ideas from multiple disciplines and provides a broad platform of opportunities for the learner. It is

completely learner centric approach in which the learner gets exposure to multiple skills and acquire multi pletra its under the guidance of experts from multiple disciplines. The analysis of various case studies discussed above reflects the need to restructure the Higher Education Institutions into more flexible curriculum-oriented approach institutions which offer unique subject combination courses that tends to create an experienced workforce of multiple skilled professionals contributing to accelerate the process of growth and development. The perfect structuring of courses and multidisciplinary teams across disciplines can contribute to develop individual shaving 21st century skills in disciplines across arts, humanities, languages, sciences, social sciences, and professional, technical, and vocational disciplines. The wide variety of nove land vocational courses will open the new doors of opportunities for the learner.

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