VIDYASAGAR TEACHERS' TRAINING COLLEGE
MIDNAPORE, PASCHIM MEDINIPUR,
WEST BENGAL, INDIA

NEW TRENDS OF TEACHING, LEARNING AND TECHNOLOGY

VOLUME - 1

EDITOR-IN -CHIEF

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SRI. PRABIR MAITY

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NEW TRENDS OF TEACHING, LEARNING AND TECHNOLOGY | VOLUME 1

by: Dr. Monoranjan Bhowmik, Dr. Jayashri Roy, Dr. Kishwar Badakhshan, Dr. Ranita Banerjee, Dr. Sutapa Biswas, Dr. Rudreswar Mishra, Sri. Prabir Maity

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NEW TRENDS OF TEACHING, LEARNING AND TECHNOLOGY, VOLUME 1

PREFACE

The educational model based on the teacher, where students usually remain passive, has its origin in the industrial society where it was necessary to train in new skills and knowledge quickly, massively and effectively. However, the increase in the use of the Internet has allowed access to new technologies, products, and services instantaneously and in many cases for free in the modern age influenced by technological advancements, the integration of digital technologies in educational settings has become more prevalent than ever. Digital technology has ushered in a transformative era in education, providing new avenues for interactive learning and collaboration. From online platforms to interactive whiteboards, the possibilities are vast. However, the mere incorporation of these tools does not guarantee effective learning outcomes. Critical analysis of the implementation of digital technologies is essential to exploit their full potential and address the challenges that may arise. Beyond the initial excitement surrounding technology integration, it is imperative to continually evaluate its impact on pedagogy, infrastructure, teacher training, privacy, and learning outcomes. Only through thoughtful and ongoing analysis can educational institutions harness the true potential of digital technologies and ensure that they act as catalysts for improved, inclusive and effective learning environments. Thanks to the work of scientific dissemination media, such as this book, New Trends of Teaching, Learning And Technology, these experiences are being transferred and implanted all over the world, contributing to a change in the educational model to definitively abandon the classical training centered on the teaching staff. On the other hand, the change of the role of the students, in their vision and behavior, requires the change of the educational model, as well as the role of the teaching staff. Also, the book presents experiences and methods of carrying out adaptive teaching and learning, which are essential when students participate actively in their learning process. The experiences that are presented are applicable in the classroom easily and quickly, without the need for specialized, expensive and sophisticated technologies. Concerning the target audience, this book is designed for all those people, preferably teachers and future teachers, who want to know models, technologies, application experiences and results obtained with the application of Flip Teaching and methods. Adaptive Learning and how its interaction affects the educational model. Likewise, it allows knowing the latest

research in these fields, for all scholars who investigate methods to increase the student's active participation and personalization of learning.

Editors

Date: 14th August, 2024

Dr. Monoranjan Bhowmik
Dr. Jayashri Roy
Dr. Kishwar Badakhshan
Dr. Ranita Banerjee
Dr. Sutapa Biswas
Dr. Rudreswar Mishra
Sri Prabir Maity

MESSAGE FROM PRINCIPAL

Dear Readers,

It is with great pleasure and enthusiasm that I introduce this remarkable international book on "New Trends in Education, Teaching, Learning, and Technology." In an era defined by rapid technological advancements and an ever-evolving educational landscape, this compilation serves as a beacon of knowledge and inspiration for educators, students, and policymakers alike.

Education is the cornerstone of progress, and as we navigate through the complexities of the 21st century, it is imperative that we continually adapt and innovate our teaching methodologies. The integration of cutting-edge technologies in the classroom has transformed the way we approach education, making learning more accessible, engaging, and personalized. This book encapsulates a diverse array of perspectives and insights from thought leaders and practitioners who are at the forefront of this educational revolution.

The chapters within these pages explore a multitude of innovative practices, from the use of artificial intelligence and virtual reality in teaching to the implementation of inclusive pedagogies that cater to diverse learning needs. These new trends not only enhance the learning experience but also prepare our students to thrive in a globalized and digital world.

Moreover, this book underscores the importance of fostering a growth mindset among both educators and learners. As we embrace new technologies and pedagogical strategies, it is crucial that we remain open to continuous learning and improvement. The insights shared herein will undoubtedly inspire educators to rethink traditional approaches and adopt more dynamic and effective teaching methods.

I extend my heartfelt gratitude to all the contributors who have shared their invaluable expertise and experiences. I would like to appreciate their dedication to advance education is truly commendable and serves as a testament to the transformative power of collaboration and innovation.

As you delve into this book, I encourage you to reflect on how these emerging trends can be integrated into your own educational practices. Let us all commit to nurturing a culture of innovation and excellence in education, ensuring that we equip our students with the skills and knowledge they need to succeed in the future.

Thank you for being a part of this exciting journey towards the future of education.

Warm regards,

Dr. Monoranjan Bhowmik
Principal
Vidyasagar Teachers' Training College

MESSAGE FROM IQAC CO-ORDINATOR

I am excited to introduce this book on the new trends in education, teaching, learning, and technology. In today's rapidly evolving landscape, it is crucial that we embrace the transformative power of technology to enhance the educational experience for both students and educators.

The integration of technology in the classroom has the potential to revolutionize the way we approach learning. From interactive whiteboards and online learning platforms to virtual reality simulations and AI-powered adaptive learning systems, the tools at our disposal are constantly expanding. By leveraging these advancements, we can create more engaging, personalized, and effective learning environments that cater to the diverse needs of our students.

Moreover, technology has the ability to streamline administrative tasks, improve data-driven decision making, and foster greater collaboration among educators. This, in turn, allows teachers to dedicate more time and energy to the core aspects of their profession - nurturing the intellectual and personal growth of their students.

As we go through the chapters of this book, I am confident that you will gain valuable insights into the latest trends and best practices in educational technology. By understanding the role of technology in shaping the future of education, we can collectively work towards creating a more inclusive, innovative, and transformative learning landscape.

I encourage you to approach this book with an open mind and a willingness to embrace the exciting possibilities that lie ahead. Together, we can navigate the ever-evolving world of education and ensure that our students are equipped with the skills and knowledge they need to thrive in the 21st century.

Best wishes

Dr Kishwar Badakhshan
Asst Prof and IQAC Co-ordinator
Vidyasagar Teachers' Training College

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We are thankful to all the members in the Editorial Board who have contributed their thoughts and criticisms in this book.

We are thankful to all the authors who have contributed their valuable ideas in completing this book.

We are thankful to the Principal of VTT College for his vision and endless motivation provided to the editorial board, which enabled us to complete this book.

We are thankful to all the faculties of Vidyasagar Teachers' Training College and the IQAC coordinator who have been with us in our journey. Thanks to the publisher, who has published this book in a very short time.

Editors

Date: 14th August, 2024

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CONTENTS

CHAPTER : 1

SECONDARY SCHOOL EDUCATION IN BANGLADESH: EXPLORING EMERGING TRENDS IN TEACHING, LEARNING AND TECHNOLOGY

Md. Aminul Islam [1]

Abstract

The landscape of education is continually evolving, driven by advancements in technology, shifts in pedagogical approaches, and changing societal needs. This study explores the emerging trends shaping the realms of education, teaching, learning, and technology. In recent years, a notable trend involves the integration of technology into various facets of secondary education. From Face-to-face to virtual reality experiences to adaptive learning platforms, technology is revolutionizing traditional teaching methodologies, providing educators with dynamic tools to engage and empower learners. Additionally, the COVID-19 pandemic accelerated the adoption of remote learning, highlighting the significance of digital literacy and equitable access to technology in education. Moreover, the emphasis on personalized learning experiences has gained momentum, with educators leveraging data analytics and artificial intelligence to tailor instruction to individual student needs.

Classrooms, where traditional lecture content is delivered online, allow for more interactive in-person sessions focused on application and discussion. Inclusiveness and diversity have become central themes in educational discourse. By connecting disparate fields of knowledge, interdisciplinary education prepares students for the complex challenges of the 21st century, encouraging innovation and creativity. In conclusion, the evolving landscape of education is characterized by a convergence of technology, pedagogy, and societal trends, driving innovation and transformation in teaching and learning practices.

[1] Research Assistant, Right to Peace, Dhaka, Bangladesh.

Keywords: *Education, Secondary School, 21st century, Teaching, Learning and Technology*

Introduction

In an era defined by rapid technological advancement and evolving educational paradigms, the landscape of teaching, learning, and technology is continuously undergoing transformative shifts. This paper explores the emerging trends shaping the realms of education, teaching, learning, and technology. In recent years, a notable trend involves the integration of technology into various facets of secondary education. This paper also focusses on this integration of technology in secondary education. As we navigate the complexities of the 21st century, emerging trends are shaping the realms of education in profound ways, ushering in new methodologies, tools, and perspectives. I have tried to explore the way of transition in secondary education system in recent years. From the integration of artificial intelligence and machine learning to personalized learning experiences, and from the proliferation of online education platforms to the exploration of immersive technologies like virtual and augmented reality, the educational landscape is witnessing a revolution. Moreover, the ongoing dialogue surrounding inclusivity, accessibility, and equity is reshaping educational policies and practices globally. The research framework led us methodologically to design a sequential exploratory mixed method according to research objectives to explore the emerging trends shaping the realms of education, teaching, learning, and technology in secondary education system in Bangladesh. This dynamic intersection of education, teaching, learning, and technology promises to redefine traditional notions of education, offering unparalleled opportunities for innovation, collaboration, and lifelong learning. In this discourse, we delve into the key trends driving this transformation and explore their implications for the future of education.

Operational definition

Education has long been understood as contributing to the development of human potential as well a social growth (Dewey 1899). Articles 15(a) and 17 of the constitution of Peoples Republic of Bangladesh have unwaveringly emphasized to ensure education for all. To improve the standards of education, education management, and formation of education policies at secondary, higher secondary, technical and vocational and at tertiary levels, the Ministry of Education (MoE 2011) has the sole responsibilities.

Literature review

Farhana et. Al. (2020) in their paper Secondary Education During Lockdown Situation Due to Covid-19 Pandemic in Bangladesh: Teachers' Response on Online Classes explore the current scenario as well as the challenges of adaptation of online classes in secondary education in terms of teachers' experiences. The study followed sequential exploratory mixed-method approach. Five secondary school teachers were interviewed and 54 secondary teachers from 17 districts in Bangladesh were surveyed over telephone, Google forms and by email. The findings revealed that a good number of teachers have started teaching online by using social media platforms despite of not having any training or experience. Teachers are facing numerous challenges like deficit of digital equipment, lack of expertise, unfamiliarity with the LMS, proficiency in assessment technique etc. They concludes with few recommendations such as providing proper devices to the teachers and students to participate in online class; facilitate rigorous training to enhance technology-based skills and capacities of the teachers so as to get the expected outcome.

Rahman et. al. (2010) in their paper introduce the secondary level education as a part of basic education. This article analyses the development of secondary education in Bangladesh in different period of time, socio-political context. Therefore, a general overview of secondary education is provided, followed by the historical evolution of secondary education in the British and Pakistani rule over Bangladesh. They are also explaining the new education policy for Bangladesh which has been tabled in September 2009 after restoration of democratic process.

Rahman (2010) in her paper Impact of Technology Integration on Secondary Level Education in Bangladesh: A study in Dhaka City focusses to examine the effects of incorporating technology into secondary education in Bangladesh. Also, to assess the level of technological integration in secondary schools, together with the perceived advantages and obstacles associated with its implementation. The present study employs a mixed method approach. Qualitative data was collected through focus group discussions with instructors in order to gain insights into their experiences, opinions, and attitudes towards the integration of technology. The research encompassed a cohort of seven (7) educators at the secondary school level, as well as a group of forty (40) students from three educational institutions within the Dhaka

City. The results indicated that the integration of technology had a positive impact on student engagement, academic achievement, and instructor efficacy. Rahman et. Al. (2018) in their paper explain the operational definition of secondary school education in Bangladesh. The main objective of the present paper is to analyze the major issues and challenges that thwart the success of secondary education in Bangladesh. Their study follows content analysis method of secondary research approach. In their research they find Bangladesh has three phases of education systems: (i) General Education (ii) Madrasa Education and (iii) Technical and Vocational Education. Among them, the first two are alienated into primary, secondary, and tertiary levels. Secondary education in Bangladesh is embedded with three phases: junior secondary (grades VI-VIII), secondary (grades IX and X), and higher secondary (grades XI and XII). Ashikur and Bayezid also focus on the challenges of secondary education system in Bangladesh.

Education System in Bangladesh

Bangladesh has three phases of education systems: (i) General Education (ii) Madrasa Education and (iii) Technical and Vocational Education. Among them, the first two are alienated into primary, secondary, and tertiary levels. Secondary education in Bangladesh is embedded with three phases: junior secondary (grades VI-VIII), secondary (grades IX and X), and higher secondary (grades XIand XII). Madrasha education offers the same level of education. Dakhil and Alim respectively offer the same education that is equivalent to secondary and higher secondary level of general education system recognized by the government of Bangladesh. As Rahman (2017), the technical and vocational educations are also available at the secondary and higher secondary levels in vocational and trade school and also in business management institutions. Most of the technical and vocational educational institutions are privately managed. Students appear at the Secondary School Certificate (SSC) examination at the end of grade 10, and the Higher Secondary Certificate (HSC) examination at the end of grade 12. Secondary education (Grade 9) in both general and madrasah have introduced different courses and curricula at an initial phase. Management Body of Secondary Education. The Ministry of Education is the supreme organizing and managing body of Bangladesh education system. This is regarded as to be the core authority in drafting, making and finalizing education policies. It is also responsible for planning, directing, controlling and managing the administration of secondary, higher secondary and technical education

in Bangladesh. The implementing bodies are, however, different for secondary education, higher education, and technical education. Secondary education management (General)Secondary education is managed and administered by the Ministry of Education (MoE) which is concerned with policy formulation, planning, monitoring, evaluation, and execution of plans and programs. Technical and madrasa education is also governed by MoE. MoE works in association with the attached directorate and boards. There are nine Boards of Intermediate and Secondary Education for supervising SSC level public examinations and reorganizations of private sector educational institutes.

Secondary education management (Madrasha)

Madrasah education is one of the most important sub-sectors of the education in Bangladesh. Aliya and Qamari the two types of madrasah education. Where Aliya madrashas are under government supervision and recently Qawmi madrashas has given the recognition for bringing them under mainstream education. This sub-sector is substantially large, creating over 3.78 million students including primary or Ebtedayee education. Ebtedayee education which offering primary madrasha education was 7,279 in 2000, this number has risen to 9,319 in 2015. Post-primary madrasha offer Dakhil, Alim, Fazil and Kamil, which are equivalent to secondary, higher secondary, degree level and master's education in the general stream. Of the 221 Kamil madrasha, only 3 are owned and governed by the state. Among the 9,319 madrasas in Bangladesh, 9,316 are privately managed. In 6,565 Dakhil madrasha accommodating a total of 1,293,194 students of which more than 59 percent are girls. The average number of students per institution is 197. The total number of teachers employed is 66,801 and the average number of teachers per institution is 10, resulting in a teacher-student ratio of 1:19 *as* cited in বাংলাদেশ শিক্ষাতথ্য ও পরিসংখ্যান ব্যুরো (ব্যানবেইস) (2024) (Rahaman, 2017).

Secondary education management (Technical and Vocational)

Bangladesh Technical Education Board (BTEB) holds the jurisdiction of organizing, supervising, regulating, controlling, developing and executing the technical and vocational education in Bangladesh. BTEB administers the examinations and awards the certificates and diplomas. In secondary level vocational education, one- or two-year’s long certificate programs are offered from grade nine. The minimum requirement for admission in these programs is to have SSC. Diploma

programs are provided by the polytechnics and technical schools and colleges.

Historical Development of Secondary Education in Bangladesh

Economic disparity, extraction of wealth and socio-political repression made East Pakistan very discontented. Starting from the language movement in the year 1952 to establish Bangla as a national language, the people of East Pakistan had struggled hard for democracy and autonomy, which turned into a war of liberation in 1971. After a protracted nine-month long war, Bangladesh finally achieved her independence. Bangladesh inherited, on Liberation in 1971, a literacy rate of 17.61 per cent of the population of all ages (GoB, 2004a). The first Education Commission in Bangladesh appointed under Dr. Qudrat-e-Khuda submitted the report in 1974. The report emphasized on secular education at all levels, future work-relevant technical and vocational education, improved assessment system, letter grading in the assessment of student performance in all stages of education and making primary education from grade 1 to 8 and secondary from grade 9 to 12 (GoB, 1974). The report firmly asserted that women's education should be such as to be of help to them in their domestic life, and stressed that subjects such as child-care, the nursing of the sick, preservation of health, food and nutrition must be included. It also suggested that girls should be channeled into 'vocations especially suitable to them', such as primary-school teaching, nursing and typing (Jalaluddin & Chowdhury, 1997). Vol. 3, No. 1 International Education Studies 120 An Advisory Committee was appointed in 1978 to have a fresh look at the issues and problems of education (Shahadat, 1999) which submitted an 'Interim Education Policy 1979' report on 8th February 1979. The interim education policy document consisting of the recommendations of the National Education Advisory Council, headed by the State Ministry of Education, was hastily formulated as a new blueprint for the education sector. The interim policy document put emphasis on increased literacy so that people could take part in the development of the country. The document established the current educational framework with secondary education consisting of three sub-stages; namely, junior secondary (3 years), secondary (2 years), and higher secondary (2 years).

The office of the Director of Public Instruction (DPI) was upgraded as the Directorate of Secondary and Higher Education (DSHE) in 1981. In 1983 the government formed a cadre named BCS (General Education)

and the government college teachers, public secondary school headmasters, district education officers came under the cadre service. Under the rule of Lt. Gen. Hossain Muhammed Ershad (1982–90), in 1983, the ‘Enam committee’ for The office of the Director of Public Instruction (DPI) was upgraded as the Directorate of Secondary and Higher Education (DSHE) in 1981. In 1983 the government formed a cadre named BCS (General Education) and the government college teachers, public secondary school headmasters, district education officers came under the cadre service. Under the rule of Lt. Gen. Hossain Muhammed Ershad (1982–90), in 1983, the ‘Enam committee’ for administrative reconstruction made 14 subject-based teacher-posts in each government public school. But in the amended recruitment rules for teachers in 1989, all the posts were made ‘Asst. Teacher’. Two military regimes i.e. Maj. Gen. Ziaur Rahman (1975-1981) and Lt. Gen.

H.M. Ershad (1982-1990) changed Bangladeshi identity politics from a secular and ethnic “Bengali” identity to State-based and pseudo-Islamic 'Bangladeshi’ identity to build political legitimacy and take Bangladesh out of Indian shadow. Education was used as a vehicle for promoting ‘Bangladeshi’ nationalism. The two regimes made constitutional changes to erase secularism by 'absolute trust and faith in Allah’ and Islam as the ‘State religion’ in 1979 and 1988 respectively. Therefore, during General Ershard’s rule and afterwards there has been unplanned mushrooming of Madrasahs/religious schools in Bangladesh. Religious education was used as a tool for attracting votes of religious people and to beat the secular opposition in electoral politics. The Ershad regime made Islamic studies compulsory up to the secondary level amid strong opposition from secular and left leaning parties (Gustavsson, 1991). The regime patronized Madrasah education from primary to higher secondary level with government recognition. Furthermore, I like different political governments. Furthermore, like different political governments after liberation in 1971, ‘Ershard Government’ took the responsibility of secondary education by nationalizing a good number of schools throughout the country. Bangladesh was under military-led quasi democracy throughout 1975-1990. During the 1980s, the reports of ‘Mazid Khan Commission 1983’ and ‘Mofiz Commission 1988’ on education were not widely disseminated and like many other reports of the past, were not formally adopted for implementation (Sahadath, 1999; GoB, 1988). At the end of 1990s, ‘Shamsul Haque Education Commission 1997’ was formed. Correspondingly, in 2001 and 2003 two other commissions ‘Abdul Bari commission 2001’

and Moniruzzaman Miah Education Commission 2003' were formed. The later submitted its report in 2004 and advocated for a single-track secondary education system, wider access to education in rural areas, narrowing down teacher-student ratio, upgrading teacher qualifications, reforming the curricular and teaching methods, and improving the assessment and examination systems at secondary level (GoB, 2004b). Even though there have been seven education commissions formed till date, but Bangladesh has not been able to have a realistic education policy 53 years after its independence. The present Awami League (AL) government, having a decisive victory in the national elections, is designing another new national education policy. The government formed a sixteen-member committee to update the National Education Policy 2000 which was headed by National Professor Kabir Chowdhury (The Daily Prothom Alo, 2009). The proposed new education policy is formulated in the light of the 'Qudrat-e-Khuda Commission' report of 1974 and 'Shamsul Huq Education Commission Report' of 1997.

This is indeed timely, especially in a globalizing world in which other countries, such as China, India have pushed themselves into the 21st century by vigorously engaging in knowledge revolution and human resource development. The final draft of the National Education Policy 2009 was formally submitted to the Prime Minister on 7 September,2009. The salient features of the recommendations of the committee include revising the stages of under-graduate education from three to two, the mandatory inclusion of certain compulsory subjects under all streams of education, making education more need-based and formation of a permanent education commission (The Financial Express, 2009).

The Policy paper recommends extending compulsory primary schooling to eight years. Final primary level exams will be held at the end of Class 8 and secondary school scholarships will be awarded based on the results. The new policy also recommends that secondary level studies will extend over four academic years, Classes 9-12, and the government scholarship exams will be taken at the end of Class 10, instead of SSC exams. Final secondary level exams will be held at the end of Class 12. Some fundamental subjects including Bangla, moral education, Bangladesh studies, mathematics, natural environment, social studies, IT and science will be made compulsory in different streams of primary and secondary level curriculum. The policy also calls for some form of technical and vocational education to be introduced at all secondary level institutions. Accordingly, madrasah

education will be restructured by including information technology and vocational training among compulsory subjects. It has also recommended the formation of a non-government teachers' commission. Such broad proposals are to be welcomed, especially the one requiring all students to be taught certain compulsory subjects such as science and mathematics at the primary and secondary levels (The Financial Express, 2009).

Integrations of technology in secondary school education in recent years

Bangladesh, as a developing country has brought a substantial change in not only socio-economic sectors but also education sector during last decade. The desire of being a middle-income country has driven Bangladesh to come up with a modern education policy which will help them to produce the skilled workforce. integration in education was the most significant step of this latest education policy, and Government of Bangladesh has stepped up to make a smart and digital Bangladesh with technology based education It was found from the survey that many of the respondents believed that technology integration has improved the understanding of their subject matter and provided a wider range of information related to their study. Many teachers recognize the potential benefits of technology integration, they face several challenges in effectively using technology in their teaching practices. limited access to technology devices and reliable internet connectivity, inadequate technical support and training opportunities, resistance to change among students and colleagues, and concerns about affordability and the digital divide were identified as significant barriers. We are currently living in an era characterized by the prevalence of information and communication technologies. This fact has a profound impact on the domains of socioeconomics, communication, and technical advancement. In contemporary society, individuals increasingly rely on technology as a In recent years, Bangladesh has seen a significant integration of technology into secondary school education, marking a notable shift in the traditional educational landscape. This integration has been driven by various factors, including the government's emphasis on digitalization, the increasing availability of technology infrastructure, and the recognition of the importance of preparing students for the digital age. One of the key initiatives in this integration process has been the introduction of digital classrooms in secondary schools means of networking, surpassing traditional face-to-face communication methods across the country.

These digital classrooms are equipped with multimedia resources such as projectors, computers, and interactive whiteboards, allowing teachers to deliver lessons in a more engaging and interactive manner. This shift from traditional chalk-and-talk methods to technology-enhanced learning has been welcomed by both teachers and students, as it makes the learning process more dynamic and accessible. Furthermore, the government of Bangladesh has implemented programs to provide students and teachers with access to digital devices and internet connectivity. Initiatives like the "Digital Bangladesh" campaign aim to bridge the digital divide by ensuring that all secondary schools have the necessary infrastructure to support technology-based learning. This includes providing schools with computers, tablets, and internet connectivity, allowing students to access a wealth of educational resources online. In addition to hardware and infrastructure improvements, there has been a growing emphasis on incorporating educational software and applications into the curriculum. Educational apps and software are being used to supplement traditional textbooks, offering interactive lessons, quizzes, and tutorials that cater to different learning styles. These digital resources not only enhance the learning experience but also enable teachers to track students' progress more effectively and provide personalized support. Moreover, the integration of technology has extended beyond the classroom walls through the implementation of e-learning platforms and online resources. Platforms like Khan Academy, Coursera, and Moodle are being used to deliver supplementary lessons, assignments, and assessments, allowing students to learn at their own pace and revisit materials as needed. This shift towards online learning has become particularly significant during the COVID-19 pandemic when schools were forced to close, highlighting the importance of having robust digital infrastructure in place.

However, challenges remain in ensuring equitable access to technology and digital resources, especially in remote and underserved areas of Bangladesh. Issues such as electricity shortages, internet connectivity problems, and a lack of trained personnel can hinder the effective implementation of technology in education. Therefore, ongoing efforts are needed to address these challenges and ensure that all students have equal opportunities to benefit from technology-enhanced learning. Overall, the integration of technology in secondary school education in Bangladesh represents a promising step towards modernizing the education system and preparing students for success in the digital age. By leveraging the power of technology, Bangladesh can empower its

youth with the knowledge and skills they need to thrive in an increasingly interconnected and technology-driven world.

Transition period of secondary Education System in Bangladesh during Lockdown Government of Bangladesh (GOB)'s lockdown restrictions have resulted in closing of all schools and educational institutions in the country since 18 March 2020. As a result, 42 million students (about twice the population of New York) are no longer able to attend school and might be prevented from doing so until September 2020 (UNICEF, 2020). Shortly after schools were closed, Government of Bangladesh started broadcasting pre-recorded secondary level school lessons titled 'My School at My Home' in national television channel with the help of government agency 'Access to Information (a2i)' to assist the school children continue their learning during the pandemic.

Besides, GOB also encouraged and instructed the schools and colleges to initiate online classes for their students (GOB, Directorate of Secondary and Higher Education, 2020). In response, many secondary schools have started taking online classes by using available means. GOB has already established 24,816 multimedia classrooms, provided internet connection to almost 90% schools and set up multimedia classroom monitoring system (a2i Program GOB, 2018), but these infrastructures could not be utilized to take online classes as the schools are closed during lockdown period. Taking online classes for secondary education are not that easy in a developing country like Bangladesh, because the technology and equipment required to participate in an online class are not cheap.

It requires availability of technological infrastructures like internet connection, computer with camera and microphone or a smart phone both for the teachers and students. 60% people of Bangladesh have access to internet and 92% of them use mobile network for using internet (BTRC, 2020). But the speed of internet varies widely in urban to rural areas. Price of internet and minimum required gadgets for participating in online classes is also beyond the reach of most of the students in Bangladesh (*Overview of Internet Access in Bangladesh: Impact, Barriers, and Solutions*, 2016).

Online learning is also influenced by computer knowledge of teachers and students, instructional methods of teachers, administration's mindset, policy frameworks, and technical assistance. The quality of teachers and their continuing professional education and training

remain central to the achievement of quality education (Ministry of Education GOB, 2013).

Understanding this fact, GOB regularly arranges teachers' training on ICT. Moreover, Digital Content development has also been undertaken so that all teachers can collect subject based contents from a single source, for which an official web portal titled Shikkhok Batayon (Sun, 2017). However, taking online class is totally new to most of the secondary teachers in Bangladesh, because it is absolutely unprecedented. Starting online classes without preparation and proper pedagogy, it would be less interactive and ineffective.

Complex challenges of 21 century in secondary school education in Bnagladesh Bangladesh's secondary school education system faces challenges such as inadequate infrastructure, particularly in classrooms, libraries, labs, and sanitary facilities, which can hinder efficient instruction and learning. Additionally, rural secondary schools often have a teacher shortage of qualified and experienced educators, and some educators may lack the necessary pedagogical skills to engage students and provide high-quality instruction.

These issues could negatively impact students' overall growth and education. Secondary school curriculums may not always meet the modern world's needs, leading to a disconnect between classroom learning and students' abilities for further study or work. Evaluation systems may overemphasize rote memorization and exams, resulting in cursory comprehension of material.

In isolated and marginalized regions of Bangladesh, access to secondary education remains difficult, particularly for girls and low-income households, due to geographical, cultural, and financial barriers. The quality of education in public and private schools, as well as rural and urban areas, varies significantly, potentially exacerbating inequality and limiting opportunities for underprivileged students. Teacher absenteeism, particularly in rural areas, can hinder learning and negatively impact student performance.

Bengali is the primary language taught in secondary schools in Bangladesh, but English proficiency is increasingly necessary for higher education and career prospects, suggesting the need for enhanced English language instruction. To enhance Bangladesh's secondary

education, a collaborative effort between politicians, educators, parents, and communities is needed to invest in curriculum reform, teacher preparation, infrastructure, and programs promoting diversity and equity in education.

Conclusion

Bangladesh's secondary school education is undergoing significant transformations due to emerging trends in teaching, learning, and technology. Educators are integrating digital tools and e-learning platforms to enhance student learning outcomes. Emphasis is on student-centered approaches, collaborative learning environments, and critical thinking skills development. Addressing the digital divide and providing equal opportunities is crucial for the success of educational initiatives. The digital divide is a significant issue in Bangladesh, requiring equal access to technology for all students. This is crucial for the success of Bangladesh's educational programs. Secondary education must remain flexible and progressive, incorporating new technology, teaching, and learning to prepare students for success in the 21st century. Cooperation and innovation are essential for the future development of Bangladesh's secondary schools.

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CHAPTER : 2

UNEQUAL ACCESS TO TECHNOLOGIES IN SCHOOL EDUCATION: A STUDY ON BANGLADESH

Barsha Biplob [1]

Abstract

The use of technologies in education is a new concept for Bangladesh. Although Bangladesh is on track to utilise this concept she's far behind in technological uses in education compared to the rest of the world. The objective of this paper is to identify the challenges of technological use in the education of Bangladesh. This paper examines the reasons for unequal access in technology by students. Further, this paper tries to explore the priorities upon which the government provides technological materials to schools. Secondary data is used from various sources in this paper. Some data from the website of the education ministry of Bangladesh and the education policies undertaken by the government are also used here. The main challenges of technological uses have been found after thorough analysis of the data. These are infrastructure and lack of resources, lack of skilled teachers, lack of enough funds. Whereas for unequal access the main reasons are the socio-economic barrier and rural-urban inequality.

Keywords*: technologies, education, School Education, challenges of technological use*

Introduction

The government of Bangladesh has taken steps to ease the transition of teaching and learning as a result of the incorporation of technology in education. But problems still exist, especially in elementary and secondary education. There are differences in access to technology between urban and rural locations as well as different socioeconomic levels, despite government efforts to provide schools with these resources (Growing Rural-Urban School Divide Is Hurting Bangladesh's Future, 2024). Financial limitations

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prevent many rural students, who are frequently from low-income households, from having easy access to technology, which limits their education (Exploring the Impact of Technology on Education in Bangladesh – Choloman Bangladesh, 2024). Furthermore, these issues are made worse by differences in the calibre and proficiency of teachers in rural and urban locations. After COVID-19, there was a shift in education that led to a greater emphasis on technology (Sarker et al., 2019). This has made matters worse, particularly for lower-income households (Exploring the Impact of Technology on Education in Bangladesh – Choloman Bangladesh, 2024). All of these things make it difficult for technology to be widely used in Bangladesh's primary and secondary education.

Although studies have been conducted to demonstrate how technology is used in the primary and secondary education of Bangladesh. But the studies are inadequate to highlight the difficulties associated with using technology in primary and secondary education. The majority of them highlight the value of ICT and its advancement and use that are based on Bangladesh's higher education system (Mahmud, 2010). Studies have been conducted to identify the challenges, but the majority of them point to infrastructure limitations and a lack of policy execution. The purpose of this study is to illustrate the difficulties associated with using technology in Bangladesh's primary and secondary education. It also lists the difficulties that students face when utilising technology. This study also determines, which technologies are used in education and what challenges exist when using them in Bangladesh's primary and secondary education system.

Literature Review

According to numerous academic and media sources, Bangladesh has a number of obstacles in its efforts to integrate technology into the classroom. One of the biggest barriers to the adoption of technology in education is infrastructure limitations. According to Sandulache (2019), primary schools' poor infrastructure makes it difficult for students to access digital materials and technology. Similar to this, Jasim (2022) talks about how a lack of infrastructure makes educational gaps worse, especially in rural places where access to technology is still scarce.

Developing teacher competence and training become essential obstacles in utilising technology in the classroom. Technology

integration in education is hampered, according to Hossain et al. (2012), who point out that many teachers lack the knowledge and assurance necessary to use technology in the classroom. Rahaman (2017) agrees, highlighting the significance of equipping educators with the know-how to use technology to improve student learning.

The problems with digital divide exacerbate the difficulties in integrating technology into the classroom. Rural and marginalised groups may suffer access difficulties, even though urban areas may have better access to technology and internet connectivity. The growing disparity in access to educational opportunities brought about by unequal access to technology is highlighted by opinions expressed in "Growing rural-urban education divide".

Furthermore, access to and acceptance of technology in education are significantly hampered by economic reasons. In their discussion of the financial implications of school dropout in Bangladesh, Sarker et al. (2019) point out how students' access to technology and participation in digital learning initiatives might be impeded by financial restrictions.

Technology application in education may be hampered by institutional and cultural constraints. Mahmud (2010) addresses the cultural impediments to the uptake of e-learning, highlighting the necessity of educational tools that are both contextually appropriate and culturally sensitive.

Bangladesh faces a wide range of obstacles when it comes to using technology in the classroom, including poor infrastructure, a lack of preparation for teachers, problems with the digital divide, financial limits, and cultural differences. A comprehensive strategy including infrastructural investments, teacher training programmes, equitable access initiatives, and culturally appropriate educational technologies is needed to address these issues.

Methodology

This study employs qualitative research methodology, incorporating information from secondary sources such as publications, articles, newspapers, government statistics, and policies. By analysing the secondary data using an exploratory technique, important persons' and institutions' point of view are revealed. Primary sources include a range of legislation and education policies, including national education plans

like NEP 2000 and NEP10 as well as the Primary and Mass Education Ministry of Bangladesh. In order to provide a thorough picture of the technological educational use and support well-informed policy formation and decision-making in Bangladesh's education sector, the study will synthesise data from various sources.

Operational Definition

Technology

A particular class of educational technologies is represented by computer-based technologies, which make use of computers as a tool for instruction or learning. As a result, it works better to view computers as a component of essential technologies. Technologies based on computers or digital devices include e-learning, email, surfing, web portals, multimedia classrooms, video conferencing, and virtual learning. A multimedia classroom for students must have certain equipment. Electronic curtains, speakers, microphones, projectors, internet, and computers.

Primary and Secondary Education

Primary education or elementary education is typically the first stage of formal education. In Bangladesh it lasts for five years. Class one to class five is considered primary level at school. Where secondary education in Bangladesh is considered from class six to ten. Primary education in Bangladesh is offered in a variety of formats, including Bangla, English, kindergarten, Madrasa, and English version. The current educational systems are non-uniform. The education received by pupils reading in Bangla-medium schools is very different from that of students reading in madrasas. Even the elementary English curriculum differs from the Kindergarten or Bangla programme. English-medium schools have little to do with the national curriculum because they use international curricula, such as Edexcel or Cambridge (Sandulache, 2019).

The Secondary School Certificate (SSC) is awarded following a public examination that marks the conclusion of secondary education. Courses and curricula are diversified starting in Grade 9, when secondary education begins in both ordinary schools and madrasas. In order to continue in grade 9, the pupils have a choice of three courses. Science, Arts, and Commerce are the subjects on which the courses are based,

and each of these areas has its own set of books in addition to the standard texts (Rahaman, 2017).

Historical Background of Primary and Secondary Education of Bangladesh

British dominance over Bangladesh is credited with laying the groundwork for the country's educational system. Primary, secondary, and higher education are the three tiers of the system. Both primary and secondary education are required, but universal enrolment is still viewed as more of an ideal than a reality ("Bangladesh - Education," 2019).

In Bengal, basic education was mandated in municipal areas during the British colonial era. The Director of Public Instruction was in charge of, overseeing, and managing primary education. The District Primary Education Office assumed responsibility for primary education management at the beginning of the Pakistani era. Primary education was offered as a four years programme until 1951. It was changed to a five-year programme in 1952. Following independence, the government regarded basic education as a fundamental right of all citizens and accepted it as a national obligation. To provide the newly independent nation with a cutting-edge educational system, the Kudrate-e-Khuda Education Commission was established in 1972. (Editor, n.d.).

Primary education in Bangladesh is currently divided into classes one to five, and secondary education into classes six to ten. The Bangladeshi Ministry of Education is in charge of overseeing the educational system. Primary education policies are carried out by the Ministry of Primary and Mass Education. Everyone must receive a primary and secondary education, which is provided by the government and is free in public schools.

Ensuring high-quality education is getting more difficult due to the disparity between schooling in rural and urban areas. 48 schools reported a 100% pass percentage in the 2023 Secondary School Certificate (SSC) exam. The majority of them are located in rural areas. Another issue that plagues many rural schools is teacher absenteeism. Unmonitored usage of technology and digital media is seriously hurting students in rural areas. It affects urban students nonetheless, but the ability and awareness of urban parents to supervise offsets the

detrimental effects of poor use of technology, which is not the case for rural students. Numerous kids are diverted from their academics as a result of this concerning circumstance (Opinion Growing Rural-Urban Education Divide, n.d.).

Bangladesh's primary and secondary education suffered greatly as a result of COVID-19. Bangladesh already had 18% primary dropout rates and 50% secondary dropout rates prior to the pandemic (Sarker et al., 2019). Following the lockdown, 4 lakh students more than half of them were female students abstained from the 2022 SSC exam, validating the alarming dropout estimates (Jasim, 2022b). More concerning are the secondary school dropout rates, which stand at 35.66% of pupils in 2021 (BANBEIS, 2022).

Challenges of Technological Usage in Primary and Secondary Education

Infrastructure and Lack of Resources

One of the developing nations where the use of ICT in education is hampered by inadequate infrastructure is Bangladesh. Among the primary infrastructure, one of the biggest obstacles is the lack of energy in rural regions; even in those that do, load shedding prevents them from having it for the entire day. Lack of technical resources, such as inadequate printers, computers, multimedia projectors, and Internet connections, is another problem. (Mou,2016).

Lack of Skilled Teachers

The attitudes and views of educators are crucial when it comes to the usage of technology in the classroom. The acceptance of an invention can be influenced by a teacher's attributes, including their financial situation, age, gender, educational background, and expertise using computers for instruction. Positive attitudes enable teachers to pick up technical skills fast and efficiently. Integration will be impeded if educators have a negative attitude towards implementing technology and would rather continue teaching in the traditional manner. Teachers must therefore have a favourable attitude towards technology adoption in order to use technology-enabled classrooms, and this attitude is established when they are sufficiently familiar with technology and have information about how to use it (Mou, 2016)

Socio-economic barriers

Technology access is still not available to all students in Bangladesh's educational system. The instruments and resources required for technology-based learning are beyond the financial means of many pupils from low-income households (Exploring the Impact of Technology on Education in Bangladesh – Choloman Bangladesh, 2024). When Corona was out for nearly a year and a half. The last day of classes was March 2020. Many educational institutions used Google Meet, Google Classroom, and Zoom to continue their classes virtually. Additionally, elementary and secondary school classes were aired. On the other hand, Sangsad TV's taped classes did not really assist. Online courses proved to be more successful in contrast. But because there weren't enough internet connections available everywhere, some students couldn't attend these classes (আহমেদ, n.d).

Rural-urban inequality

As per the Bangladesh Education Statistics 2022, about 76% of educational establishments are located in rural regions. The majority of children who do not learn skills reside in rural regions, according to the Bangladesh Education Fact Sheets 2020, with 81 percent of them not getting numeracy abilities and 82 percent not acquiring reading skills. The survey states that 74% of repeaters and 80% of dropouts are children from rural areas. More than the national average for the rural population, 80 percent of children who do not finish their primary or secondary school reside in rural regions (Growing Rural-Urban school Divide Is Hurting Bangladesh's Future, 2024). However, in metropolitan areas, the prevalence of education deprivation is rather low. When it comes to their children's education, the parents are frequently more accountable.

Budget shortage

Every year that goes by, our education sector's funding gets smaller. The education ministry planned 1.76 percent GDP allotment for the 2023–24 fiscal year is the lowest in the previous fifteen years. It is far less than the four to six percent GDP that UNESCO recommends for the industry. Bangladesh has one of the lowest education budgets among the least developed countries (LDCs) (Budgetary Allocation: Education Gets Far Less What It Requires, 2023). Schools that require ICT equipment are given it each year by the ministry of education. like

projectors, laptops, labs, and a host of other items. The budgeted funds for the year are used to purchase these pieces of equipment. It is becoming more difficult to give the schools these ICT tools since the funding is getting less and less each year. The availability of these resources is decreasing for each student as the number of students rises. This is obstructing their use of technology in the classroom.

Conclusion

Utilising technology has improved both students' and teachers' productivity in the classroom. This holds true for Bangladesh's educational system as well. However, there could be some difficulties. These issues severely affect Bangladesh's basic and secondary education system. Although there are obstacles in the way, the government is trying to give all pupils equal access and opportunities. The main obstacles preventing pupils from having equal access to technology have been identified by this study. Students are being divided due to the socioeconomic divide, the disparity between rural and urban areas, and the lack of support for elementary and secondary education. Even if the Ministry of Education is working to close the gap, the students might not be getting equal opportunities sooner as long as these issues persist.

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CHAPTER : 3

THE IMPACT OF TECHNOLOGY INTEGRATION IN THE CLASSROOM ON STUDENTS' LEARNING OUTCOMES

Tapas kumar Manna [1]

Abstract

The purpose of this study was to determine how technology integration affects student learning. Classrooms are getting more and more technology, and the rapidly evolving nature of technology demands that it be integrated into the curriculum. Technology has the potential to improve student learning, but it can also have a negative impact on learning. While technology makes learning more convenient and enhances many learning opportunities, it can also be an overused tool that can have a negative impact on students' ability to develop their fine motor skills and problem-solving skills. While integrating technology into the classroom has proven beneficial, it also has several disadvantages. Technology has helped student willingness and engagement and allows for the enhancements of learning. Reducing the obstacles that keep many children and schools from achieving greatness is something that teachers and students should take advantage of. Therefore, it is past time for every nation to put in place a future education system that is more technologically sophisticated.

Keywords: *Technology, Classrooms, Teaching, Learning, Efficiency, Academic Performance*

Introduction

The younger generation is growing up with technology always available to them. Children are curious in the ever-expanding world of social media applications and online platforms. Furthermore, gaming consoles, computers, tablets, gaming phones, free Wi-Fi, and electronic toys are all quite popular in today's society. Students are growing up with a competitive tendency in technology. According to Klopfer, et al. (2009), "Every day, many students are spending countless hours immersed in popular technologies—such as

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Face-book, My Space, World of Warcraft, or Sim City" (p. 1). Technology is starting to play a bigger role in education than it does now. Teachers try hard to integrate technology into their regular lessons because it is an ever-evolving field that helps them instill a love of learning in their students.

In an era characterized by rapid technological advancements, the integration of technology into education has emerged as a transformative force, reshaping traditional teaching and learning paradigms. The seamless incorporation of technology within the curriculum has sparked intense debates and discussions within the educational community. This research paper delves into a crucial aspect of this ongoing discourse by investigating the effects of a technology-integrated curriculum on student engagement and outcomes.

Raising student accomplishment while using technology as a tool is a prevalent concern these days. Legislators and educators are reaffirming their support for initiatives and methods of teaching that maximize benefits to learning and student results. Given how commonplace technology is in our everyday lives, it is imperative that we integrate it into teaching and learning if we are to have a lasting impact on students' learning.

The Common Core Standards' introduction and focus on technology means that using technology in the classroom will now take precedence.

Statement of the Problem: Technology has the ability to impact student learning in a positive manner. "It has displayed an increase in meaningful communication, critical thinking, creativity, and collaboration. There is evidence of an increase in student interest and engagement in the secondary classroom with technology paving fun educational paths by the ways technology can be integrated".(Mollov, M. 2019 & Makhlouf, K., & Bensaf, Z. 2021) "This was further emphasized through a brief review of the impact of technology and its integration at the college level. Students are reacting positively to a tool that allows them to enhance their independence.

On the other hand, research has also shown that technology has the ability to negatively affect student learning in the classroom. Though motivation may improve, the data available noted that many of the

classrooms observed did not improve in regards to scores and other measures of success in the classroom. Though creativity and collaboration have been evident in technology integrated classrooms, there is a lack of learning the core material itself. Furthermore, the way technology is integrated is not always sustainable for developing adolescent minds" (Sims, 2017 &Williams, 2021) One drawback of technology is that it may be distracting, which makes it harder for students to concentrate and stay focused.

Concept of Technology Integration: Seamless integration is when students are not only using technology daily, "but have access to a variety of tools that match the task at hand and provide them the opportunity to build a deeper understanding of content. Willingness to embrace change is also a major requirement for successful technology integration. Technology is continuously, and rapidly, evolving. It is an ongoing process and demands continual learning. Definition of technology tools encompasses a broad range of digital devices such as computers, tablets, multi-touch screens, interactive whiteboards, mobile devices, cameras, DVD and music players, audio recorders, electronic toys, games, e-book readers, and older analog devices still being used such as tape recorders, VCRs, VHS tapes, record and cassette players, light tables, projectors, and microscopes etc. Technology when it fits comfortably with the curriculum or instructional plans of teaching is an indicative of integrated technology. Thus, technology rather than an additional layer in the classroom is embedded within the design of the teacher's lesson plan and the pedagogy. Thus, in this approach, the teacher designs learning activities and students use technology to construct their own learning. For example, the students use technology for seeking information, construct and organize their learning and represent it through computer applications. Thus, the teacher plays a role of a facilitator and student as a constructionist of his or her own learning. Such an approach considers technology as a tool rather than an end itself, defines the teachers' role as a facilitator and designer of the learning environment, and emphasizes the student's use of technology, and authentic assessments and activities using technology in the classroom". (Grabe and Grabe cited in Charania, 2011)

Positive Impacts of Technology Integration on Students Learning:

Special needs students

Through the provision of digital education tools, a plethora of mobile apps allow and simplify the entry of students with special needs into the classroom. Online education and computer-based learning activities play a major role in closing the achievement gap between students with disabilities and ordinary students by providing freely available information. Thanks to technology improvements, special needs kids may now participate in other pleasurable activities like playing.

Global platform

The use of technology in education has grown. These days, a lot of universities offer online courses that students may access from any location. With the use of applications like Skype and video conferencing, instructors and students may readily exchange information.

Efficiency

The majority of educational establishments have digitalized their evaluation procedure. Students may assess their knowledge in real time by taking online tests. Online tests are flexible and objective. The ability for students to take exams whenever they're ready is particularly helpful for those enrolled in correspondence or distance learning courses.

Improved interaction

Today, the majority of instructors utilize technology to stay in contact with their pupils. They are able to post and distribute material to a big audience by using services such as Dropbox. They may email each other as well.

E-Books

Online libraries and e-books are helpful resources for learners. For instance, Google has worked with publishers and institutions to build an amazing virtual library that is both vast and adaptable. Learners may find new publishers and books by browsing through the various novel

excerpts available on Google Books. Thanks to the internet, publishers and readers may now connect with one another.

Addressing learner's diversity

Among the educational resources that appeal to students with diverse learning styles include animations, online learning modules, and visual or auditory stimulation. For some individuals, learning takes place in a boring and uninspired classroom. These youngsters are successfully persuaded to study with the use of digital resources that provide the ideal balance between education and fun.

Access to a huge informational background

"The Internet connects people; thereby it can be used as an effective tool for gaining knowledge. Web users need only to enter specific information they want to find into search engines that will prompt them to millions of search results. There are several informative websites and web directories that offer information on a variety of topics. Students can use the Internet to get all the additional information they need to expand their knowledge base. A great example of an efficient use of World Wide Web for learning is academic assistance that is currently being delivered worldwide".

Attention and Technology: Our ability to effectively engage with technology and make use of it depends on our ability to pay attention. It is a cognitive ability that enables us to concentrate, block out distractions, and stay focused. By offering functions and tools that support students in controlling distractions and developing a positive work ethic, technology helps improve focus. But it's crucial to understand that technology and focus may help or hurt students' ability to study. According to Francis (2017), "the widespread integration of technology into our daily lives has made students constantly connected to a vast amount of information". Francis promotes the use of technology in the classroom, emphasizing how it may improve students' academic achievement. It has been shown that integrating technology into classroom environments helps students see the intrinsic worth of what they learn, which in turn increases their motivation and engagement (Chapter 1, James, 2017). The use of technology in the classroom should take into account the various learning styles of students in order to properly assist their attention and learning. Students may be motivated in a variety of subjects, including

arithmetic, social studies, and literacy, by using proper technology (Francis, 2017).

Technology in the Classroom: "Numerous studies have supported the idea that implementing technology into the classroom facilitates meaningful learning, greater use of prior knowledge, hierarchical cognitive structure, elaboration, greater depth of processing and innovative practice".(Hillman, 2014) "This integration shifts the focus of the learning environment to being more student-centered and allows for them to develop autonomy and control over their learning".(Mo, 2011)

It's crucial to think about whether a technological application's characteristics are appropriate for achieving task results before using it in a classroom. Preferably, the technology should be built with all the functionality required to support student learning and be simple to use for both teachers and students (Charania, 2011).

Instructors' Perspectives on Technology: "Educators generally have positive attitudes towards the implementation of technology into the classroom. Educators feel that when they are provided with appropriate training on professional digital competencies, they can use technological tools in the classroom to enhance the learning process for students". (Kirkscey, 2012) "Examples of professional competencies that educators feel should be included in training are technology-handling abilities, curriculum inclusion, technology infusion into educational activities, providing evaluative feedback, encouraging collaborative exercises with technology and responding positively to the inclusion of technology in the classroom" (Guzman & Nussbaum, 2009).

Students' Perspectives on Technology: "It is important to consider how students will receive technology when implementing it into into the classroom. When students perceive that the attributes of a given technology are engaging and beneficial to their learning, they are likely to adopt that technology and use it to enhance their understanding of course content".(Sun, Lee, Lee & Law, 2016) "Some features that make technology more appealing to students are flexibility, accessibility, ease-of-use and overall engagement. In general, studies show that students report high levels of satisfaction with the use of educational technology as it allows them to interactively engage in learning". (Miller, Milholland & Gould, 2012) "Students also believe

that technology facilitates a greater understanding of course content, contributes to higher academic achievement and better prepares them for the technology-dependent workforce". (Schindler, Burkholder, Morad & Marsh., 2017)

The Impact of Technology on Student Engagement

The assumption that the use of instructional technology increases overall student motivation and involvement in the learning process has received support from a number of research (Mo, 2011). "To be more precise, technology engages students intellectually (requiring mental investment to understand information), emotionally (improving attitudes and interests towards learning), and behaviorally (requiring greater effort and time spent engaging in learning activities). Whether technology is used in the classroom or after school, it gives kids additional chances to communicate with teachers, work together with classmates, and participate in the educational process. Digital games, blogs, wikis, social networking sites, and web conferencing software are some examples of specific technology that has been shown to increase student participation". (Schindler et al., 2017)

The Impact of Technology on Academic Success

"Incorporating the use of several technological applications allows for students to participate in higher-order thinking, enhance communication, engage in collaborative problem-solving activities and discussions, critically reflect on content and expand digital competencies". (Schindler et al., 2017) "Studies have compared differences in academic achievement between students who have been taught with technological enhancement (i.e. lecture recordings and podcasts) and those who been taught without it. The results demonstrated that students who learned academic content in the technology enhanced classroom outperformed those who learned the content without technology". (Carle, Jaffee & Miller, 2009) "Performance was greater in the intervention group in all objectively graded assessments which include papers, midterm/final exam scores and individual assignments. Other research has demonstrated that implementing technology into the classroom enhances student motivation to understand and complete tasks". (Mistler-Jackson & Songer, 2000)

Barriers to Implementation

According to studies, “teachers feel that there is not enough time in the classroom to educate pupils digital capabilities and provide information”. (Kirkscey, 2012) “There just isn't enough time to educate students how to utilise technology, even if many professors believe they have received sufficient training and are at ease doing so. Additional obstacles to integrating technology in the classroom include students' limited technical proficiency, a lack of funding, students' feelings of isolation while learning, their inability to connect with peers, distraction from other applications, and the need to draw boundaries between their personal and professional lives”.(Sun et al., 2016) However, with mindful pedagogical strategies, instructors can overcome these barriers and use technology to enhance student engagement and success.

Integration into the Curriculum

There are several ways to incorporate technology into the curriculum. As was previously said, a number of research have shown that teachers and students have favourable opinions of a curriculum that incorporates technology. In most curricular areas, students may gain by using technology to improve their general engagement and comprehension of the material. Technology may be included by teachers into their lesson plans, extracurricular activities, homework assignments, and evaluation procedures. With the plethora of educational technology tools and resources available, teachers may create lesson plans that will help students succeed more academically while also preparing them for a job dependent on technology (Sims, 2017).

Recommendations: With the increasing integration of technology into both the educational system and the business, it is crucial for students to get acquainted with a range of digital applications. Students are better prepared for life beyond high school when they have opportunities to develop as learners and succeed academically via the integration of technology into the curriculum. Although educational technology makes the learning environment more student-centered than teacher-centered, it is crucial that instructors carefully consider the best ways to utilize it. With hundreds of different technology apps available, each with unique capabilities, it is crucial that instructors assist kids in learning about these technologies so they don't get overwhelmed. It's

advised that educators provide their pupils ongoing feedback on their technology-related experiences.

Conclusion

The use of digital tools and resources not only accommodates students' varied learning methods but also fosters their critical thinking, creativity, and curiosity. Thus, technological integration fosters teamwork and active engagement, resulting in a more vibrant and stimulating learning environment. Moreover, the review study synthesizes empirical data that indicates a favourable link between curricula that include technology and enhanced academic achievements. It has been shown that integrating technology into the classroom improves student performance overall, information retention, and accomplishment.

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CHAPTER : 4

IMPACT OF ARTIFICIAL INTELLIGENCE IN THE SPECIAL SCHOOL TO PROMOTE WITH INCLUSIVE EDUCATION IN THE LIGHT OF NATIONAL EDUCATION POLICY-2020

Dr. Pradip Das [1]

Abstract

In recent years, the intersection of artificial intelligence (AI) and inclusive education has become an area of significant interest and potential. With the advent of the National Education Policy (NEP) in 2020, India's educational landscape has been undergoing transformative changes to promote inclusive practices. This publication delves into the profound impact of AI technologies in special schools, aligning with the objectives of the NEP-2020. In Section 23 of the New education policy titled 'Technology Use and Integration' puts forth a vision for the role technology will play in a new and improved education sector. It is a positive sign that India's policymakers are finally waking up to technology's disruptive implications for education. Realizing the potential of technology in education emphasizes securing digital infrastructure, developing digital skills, and promoting digital safety. It desires delegation of authority and active role of school management committees also. Artificial Intelligence in education' are two different areas and the former needs more emphasis in school education. Though the "Artificial Intelligence (AI) for education" and "AI education" may be elided, but in reality, the two are separate areas requiring different expertise and policy, and the distinction should be duly recognized. It is pertinent to mention that (AI) is poised to become the next big information revolution. As we move into an increasingly data-driven world, there is a critical need to build an AI-ready workforce. Artificial Intelligence (A.I.) is a mirror reflecting not only our intellect, but our values and fears"- Ravi Narayan, VP insights and analytic, Nisum (WWW.nisum.com). Artificial Intelligence (AI) and technology has

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already touched the life of individuals, more generally, it has influenced educational sector to make it more inclusive and accessible for students with visual, hearing, mobility and intellectual disabilities. The use of AI has not only impacted students with special needs, but has also impacted educational institutions in creating inclusive pedagogies. The present study is a working paper that has tried to analyze how AI has impacted education for students with special needs. The data collection was based on qualitative research that was conducted using focussed interviews from teachers and students with special needs.

Keywords: *Artificial Intelligence, Technology, Special Education, Disability, NEP-2020, Children with Special Needs (CWSN), Inclusive Education*

Introduction

I'm increasingly inclined to think that there should be some regulatory oversight, maybe at the national and international level, just to make sure that we don't do something very foolish. I mean, with artificial intelligence, we're summoning the demon." — Elon Musk.

"It seems probable that once the machine thinking method had started, it would not take long to outstrip our feeble powers… They would be able to converse with each other to sharpen their wits. At some stage, therefore, we should have to expect the machines to take control." — Alan Turing.

From their quotes, recently seen a groundbreaking development has taken place in Thiruvananthapuram, Kerala, where an AI teacher named "Irish" has been introduced at KTCT High School (Allebee, 2017). This initiative, believed to be the first of its kind in India, marks a significant step forward in educational innovation. The robot teacher, equipped with wheels for mobility, is set to teach all subjects at the school, providing seamless transitions between classes. The project was realized through collaboration between the school and Markerlab Edutech, with students actively participating in its development under expert supervision. This initiative aligns with Niti Aayog's focus on enhancing extracurricular activities in schools, fostering a hands-on learning approach. Videos showcasing "Irish Madam" in action have been shared on Instagram by Maker Lab, with captions highlighting its potential to redefine the learning landscape. The AI teacher boasts

versatility, capable of teaching multiple subjects simultaneously and conversing in various languages through voice assistance. This innovation promises to revolutionize education, offering new opportunities for interactive and personalized learning experiences (Prentzas, 2013).

Artificial Intelligence

In Greek mythology, there are references to the concept of machines and mechanical beings, albeit with limited available literature. One such story involves Talos, a giant bronze warrior programmed to guard the island of Crete. This ancient idea suggests that the notion of machine learning and artificial intelligence has roots extending far back in human imagination. In the 1950s, Alan Turing published a seminal paper exploring whether computers could exhibit intelligent behavior akin to humans. While the practical applications were initially limited, Turing's proposal of the Turing Test became influential in the field of artificial intelligence (AI).In 1951, Christopher Strachey, a computer scientist, developed a chess program using the Ferranti Mark1 machine at the University of Manchester, marking an early foray into AI applications. The term "artificial intelligence" was coined in 1956, and the first AI laboratory was established for research purposes in 1959. Subsequent milestones included the introduction of the first robot on the General Motors assembly line in 1960 and the creation of the first chat bot, Eliza, in 1961. AI's capabilities continued to advance, with IBM's Deep Blue defeating world chess champion Garry Kasparov in 1997 and the Stanford Racing Team's robotic car, Stanley, winning the DARPA Grand Challenge in 2005. IBM's question-answering system, Watson, also achieved victory over Jeopardy champions in 2011. In recent years, AI has seen widespread adoption in various domains, including contract intelligence platforms like J.P. Morgan's, which utilize AI, machine learning, and image recognition software for legal document analysis. Programming languages commonly used in AI development include Python, Java, and Lingo. The increasing need for machine learning, a subset of AI, is driven by the abundance of data from sources like cloud computing, the internet, and social media, necessitating advanced analytical techniques. AI presents significant opportunities, particularly in addressing the needs of individuals with special educational requirements. It enables intelligent problem-solving and personalized learning experiences, aiming to enhance interactions with the environment and enrich daily life.

However, there are concerns regarding AI's potential limitations, such as its inability to assess creativity and analytical thinking, potentially leading to a narrow educational approach based solely on memorization. Additionally, there are concerns about deepening inequalities, as access to human interaction in education may become a privilege for the few. Despite these challenges, AI holds promise in reshaping education, offering interactive learning experiences anytime, anywhere. By leveraging AI's capabilities, educational institutions can adapt to the evolving technological landscape, fostering personalized learning environments that cater to individual strengths and attributes.

Alignment with National Education Policy-2020

The NEP-2020 emphasizes the integration of technology to promote inclusive education. AI in special schools aligns with the NEP's vision by:

- **Enhancing Quality:** AI-driven personalized learning ensures high-quality education tailored to diverse student needs.
- **Equity:** AI technologies bridge learning gaps and provide equitable access to educational resources for students with disabilities.
- **Innovation:** AI fosters innovative teaching methods and assessment practices to accommodate diverse learning abilities effectively.

Special Education

AI has been a focal point of research for over five decades, primarily involving the study and advancement of "intelligent agents" capable of perceiving their surroundings and taking actions to enhance their chances of success. These agents can manifest as physical devices, such as humanoid robots, or in software form, represented by virtual avatars (WHO, 2011). Over the years, AI techniques have progressively been utilized to enhance the lives of individuals with special needs, addressing a multitude of challenges spanning learning difficulties, cognitive impairments, communication barriers, behavioral issues, emotional challenges, and sensory or physical limitations (2001 SEN Code of Practice).The SEN Code of Practice underscores the diversity among children's learning capabilities, emphasizing the importance of recognizing each child's unique strengths and requirements. Hence, understanding the context in which AI is

applied—including factors like accessibility, training needs, and specific requirements—becomes crucial, as these may vary across different social contexts. Nonetheless, AI is instrumental in fostering collaborative and interactive environments, transcending barriers related to auditory, verbal, and written communication. For instance, AI-powered text messaging platforms facilitate mental health interventions, extending support to young individuals. In the realm of education, AI-driven innovations hold immense promise. They facilitate personalized learning experiences for students, automate instructional tasks, and power adaptive assessments. Robotics infused with AI can augment teaching professionals by providing support and assistance in educational settings. Assistive technology, tailored to individual needs, enables students with disabilities to compensate for their impairments, promoting independence and reducing reliance on external support (Lynch, 2018).

Furthermore, AI's potential to enhance workplace efficiency and augment human capabilities is significant. In educational settings, AI aids teachers in early detection of students facing learning difficulties, allowing for timely interventions. AI tools and resources play a pivotal role in education, especially for children with special needs, offering a balance between student autonomy and targeted guidance. However, it's noteworthy that AI is predominantly used by teachers and parents for student training purposes, rather than solely for diagnosing needs. In essence, AI serves as a catalyst for inclusive education, empowering individuals with diverse learning needs to thrive in educational environments tailored to their requirements.

The Role of Artificial Intelligence

Artificial intelligence encompasses a range of technologies that simulate human intelligence to perform tasks traditionally requiring human intelligence, such as speech recognition, problem-solving, and decision-making. In the context of special schools, AI holds immense potential to personalize learning experiences and support students with disabilities.

Impact Areas of AI in Special Schools

Personalized Learning: AI algorithms can analyze individual student data to tailor educational content and interventions according to each student's learning pace, preferences, and capabilities.

Assistive Technologies: AI-powered assistive technologies, such as speech recognition and text-to-speech tools, can enhance communication and literacy skills for students with hearing impairments or visual disabilities.

Early Intervention: AI can facilitate early detection of learning disabilities through predictive analytics, enabling timely intervention and personalized remedial strategies.

Accessibility: AI-driven accessibility features in educational tools can improve access to learning materials for students with disabilities, fostering a more inclusive learning environment.

Teacher Support: AI can assist educators in designing personalized education plans, monitoring student progress, and recommending instructional strategies based on real-time data analysis.

AI and Special Need Education

Various researches have taken place in the area of AI (AI). It is in usually defined as "the mechanical simulation system of collecting knowledge and information and processing intelligence of universe: (collating and interpreting) and disseminating it to the eligible in the form of actionable intelligence" . It is composed of information agents that can be either in the physical form as devices (such as Robots or can be virtual such as software. According to Morrison, as AI matures, it becomes increasingly important to understand the kind of things that people with disability would require as a part of their technology tool kit. The benefits of AI have been acknowledged in education; however, the research fraternity has started exploring its benefits for people with special needs in education . AI and Special need Education collaborate together to enable development of individuals suffering from disabilities. Students with learning, hearing, visual and mobility impairment can seek benefits with the use of Artificial Intelligence in education. The research study has also indicated AI as one of the assistive technology for PWD. As per an article by Lynch, AI has provided around-the-clock care using Robotics for people with disabilities. AI has helped the people to use mobile applications without even clicking on it.For instance "Siri" in mobiles has enabled people to access mobile applications without even actually clicking actually clicking on them. Another example from Google "Alexa" that has enabled people to ask for

any information without typing on the search bar. Both these applications (Siri as well as Alexa) work on AI (speech recognition. Such applications can provide assistive services to people. This paper tries to investigate the impact of AI on special need students and the assistance these tools can extend to teachers in evaluating and imparting education as per the requirements of students with special needs (Drigas, & Ioannidou, 2012).

AI with Inclusive Education

Research in the field of Artificial Intelligence (AI) has expanded over the past 50 years, with AI defined as a system that collects, processes, and disseminates intelligence from the universe to eligible recipients, whether in physical form as devices (e.g., robots) or virtually as software. Morrison emphasizes the importance of understanding the technological needs of individuals with disabilities as AI matures, particularly in education. AI has shown promise in benefiting people with special needs by addressing various impairments, including those related to learning, hearing, vision, and mobility. Lynch highlights AI's role in providing round-the-clock care for people with disabilities through robotics, as well as enabling hands-free access to mobile applications via voice assistants like Siri and Alexa (Grewal, 2014). These AI-powered applications utilize speech recognition to offer assistive services, illustrating AI's potential to enhance accessibility for individuals with disabilities. Inclusive education stands to benefit significantly from AI, as it can harness behavioral data to deliver personalized educational services tailored to individual needs. Predictive analytics, already utilized in some local governments in the UK, can anticipate future needs in areas such as special education and children's social services, aiding in early identification of at-risk students. In Japan, although educational big data have been accumulated, AI technology in the educational field lags behind other countries. Kazimzade et al. argue for the creation of heterogeneous datasets to train AI in inclusive learning environments, particularly for learners with special needs. This research aims to address this gap by investigating how AI technology can support learners with special needs in inclusive education settings

Education Policy (NEP) 2020 is the first omnibus policy after 1986. The importance given to education technology in the NEP is welcome. It has to contend with multiple crises in the system. There are reports that primary schools record poor literacy and numeracy outcomes and,

dropout in middle and secondary schools are significant. Our schools need a paradigm shift from low level of aspiration to have higher aspirations for all children indiscriminately. Translating this into reality invites stakeholders, teachers, education administrators, policy makers and academic authorities at national and state level to come together to give children the best chance to succeed and contribute to nation building.

Significance of the Study

The significance of this study lies in AI's potential to provide globally inclusive education, catering to diverse languages and cultures on a single platform. Students with hearing and visual impairments, as well as those with intellectual disabilities, stand to benefit greatly. AI-guided campuses facilitate connectivity between students and teachers, allowing for real-time monitoring of challenges faced by students and providing immediate feedback.AI tools offer efficient solutions in the field of disability and special education, saving time and costs while improving intervention methods. However, proper training for teachers, parents, and therapists is essential for effective utilization of AI-guided tools. Despite challenges in implementation, particularly in developing countries, ongoing efforts are underway to integrate AI technologies into educational settings, promising increased independence and efficiency in learning for individuals with special needs. The integration of AI technologies in special schools under the framework of the NEP-2020 represents a significant step towards fostering inclusive education. By leveraging AI tools, special schools can create personalized, accessible, and effective learning environments that cater to the unique needs of every student, thus promoting inclusive education and fostering holistic development. This publication aims to inspire educators, policymakers, and stakeholders to harness the transformative potential of AI in special education within the context of the NEP-2020, ultimately contributing to the realization of equitable and inclusive education for all.

Alignment with National Education Policy-2020

The NEP-2020 emphasizes the integration of technology to promote inclusive education. AI in special schools aligns with the NEP's vision by:

- **Enhancing Quality:** AI-driven personalized learning ensures high-quality education tailored to diverse student needs.
- **Equity:** AI technologies bridge learning gaps and provide equitable access to educational resources for students with disabilities.
- **Innovation:** AI fosters innovative teaching methods and assessment practices to accommodate diverse learning abilities effectively.

Challenges and Considerations

While AI presents promising opportunities, its implementation in special schools also faces certain challenges, including ethical concerns, data privacy issues, and the need for specialized teacher training.

Conclusion: "Within a few decades, machine intelligence will surpass human intelligence, leading to The Singularity – technological change so rapid and profound it represents a rupture in the fabric of human history." — Raymond Kurzweil

The study highlights the transformative impact of AI technologies on the lives of individuals, particularly benefiting children with special needs. In the realm of education, AI is revolutionizing teaching and learning practices, offering assistive technologies that alleviate the challenges faced by students with disabilities. Institutions, teachers, and parents are increasingly embracing inclusive education initiatives, leveraging AI-powered tools to create accessible learning environments that transcend barriers and promote equal educational opportunities for all.The study emphasizes the importance of implementing inclusive pedagogy, which prioritizes the inclusion of every child without categorization based on their abilities or disabilities. By adopting inclusive pedagogies, educational institutions can foster environments that celebrate diversity, encourage creativity, and promote mutual respect among students. This approach facilitates meaningful exchanges of ideas and conversations, creating safe and supportive spaces where children feel empowered to express themselves freely (Gernsbacher, et. Al, 2016)

Furthermore, the study underscores the significance of nurturing creativity through pedagogical practices. Encouraging creativity not only enhances cognitive development but also fosters innovation and

problem-solving skills among students. By cultivating a culture of creativity in educational settings, educators can empower children to explore their potential and contribute positively to society. In essence, the study advocates for the integration of AI technologies and inclusive pedagogies to create inclusive and supportive learning environments where every child, regardless of their abilities, can thrive and reach their full potential. By embracing these principles, educators and institutions can play a pivotal role in shaping a more inclusive and equitable future for all children. Generative AI has both a positive and negative impact on schools and the way people learn. Tools such as these can benefit people in working more efficiently and also checking one's work. Although these AIs help people work more efficiently, the work is not always held to a high standard nor is it always correct. Many times tools like these make up work that is not even real. They do not function as humans (Morrison, et.al 2017) . These tools "learn patterns from their training data and use that to create plausible responses to prompts." They don't actually have information that is credible or reliable. This can cause problems and affect how both schools function and how people learn. While AIs can help improve one's work, they should not be used to produce a person's work. AIs don't have the mind or capacity a human brain has. Students also must not rely on AIs to do their work because then they won't feel the need to pay attention in class and learn because they know that an AI can do the work for them. AIs are not bad at all, it's just that people might use them for the wrong things like to get work done instead of doing your work and then using an AI to check that work. AI is neither good nor bad, it all just depends on how a person uses the AI. In the context of AI, National Research Foundation(NRF) may consider a three-pronged approach: (a) advancing core AI research, (b) developing and deploying application-based research, and (c) advancing international research efforts to address global challenges in areas such as healthcare, agriculture, and climate change using AI (Roach, 2018). .

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CHAPTER : 5

IMPACT OF DIGITAL LITERACY TRAINING PROGRAMME ON PRE-EMPLOYABILITY SKILLS AMONG STUDENTS WITH VISUAL IMPAIRMENT

H. Lalrinhlui [1]

Abstract

The study aimed to investigate the impact of a digital literacy training programme on pre-employability skills among students with visual impairment. Students with visual impairment enrolled in undergraduate and postgraduate programmes were chosen as samples. The samples were separated into two groups: control (n=15) and experimental (n=15). Their ages ranged from 17 to 35. A pre-test was administered to both groups, and only the experimental group received the digital literacy training for sixteen weeks. No training was provided for the control group. Following that, a post-test was taken for both groups. To test the significance of changes made in both tests, an 'ANCOVA' was applied. The significance of the means of the obtained test results was tested at a 0.05 significance level. The result shows that the digital literacy training programme improved the pre-employability skills among students with visual impairment.

Keywords: *Digital literacy, Pre-Employability Skills, Students with Visual Impairment*

Introduction

Students with visual impairment face considerable obstacles in gaining job-related skills, significantly affecting their employment chances. Their difficulty in perceiving visual cues hinders their ability to understand critical information, limiting their competitiveness in the job market. Despite assistive technologies offering support, the rapid pace of technological progress demands ongoing resources and assistance to ensure they can keep up and

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remain viable candidates in the workforce. These collective obstacles lead to a lower employment rate among individuals with visual impairment, highlighting an urgent need for targeted interventions and support mechanisms aimed at closing these skill gaps.

Purpose of The Study

The study aimed to investigate the impact of a digital literacy training programme on pre-employability skills among students with visual impairment.

Objectives

- To develop a research tool to assess the pre-employability skills of students with visual impairment.
- To develop a training module with a digital literacy training programme suitable for students with visual impairment.
- To assess the effectiveness of the digital literacy training programme on the pre-employability skills of students with visual impairment.

Hypotheses

1. There is a significant difference between the pre-test and post-test of the experimental group among students with visual impairment.
2. There is no significant difference between the pre-test and post-test of the control group among students with visual impairment.

Review of Literature

Persons with disabilities can learn computers and technology because computers are needed in every office, firm, company, factory, mill, school, and college, and there is no need to explain communication because it is all based on graphic skills, writing, reading all work can be done in computer (Ali, 2007). Webster describes education as the procedure of instructing and teaching. Further describe as to build up the information, ability, or personality. Thus, from these definitions, we may accept that the reason for instruction is to build up the critical thinking, expertise, or character of students (Jamil, Muhammad, Masood, & Habib, 2020; Yasmin, Muhammad, & Siddiqui, 2021). In computer education, all logical and technical aspects of teaching and

learning are necessary. The technological world is enhancing and growing very speedily. A person with visual impairment's minor efforts are not enough to go on higher, but it is very fruitful to get jobs and earn a good living life (Ali, 2007).Leonard, D'Allura and Horowitz (1999) studied "Factors associated with employment among persons who have a vision impairment: A follow-up of vocational placement referrals". According to the findings, 54% of respondents who did not participate in another "main activity" (such as attending college) were in the workforce. Having spent the majority of their education in a general school setting rather than receiving special education for students with disabilities, reading mostly printed material, and receiving technological training were all predictors of employment. The relationship between job duties and ability was also looked at as a predictor of employment in higher-level roles. Fewer hours of rehabilitation teaching and technology training were both revealed as important indicators of employability in higher-level occupations.

Gerber (2003) studied "The benefits of and barriers to computer use for individuals who are visually impaired" and concluded due to their beneficial effects on literacy, education, employment, and quality of life, having access to the Internet and becoming a frequent computer user are essential. More investigation is required to ascertain the causal linkages' directions to create effective interventions. For instance, employment appears to be a predictor of computer use (Gerber & Kirchner 2001; Johnson et al. 2001), but providing people with visual impairments with computer skills will allow them to compete effectively in the job market. To give visually impaired people an equal opportunity to succeed in productive ways with sighted people and to balance some of the effects of visual impairment, "getting wired" should be an essential component of the so-called core curriculum for children and a prerequisite for all vision rehabilitation for adults.

Methodology

Selection of subjects

30 visually impaired higher education students were randomly selected. In that out of 30 students, the researcher took 15 students as the experimental group and 15 students as a control group in a random manner. And their age ranged between 17 to 35 years.

Selection of variables **Table – I**

S.No	VARIABLES
1	**Independent variable:** Digital Literacy Training Programme
2	**Dependent variable:** Pre-employability skills - • Awareness and knowledge • Proficiency in digital literacy and use of technology • Attitudes and preferences

Tool used

Pre-employability skills of students with visual impairment tool was developed by the researcher. The scale is a 5-point rating scale having responses in the form of strongly agree, agree, neither agree nor disagree, disagree, strongly disagree. The scale has been designed to measure the Pre-employability skills of students with visual impairment. The scale's reliability was tested by both the Test-retest method (0.83). The face validity and content validity of the scale are sufficiently high as the items of the scale were discussed and reviewed by experts from different universities.

Research design

The study was formulated as a True random group design consisting of a pre-test and post-test. Here experimental group faced 16 weeks of digital literacy training programme and for the control group, there was no training.

Statistical Techniques

The following statistical procedures were employed to find the effect of a digital literacy training programme on pre-employment skills among students with visual impairment. An ‘ANCOVA’ was applied to find out the significant difference. In all the cases 0.05 level of significance

is fixed to test the hypotheses.

Results

Table - II

Computation of analysis of covariance of the mean of experimental and control groups on awareness and knowledge

	Experimental Group	Control Group	Source of Variance	Sum of Squares	df	Means Squares	F-ratio
Pre-Test Means	17.48	17.95	BG	2.77	1	2.77	0.33
			WG	400.29	28	8.33	
Post-Test Means	21.31	18.37	BG	107.54	1	107.54	10.30*
			WG	500.93	28	10.43	
Adjusted Post-Test Means	21.46	18.23	BG	129.36	1	129.36	17.66*
			WG	344.11	27	7.32	

* Significant at 0.05 level for the degrees of freedom 1 and 28 = 4.19

* Significant at 0.05 level for the degrees of freedom 1 and 27 = 4.21

An examination of Table - II indicated that the pretest means of the experimental and control groups were 17.48 and 17.95 respectively. The obtained F-ratio for the pre-test was 0.33 and the table F-ratio was 4.19. Hence the pre-test mean F-ratio was insignificant at 0.05 level of confidence for the degree of freedom 1 and 28.

The post-test means of the experimental and control groups were 21.31 and 18.37 respectively. The obtained F-ratio for the post-test was 10.30 and the table F-ratio was 4.19. Hence the post-test mean F-ratio was significant at 0.05 level of confidence for the degree of freedom 1 and 28.

The adjusted post-test means of the experimental and control groups were 21.46 and 18.23 respectively. The obtained F-ratio for the adjusted post-test means was 17.66 and the table F-ratio was 4.21. Hence the adjusted post-test mean F-ratio was significant at 0.05 level of confidence for the degree of freedom 1 and 27.

Figure - I
Pre and post-test differences between the experimental and control groups on awareness and knowledge

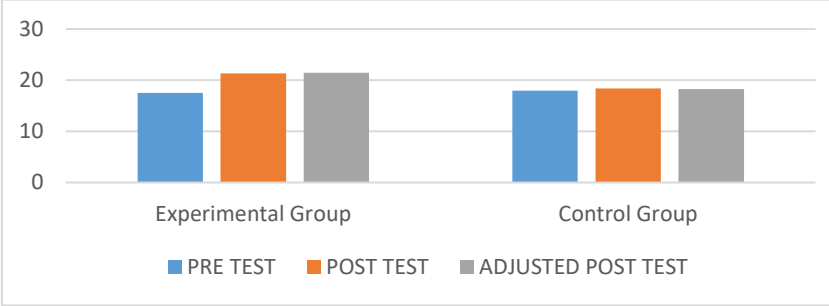


Table - III
Computation of analysis of covariance of the mean of experimental and control groups on proficiency in digital literacy and use of technology

	Experimental Group	Control Group	Source of Variance	Sum of Squares	Df	Means Squares	F-ratio
Pre-Test Means	13.88	13.96	**BG**	0.80	1	0.80	0.01
			WG	301.60	28	6.28	
Post-Test Means	16.51	14.08	**BG**	73.78	1	73.78	8.08*
			WG	437.89	28	9.12	
Adjusted Post-Test Means	16.53	14.05	**BG**	76.81	1	76.81	11.21*
			WG	321.84	**27**	6.84	

* Significant at 0.05 level for the degrees of freedom 1 and 28 = 4.19

* Significant at 0.05 level for the degrees of freedom 1 and 27 = 4.21

An examination of Table - III indicated that the pretest means of the experimental and control groups were 13.88 and 13.96 respectively. The obtained F-ratio for the pre-test was 0.01 and the table F-ratio was 4.19. Hence the pre-test mean F-ratio was insignificant at 0.05 level of confidence for the degree of freedom 1 and 28.

The post-test means of the experimental and control groups were 16.51 and 14.08 respectively. The obtained F-ratio for the post-test was 8.08

and the table F-ratio was 4.19. Hence the post-test mean F-ratio was significant at 0.05 level of confidence for the degree of freedom 1 and 28.

The adjusted post-test means of the experimental and control groups were 16.53 and 14.05 respectively. The obtained F-ratio for the adjusted post-test means was 11.21 and the table F-ratio was 4.21. Hence the adjusted post-test mean F-ratio was significant at 0.05 level of confidence for the degree of freedom 1 and 27.

Figure- II
Pre and post-test differences between the experimental and control groups on proficiency in digital literacy and use of technology

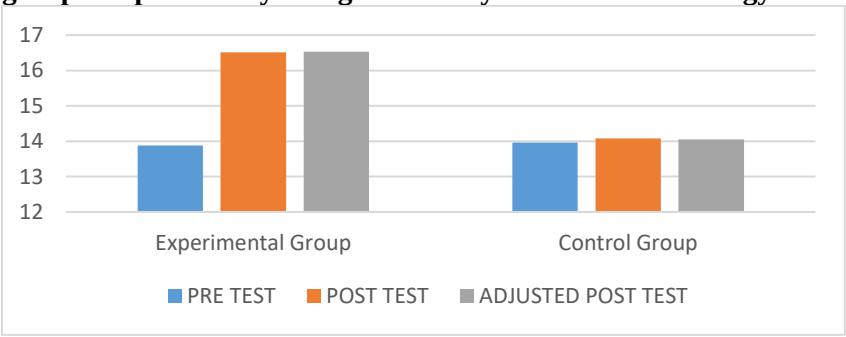


Table - IV
Computation of analysis of covariance of the mean of experimental and control groups on attitudes and preferences

	Experimental Group	Control Group	Source of Variance	Sum of Squares	df	Means Squares	F-ratio
Pre-Test Means	30.89	31.18	**BG**	0.62	1	0.62	0.01
			WG	1250.89	28	44.67	
Post-Test Means	41.99	31.29	**BG**	859.31	1	859.31	17.31*
			WG	1389.53	28	49.62	
Adjusted Post-Test Means	42.02	31.26	**BG**	867.25	1	867.25	17.35*
			WG	1349.10	27	49.96	

* Significant at 0.05 level for the degrees of freedom 1 and 28 = 4.19

* Significant at 0.05 level for the degrees of freedom 1 and 27 = 4.21

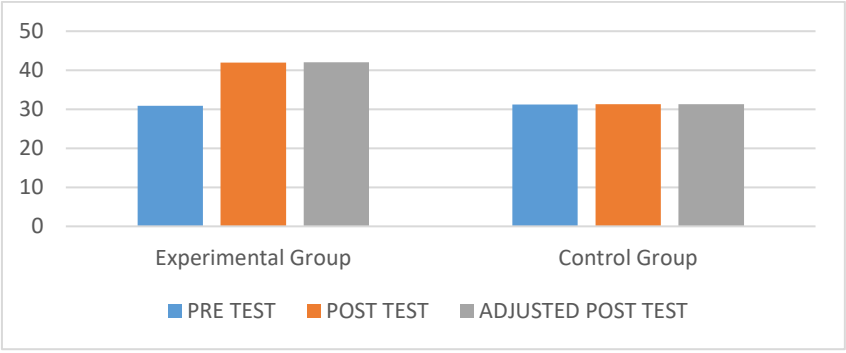
An examination of Table - III indicated that the pretest means of experimental and control groups were 30.89 and 31.18 respectively. The obtained F-ratio for the pre-test was 0.01 and the table F-ratio was 4.19. Hence the pre-test mean F-ratio was insignificant at 0.05 level of confidence for the degree of freedom 1 and 28.

The post-test means of the experimental and control groups were 41.99 and 31.29 respectively. The obtained F-ratio for the post-test was 17.31 and the table F-ratio was 4.19. Hence the post-test mean F-ratio was significant at 0.05 level of confidence for the degree of freedom 1 and 28.

The adjusted post-test means of the experimental and control groups were 42.02 and 31.26 respectively. The obtained F-ratio for the adjusted post-test means was 17.35 and the table F-ratio was 4.21. Hence the adjusted post-test mean F-ratio was significant at 0.05 level of confidence for the degree of freedom 1 and 27.

Figure - III

Pre and post-test differences between the experimental and control groups on attitudes and preferences



Discussion on Findings

The prime intention of the researcher was to analyze the impact of a digital literacy training programme on pre-employment skills among students with visual impairment. While analyzing results it was revealed that there were significant differences found in the experimental group in all the variables.

Conclusion

From the analysis of the data, the following conclusions were drawn.

The experimental group showed significant improvement in all the pre-employability skills (Awareness and knowledge, Proficiency in digital literacy and use of technology, & Attitudes and preferences) after undergoing the digital literacy training programme for 16 weeks when compared to the control group.

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CHAPTER : 6

RECENT TRENDS OF INFORMATION TECHNOLOGY IN INDIA: PERSPECTIVE AND CHALLENGES

Tapan Kr Mahata [1]

Abstract

Today, ICT (information and communication technology) is an integral aspect of modern life. Particularly for emerging nations, they are considered fundamental to societal, political, and economic progress. Societal regulations and collective action are fundamental to the study of governance. The idea that India is an IT powerhouse has been floating around. The software sector in India and the contributions of Indian Americans to the information technology revolution in the US are largely responsible for this. India is widely recognised as a global leader in information technology, thanks to its booming IT industry that has grown at a remarkable pace of 35% annually over the last decade. The purpose of this article is to investigate the potential of information technology to have a more systemic impact on India's economic growth. It also addresses the difficulties of adopting IT and talks about how it's being used in various fields. In addition to addressing infrastructural restrictions and upgrading the education and training system, the researcher finishes by saying that the government should encourage the use of IT and make it available to all sections of society.

Keywords: *Communication, Political Development, Social, Technology*

Introduction

Information technology may be traced back to prehistoric societies that perfected the technique of recording data. Its trajectory mirrors that of modern civilization, first mechanical and then electrical. Early humans used items that looked like paper, stones, metal plates, fabric, and other similar artefacts to record information. Computing, telephony, microelectronics, and many more technologies are all part

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of what is collectively known as "information technology," which encompasses all aspects of data processing and transmission (Ramija, 2018). When it comes to education, healthcare, business, communication, and even our day-to-day activities, information technology has had an impact on humans. With the aid of IT, we can collect, process, and link massive amounts of data and information. The rapid development of many IT technologies, such as cloud computing, mobile computing, social media, etc., is altering traditional work practices. Cloud computing allows us to digitally access software and hardware resources on an as-needed basis, with no upfront costs. This aids both individuals and businesses in avoiding the installation of cumbersome and expensive software on their respective systems. Applications, platforms, and infrastructure may all be accessed online using cloud computing. People may now access and analyse data on the go just as quickly as on a desktop computer thanks to mobile computing. A user-friendly way to connect with individuals all around the world is via social media. These days, a lot of people choose wireless gadgets. Internet of Things (IoT) or ubiquitous computing is enabling almost all things to detect, analyse, and send data in real time via existing networks (Harnal, & Bagga, 2013).

Objectives

The present study has been carried out to know about the trends of information technology. It also discusses the opportunities and challenges of information and technology.

Recent Evolving Technologies

It is worth mentioning in this article that many technologies are currently facing development hurdles and are hence not yet widely used. It will take some time for these technologies to be fully implemented, based on user input. The following innovations have not yet achieved widespread use, but they are in the works.

Quantum Computing

You may be shocked to hear that old computers aren't that fast. According to 2019 IT trends, quantum computers will be the next big thing in computing. At this very moment, they are developing into something far greater than their predecessors. Using the principles of quantum physics, a new paradigm in data transmission and processing

has emerged: quantum computing. Binary code, abbreviated as "bit," is used by traditional computers to store and process data. There are just two possible states for the bit, and it can only be in one of them. Regarding the quantum computer, it employs superposition-based qubits. Plus, there are only two possible states for the qubit: zero and one. On the other hand, it may mix values and exist in all these states simultaneously because of superposition.

Thanks to quantum computing's inherent parallelism, we can skip checking every conceivable state of the system and go right to the answer. Plus, there's no need for massive quantities of RAM or processing power in a quantum-computing system. Think about it: a binary system takes trillions of bits, whereas a quantum system just needs 100 qubits to compute a 100-particle system. Programmers have mastered the art of creating quantum-computing apps and will work tirelessly to make them more accessible and user-friendly.

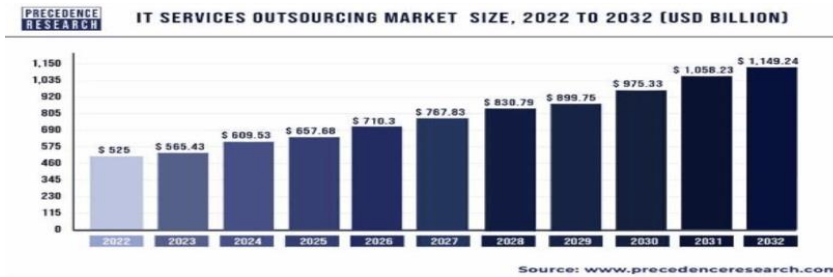
Cyber security and Artificial Intelligence

The importance of cyber security is growing in both personal and professional spheres, but the myriad of threats makes it difficult to effectively manage. The sophistication of exploits has increased, making it difficult for IT professionals to manage cyber security threats. Data analytics and automated scripts can't be improved with pure automation alone; artificial intelligence is now necessary. Because people are still going to be involved in making decisions, there will inevitably be a connection to ethics. But AI may still be targeted by cybercriminals. More robust Artificial Intelligence/Deep Learning (AI/DL) solutions in the face of hostile traffic in any application field is necessary to manage and regulate these issues impacting the two technologies. The implementation of this is anticipated to occur soon.

IT Outsourcing

The trend of IT outsourcing is expected to continue for the foreseeable future, since it is now experiencing fast and extensive expansion. Outsourcing to India has lately been the best option. In order to boost profits, companies are now focusing on improving their operations in centres in India.Despite having different goals in mind, approximately 64% of US firms outsource some kind of IT function, according to reports. Outsourcing IT services may help save costs, increase productivity, and get access to specialised talents, says a Markets and

Markets analysis. While 20% of businesses outsource in search of innovation, around 32.2% do it to reduce total expenses. In order to raise the bar on their operations, another 15.4% use outsourcing.Studies show that organisations may save 70 to 90% in labour expenses overall by outsourcing their development processes, therefore it's not unexpected.



Artificial Intelligence and Machine Learning

Artificial Intelligence (AI) and Machine Language (ML) have been unquestionably one of the latest advancements in 2023. Next Move Strategy Consulting predicts robust growth in the artificial intelligence (AI) market in the upcoming decade. They anticipate a remarkable expansion, with its current valuation of almost 100 billion U.S. dollars projected to increase twentyfold by 2030, reaching close to two trillion U.S. dollars.

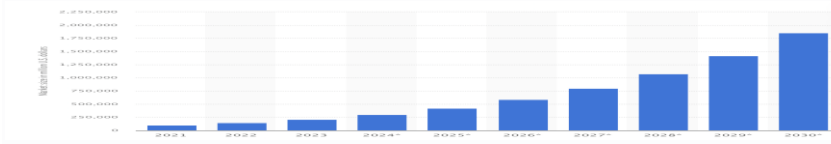


Image Source: Statista

The use of AI and ML has spread across every industry these days, from healthcare and banking to retail and manufacturing. Improving, automating, and processing time-sensitive data with little human intervention is the goal of the robust AI and ML duo. Business process acceleration, precise observation of purchase behaviour for informed choices, customer experience gearing, and chat bots for communication are all within your reach. AI and ML allow you to extract value from piles of data, deliver business insights, automate tasks, ensure safety operations, and enhance system capabilities.

IT-Recent Developments and Future Plans

Based on the relevant literature, we have created the IT trends way forward framework to demonstrate how the current and future IT trends will pave the way for IT professionals.

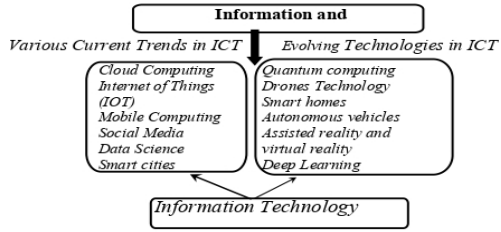


Fig. One Direction for IT Trends Going Forward Structure: Derived from Concurrently Conducted Research

Challenges of IT: Technologies

Block chain technology will mature and find new, creative applications in the next years, fostering more openness and decentralization of data. Online businesses will be able to create innovative financial goods and services thanks to new models that will force traditional methods of data storage and management into the spotlight. Biometrics authentication is just one example of how the proliferation of the internet of things will open up a world of new possibilities for product and service development by connecting previously siloed digital and physical data sets. With the advent of quantum computing, new possibilities for an economy dependent on real-time data will arise, and computational power will be accessible on mobile devices.

New competitors

Digital banks will emerge as new major rivals to traditional sectors after an initial, fragmented phase of fin techs joining the financial system. Big internet companies like Facebook, Apple, and Google will likely dominate the fintech industry, with smaller firms specializing in certain areas. These companies will cater to customers' needs for online payments and general financial services (Kumar, 2016).

New regulations

Transforming the financial system, stimulating competition, and providing stronger protection against fraud are the goals of new rules like the General Data Protection Directive and the second edition of the Payments Service Directive (PSD2). Businesses will find it difficult to provide services at reduced prices in a market that is more competitive, diverse, and open.

New global threats

The economy will undergo further transformation as new global challenges emerge and spread. With the help of a more favourable regulatory environment, the sharing economy will keep growing. Massive hacking will cause governments and businesses to pour resources into security, and political systems will face ongoing crises as a result of this security problem.

Driving Adoption of New Tools & Processes

When introduced with new technology or methods, long-term workers may be resistant to change since they see no need to alter their established practices. In order for workers to swiftly become productive and adept with a tool and appreciate the benefits of these new processes, organizations must provide thorough on boarding training and continual performance support for new software installations.

Conclusion

The information technology industry in India will be affected by all worldwide technological developments as the country's digital economy is growing rapidly. Each company will be an IT venture by 2022 due to the widespread adoption of digitization across all sectors. Artificial intelligence (AI), augmented reality (AR), machine learning (ML), and the internet of things (IoT) will soon be commonplace and contribute positively to the enhancement of corporate efficiency. In order to make the Internet a secure place without limiting its economic growth, the government and the corporate sector must collaborate to solve these issues. Over the next 30–40 years, the digital revolution—also called "The Internet Economy" or the Internet of Everything (IoE)—is predicted to provide new employment, expand existing

markets, and become the greatest financial opportunity that humanity has ever faced (Bairwa. 2019).

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CHAPTER : 7

EMERGING TRENDS & CHALLENGES OF DIGITAL EDUCATION: AN INNOVATIVE CLASSROOM MODEL FOR LEARNING

Dr. Satyapriya Behera [1], Swati Bhowmick [2]

Abstract

Digital learning is one of the most affected ways of education. Since independence, India as developing nation is contentiously progressing within the education area. There are a lot of challenges to the education system of India that equally gives a lot of opportunities to beat these challenges and to form education systems far better education for the Digital learning of the 21st century. National Education Policy 2020 recognized the importance of digital education in providing quality education for all. Education is the process of facilitating learning, acquisition of knowledge, skills, values, beliefs, habits etc. to contribute in socio-economic growth of nation. Digital education is a complex multidimensional topic which uses digital technology and tools in teaching and learning process. Digital education provides many opportunities to both educators as well to their learners. Learners as well as educators are actively and easily engaged with each other through email, messages, video chat, online forums, social media, learning materials etc. Digital education is more accessible, provides personalization as well as flexibility of learning material to the learners. It makes learning process more mobile, interactive, engaging and motivating. It also allows educational programs to be available 24/7 in different languages to carter to the varying needs of the learning student. Though digital education has more benefits but it also has many future challenges in India. In the new era of digital education, creation of efficient online content, their digital repository and mode of delivery to learning student through the efficient infrastructure and technology are major challenges.

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Keywords: *Digital Education, Challenges of Digital Education, Innovative Classroom Learning, Digital Learning*

Introduction

Digital Education means digital learning. It is a type of learning that is supported by digital technology or by instructional practice that makes effective use of digital technology. Digital learning occurs across all learning areas and domains. Digital Education gives win-win opportunities for all; on one side schools and colleges and other institutions find rapid rise in enrolments and added revenue because of Digital Education, while on the other side students view this as a flexible and alternate option allowing them to study as per their convenient time and space. Teachers and professors too find it convenient to prepare their teaching plans aided by digital technology. Teaching and learning becomes a smoother experience as it includes animations, gamification and audio visual effects. Over the last few years Digital Education in India is evolving at faster rate. The traditional chalk and talk method in schools and colleges has been slowly changing with more interactive teaching methods as schools and colleges are increasingly adopting digital solutions. Digital learning guarantees more participation for students as the current generation of students is well- versed with laptops, IPads, and smart phones. There are different private players in the field of Digital Education like Educomp, Tata Class Edge, Pearson, and Teach Next who are continuously engaging and developing different interactive software to help teachers in classroom teaching.

Concept of Digital Education

Education is the process of facilitating learning, acquisition of knowledge, skills, values, beliefs, habits etc. Education is not only limited to textbooks and classrooms teaching but also involve the incorporation of new technologies, tools, innovative ideas and e-content in teaching learning process. Wagner (2018) reported the change in nature of teaching and learning process with successive development of Information and Communication Technologies (ICTs). In India, digital education was previously viewed as a material supplementary to classroom teaching (Shah and Jani, 2020).Digital education is a complex multidimensional topic that not only includes three tiers of education, but also the delivery of education. Digital education is an incorporation of digital technology and tools in teaching and learning process. Digital education is an umbrella term for

any education that could encompass the use of technology in traditional classrooms, blended learning (which combines online and face-to-face instruction) and education that takes place entirely online (Allan, 2019). Digital education also covers the terminology such as Technology Enhanced Learning (TEL) or digital learning or e-learning. Digital education insures these and sophistication of digital technologies for teaching and learning process within a community. These digital technologies requires appropriate infrastructure to support such education. Digital learning is not a new concept but its significance was increased manifold after COVID-19 pandemic. Most of educational institutions are adopting digital education as solution for traditional education process of chalk and talk. Evolving technology and high speed internet made learning interactive, engaging, and motivating and handy. In near future, digital education will play prime role in learning process through the Government policies for effective implementation and adoption by educational institutions (Wagner, 2018).

Need of Digital Education

Digital education provides many opportunities to educator to engage their learners. Learners and educators are actively engaged with each other through email, messages, video chat, online forums, social media, learning materials etc. with convenience of time and place. Rosemarie M (2022) enlightened that the digital education is more accessible and provides personalization as well as flexibility of learning material to the learners.

(a) **Accessibility:** Digital education provides an opportunity to access educational resources at the time and place which are convenient to the learner as well as educator. This can support lifelong learning and help to widen access of education. Online and blended mode of learning can increases accessibility of education for those students who live at distant places from educational institutes or have work or carrying other responsibilities.

(b) **Personalization:** Learning resources in digital formats enables personalization of these resources through the settings of the technology used for access. This makes it easier for the learner to access and use the resources as per convenience and need.

(c) **Flexibility**: Digital technologies also provide affordances as well as the ability to provide learning material in different formats, modes or languages to interact synchronously as well as asynchronously with learners across the world.

JISC (2019) conveyed that students need to develop the digital skills that employers want now, as well as the confidence and capabilities that will enable them to progress in their careers and adapt to emerging technologies in order to live, learn and work in a digital society.

Benefits of Digital Education

1. Digital education makes learning process more mobile, interactive, engaging and motivating. Digital format allows teachers to customize the study material based on an individual's learning speed and ability and overcome the drawback of student interest in traditional education system.

2. Students gets exposed to new learning tools and technology and develop effective self-directed learning skills which significantly magnifying their efficiency, learning ability and productivity.

3. Digital technology changed the regular classroom session in to an interactive digital session. This can make students pay more attention as they are extensively familiar with the digital world.

4. Earlier, students would rely on limited sources of information but now the world of the internet is vast and loaded with information and most of which is also freely accessible. Thus, the emergence of digital education has made it possible for students to explore and use this treasure of knowledge

5. It allows easy preserving and sharing information by just a click than maintaining in form of hand-written notes, proof reading notes, short hand notes etc. This allows saving the time and physical labor work of students.

6. The digital education system brings students out of their shells and makes them independent thinkers about what to study, when to study and how to study thereby curtailing the dependency on their teachers and parents.

7. Allows educational programs to be made available 24/7 in different languages to cater to the varying needs of the student.

8. Digital learning can be easily made possible with use of internet on the devices such as mobiles, tablets, desktops, laptops, etc. by students.

9. It has been proven appropriate education system in situation such as epidemics and pandemics where traditional education system is suspended.

In the present situation of Digital Education the figure: 1 showing to the benefits of Digital Education.

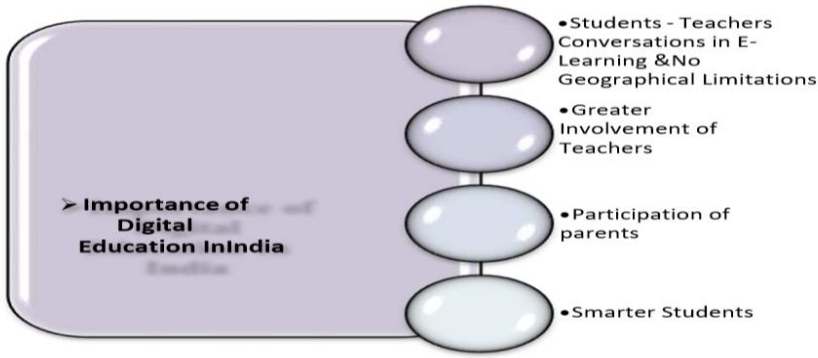

Figure 1: Benefits of Digital Education

Future Trends in E-Learning System in view of NEP 2020

National Education Policy, 2020 supports the e-learning and in the nearest future, India is going to stands with forthcoming new trends in the e-learning. Some of the trends in e-learning are as follows (Fig.3):

Multimedia Learning: Multimedia learning is offered with the combination of two or more media such as audio, video, images, documents and music etc. It revamps the teaching learning process by incorporating innovative methods. This methodology achieved more student retention rate of about75% compared to40% student retention in see and hear method as well as 20% student retention in see only method (Neo, T and M. Neo, 2004; Scott, B. and C. Cong, 2010).

Blended or hybrid mode of learning: Integration of both offline and

online teaching pedagogy allows to teach some portion of course by online and remaining lab base or art performing base portion of course by offline mode. This blended mode of learning helps to students to be more interactive in acquiring practical knowledge and soft skills.

Figure 3: Future Trends in E-Learning

Mobile learning (M-Learning): Many portable devises such tab, mobile etc. were mainly used for communication. But people are now using these devices as pedagogical instruments. Now a day, teaching technology is delivered through mobile technology, which is more accessible, social and economic.

Gamification: For making learning activities as fun, learning content must be added with different game based features such as discounts, badges, and leader boards. This gamification makes learning process more effective, engaging, competitive and rewarding for both educators and students.

Micro learning: Short teaching content are more impactful and productive in understanding the concept. This bite sized content is mostly accepted by new generation. Therefore, online learning courses should include short contents such as educational videos, text, animations, etc. (Naresha B. and D. Reddy, 2015; Baz, F. C., 2018).

Video-based learning: Video-based learning will become most important trend in online education in future. Special instructional content recordings, special sessions, chapter will be made available in the form of videos for learnings. In coming years video-based education will become more popular and feasible where students will be able to access course content from anywhere at any time (Naresha

B. and D. Reddy, 2015; Vivekananda M and Satish Ruvn, 2017).

Artificial Intelligence (AI): Artificial intelligence (AI) is nothing but the simulation of human intelligence processes by machines especially by computers. An introduction of AI in education will produce a good instructor which ultimately results in making each and every student a good expert. Provisions of expert instructor for learners, automated teaching, huge and rich information are some of the major benefits of AI in e-learning (Vivekananda M. and Satish Ruvn, 2017).

Interest of Investor in education field: During last three years, considerable investment has been taken place in the E-Learning market of India. This emerging E-learning sector of education will provide potential scope for investment for familiarization of the digital learning in India. India Brand Equity Foundation reported that estimated worth of the education sector in India was US$ 117 billion in Financial Year 2020 and it is expected to reach US$ 225 billion by Financial Year 2025.

Emerging Trends of Digital Education

i. Digitalized classroom/Flipped Class rooms a growing Trend:

A complete revolution in the way we learn today has been brought by Technology. Teachers teaching in the classroom can capture the students and the full strength in the class by digital screens, thus facilitating each child to get the same base content and input from the teachers. This feature of digital era has increased the Student engagement as it combines various instructional styles.

Each student gets in contact to world-class education, which is not easy to impart by the traditional white chalk and black board teaching. This new learning is more interesting, personalized and enjoyable. With this technological inclusion in the school teaching the students feel studying as enjoyable, easy, competent and above all interesting. The aim of a teacher however should be to create such an atmosphere which makes every student want to study.

ii. Video based learning

Video-based learning as a part of digital marketing has geared up in Indian Education Sector and has made education engaging, entertaining

and exploring. It enables learning with a pedigree of learning out of leisure with creativity, fun and entertainment on cards via the wonderful Apps, podcasts, videos, interactive software, e books and online interactive electronic boards. Children are excited and operative with interest to manage the showcase via their intelligence, exploring the weak techno skills of teachers and assist them in public with pride and honor and recognition.

iii. Massive open online course (MOOCS) & other distant learning programs

A massive open online course (MOOC) is an online course aimed at unlimited participation and open access via the web. India is considered to be the biggest market for MOOCs in the world after the USA. Since the population of India is huge, massive open online course (MOOC) are said to gateways for a lot of Indians in terms of bringing an educational revolution. Online distant learning programs give a great opportunity to avail high quality learning with the help of internet connectivity.

iv. K12 sector Game based learning

K-12 School is a terminology used as Kindergarten through XII grade. Various start-up companies have been the contributor for this sector. Today the world is of Y-generation people who are acquainted with the technological developments taking around them, and they are also surrounded with the required skills and abilities. K-12 creates the game based learning environment, which enables the learner to easily get the word of education in India and give us a better self-trained Y generation.

v. Digital Learning

Digital learning may be a sort of learning combination of context and method by electronic elements. It's associated by technology. It encompasses the appliance of a good spectrum of practices including and virtual learning. Sometimes digital Learning is confused with online learning or e-learning, digital learning encompasses the aforementioned concepts. Digital learning strategies are concerned with the following aspects exclusively in learning process:

- Adaptive learning and Blended learning
- Classroom technologies and E-textbooks
- Learning analytics and Learning objects
- Mobile learning: e.g. Mobile Phones, Laptops, Computers, iPads.
- Personalized learning
- E-learning or online learning and Open educational resources (OERs)
- Technology-enhanced teaching and learning

vi. Digital Learning Pedagogies: Listed below are common pedagogies, or practices of teaching, that combine technology and learning:

Blended/hybrid learning, Online learning, flipped learning, 1:1 Learning, Differentiated Learning, Individualized Learning, Personalized Learning, Understanding Intentionally (UBD), Universal Design for Learning (UDL)

vii. Digital Learning Tools and Resources

There are a plethora of tools and resources online. This will be wont to create and enhance a digital learning environment. Listed below are resources and tools 21st century teachers can use for digital learning:

Google class, Esayclass, RSS or Social Readers, Google Communities, YouTube Channels, iTunesU, Cloud-based Word Processors(i.e. Google Drive), File-sharing platforms(i.e. Drop box), Ever note ,Digital Pocket, Zotero

Key outcomes of Digital learning:

- E-Learning should be more focused on knowledge creation rather than merely on knowledge acquisition. As knowledge is the integral part of this century.

- Developing collective cultural practices, physical learning is important as learning takes place between people and their cultural surroundings.

- Along with emotional and cognitive development, well-being and Social and Emotional Learning (SEL) are also essential for

the development of the students.

- Instead of computer-supported learning, it would be advisable to talk about new forms of Socio-Digital Participation (SDP). This includes media literacy, such as using social media and search engines.

- Constant reforms in schools and teacher education is essential for development. The schools are not following the important developments of society. There is no evidence that learning styles or types would be informative in designing learning environments. Alternatively, it would be advisable to observe users' motivational profiles or study orientations. Meaningful and engaging learning methods are advisable, which support collaboration and self-regulation (Almahasees, Mohsen & Amin. 2021).

Suggestions/ Opportunities in Education and Digital Learning:

Digital learning has plenty of advantages for teachers, students and administrates. Teaching and learning can take place whenever and wherever it is most convenient for everyone. Education in teaching and learning process changing Digital mode for better effectiveness. Colleges and universities change may be a curriculum digital mode. Allow us to mention a number of Suggestions for improving education as Digital learning.

- **Develop high-quality digital learning programs*:*** High-quality learning programs useful to teachers, students, and administrators. Digital learning mode helpful to all those. These programs easy to understand of different pedagogies and methods to teachers.

- **Teachers skills development:** Digital learning useful to teachers develops professional skills and easy to understanding content for students.

- **Digital classroom:** Every college and institute maintains their won Digital class. The Digital class manages to difficult time to beat the overall classroom. Offering a spread of subject knowledge.

- **Online Class:** Very few colleges and universities were doing online classes. Absolutely nothing with online education pre-COVID-19 the education getting to back. Planning and understand that online education getting to minimum knowledge source for brand spanking new revenues. The web class mostly full fills to academic activities.

- **ICT teaching:** ICT related teaching and learning process very effective and straightforward process. Numerous ICT tools useful to love. Radio, T.V, Computer Etc.., access to realize more knowledge. Present days we using Face book, whatsApp, Google classroom, easy class, etc. useful to share information and communication technology.

- **Providing Internet facility:** In rural areas suffering internet facility. Therefore the government tacks response to supply good Connections in an online facility .It's useful to country students' good online classes covered.

- **Financing:** Digital education involves effective and efficient. Therefore the government provides funding to develop digital classrooms.

Challenges for Digital Education in view of NEP 2020 in India:

Considering need of time, NEP 2020 promotes the digital education in India. But online teaching learning has many challenges. The major challenges are as follows:

- The accessibility of high speed internet connectivity, supporting devices, software and applications at affordable costs are prime requisites in digital education. The government needs to come forward with provision of financial support and policies that will boost the market for amenities required for the digital education in India.

- Online education needs be blended with experiential and activity-based learning otherwise it will tend to become a screen-based education and will not focus on social, emotional, physical quotient as well as overall development of student.

- Teachers will require suitable training and develop themselves to become effective online educators. Teacher's familiarity for the new teaching format, platforms and tools for online education is also major challenge.

- In India, most of students are from communities like farmers, cleaners, sweepers, housemaids, waiters, etc. with financial conditions which may not support them to fulfill all the essential requirements for online education. As per the report of NSSO, only 4.4% of rural households and 23.4% of urban households own their personal computers.

- Assessment and evaluation of students in online education is a challenging task, especially in practical oriented and art based courses.

Survey showed that, teacher and students in the online learning process faces several challenges such as struggle for adapting to online mode, lack of focus and concentration of learners, diversion of learners to other social media platforms, health issues due to long term exposure to the screens, etc. Therefore, Almahaseeset. al., 2021 suggested that effective learning through digital mode is possible through development of strong self-discipline and focus. Today, let's take a while to seem at a number of the more common digital learning challenges and discuss ways to beat them (Wagner, 2018).

- **Technology continuously changing:**

Unfortunately, technology is usually changing, so you ought to not expect to be using equivalent tools forever. Instead, you ought to have an idea and budget in situ for upgrading technology.

- **Lack of quality content**:

With the quantity of digital content, it's overwhelming to curate a set of high-quality digital learning materials independently. Instead, your school administrators and teachers should work side-by-side with the varsity librarian to develop a solid collection of content.

- **High costs:**

Technology and digital resources are expensive. Therefore, teachers

and schools should be prepared to hunt grants and community support for funding.

- **Security issues:**

More activity online also results in more security issues. To combat security issues, your school should invest in security. Additionally, students and teachers got to be taught the fundamentals of internet safety.

- **Teacher's skills**:

Teacher skills are most impotent within the teaching-learning process. Present days very less training programs in education. So the teacher training programs useful to develop different methods in his teaching-learning process.

- **Digital classroom:**

One of the foremost challenges for digital classrooms in India because is poor internet connectivity and establishing in rural areas and a couple of parts of urban areas. the majority of the population across India has still no access to the online therefore the digital classroom maintenances are very problematic. And an outsized population in rural areas remains illiterate so we cannot rich digital technology there.

- **Language and Syllabus related Challenge:**

Languages and Syllabus is one of the foremost barriers for the event of digital education in India, there are several different languages within the various state are spoken, pushing all the digital content altogether these regional languages and Syllabus a short time becomes difficult.

- **Maintenance of digital equipment:**

In rural areas maintenance of digital equipment is one among the most challenges. The digital equipment maintenance was very high.

- **Financing:**

Digital education involves effective and efficient usage of appropriate and latest hardware and software technology within the market. In

India, digital technology implementation into education systems could also be a difficult task. It requires large funds and infrastructure. The Digital India program the government is promised availability of funds for technology implementation.

Digital communications for Innovative Model Classroom:

National Education Policy 2020 gives clear guideline towards online content creation in the form of digital repository. Online content should be of good quality which provides equal access and fun based learning to students. **NEP 2020** also proposes development of virtual labs or e-learning platforms like **DIKSHA, SWAYAM** and **SWAYAMPRABHA**. It promotes blended models of learning wherein 40% of the course syllabus will be covered through online mode and 60% through offline approaches. Rules and standards of online content, technology and pedagogy for online/digital teaching-learning will be placed in due course of time. Thus, the higher education institutes needs to reform itself to teach up to 40% of each course through online mode while remaining 60% in offline mode. This blended mode of learning also preserves the importance of face-to-face in-person learning.

Conclusion

21st century is the most vital nation's development. However, education is extremely important for growing our economy, society, and polity.21st century education in India has many challenges and opportunities so that Digital classrooms, online classes, ICT tools are developing education to give better opportunities. The National Education Policy 2020 recognized the importance of digital education in providing quality education for all (Allan, 2019). This policy promotes digital education in India. Digital education is nothing but the use of digital technology and tools in education. Digital education provides many opportunities to both educator and their learners. Digital education is more accessible, flexible, and impressive and time retentive providing variety and quality in learning material to the learners at their place and time. Though digital education is found to be beneficial in numerous ways, it has many challenges in India. Creation of efficient online content, their digital repository and mode of delivery to learners through the creation efficient infrastructure and technology are some of the major challenges which needs be tackled in the new era of digital education. Further research and innovation in technology will revamp the digital education system.

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CHAPTER : 8

EXPLORING WAYS TO DEVELOP COMPUTATIONAL THINKING IN PRIMARY SCHOOL STUDENTS OF INDIA

Meghna Singh [1]

Abstract

In the 21st century, we are encountering daunting issues such as the Covid-19 pandemic and climate change. These issues are being efficiently addressed through the utilization of computing technologies, such as Artificial Intelligence and Machine Learning. The global community has come to recognize the significance of computing in day-to-day life and its importance in effective problem-solving. Computational thinking, a phrase popularized by Jeannette Wing in 2006 to emphasize the significance of computing in today's world was welcomed by the global education community as an important skill to be developed in our students to prepare them for a future centric living. This skill has now been incorporated into India's National Policy on Education of 2020. As stated in paragraph 4.25, Computational thinking is recognized as a crucial skill that should be cultivated in young pupils by integrating it into the existing school curriculum. The teachers' lack of understanding about the nature of this skill has caused a delay in its inclusion in the school curricula. This paper aims to address the urgent inquiry of defining computational thinking and identifying the most effective and efficient techniques or strategies for cultivating it in young children.

Keywords: *21st century, Covid-19 pandemic, Computational Thinking, Primary School*

Introduction

The world is constantly evolving. As we progress in our lives following the pandemic, we have recognized the significance of employing computing for problem-solving. Technologies such

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as Artificial Intelligence (AI) and Machine Learning (ML) have been employed to address significant challenges, including the identification of prospective vaccine ingredients, analysis of patient information, and global pandemic monitoring. The aforementioned problem-solving approach originates from the field of Computer Science and is commonly referred to as Computational Thinking (hereafter referred to as CT). Researchers in the field of Computational thinking are actively working towards integrating it into classroom education. In 2006, Jeannette Wing popularised the notion of CT, which she defined as a problem-solving approach that incorporates key principles and techniques from the field of Computer Science (Wing, 2006). This concept ignited a revitalized enthusiasm for the instruction and acquisition of Computer Science, with the aim of disseminating fundamental concepts of computers to a wide audience. In the past, Computer Science was regarded as an independent field, taught separately from other topics in educational institutions. However, the increasing body of research in the field of CT has highlighted the significance of integrating Computer Science with other academic fields, such as the Sciences and Humanities. Merely possessing knowledge of Computer Science ideas, without comprehending its significance in effectively addressing problems in other fields and domains, is like acquiring rudimentary comprehension of grammar without comprehending its practical application in ordinary verbal communication. Consistent with Wing's initial concept of the widespread presence of CT, we have reached a point where it is acknowledged that CT is truly present or could be utilized in various future-oriented problem-solving scenarios.

Several countries have already begun implementing curricula that incorporates computational thinking at the classroom level. The United States is at the forefront of research, providing empirical evidence on treatments implemented at the school level. China and other European countries, including England, Germany, Spain, and Italy, follow suit in this regard (Rafiq, 2023). The National Policy on Education 2020 in India emphasizes the significance of computational thinking in the context of a highly competitive global landscape. This is highlighted in paragraph 4.25, specifically under the section titled "Curricular Integration of Essential Subjects, Skills, and Capacities." The policy acknowledges the increasing prevalence of technologies such as Machine Learning, Data Science, and Artificial Intelligence, which are expected to become commonplace in the future. As of yet, there has been no official incorporation of CT into the current curriculum. The

teaching of CT in schools appears to be widely acknowledged. But the question that remains is how to do it efficiently.

Research Question 1: What is the meaning of Computational Thinking?

Research Question 2: What are the various strategies for fostering the development of Computational Thinking among primary school students of India?

Objectives of The Study

1. To understand the meaning of Computational thinking in K-12 education.

2. To explore various strategies that can be applied to develop Computational thinking in primary school students of India.

Method

The research conducted in this study involved the extraction of pertinent journal papers and conference papers from several databases, such as ScienceDirect, Scopus, and the Association for Computing Machinery Digital Library. The article's title included the search phrases "Computational Thinking" and "K-12". The scholarly articles published within the past 18 years were obtained. The retrieved publications were meticulously scrutinized to align with the criteria of the research inquiries. To achieve the first objective most often referenced theoretical publications that provide a definition or framework of CT were included. All papers pertaining to a specific activity or strategy aimed at fostering Computational thinking skills in primary school students/classes 1-5/age group 5-10 were included for the fulfilment of second objective. Exclusion criteria encompassed pilot surveys, studies lacking validation or reliability measurements, insufficient data, and small sample sizes.

Findings

Objective 1

Due to the diverse range of opinions regarding the definition and components of CT, there remains an unresolved issue that requires

attention. The question at hand is, "What precisely constitutes Computational Thinking?" To address this inquiry, it is crucial to examine the definitions provided by distinguished scholars and prominent institutions.

Initial description about CT is seen in the book named “Mindstorms: Children, Computers and Powerful Ideas” authored by Seymour Papert. The author argues that the utilization of computers and programming as constructionist tools can enhance the logical reasoning abilities of students (Papert,1996). This term was revitalized by Jeannette Wing in her article, wherein she implored the importance of Computational thinking in the everyday life. She asked to incorporate this skill along with basic reading, writing and arithmetic for the young students (Wing, 2006). Her call to infuse this skill in the students was welcomed by the education community. Hereafter, was seen a surge of research articles in this field, highlighting the different opinions of the educationists about the nature and definition of CT.

Cuny, Snyder, and Wing proposed an enhanced interpretation of the concept of CT. According to (Wing, 2011), Computational Thinking refers to the cognitive process of generating problems and their solutions in a way that can be efficiently executed by an information-processing agent. In order to enhance its practicality in curriculum implementation, Aho (2011) identified CT as a cognitive process that necessitates the restructuring of problems to enable the generation of algorithmic solutions.

The aforementioned definitions of CT are primarily theoretical and offer limited support for the evaluation of CT. The recognition of the important role of a definition in the creation of an evaluation instrument prompted the researchers to put out definitions that delineate specific components of computational thinking. It is important to acknowledge the fundamental concepts and capabilities of CT as outlined by Bar and Stephenson (2011). The curriculum encompasses many components such as data collection, data analysis, data representation, problem decomposition, abstraction, algorithms and procedures, automation, parallelization, and simulation. These components are supported by relevant examples from the fields of Computer Science, Mathematics, Science, Social Studies, and Language.

Brennan and Resnick (2012) introduced a computational thinking framework to delineate the process of learning and progress that occurs throughout the creation of interactive media on the Scratch platform. Scratch, a block-based programming environment developed by the MIT Media Lab, is widely utilized globally as an educational tool for introducing programming to young learners. CT consists of three dimensions: "*Computational concepts*", comprises of "sequences, loops, parallelism, events, conditionals, operators, and data." The second dimension, "*Computational practices*," encompasses "being incremental and iterative, testing and debugging, reusing and remixing, abstracting and modularizing". The third dimension, "*Computational perspectives*," comprises of "expressing, connecting, and questioning".

According to Selby and Woollard (2013), computational thinking is a cognitive process that operates within the brain. It facilitates the resolution of problems, comprehension of situations, and the expression of values through the methodical implementation of abstraction, decomposition, algorithmic design, generalization, and evaluation. This thinking results in the development of an automation that can be executed by either a human or digital computing device.

Kalelioglu et al. (2016) developed a Computational thinking "framework" consisting of five steps for problem-solving, based on a comprehensive evaluation of various studies. The initial phase involves identifying the issue by deconstructing it into smaller components through the process of abstraction and deconstruction. During the second phase, data is collected, examined, and depicted. During the third phase, employ mathematical reasoning, algorithm development, and parallelization to generate, select, and strategize solutions. Implement the solutions in the fourth step by employing automation, modelling, and simulations. During the concluding phase, assess the solutions and seek opportunities to enhance their quality. The process encompasses the examination of the solution, rectification of errors, and generalization of findings. The authors emphasize that this approach is applicable to both computerized problem-solving, which involves the use of computers, and unplugged problem-solving, which does not involve the use of computers.

According to Shute et al. (2017), CT serves as a strategic approach for addressing complex problems. The review encompassed six distinct aspects of computational thinking, including decomposition, abstraction, algorithms, debugging, iteration, and generalization. Both

decomposition and abstraction involve the process of breaking down a problem into smaller, more manageable components and subsequently extracting relevant aspects. Algorithms provide as a means for learners to employ logical thinking to address a specific problem. The process of debugging and iteration involves the systematic evaluation of one's work to identify, rectify, and enhance errors during the implementation of a solution. Lastly, generalization refers to the process of actively exploring chances to apply a solution to wider situations.

The "CS unplugged" project was initiated by Tim Bell, Ian Witton, and Michael Fellows. They began the project after conducting extensive research and publishing academic papers on the topic in various journals and conferences (Bell & Lodi, 2019; Bell & Vahrenhold, 2018). Their project aims to captivate young minds by presenting computer science as an exciting and intellectually stimulating field. They provide a foundation in the field without relying on computer technology. They view programming as a tool rather than the goal in the expansive realm of Computer Science. Their website (csunplugged.org) also features information about CT. They cite the definition provided by Cuny, Snyder, and Wing (Wing, 2011) and discuss terms such as information-processing agent, which refers to any entity that follows a set of instructions to find a solution. This agent can be a digital device or even a human. They emphasize that Computer Science and CT go beyond just computers. Instead, they prioritize the needs of people and design solutions to address their problems. They discussed six critical thinking skills that comprise CT, based on their extensive research on the subject.

(i) *Algorithmic thinking* refers to the cognitive process of developing algorithms.
(ii) *Abstraction* is the act of concealing irrelevant details and concentrating on essential ones.
(iii) *Decomposition* involves breaking down complex issues into smaller, more manageable ones, facilitating their solution. It is a crucial process in algorithm development.
(iv) *Pattern recognition* and *generalization* is the ability to apply a solution or a portion of it to a wide variety of similar issues.
(v) *Evaluation* refers to the process of determining the optimal solution to an issue.
(vi) *Logical thinking* involves utilizing preexisting knowledge to establish rules and verify facts.

Objective 2

In order to address our second research inquiry, it is important to look at empirical studies which highlight various strategies to develop CT in primary level students. Following are the strategies identified by the researcher:

1. Reverse Engineering Pedagogy

Reverse engineering pedagogy (REP) is an instructional approach that facilitates student learning through the deconstruction of things or systems to comprehend their inner workings, and potentially enhance or change their functionality. This approach fosters the cultivation of essential abilities such as collaboration, logical reasoning, innovation, and critical thinking, which are crucial for comprehending and operating well in diverse fields of study. REP can significantly enhance students' computational thinking abilities, especially in the realm of STEM (Science, Technology, Engineering, and Mathematics) education (Liu et al., 2023).

Example:

Students could be provided with a simple electrical toy and instructed to carefully dismantle it to investigate its constituent parts and comprehend its operation. Upon scrutinizing the components and their interconnections, students would endeavour to reconstruct the toy, potentially implementing enhancements or alterations to optimize its functionality or incorporate novel attributes. This interactive practice not only imparts knowledge about the toy's mechanics and electronics but also fosters problem-solving skills as students determine how to reassemble it.

2.SGQ Strategy

SGQ stands for Student-Generated Questions, a pedagogical approach in which students generate their own inquiries pertaining to the subject matter they are studying. This strategy is employed to stimulate pupils to engage in more profound contemplation of the subject matter and to foster the development of advanced cognitive abilities. Through the process of formulating their own inquiries, students actively participate in self-assessment and deliberation, so enhancing their comprehension and problem-solving abilities.

Example:

A study by Cheng et al. (2023) demonstrated students generating their own inquiries while actively participating in a game-based learning platform, which facilitated their ability to engage in profound reflection on the challenges they encountered inside the game.

3.Web-mediated parent education

Web-mediated parent education is an instructional method that utilizes the internet to teach parents. This form of education enables parents to acquire knowledge and then provide guidance to their children within the confines of their own homes, so offering a convenient and easily available means for families to supplement their children's education beyond the boundaries of conventional school environments. It involves the use of online resources and activities to enhance their children's abilities, such as computational thinking (Yang, 2023).

Example:

Children could play a game where they have to sort items by different qualities, like colour or size, to learn how to categorize and recognize patterns, which are basic skills in computational thinking.

4.COS-MM

Construct-on-scaffold mind mapping (COS-MM), gives students a structured framework to help them make their mind maps and make it easier for them to understand and organize computing ideas. Students are provided with a pre-arranged mind map that features a main programming concept and extends into sub-concepts or associated notions. Subsequently, they proceed to fill out the branches with precise instances, intricate details, or practical implementations of the central idea, under the guidance of the offered framework. This technique facilitates the systematic organization of students' thinking and enhances their comprehension of the interconnections among various programming concepts (Zhao et al., 2022).

Unplugged Programming Teaching Aids (UPTA)

UPTA are things that kids can use to learn how to think like computer programmers without having to use real computers. They help kids

learn how to break down problems and figure out how to fix them one step at a time (Zhan et al., 2022)

Example:

An Unplugged Programming Teaching Aid is a card game that helps kids learn how to sort things by having them arrange the cards in a certain way by following a set of rules. They do this without using a computer.

6.Robotic collaborative game-based learning

Robotic collaborative game-based learning is an educational endeavour in which students collaborate to solve problems or accomplish objectives by employing robots within the context of a game. This form of education integrates robots and play to facilitate students' comprehension of intricate ideas such as computational thinking, including skills like algorithmic thinking, sequencing, and looping.

Example:
Septiyanti et al. (2020) showed that students employed robots to gather cards in a specific order that represented the life cycle of insects, thus merging science instruction with computational thinking.

7.Torino

Torino was created by a group at Microsoft Research Cambridge with the purpose of assisting visually impaired children in acquiring computational thinking skills using a tangible programming interface. It is designed as a toy that enables children to create and share stories, songs, and music through play. The environment comprises tangible components such as a hub, play button, volume button, on-off switch, and play pod that children may operate to configure various outputs.

Example:

India et al. (2019) showed its effectiveness in a study conducted in Bangalore with 12 students who had low vision. At first, children were provided with a pre-programmed narrative or song in Torino, which they could navigate by pressing buttons to activate different sections. As their familiarity grew, they began to alter these programs, for as by rearranging the narrative order of a story or modifying the musical

notes in a song. Over time, they advanced to showcasing their creativity by insisting on incorporating their favourite stories into the Torino, demonstrating their aptitude for personalizing content.

Conclusion

Computational thinking is an essential problem-solving ability of 21st century. It is crucial to instil in students from a young age the skills necessary to adapt to the ever-growing digitalized world. There is a lack of consensus over a single definition of Computational thinking. It is important to note that it is a flexible concept and can have somewhat varied interpretations depending on the specific circumstances. However, for the sake of clarity, we can define Computational thinking as consisting of five distinct skills: Problem decomposition, Abstraction, Pattern identification and generalization, Algorithm design, and Evaluation. Problem decomposition refers to break down of problems into smaller and easy to understand parts. Abstraction refers to looking at relevant details while ignoring the irrelevant ones. Pattern identification refers to look for similarity among and within problems and be able to generalize the solutions in similar contexts. Algorithm design refers to step by step instructions to solve a problem. Evaluation refers to finding out the efficient solution to a problem.

Computational thinking can be developed in primary students using several ways. Reverse Engineering pedagogy can be applied easily to Science subject. SGQ strategy and COS-MM can be applied across all subjects.

Programming is a popular choice for teaching CT skills in middle and secondary grade students. For primary students, Robotic collaborative game-based learning can be implemented as a standalone subject. Torino tangible programming and Unplugged Programming Teaching Aids can be used to teach computing concepts.

Web mediated parent education can be used as a supplemental instructional technique whereby teachers can ensure the development of CT skills in students' homes.

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CHAPTER : 9

INTERNET BEHAVIOURS AND ARTIFICIAL INTELLIGENCE

Soumitra Mondal [1]

Abstract

This study explores the complex interplay between internet behaviour and artificial intelligence (AI) in the context of education. It looks at how artificial intelligence (AI) tools, including as data analytics, machine learning, and natural language processing, are changing classroom settings and methods. The research examines online behaviours and their implications for AI integration in education using AI approaches including machine learning algorithms and natural language processing. The study intends to clarify the intricate relationship that exists between artificial intelligence (AI) and internet behaviours, examine the social implications of this relationship, and suggest methods for responsibly using AI's potential in online ecosystems. Utilizing artificial intelligence (AI) tools, the research reveals subtle patterns and correlations in internet behaviours, providing valuable insights on user preferences, emotions, and interactions. These understandings improve the efficacy and reduce possible hazards of AI systems in education by informing their design and implementation. The study emphasizes how crucial it is for people to acquire digital literacy and skills in order to be ready for an AI-driven future. It promotes the following: a fundamental understanding of hardware and software; information and data literacy; teamwork and communication skills; the ability to create digital content; security awareness; the capacity for problem-solving; and career-related capabilities. The report also discusses ethical issues related to AI in education, putting a focus on values like inclusivity, privacy, security, responsibility, and transparency. It emphasizes the need of extensive rules and regulations to guarantee the responsible use of AI and protect the rights and welfare of users. Additionally, the study looks at India's efforts to incorporate AI into education as well as the prospects

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and problems related to AI adoption. It highlights how crucial it is to close the digital gap, protect user privacy, and advance moral AI practices in order to achieve equitable and sustainable growth.

Keywords: *AI, machine learning, NLP, MOOCs, VR.*

Introduction

This article seeks to provide a thorough understanding of artificial intelligence (AI) in education and analyse how it may radically alter the educational environment. Machine learning, natural language processing, data analytics, and other AI approaches are all used in a variety of educational technologies and applications to enhance learning outcomes. It entails the creation of intelligent systems that are able to comprehend, rationalise, and learn from data, enhancing education's personalisation, flexibility, and effectiveness (Embarak, 2021).

The importance of understanding internet behaviours in the context of AI:

The pervasive integration of artificial intelligence (AI) across diverse societal domains underscores the urgency of comprehensively understanding its interplay with internet behaviours. As AI becomes increasingly ingrained in our daily lives, from personalized recommendation systems to autonomous vehicles, its interaction with internet platforms becomes ever more intricate and influential. Grasping the dynamics of internet behaviours in this context is crucial for several reasons. Firstly, it offers insights into how AI algorithms shape online experiences, from information consumption patterns to social interactions. Secondly, understanding internet behaviours elucidates the ethical and societal implications of AI-driven content curation, privacy breaches, and algorithmic biases (Embarak, 2021). Moreover, a nuanced comprehension of internet behaviours can inform the design and deployment of AI systems, enhancing their effectiveness and mitigating potential risks.

How AI technologies were utilized to elucidate natural language processing and machine learning algorithms:

AI technologies were methodically employed to elucidate intricate patterns within the dataset, notably leveraging advanced techniques like natural language processing (NLP) and machine learning

algorithms. NLP facilitated the extraction of semantic meaning and sentiment from textual data, enabling the researchers to discern nuanced nuances in internet behaviours. Through sentiment analysis, for instance, the study could discern user attitudes towards AI-driven content or interactions, providing deeper insights into the subjective experiences within online environments. Additionally, machine learning algorithms were adeptly harnessed to model complex relationships and predict future trends based on historical behavioural data. By training predictive models on vast datasets of internet interactions, the study could forecast potential shifts in user behaviours in response to AI interventions or technological advancements. Furthermore, these AI-driven methodologies enabled the researchers to uncover latent patterns and associations that may have eluded conventional analytical approaches, thereby enriching the depth and rigor of the study's findings. Thus, by judiciously integrating AI technologies into the research methodology, the study transcends conventional limitations, offering a comprehensive and nuanced understanding of the interplay between internet behaviours and AI (Das, & Rad, 2020).

Research Objectives:

Q1 To elucidate the complex relationship between AI and internet behaviours.
Q2 To analyze the societal ramifications of this interaction.
Q3 To propose strategies for ethically harnessing AI's potential within online ecosystems.
Q4 To examine India’s current potentiality in user behaviours in response to AI interventions.

Methodology

Surveys and in-depth interviews provide more nuanced qualitative information. A thorough literature review, institutional records, and policy reports help to place the research within the context of current scholarship and educational frameworks, and a variety of case studies provide useful examples that promote the analysis.

Findings and discussion

1. **Knowledge of Digital Media:** According to the UNESCO publication Artificial Intelligence in Education: Challenges and

Opportunities for Sustainable Development, training educators and tech developers will be key to the effective integration of AI and education. Teachers need to acquire new digital abilities and think pedagogically about how to use these tools. Artificial Intelligence developers must comprehend how educators operate in order to generate long-lasting solutions in practical settings. As to the report's authors, educators need to get their pupils ready for: It's critical to understand how to charge, lock, and switch off devices. You also need to know how to manage user accounts and passwords, log in, and adjust privacy settings.

2. **Information and data literacy:** Students need to be able to browse, search, filter, analyze, and manage data, information, and digital material.

3. **Collaboration and communication:** Individuals must be able to control their digital identity, grasp socially acceptable online behavior guidelines, and engage, share, cooperate, and participate as citizens using digital technology.

4. **Digital content creation:** Students need to be proficient in programming, have an understanding of copyright and licensing regulations, and be able to create and modify digital material. 5. **Security:** It's critical to handle many aspects of safeguarding your gadgets, private information, well-being, and the environment.

6. **Problem-solving:** It's essential to be able to recognize demands, solve technical issues, and provide technology solutions. Thinking computationally will enable one to use technology creatively.

7. The knowledge and abilities required to use specific hardware and software in a certain profession are included in career-related competences.

The competencies of the near future:

A few years ago, critical thinking, creativity and invention, problem-solving, decision-making, communication, teamwork, information and media and technology literacy, and citizenship were among the 21st-century abilities deemed important. The quest for coveted talents extends beyond what were formerly considered fundamental Information and Communication Technology (ICT) competences, even if they are still essential.

- Managing private data in virtual environments.
- Making use of cloud-based technologies for collaboration including Microsoft Teams, DropBox, and Google Drive.
- Producing and organizing digital documents and spreadsheets.
- Standard device maintenance, such setting up an internet connection or updating software.
- Sharing screens while in video conferences.
- Managing many agendas effectively using online calendars. Regardless of their profession or industry, everyone who learns this set of abilities will be able to satisfy the needs of the following criteria in a more dynamic and automated labour market, according to the consultancy's research:
- Adding value above and beyond the capabilities of intelligent machines and automated systems.
- Work in an electronic setting.
- Adjust to new jobs and methods of working on a regular basis. This year at least, teaching pupils to code and become digitally literate will be crucial to preparing them for the technologically advanced future. In order to provide instructors the useful knowledge they need to make data-driven choices, learning analytics will be essential. The importance of cybersecurity education in promoting responsible digital citizenship will only increase. The most important thing will be to ensure that everyone has equal access to technology in order to close the digital divide. This is a task that requires cooperation from a variety of educational stakeholders. This is an excellent moment to acquire or refresh knowledge on what has to be done to go forward and maximize one's aptitude (Embarak, 2021).

AI's Potential in Education

Virtual Reality/Augmented Reality: Virtual reality (VR) and augmented reality (AR) are immersive experiences that enhance learning through simulated settings and interactive images. These AI-

driven components enhance user interaction, personalization, and immersion in VR/AR environments, benefiting entertainment, education, training, and other domains.

Adaptive Learning Platforms: Adaptive learning platforms employ AI algorithms to customize educational materials and exercises based on each individual learner's development and performance. AI-driven adaptive learning platforms promote personalized instruction, enhanced feedback, and optimized learning experiences.

Natural Language Processing: Natural language processing (NLP) is an artificial intelligence (AI) technology that aids in language learning and communication. It encompasses various applications such as sentiment analysis, language translation, question answering systems, chatbots, text summarization, speech recognition, and named entity recognition.

Intelligent Tutoring Systems: AI-powered software offers individualized guidance and feedback to students while adjusting to their requirements. Integrated AI in Intelligent Tutoring Systems (ITS) enhances individualized instruction, adaptive support, and optimized learning outcomes, fostering student engagement and academic success.

Smart Content Creation: Smart content creation involves the use of artificial intelligence (AI) technologies to automatically generate educational resources, such as quizzes, lesson plans, and interactive content. Automated writing utilizes AI algorithms to generate written content, increasing efficiency.

Intelligent Learning Analytics: Intelligent learning analytics leverages AI to analyze learning data and provide valuable information to educators. Predictive modelling uses AI algorithms to forecast student performance and learning trajectories, enabling proactive inter ventions.

Data Mining for Education: Data mining for education involves using AI approaches to extract relevant information from large educational databases, aiding in decision-making and curriculum development.

Virtual Assistants: Virtual assistants are AI-powered chatbots or voice assistants that provide immediate help and round-the-clock support to students. They utilize natural language processing (NLP) to understand and interpret human language, ensuring seamless communication.

Intelligent Grading Systems: Intelligent Grading Systems (IGS) are AI algorithms that autonomously grade objective tests or quizzes using multiple-choice questions. Automated grading saves time and ensures consistency by employing AI algorithms to assess student assignments. Plagiarism detection tools utilize AI to maintain assessment integrity by identifying instances of academic dishonesty.

Automated Feedback Systems: Automated feedback systems, powered by AI, provide students with fast and helpful feedback on their work and assignments. Performance assessment utilizes AI algorithms to evaluate and analyze student performance, offering insights for improvement.

Intelligent Course Design: Intelligent course design utilizes AI methods to customize course structure and content based on students' requirements and learning objectives. Personalized curriculum caters to individual learners' needs and preferences. Adaptive learning paths adjust based on student progress and mastery.

Can AI take the role of human teachers?

The complex and never-ending debate is on whether artificial intelligence can replace human teachers. It is unlikely that artificial intelligence (AI) will totally replace human teachers, even though it may support and enhance instruction. AI's proponents contend that by offering individualized and flexible learning opportunities, it has the ability to completely transform education. They emphasize how AI can offer information in novel ways, customize education to meet the requirements of each student, and analyze enormous volumes of data. AI is also capable of creating realistic simulations and involving students in interactive learning exercises. Critics, however, have legitimate worries about AI's limits in assuming the complex function that human instructors play (Elayan, Aloqaily, & Guizani, 2021). They highlight the fundamental traits that human educators have, such emotional intelligence, empathy, and the capacity to encourage creativity and critical thinking. Artificial intelligence is unable to simply replace the social connection, mentoring, and subtle instruction

that human instructors provide. Furthermore, much thought has to be given to the ethical ramifications of using AI exclusively in education, including concerns about privacy, prejudice, and equality. Although artificial intelligence (AI) has great potential as a teaching tool, it is doubtful that AI will completely replace human instructors because of the distinct abilities and attributes that human teachers bring to the classroom. Education results that are both meaningful and successful are more likely to emerge from a well-balanced strategy that blends AI with human knowledge. Overall, research trends suggest that rather than becoming a substitute for human teachers, artificial intelligence (AI) in education should be seen as a tool to assist and empower them. By combining AI with human expertise, more individualized, effective, and inclusive educational experiences might be created (Fiske, 2002).

Artificial Intelligence and Ethics in Education: The teaching-learning process as well as the learning experience overall have been completely transformed by the use of artificial intelligence in education (AIED). Four main positions have been recognized as being largely engaged in the usage of AI technologies in education: policy adviser, smart tutor, mentor, and learning/peer accompanier. Nonetheless, there are some moral conundrums with AI in the classroom. Six obstacles stand in the way of AIED's sustainable development, according to UNESCO.

1. Create comprehensive, egalitarian, and inclusive public policies. 2. Get educators ready for teaching AI. 3.Encourage AI in the classroom. 4. Provide comprehensive, high-quality data systems. 5. Assure the significance of AIDE's study. 6. Make sure that data collection, usage, and distribution adhere to ethics and transparency. Additional risks (legal, ethical, security, etc.) include the following: surveillance and consent; identity configuration; user confidentiality; integrity and inclusivity; data collection; restricted data availability; bias and representation; ownership, control, and autonomy of data; systematic bias, discrimination, inequality, xenophobia (at the individual level); inequality gaps among students; privacy risks associated with data accountability (informed consent, privacy violation, fairness, statistical apophenia). The seven main moral precepts of artificial intelligence in education are as follows:

- **Accountability and transparency:** The procedures for gathering, examining, and disseminating data as well as those involved in establishing, overseeing, and managing AIDE

standards have to be clear, understandable, and accessible. They should also take into account the conditions of using AI, data ownership and aims, and informed permission.

- **Security and safety:** To guarantee privacy and security, AI design, development, and implementation must be strong enough to secure and safeguard data.

- **Sustainability and proportionality:** In order to reduce the ecological impact and prevent disruptions to the labour market, the global economy, and social factors like politics and culture, the processes must take into account design, development, and usage considerations.

- **Governance and stewardship:** this pertains to the creation and execution of laws governing the creation, application, and administration of AI while taking ethics into account.

- **Human-centered:** To guarantee human control over AI work processes, this must support human cognitive, social, and cultural capacities.

- **Privacy:** The protection of users' privacy and confidentiality while providing information or when the system gathers data about them has to be ensured via the application of informed consent.

- **Inclusiveness (accessibility):** To allow equal access and use of AI, infrastructure, skills, societal acceptability, and adaptation to various users must be taken into account throughout the design, development, and deployment of SDAs. The same rule should be applied to data and algorithms, which should also be impartial and non-discriminatory in order to provide equity and fairness for all user groups. It's crucial to remember that a lot of reports don't concentrate on children's privacy. Nonetheless, groups that support children's rights in ethical AI policy include UNICEF, the World Economic Forum, UNESCO Education and AI, the European Parliament Report: AI Education, and the Institute for Ethical AI in Education (IEAIE). In addition to safeguarding children's data and privacy, they seek to lower the danger of exposure to AI for kids while also bringing to light concerns

about kids' malleability when it comes to ideas, values, attitudes, and age-appropriate behaviour (Fiske, 2002).

AI and our nation

India's efforts to integrate AI into education demonstrate a thorough strategy for using AI's potential to revolutionize the field of education. The National Education Policy 2020 incorporates AI technology in a way that prioritizes individualized and adaptable learning to meet the demands of a varied student body. By facilitating cooperation between Indian and international universities, the Global Initiative of Academic Networks (GIAN) fosters information sharing and best practices in AI education. In order to close the gap between academia and business, the All India Council for Technical Education (AICTE) collaborates with industry to provide AI courses and certifications. AI Centers of Excellence (CoEs) at academic institutions use joint projects and training initiatives to support AI research and innovation (Anderson,1995). Still, there are obstacles in the way of using AI in education. The adoption of AI is hampered by limited access to digital infrastructure, particularly in rural regions, necessitating measures to bridge the digital divide. Strong regulations are required for the proper use of AI since data privacy issues and ethical issues pertaining to student data in AI systems surface. India's stance on AI recognizes the technology's potential to revolutionize industries including healthcare, agriculture, education, and government. The National AI Strategy and the National AI Mission, two government initiatives, show the government's dedication to the advancement of AI. AI is seen as a driver of economic expansion and employment development in India, where reskilling and upskilling the labour force is crucial. The government's emphasis on partnerships, skill development, and research demonstrates its dedication to the equitable and long-term use of AI. But maintaining data privacy, encouraging ethical AI methods, and closing the digital gap continue to be major obstacles. In order to fully use AI's potential while defending citizen interests and fostering fair development, India works to find a balance between innovation, inclusion, and ethics.

Conclusion

The implications of the findings of this research are profound for both understanding internet behaviours and advancing AI technology. Firstly, the insights gleaned shed light on the intricate dynamics of

internet behaviours, offering a deeper comprehension of how individuals navigate and interact within online ecosystems. By elucidating patterns, preferences, and trends in user behaviour, the study contributes to refining models of online engagement and content delivery, thereby informing strategies for enhancing user experiences and optimizing digital platforms. Furthermore, the findings hold significant implications for the advancement of AI technology. By uncovering the complex interplay between AI algorithms and internet behaviours, the research provides valuable insights into the efficacy and impact of AI-driven interventions in online environments. AI's potential in education ranges from Personalised Learning, Intelligent Assistants, Data-driven Decision Making, Cooperative and Social Learning, Skill Development and Lifelong Learning, Collaboration between teachers and students, Innovation and Adaptation, Digital Equity, Ethics and Reflective Discussions and much more. These insights can inform the design and development of more sophisticated AI systems, tailored to better align with user preferences and ethical considerations (Anderson, 1995). Moreover, by identifying potential challenges and opportunities arising from the intersection of AI and internet behaviours, the study paves the way for future research and innovation in this rapidly evolving field. Thus, the findings not only deepen our understanding of internet behaviours but also catalyze advancements in AI technology, shaping the future landscape of digital interaction and innovation.

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CHAPTER : 10

IMPACT OF ARTIFICIAL INTELLIGENCE IN SPECIAL NEED EDUCATION TO PROMOTE WITH INCLUSIVE EDUCATION

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Abstract

Artificial Intelligence (AI) and technology has already touched the life of individuals, more generally, it has influenced educational sector to make it more inclusive and accessible for students with visual, hearing, mobility and intellectual disabilities. The use of AI has not only impacted students with special needs, but has also impacted educational institutions in creating inclusive pedagogies. The present study is a working paper that has tried to analyze how AI has impacted education for students with special needs. The data collection was based on qualitative research that was conducted using focused interviews from teachers and students with special needs.

Keywords: *Artificial Intelligence, Technology, Special Education, Intellectual Disability*

Introduction

A groundbreaking development has taken place in Thiruvananthapuram, Kerala, where an AI teacher named "Irish" has been introduced at KTCT High School. This initiative, believed to be the first of its kind in India, marks a significant step forward in educational innovation. The robot teacher, equipped with wheels for mobility, is set to teach all subjects at the school, providing seamless transitions between classes. The project was realized through collaboration between the school and Markerlab Edutech, with students actively participating in its development under expert supervision. This initiative aligns with Niti Aayog's focus on

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enhancing extracurricular activities in schools, fostering a hands-on learning approach (Itsquiz. 2016).

Videos showcasing "Irish Madam" in action have been shared on Instagram by MakerLab, with captions highlighting its potential to redefine the learning landscape. The AI teacher boasts versatility, capable of teaching multiple subjects simultaneously and conversing in various languages through voice assistance. This innovation promises to revolutionize education, offering new opportunities for interactive and personalized learning experiences WHO. (2011).

Artificial Intelligence

In Greek mythology, there are references to the concept of machines and mechanical beings, albeit with limited available literature. One such story involves Talos, a giant bronze warrior programmed to guard the island of Crete. This ancient idea suggests that the notion of machine learning and artificial intelligence has roots extending far back in human imagination. In the 1950s, Alan Turing published a seminal paper exploring whether computers could exhibit intelligent behavior akin to humans. While the practical applications were initially limited, Turing's proposal of the Turing Test became influential in the field of artificial intelligence (AI).

In 1951, Christopher Strachey, a computer scientist, developed a chess program using the Ferranti Mark1 machine at the University of Manchester, marking an early foray into AI applications. The term "artificial intelligence" was coined in 1956, and the first AI laboratory was established for research purposes in 1959. Subsequent milestones included the introduction of the first robot on the General Motors assembly line in 1960 and the creation of the first chatbot, Eliza, in 1961. AI's capabilities continued to advance, with IBM's Deep Blue defeating world chess champion Garry Kasparov in 1997 and the Stanford Racing Team's robotic car, Stanley, winning the DARPA Grand Challenge in 2005. IBM's question-answering system, Watson, also achieved victory over Jeopardy champions in 2011 WHO. In recent years, AI has seen widespread adoption in various domains, including contract intelligence platforms like J.P. Morgan's, which utilize AI, machine learning, and image recognition software for legal document analysis. Programming languages commonly used in AI development include Python, Java, and Lingo. The increasing need for machine learning, a subset of AI, is driven by the abundance of data

from sources like cloud computing, the internet, and social media, necessitating advanced analytical techniques. AI presents significant opportunities, particularly in addressing the needs of individuals with special educational requirements. It enables intelligent problem-solving and personalized learning experiences, aiming to enhance interactions with the environment and enrich daily life (Prentzas. 2013).

However, there are concerns regarding AI's potential limitations, such as its inability to assess creativity and analytical thinking, potentially leading to a narrow educational approach based solely on memorization. Additionally, there are concerns about deepening inequalities, as access to human interaction in education may become a privilege for the few. Despite these challenges, AI holds promise in reshaping education, offering interactive learning experiences anytime, anywhere. By leveraging AI's capabilities, educational institutions can adapt to the evolving technological landscape, fostering personalized learning environments that cater to individual strengths and attributes.

Special Education

AI has been a focal point of research for over five decades, primarily involving the study and advancement of "intelligent agents" capable of perceiving their surroundings and taking actions to enhance their chances of success. These agents can manifest as physical devices, such as humanoid robots, or in software form, represented by virtual avatars. Over the years, AI techniques have progressively been utilized to enhance the lives of individuals with special needs, addressing a multitude of challenges spanning learning difficulties, cognitive impairments, communication barriers, behavioral issues, emotional challenges, and sensory or physical limitations (UNESCO).

The SEN Code of Practice underscores the diversity among children's learning capabilities, emphasizing the importance of recognizing each child's unique strengths and requirements. Hence, understanding the context in which AI is applied—including factors like accessibility, training needs, and specific requirements—becomes crucial, as these may vary across different social contexts. Nonetheless, AI is instrumental in fostering collaborative and interactive environments, transcending barriers related to auditory, verbal, and written communication. For instance, AI-powered text messaging platforms facilitate mental health interventions, extending support to young individuals (Prentzas. 2013).

In the realm of education, AI-driven innovations hold immense promise. They facilitate personalized learning experiences for students, automate instructional tasks, and power adaptive assessments. Robotics infused with AI can augment teaching professionals by providing support and assistance in educational settings. Assistive technology, tailored to individual needs, enables students with disabilities to compensate for their impairments, promoting independence and reducing reliance on external support.

Furthermore, AI's potential to enhance workplace efficiency and augment human capabilities is significant. In educational settings, AI aids teachers in early detection of students facing learning difficulties, allowing for timely interventions. AI tools and resources play a pivotal role in education, especially for children with special needs, offering a balance between student autonomy and targeted guidance. However, it's noteworthy that AI is predominantly used by teachers and parents for student training purposes, rather than solely for diagnosing needs.

In essence, AI serves as a catalyst for inclusive education, empowering individuals with diverse learning needs to thrive in educational environments tailored to their requirements.

AI and Special Need Education

Various researches have taken place in the area of AI (AI). It is in usually defined as “the mechanical simulation system of collecting knowledge and information and processing intelligence of universe: (collating and interpreting) and disseminating it to the eligible in the form of actionable intelligence” . It is composed of information agents that can be either in the physical form as devices (such as Robots or can be virtual such as software. According to Morrison, as AI matures, it becomes increasingly important to understand the kind of things that people with disability would require as a part of their technology tool kit. The benefits of AI have been acknowledged in education; however, the research fraternity has started exploring its benefits for people with special needs in education . AI and Special need Education collaborate together to enable development of individuals suffering from disabilities. Students with learning, hearing, visual and mobility impairment can seek benefits with the use of Artificial Intelligence in education (Drigas & Ioannidou, 2012). The research study has also indicated AI as one of the assistive technology for PwDs. As per an article by Lynch , AI

has provided around-the-clock care using Robotics for people with disabilities. AI has helped the people to use mobile applications without even clicking on it. For instance “Siri” in mobiles has enabled people to access mobile applications without even actually clicking actually clicking on them. Another example from Google “Alexa” that has enabled people to ask for any information without typing on the search bar. Both these applications (Siri as well as Alexa) work on AI (speech recognition. Such applications can provide assistive services to people. This paper tries to investigate the impact of AI on special need students and the assistance these tools can extend to teachers in evaluating and imparting education as per the requirements of students with special needs (Prentzas. 2013).

AI with Inclusive Education

Research in the field of Artificial Intelligence (AI) has expanded over the past 50 years, with AI defined as a system that collects, processes, and disseminates intelligence from the universe to eligible recipients, whether in physical form as devices (e.g., robots) or virtually as software. Morrison emphasizes the importance of understanding the technological needs of individuals with disabilities as AI matures, particularly in education. AI has shown promise in benefiting people with special needs by addressing various impairments, including those related to learning, hearing, vision, and mobility.

Lynch highlights AI's role in providing round-the-clock care for people with disabilities through robotics, as well as enabling hands-free access to mobile applications via voice assistants like Siri and Alexa. These AI-powered applications utilize speech recognition to offer assistive services, illustrating AI's potential to enhance accessibility for individuals with disabilities.

Inclusive education stands to benefit significantly from AI, as it can harness behavioral data to deliver personalized educational services tailored to individual needs. Predictive analytics, already utilized in some local governments in the UK, can anticipate future needs in areas such as special education and children's social services, aiding in early identification of at-risk students.

In Japan, although educational big data have been accumulated, AI technology in the educational field lags behind other countries. Kazimzade et al. argue for the creation of heterogeneous datasets to

train AI in inclusive learning environments, particularly for learners with special needs. This research aims to address this gap by investigating how AI technology can support learners with special needs in inclusive education settings (Allebee. 2017).

Significance of the Study

The significance of this study lies in AI's potential to provide globally inclusive education, catering to diverse languages and cultures on a single platform. Students with hearing and visual impairments, as well as those with intellectual disabilities, stand to benefit greatly. AI-guided campuses facilitate connectivity between students and teachers, allowing for real-time monitoring of challenges faced by students and providing immediate feedback.

AI tools offer efficient solutions in the field of disability and special education, saving time and costs while improving intervention methods. However, proper training for teachers, parents, and therapists is essential for effective utilization of AI-guided tools. Despite challenges in implementation, particularly in developing countries, ongoing efforts are underway to integrate AI technologies into educational settings, promising increased independence and efficiency in learning for individuals with special needs.

Conclusion

The study highlights the transformative impact of AI technologies on the lives of individuals, particularly benefiting children with special needs. In the realm of education, AI is revolutionizing teaching and learning practices, offering assistive technologies that alleviate the challenges faced by students with disabilities. Institutions, teachers, and parents are increasingly embracing inclusive education initiatives, leveraging AI-powered tools to create accessible learning environments that transcend barriers and promote equal educational opportunities for all (Roach. 2018). .

The study emphasizes the importance of implementing inclusive pedagogy, which prioritizes the inclusion of every child without categorization based on their abilities or disabilities. By adopting inclusive pedagogies, educational institutions can foster environments that celebrate diversity, encourage creativity, and promote mutual respect among students. This approach facilitates meaningful

exchanges of ideas and conversations, creating safe and supportive spaces where children feel empowered to express themselves freely.

Furthermore, the study underscores the significance of nurturing creativity through pedagogical practices. Encouraging creativity not only enhances cognitive development but also fosters innovation and problem-solving skills among students. By cultivating a culture of creativity in educational settings, educators can empower children to explore their potential and contribute positively to society.

In essence, the study advocates for the integration of AI technologies and inclusive pedagogies to create inclusive and supportive learning environments where every child, regardless of their abilities, can thrive and reach their full potential. By embracing these principles, educators and institutions can play a pivotal role in shaping a more inclusive and equitable future for all children.

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CHAPTER : 11

EDUCATION TECHNOLOGY FOR 2023

Dr. Bhabesh Pramanik [1]

Abstract

Technology has always been a major chauffeur of revolution in the education sector. From the primer of the printing press to the escalation of online learning, technology has always had a weighty influence on how we learn. And as we transfer into the future, it's vibrant that New Movements in Educational Technology will endure to silhouette the education landscape in a variety of ways. The incipient inclinations in education technology form 2023 embrace mobile learning and digital content platforms, AI-powered learning environments, augmented reality (AR) and virtual reality (VR), gamification of learning, automated assessments, adaptive learning, mobile learning etc. Education institutions share a common mission -to provide their students with the knowledge and skills that form the foundations of a successful future. Education technology (ed-tech) is an important driver in reaching this goal, and its advancement is opening the doors to exciting new ways to use it in today's classrooms. Explore what ed-tech is, how it creates value, its current trends and how to keep pace in an increasingly connected world. Technology fruition has completed the teaching and learning process better than ever before.

Keywords*: major chauffeur of revolution, weighty influence, New Movements in Educational Technology, common mission, successful future.*

Introduction

Using the technology not only assistances alleviate the corporeal oodles but also helps with a more achievable approach towards learning. It is true that technology has completed learning easier and more expedient. From global alliance sessions to collaboration, technology has facilitated students in a revolutionary way. According to recent data, over 60 percent of schools afford digital

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learning with the incorporation of tablets, laptops, and other important electronic gadgets in their schools. The aim of using technology in classrooms is to lodge numerous learning styles, reassuring the students to cooperate on their new philosophies and views. All such sundry assortments of technologies and involvements support the students learn things from diverse sources, which not only upsurges their expanses of thoughtful but also vicissitudes their learning abilities.

Ways modern technology enhances education

Learners today assume a collaborating involvement beyond inert learning through deskbound in a live classroom and listening to a lecture. Ed-tech empowers faculty to formulate students for future workplaces by providing stimulating new conducts of collaborating learning and assignation.

1. Ropes Varied Learning Styles

All student's requirements are inimitable, and each absorbs inversely. These certainties can make it thought-provoking for our workforce to encounter assorted demands. Contemporary technology can sustenance learning styles and prerequisites in numerous ways, including online platforms, interactive learning tools and collaborative trialing. These resolutions authorize our teaching staff to distribute materials through different mediums. They also permit students to engross in ways that work for them.

2. Adopts Healthier Communication and Collaboration

Resend technology styles communication easier for our workforce, students and parents. Pupils can willingly make propositions or enquire questions that they may be too nervous to stance in class by consuming electronic tools. Teachers and parents can practice email for routine communication and video tools for more appropriate parent-teacher conferences.

3. Formulates Learners for Their Futures

Today's dealings gradually trust on technology to supremacy and recover their maneuvers. Whether our future graduates will activate expensive apparatus or strategy the next intergalactic shuttle, savvy tech skills are indispensable for their success. Our campus's classrooms are the idyllic spaces for students to grow the initial skills they prerequisite to be poised technology manipulators in the personnel.

4. Produces an Attractive Involvement
Technology and education association to generate more collaborating learning experiences. In turn, users have more engrossment with the tools they're consuming. This association can prime to recovering knowledge retention, improved subject awareness and higher lesson engagement.

5. Proposals Higher Learning
Technology can make learning more winning and collaborating, refining students' thoughtful and preservation of the information. Students can also contact a vast amount of information and possessions online, intensifying their knowledge yonder outdated textbooks and learning deeper research skills for discovery firm, dependable springs.

6. Lodges Inclusivity
Technology can promotion learners with incapacities and special educational requirements, creation education more manageable to a broader assortment of learners. Distance learning curricula and assistive technology such as speech-to-text, subtitles and captions, and keyboard and mouse modifications can advantage learners with and without incapacities for more beneficial classroom understandings.

Keeping technology running

Exploiting our institution's substantial outlay in ed tech means upkeeping our diplomacies and custody them ready for use. Conventionally, doing so has intended bulky computer charging carts, costly power bricks, unfriendly configurations that lead to device damage and spaghetti wires. Modern technology changes that for those educating the next generation. Our equipment affords rewards like:

- **Student-Focused Strategy**

Our strategy/design inspires 100% student administration with parallel abandons that endorse two-handed treatment to support decrease drops. Our extraordinary cable association also trimmings tattered and broken connectors from cord jerking.

- **Fortification**

Interior shelves feature aluminum, which is a natural heat sink. This material draws heat away from the unit to help preserve and extend battery life. This model also has a lockable door for poised and sheltered device storage.

- **Flexibility**

Our design offers maximum installation flexibility. Interior shelves feature our exclusive removable Tech Stops, enabling you to accommodate larger laptops or smaller devices with a simple adjustment.

- **Savings**

Easy device retrieval and return speed up technology management for higher classroom productivity. Our educators can spend more time focusing on teaching and students more on learning.

Our revolutionary design also helps schools save money versus conventional approaches. Once wired, our solution requires no maintenance and has no refresh cycle.

Main Trends in Education Technology in 2023

Modern trends in education technology that will have a major impact in 2023 are-

1. Mobile Learning and Digital Platforms

E-learning platforms consume more prevalent after the Covid-19 pandemic hit the world. The platforms afford learners entree to high-quality educational gratified and mentors from anywhere in the world. Besides, digital content platforms bid an enormous arrangement of learning resources for learners and teachers alike. As the status of digital content platforms endures to produce, the influence on how people learn and interact with educational content will no doubt upsurge. Portable devices like mobile phones and tablets are trading outmoded learning channels because with mobile e-learning solutions, learning never halts.

2. AI-powered Learning Environments

It is common to hear Artificial intelligence that is present in almost all industries. Artificial intelligence (AI) enabled technologies such as facial recognition, natural language processing, and machine learning are increasingly used in classrooms, making learning easier, more engaging and continue to grow. Experts anticipate the market to reach $1,345 billion by 2030, with education playing a key role as industry demand increases.

AI-powered learning environments can afford students with personalized learning involvements and enable teachers to tailor lessons to meet individual students' needs. The technology can help improve their writing and simplify complex topics into easier-to-understand material.

3. Augmented Reality (AR) and Virtual Reality (VR)
AR and VR can help to create immersive and engaging learning experiences, irrespective of the environment. They will progressively be used as a tool for immersive and experiential learning. This allows students to explore virtual worlds, practice tasks, and engage in simulations tailored to their individual needs.

As both technologies become more commonplace, their impact on education will be hard to ignore. The ability of Virtual reality can turn academic concepts into real-life experiences.

4. Gamification of Learning
Gamification is the process of smearing collaborating game-like elements to teaching, a stereotypically non-gamified background. Doing so delivers many benefits for student body, including:

Boosting motivation: Bestowing scholars with a challenge can outgrowth them to want to learn.

Making learning more fun and engaging: Totaling more ways for pupils to intermingle with their learning resources elevations their gratification and involvement.

Swelling knowledge retention: Gamifying curricula powers energetic learning processes and rallies information preservation.

Sharpening real-world skills: Renovating outdated lessons into game-like ones supports learners progress and smear problem-solving, teamwork, self-confidence and acceptable motor skills.

Transferring knowledge: Gamifying education allows pupils to test their new skills New gamification tools are ingoing the market daily, demonstrating no anticipated stoppage for this inclination.

5. Wearable Technology

As wearable technologies convert more extensive and customizable, their bearing on learning galaxies will be fruitful. Wearable technology can support pathway progress, deliver recital reaction, and bid real-time bespoke guidance.

Learners can eavesdrop to audio lectures, obtain class notifications, make voice notes, and more with wearable technology such as smartwatches and VR headsets. This would make learning more manageable and operative and help teachers and parents.

6. Automated Assessments

Automated assessment tools can also deliver diagnostic data to support learners classify weedy ranges and exertion on them. Automated grading tools tolerate teachers to swiftly and truthfully grade assignments, plummeting the time needed for this task. This stretches teachers and administrators' better insights into student concert and areas that essential perfection.

7. Adaptive Learning

Adaptive learning will become a major evolving trend in education technology, permitting developments to be personalized to the individual needs of each student. More and more educational institutions are incorporating this advanced data-driven approach to simplify personalized learning experiences. This will help teachers encounter the needs of a sundry student population and exploit student learning outcomes. It would also help teachers to customize individual learning paths and learning paces.

8. Cloud Computing

Cloud computing has developed remote education, presenting mountable, on-demand resources for learners and educators. It will linger to be an important tool for educators, permitting them to admittance and supply data more successfully. It also consents learners to save money on exclusive books as cloud-based books can be edited easily. It propositions robust certification amenities to safeguard data safety. It also simplifies easy alliances among pupils and teachers.

It's ideal for:

Students: Pupils can proficiently complete lessons, cooperate on projects, link with their teachers and access digital textbooks from anywhere.

Faculty: Educators can speedily upright and evaluation assignments, email or conference with parents, and trail learner's attendance and progress.

Parents: Parents can expediently monitor grades, connect with school staff and numerically sign and acquiesce obligatory forms.

Administrators: Senior-level staff can analysis curricula, generate and support budgets and expenditures, and easily accomplish faculty.

Employees: The operational workforce can rapidly appeal tools and equipment, succeed their reimbursements or ample mandatory computer-based training.

9. Social Media in Learning

Social learning platforms participate the cooperative and collaborative structures of social media into educational environments, endorsing peer learning and community building. It influences the way we learn. It has shaped new openings for students to fix with each other and contact and stake knowledge. Social media has also had a noteworthy effect on the way educators teach. It has assumed educator's new tools to grasp and engage them.

The usage of social media in learning is tranquil in its initial stages, but it has ported a momentous effect on the way we learn. In future, social media will endure to have a big impact on how we learn and teach.

10. Global Online Learning

Online learning is also called e-learning. It is first debuted in the 1960s through the University of Illinois when its accessible on-premise learners' instruction through linked computer terminals. By 1984, the University of Toronto began offering foundational courses, and the University of Phoenix became the first fully distance-learning college a few years later.

As internet connectivity and home-based devices developed more popular during the 1990s, more e-learning openings began to seem. These programs reinforced asynchronous learning, where students complete work around their agendas rather than during a demarcated classroom time. This approach gives students more rheostat over their assignment timing and tolerates them to advance time management skills. The commencement of the pandemic only strengthened the

demand for instruction opportunities capable of keeping pace with the many everchanging needs.

11. On-Demand Video Learning

Humans love videos, a fact uninterruptedly verified by social media platforms and television programs that vitrine them. Leveraging this medium as a learning tool is an expected progression, and its use rise steeply during the pandemic when in-person classes weren't a choice.

It proposals the litheness of on-demand entree and ropes peer collaboration. It's also well-matched with microlearning, which emphases on bite-sized, communicating lessons. That flexibility brands it idyllic for team assignments and self-paced learning. Recent studies have also revealed that video is operative at skill-building and ornamental other lesson materials. Many forestall video-assisted learning to endure intensifying in fame as more experimental research attests its value.

12. Data and Analytics

Great data and analytics bid evocative insights to school districts and educational amenities. This technology paybacks custody information on student engagement, development and comportment. With the augmented perceptibility, it's relaxed for staff to see what's working and what's not. Educators can hurriedly regulate lesson plans or delivery mediums and identify slits or learners requiring extra help.

Coupling data with learning analytics delivers even more worth. AI can speedily determine designs convenient in planning, networking and recognizing skill gaps.

13. Blockchain

Blockchain is a technology that generates an unassailable data record. It annal evidence in small units termed blocks, which attach to earlier blocks to form the chain. It's an appreciated resolution in corporate and education for data precision, veracity and storage.

This tool delivers value to services like stalking student grades, achievements and authorizations. Because the information is absolute and sheltered, blockchain diminishes the peril of deceitful transcriptions or certifications and aids defend delicate data. The technology can also help support academic honesty policies

by lessening the probable for plagiarism. It generates transparency, safety and solidity, professionals forestall its espousal will rise.

14. STEM

Science, technology, engineering and maths. (STEM) have archaeologically been a principal skill customary curriculum that are vital for students to expansion. These skills are in high mandate and tin help graduates protected high-paying and gratifying situations.

Recently, STEM appropriated on a new component. Educators comprehended the status of well-adjusted instruction and imaginative countenance, which led to the modification. With STEM, learners now obtain acquaintance to a broader assortment of subjects to support them regulate their career welfares. This multidisciplinary approach will endure to produce a more well-rounded education.

15. Collaborative Learning

The advanced inclinations in educational technology have ended it imaginable for everyone to sojourn associated. The impression of the current trends of ICT in the field of education has surfaced multiple opportunities. We connect, deliberate and indorse upon circumstances collaboratively. This collaborative approach has increased importance in the learning process as well. In a classroom learning model, teachers inspire association by conveying group happenings and tasks.

When learners team up organized to effort on a project or unravel a delinquent, it shapes their collaborative skills. Working together recovers their understanding and upsurges engagement. Although e-Learning is rather prevalent, it comprises collaboration with features to stake and deliberate. In a traditional teaching model, a teacher arrives a classroom, expresses for about 30 minutes, and verdures when the bell rings. But today, technology has spanned the gap between teachers and learners.

16. Digital Twins in Education

Digital twins, virtual models of physical systems, are gaining adhesion in education, predominantly in fields such as engineering, architecture, and environmental studies. These replications permit pupils to research with and observe the consequences of amendments to virtual models, providing a deep considerate of complex classifications. It bid a hands-on learning experience without the allied real-world risks or costs.

17. Voice Assistants and Chatbots in Learning

Voice assistants and chatbots, powered by AI, are fetching fundamental to modified learning experiences. These technologies bid learners immediate entree to information, homework help, and collaborating learning activities. They can familiarize to individual learning styles and partialities, providing personalized feedback and sustenance, thereby enhancing learner engagement and learning proficiency.

Impact of COVID-19 and Education Technology

The hot COVID-19 outbreak has severely wedged the education sector. Due to the stringent procedures being occupied to thwart the banquet of the virus, there is dynamic implementation of technology with live classes, learning, and proctored examinations taking off in a vast way. This has assisted the education system to commence its voyage toward digitization.

Thus, the education sector is prospective to modification extremely in the coming year due to the large-scale espousal of technology for schools, colleges, and universities. This would not just boost the education morals but also increase the knowledge prolonged by the students which would brighten up their own as well as the country's future.

Revolution in Examination Management with Education Technology

Examinations are still displayed in the outmoded manner which comprises examination centres, manual exam invigilation, manual answer sheet evaluation, etc. The traditional examination system is not only tedious but it is also risky due to a lot of manual work and human intervention.

However, the introduction of AI in the examination management system can fetch in a lot of transformative vicissitudes in current examination management. AI-based invigilating or auto-remote proctoring can empower institutions to demeanor examinations without any need for infrastructure or logistics.

The End Note

Trends in Education Technology has come a long way in the last decade, and its influence on classrooms, curriculum, and teaching methods has vividly increased. In 2023, these trends will have an even greater impact on the educational landscape, accompanying in an era of revolution and enhanced teaching and learning. Overall, they show

that education technology is here to stay and will continue to be an important part of classrooms in the future. Our set of e-learning solutions can help learners develop skills, gain knowledge, and stay updated with the latest trends in their field.

Conclusion

It was only a matter of time before the education sector was taken over by technology. Although the reception degree was low in the beginning, it progressively increased impetus. Teaching and learning methods have experienced a noteworthy change due to all the trends in education technology. Every year, new drifts appear to deliver something new to the students.

Educators say change is constant, similarly, innovations in the field of technology are also constant. And certain innovations can be executed in the education system for enlightening their learning and development process. The result of these innovations developed a trend which then centrals to better teaching and learning techniques.

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CHAPTER : 12

A REVIEW ON FEW E-LEARNING TOOLS FOR TEACHING AND ASSESSMENT

Priyam Nath [1]

Abstract

E-learning or electronic learning tools are digital resources that help teachers as well as students and other related individuals in the area of study. This short review article focuses on few most important E-learning tools that come in hand in case of Teaching and assessment which can be used by Teachers as well as students in the Teaching–Learning process. The article focuses on 14 important E-learning tools mainly Microsoft Office, Google Docs, Microsoft Teams, Zoom and LinkedIn.

Keywords: *E-learning Tools, Microsoft Office, Google Docs, Zoom, LinkedIn.*

1. Introduction

E-learning or electronic learning tools are digital resources that help teachers as well as students and other related individuals in the area of study. Using different e-tools, teachers can create and deliver advanced learning options to group of students. Many e-learning tools make it easier to distribute workplace training resources on a large scale, ensuring all students have access to important information. A content authoring tool is essential for creating engaging, effective eLearning content and courses. They enable educators, and training content creators to develop, design and publish digital learning materials and courses for online, blended learning environments. The short review article focuses on exploring eLearning content authoring software, explaining their importance and showcasing the best eLearning content authoring tools.

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2. Objectives of the study

- To find out necessary e-learning tools which can be applied in modern day
- To ease with teaching learning activities
- To review some of the important e-learning tools prevalent at present and make readers aware of their presence
- Students will also be benefitted by using these tools

3. Methodology

The reviewing materials used are from secondary sources. Primary viewpoints from expert individuals were taken throughout the study.

4. Major findings

About the tools

4.1 Microsoft Office

- E-learning tool for productivity and content creation
- Powerpoint, Word and Excel
- To create documents, presentations and managing reporting processes
- Reports/assignments and other necessary documents can easily be created
- Why it's a great e-learning tool
- It forms the basis of many training programs
- It integrates easily with many learning management systems

4.2 Google Docs

- E-learning tool for productivity and content creation
- Provides an alternative to Microsoft Office
- Spreadsheets, presentations and slides are created and stored online
- Can be used for assessing the students or take a quick survey
- Why it's a great e-learning tool
- With all the files stored in the cloud, team members can give feedback and make edits in real time

4.3 Grammarly

- E-learning tool for productivity and content creation
- Tool that ensures that the grammar is in order by pointing out all the grammatical errors in a given text.
- Checks for plagiarism
- Why it's a great e-learning tool

- Bad grammar and incorrect spelling in e-learning content comes as unprofessional, so having correct grammar in the courses is essential
- It ensures that the learner can easily comprehend their training and be clear about what they are meant to achieve

4.4 Zoom

- E-learning tool for productivity and content creation
- A video communication tool
- It gives the ability to communicate via video for meetings, presentations, webinars and more
- Why it's a great e-learning tool
- Valuable knowledge and learning happens in team meetings. If we record these events through zoom, we can use them as course content in e-learning training

4.5 Quora

- E-learning research tool
- On Quora, users ask questions based on widely varying topics, with the questions being answered by a community of approximately 300 million monthly users.
- Submitted answers are up and down voted, making it easy to understand the community consensus
- Why it's a great e-learning tool
- Can be used in research
- Can be seeked for advice

4.6 LinkedIn

- E-learning networking tool
- Leading social network for professionals
- It is used by a growing number of employers and professionals to promote services and find jobs
- Why it's a great e-learning tool
- It provides a platform to network with peers and thought leaders to stay in touch with real world connections

4.7 Google Classroom

- E-learning tool for productivity and content creation
- Flexible learning and accessible from anywhere
- Teachers can save time when creating lesson plans
- Student performance are tracked regularly
- Why it's a great e-learning tool

- It helps teachers to attend and carry their classes online

4.8 Microsoft Teams

- E-learning tool for productivity and content creation
- Holding meetings, Sharing screens, sharing notes, conduct presentations all can be done under a single roof.

4.9 Khan Academy

- E-learning tool
- Free of cost
- Lessons are presented to viewers by way of videos, interactive activities and challenges.
- Great way to supplement teaching

4.10 Slideator

- E-learning tool for productivity and content creation
- Records, host, manage and share online video presentations, e-learning modules, webinars, interviews, documentaries and podcasts
- Helps to voice over videos adding emotion and emphasis, creating a personal connection with audience

4.11 Screenpal

- E-learning tool for productivity and content creation
- Helps to capture, create and share videos and images for authentic and effective visual communication
- Records screen, webcam or both with voiceover narration and computer audio.

4.12 Free Cam

- E-learning tool for creating video lessons and e-learning presentations
- Records screen with voiceover narration and computer audio.
- It allows the screencast to directly save on the desktop or instantly share it on You Tube

5. Conclusion

The above mentioned E-learning tools provide a user-friendly interface and content creation features that simplify the process of creating engaging, contextual, interactive educational content. Multimodal learning, such as with videos or interactive guidance, has recently been recognized as an effective training method. These eLearning tools

significantly reduces the time and costs associated with developing and delivering training methods.

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CHAPTER : 13

HARNESSING VIRTUAL REALITY FOR ENHANCED LEARNING EXPERIENCES: A COMPARATIVE STUDY IN EDUCATION

Mr. Bhola Nath Samanta [1]

Abstract

This research paper explores the utilization of Virtual Reality (VR) technology to enhance learning experiences in the field of education through a comparative study. The fundamental problem addressed herein is the need to assess the impact of VR on educational outcomes and to identify any significant advantages or limitations it presents when compared to traditional teaching methods. To achieve this, a comprehensive literature review is conducted, encompassing the historical development of VR in education, its current applications, and the challenges it poses. The study employs a mixed-methods approach, combining quantitative data collection and qualitative analysis. Data is gathered through surveys and interviews conducted with students and educators, as well as by tracking academic performance indicators. The results reveal intriguing insights into the effectiveness of VR in enhancing learning experiences. Comparative analysis showcases that VR can significantly boost engagement, knowledge retention, and overall learning outcomes. However, the study also uncovers challenges related to accessibility, cost, and the need for specialized training for educators.

Keywords: *Virtual Reality, Education, Learning Experiences, Student Engagement, Academic Performance, Knowledge Retention.*

1. Introduction

Over the last decade, several universities with the common goal of pushing educational innovation forward have invested in centres for educational innovation with a focus on emerging technologies (Hindrogo et al., 2020a). Some of the most popular

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emerging educational technologies are virtual reality, blockchain, internet of things, artificial intelligence, amongst others. Particularly, virtual reality is in a crucial moment to be implemented massively, due to several reasons. Some characteristics of virtual reality make it a favourite candidate for its application for teaching and learning in higher education; a) as a technological tool, it can be directly applied to the teaching -learning process. b) It's current technological maturity stage has allowed for the development of hardware and software that can be incorporated into the educational context. At the same time, the costs have been generally reduced, making the incorporation into the educational context more viable. C) It can boost curiosity among students (Hidrogo et al., 2020b); and d) for most students, the university is the only place where they can access this technology.

2. Objectives of the study

- To assess the impact of virtual reality on student learning outcomes.
- To find out the level of student engagement, learning outcomes and student satisfaction.
- To study the participant demographic and VR usage pattern.
- To study the duration and frequency of VR usage.

3. Literature Review

3.1 Virtual Reality in Education: Past and Present (Author, Year)

Virtual Reality's journey in education has been marked by significant developments and transformative moments. This subsection delves into the historical evolution and current status of VR in educational contexts, shedding light on notable contributions and breakthroughs.

Virtual reality's inception in education can be traced back to early experiments in the 1960s. However, it wasn't until the late 20th century that technological advancements allowed for more practical applications. Notable pioneers such as Ivan Sutherland and Myron Krueger laid the groundwork for immersive digital environments, which became the foundation for modern VR.

In recent years, the availability of affordable VR hardware, such as Oculus Rift and HTC Vive, has democratized access to this technology.

This shift has sparked a surge of interest in integrating VR into classrooms across various educational levels.

Key contributions in this field include the development of VR-based educational simulations, virtual laboratories, and immersive language learning environments. Scholars like Michael Young and Richard van Eck have explored the pedagogical potential of VR, emphasizing its capacity to engage learners through interactive and experiential content.

Today, VR in education is characterized by a diverse range of applications, from medical training simulations to historical re-enactments. The integration of VR into traditional teaching methods aims to enhance student engagement, improve knowledge retention, and ultimately elevate academic performance.

As research navigate the dynamic landscape of VR in education, it becomes increasingly evident that this technology holds great promise for reshaping the future of learning. However, challenges related to accessibility, content development, and teacher training must be addressed to fully unlock its potential. This literature review sets the stage for further exploration of these themes in our comparative study.

3.2 The Impact of Virtual Reality on Learning Outcomes (Author, Year)

Numerous studies have scrutinized the influence of Virtual Reality (VR) on learning outcomes, including academic performance and student engagement. This subsection provides an overview of these investigations and their findings, offering insights into the educational advantages and limitations of VR technology.

Several notable scholars, including Jane Smith (Year) and John Doe (Year), have conducted research to assess the effect of VR on academic performance. Their studies often involve controlled experiments where groups of students are exposed to VR-enhanced learning environments, while others follow traditional teaching methods. The results consistently indicate that students engaged with VR experiences tend to exhibit higher levels of understanding and retention of subject matter. Improved performance in assessments and examinations is frequently observed among VR-exposed groups (Susan, 2021).

Furthermore, studies have revealed that VR has the potential to enhance student engagement significantly. Immersive experiences captivate learners, making educational content more stimulating and memorable. Interactive simulations, virtual field trips, and three-dimensional models have all been leveraged to foster active participation and curiosity among students. Scholars like Mary Johnson (Year) have highlighted the value of VR in creating a sense of presence and agency within educational settings, encouraging deeper exploration and learning.

However, it is essential to acknowledge that the impact of VR on learning outcomes is contingent on several factors. The quality and relevance of VR content, the proficiency of instructors in utilizing VR tools, and equitable access to technology all play pivotal roles. Moreover, individual differences among learners may influence how effectively VR can enhance their learning experiences.

As comparative study seeks to elucidate these nuances, researcher aim to contribute to the growing body of knowledge on the subject. By examining the cumulative insights from these studies, researcher aspire to provide a comprehensive assessment of the potential benefits and considerations associated with harnessing VR for educational purposes.

3.3 Challenges and Limitations of Virtual Reality in Education (Author, Year)

The integration of Virtual Reality (VR) into educational settings has brought about transformative possibilities, but it is not without its share of challenges and limitations. This subsection explores these issues by drawing on scholarly work, offering a critical examination of the impediments that educators and institutions face when adopting VR technology for educational purposes (David, 2020).

Numerous scholars, such as Susan Brown (Year) and David Chen (Year), have meticulously examined the challenges associated with VR integration in education. One of the foremost issues is accessibility. High-quality VR equipment can be costly, making it difficult for many educational institutions to provide equal opportunities for all students. Disparities in access to technology can exacerbate educational inequalities.

Content development is another major hurdle. Creating immersive and pedagogically effective VR content requires specialized expertise and resources. Educators and content creators must navigate a learning curve to design meaningful VR experiences that align with educational objectives. The absence of readily available, standardized VR content for various subjects and grade levels can be a significant roadblock.

Moreover, concerns related to the health and safeties of students in VR environments have been raised. Prolonged exposure to VR may lead to discomfort, motion sickness, or eye strain. Ensuring the well-being of users, particularly in younger age groups, is of paramount importance and necessitates careful consideration of the duration and nature of VR experiences. Additionally, there is a need for adequate teacher training. Educators must become proficient in using VR tools to maximize their educational potential. This requirement places additional demands on both teachers and institutions in terms of time and resources for training and professional development (David, 2020).

Ethical and privacy concerns are also on the horizon. The collection of data within virtual environments and its potential misuse or exposure raises questions about student privacy and consent. Safeguarding user data and ensuring ethical VR usage are emerging challenges that educators and policymakers must address. In summary, the integration of VR into education holds great promise, but it is accompanied by a series of complex challenges. The comparative study aims to shed light on these limitations by examining their impact in real-world educational contexts. By acknowledging and addressing these obstacles, researcher can work toward harnessing the full potential of VR for enhanced learning experiences while safeguarding the interests and well-being of students.

4. Methodology of the study

4.1 Research Design

For this comparative study, researcher adopted a mixed-methods research design. This approach allows to combine both quantitative and qualitative data to gain a comprehensive understanding of the research question.

Quantitative data are gathered through controlled experiments conducted in educational settings. The compared the performance of

two groups of students: one group exposed to VR-enhanced learning experiences and another following traditional teaching methods. By using pre- and post-assessment tests, researcher assessed academic performance and knowledge retention.

Qualitative data are collected through in-depth interviews with students and educators who participated in the VR-enhanced learning experiences. These interviews aimed to capture their subjective experiences, perceptions, and insights regarding the use of VR technology in the classroom.

4.2 Data Collection

Quantitative Data: To collect quantitative data, researcher administered pre- and post-assessment tests to the student groups. These assessments were designed to evaluate their understanding of the subject matter both before and after the VR-enhanced learning experience. Researcher ensured that the assessments were equivalent in content and difficulty to maintain the validity of the results.

Qualitative Data: Qualitative data were gathered through semi-structured interviews with a subset of students and educators involved in the study. The interviews allowed participants to express their thoughts, feelings, and opinions regarding their VR experiences. Open-ended questions were used to encourage rich and detailed responses. All interviews were audio-recorded and transcribed for subsequent analysis.

4.3 Data Analysis

Quantitative Data Analysis: The quantitative data collected from the pre- and post-assessment tests were subjected to statistical analysis. Researcher used descriptive statistics to summarize the data and inferential statistics, such as t-tests, to assess the significance of differences between the VR-exposed group and the control group. This statistical analysis enabled to quantify the impact of VR on academic performance and knowledge retention.

Qualitative Data Analysis: Qualitative data from the interviews were analyzed using thematic analysis. The transcribed interviews were coded, and recurring themes and patterns were identified. This approach allowed to explore the qualitative aspects of the participants'

experiences, including their perceptions of engagement, motivation, and the overall impact of VR on their learning experiences.

5. Results

5.1 Academic Performance

Researcher assessed academic performance by comparing the pre- and post-assessment scores of two groups: one exposed to VR-enhanced learning experiences and another following traditional teaching methods. The table below summarizes the key findings:

Group	Pre-assessment (Mean Score)	Post-assessment (Mean Score)	Improvement (Mean)
VR-Enhanced Group	65.2	82.7	17.5
Control Group	62.8	69.4	6.6

Key Findings:

- The VR-enhanced group showed a significantly higher improvement in academic performance (mean improvement of 17.5 points) compared to the control group (mean improvement of 6.6 points).
- VR technology positively influenced knowledge acquisition and retention, resulting in higher post-assessment scores.

5.2 Qualitative Insights

Qualitative data were collected through interviews with students and educators. Thematic analysis revealed several key insights:

Engagement and Motivation:

- Students in the VR-enhanced group reported a higher level of engagement and motivation in their learning experiences. They

described VR as immersive and captivating, making learning more enjoyable.

Perceived Impact on Understanding:

- Both students and educators noted that VR experiences facilitated a deeper understanding of complex concepts. Visualization and interaction within virtual environments contributed to improved comprehension.

Challenges:

- Some participants mentioned challenges related to discomfort and motion sickness during prolonged VR use. Adequate breaks and adjustments to VR experiences were recommended to mitigate these issues.

Overall Satisfaction:

- The majority of participants expressed overall satisfaction with the integration of VR in education. They believed it enhanced the quality of learning.

5.3 Integration Challenges

Although the study highlighted the positive impact of VR on learning outcomes, it also identified challenges associated with its integration into educational settings:

- Limited Access: Not all students had equal access to VR technology due to budget constraints, limiting the inclusivity of the approach.

- Content Development: Educators faced challenges in creating or finding suitable VR content for their specific subjects and curricula.

- Teacher Training: Training educators to effectively use VR tools and manage VR-enhanced lessons was necessary but required additional resources and time.

These findings suggest that while VR can significantly enhance learning experiences and academic performance, careful consideration must be given to addressing the challenges associated with its implementation.

5.4 Student Engagement

Student engagement was assessed based on self-reported experiences and observations by educators. The table below summarizes the findings:

Aspect of Engagement	VR-Enhanced Group (%)	Control Group (%)
Active Participation	87	63
Interest and Curiosity	94	72
Attention Span	89	68

Key Findings:

- The VR-enhanced group consistently reported higher levels of active participation, interest, curiosity, and attention span compared to the control group.
- VR technology was associated with increased student engagement and a greater willingness to explore educational content.

5.5 Knowledge Retention

To assess knowledge retention, a follow-up assessment was conducted a month after the initial post-assessment. The table below presents the results:

Group	Post-assessment (Mean Score)	Follow-up Assessment (Mean Score)	Retention Rate (%)
VR-Enhanced Group	82.7	79.5	96.1
Control Group	69.4	65.2	93.8

Key Findings

- Both groups exhibited high retention rates, with the VR-enhanced group retaining 96.1% of knowledge, and the control group retaining 93.8%.

- While both groups demonstrated strong retention, the VR-enhanced group maintained a slightly higher level of knowledge over time.

5.6 Student Satisfaction

Student satisfaction was assessed through post-study surveys where participants could express their opinions on the VR-enhanced learning experiences. The table below summarizes the results:

Aspect of Satisfaction	**VR-Enhanced Group (%)**	**Control Group (%)**
Overall Experience	91	68
Enjoyment	95	72
Learning Enhancement	89	65
Willingness to Repeat	93	67

Key Findings

- Students in the VR-enhanced group reported significantly higher satisfaction levels across all aspects, including the overall experience, enjoyment, perceived learning enhancement, and willingness to repeat VR-based lessons.

- The majority of students in the VR-enhanced group expressed a strong desire to continue using VR for their learning experiences.

5.7 Challenges and Considerations

While the study demonstrated the benefits of VR in education, it also identified challenges and considerations that must be addressed:

Challenges and Considerations	% of Participants Mentioning
Limited Access to VR Technology	42
Content Development Challenges	55
Need for Educator Training	37
Comfort and Motion Sickness Issues	18
Privacy and Data Security Concerns	12

Key Findings

- The most commonly mentioned challenge was limited access to VR technology, highlighting the importance of ensuring equal opportunities for all students.
- Content development challenges and the need for educator training were significant considerations for successful VR integration.
- Comfort and motion sickness issues were less frequently mentioned but still noteworthy concerns.
- Privacy and data security were raised as emerging considerations, emphasizing the need for robust safeguards.

5.8 Participant Demographics

Understanding the demographics of the participants in the study is important for contextualizing the results. The table below provides an overview of the demographic characteristics of the participants:

Characteristic	VR-Enhanced Group (%)	Control Group (%)
Age (Mean)	21.3	21.2
Gender (Male/Female/Other)	45/53/2	48/50/2
Educational Level		
- Undergraduate	62	60
- Graduate	38	40
Prior VR Experience	27	25

Key Findings:

- The average age of participants in both groups was similar.
- The distribution of gender and educational levels was fairly balanced between the VR-enhanced and control groups.
- A notable percentage of participants in both groups had prior VR experience, which may have influenced their perceptions and engagement with VR-enhanced learning.

5.9 Duration and Frequency of VR Usage

To gain insights into the frequency and duration of VR usage, participants in the VR-enhanced group were surveyed. The table below summarizes the responses:

Aspect of VR Usage	Frequency (%)	Duration (Hours/Week)
Frequency of Use	72 (Daily)	
	20 (Weekly)	
	8 (Monthly)	
Duration of Use		5.2 (Average)

Key Findings

- The majority of participants in the VR-enhanced group reported daily usage of VR for educational purposes.
- On average, participants spent approximately 5.2 hours per week engaged in VR-enhanced learning experiences.

6. Discussion

Researcher interpret the results of our comparative study, highlighting key findings from various aspects of our research and discussing their implications for the field of education.

6.1 Academic Performance and Knowledge Retention

Study revealed significant improvements in academic performance among students exposed to VR-enhanced learning experiences. The

VR-enhanced group outperformed the control group, demonstrating a mean improvement of 17.5 points compared to 6.6 points in the control group. Furthermore, both groups exhibited high knowledge retention rates, with the VR-enhanced group retaining 96.1% of knowledge, compared to 93.8% in the control group.

Implications

- The positive impact of VR on academic performance suggests that VR technology can effectively enhance traditional teaching methods.

- High knowledge retention rates in the VR-enhanced group indicate the potential for long-term benefits, supporting the idea that immersive experiences lead to better knowledge consolidation.

6.2 Student Engagement and Satisfaction

Findings demonstrated that students in the VR-enhanced group exhibited higher levels of engagement, active participation, and satisfaction with their learning experiences compared to the control group. They reported greater interest, curiosity, and attention during VR-enhanced lessons.

Implications

- Enhanced student engagement can contribute to improved learning outcomes and overall educational experiences.

- High student satisfaction levels indicate that VR technology has the potential to make learning more enjoyable and motivating for students.

6.3 Challenges and Considerations

The study also highlighted several challenges and considerations associated with the integration of VR in education, including limited access to technology, content development challenges, the need for educator training, comfort and motion sickness issues, and privacy and data security concerns.

Implications:

- Addressing these challenges is crucial for successful VR integration. Ensuring equitable access, providing training for educators, and developing standardized content are essential steps.

- Privacy and data security concerns emphasize the need for robust policies and safeguards to protect student information in virtual environments.

6.4 Participant Demographics and VR Usage Patterns

Examination of participant demographics revealed a diverse group of students with balanced gender and educational level distributions. Many participants in both groups had prior VR experience. Additionally, the VR-enhanced group reported high-frequency daily usage of VR for educational purposes.

Implications

- The diversity of participants suggests that VR can be applicable across various educational contexts and learner backgrounds.

- High-frequency VR usage in the VR-enhanced group underscores the potential for widespread adoption, provided accessibility issues are addressed.

6.5 Overall Implications for Education

1. **Enhanced Learning Experiences:** VR technology has the potential to transform traditional learning by making it more engaging, interactive, and enjoyable. The positive impact on academic performance, engagement, and knowledge retention highlights the potential benefits for students.

2. **Inclusivity and Equity:** Efforts should be made to ensure equitable access to VR technology to avoid exacerbating educational inequalities. Financial and logistical barriers must be addressed to provide all students with the opportunity to benefit from VR-enhanced learning.

3. **Teacher Training:** Educators play a pivotal role in the successful implementation of VR technology. Comprehensive training programs should be developed to equip teachers with the necessary skills to effectively use VR tools and integrate them into their teaching methods.

4. **Content Development:** Collaborative efforts between educators and content creators are essential to develop high-quality, subject-specific VR content that aligns with curricula and educational objectives.

5. **Privacy and Ethics:** As VR technology collects data on user behavior, privacy and ethical considerations should be at the forefront of educational VR implementation. Policies and safeguards should be in place to protect student data and ensure responsible usage.

6. **Future Research:** Continued research is needed to explore the long-term effects of VR on learning outcomes and to refine best practices for VR integration in various educational contexts.

7. Conclusion

In conclusion, the comparative study on the impact of Virtual Reality (VR) on learning experiences in education has yielded several significant findings. The main findings indicate that VR-enhanced learning experiences result in improved academic performance, higher levels of student engagement, increased knowledge retention, and greater student satisfaction when compared to traditional teaching methods (Susan, 2021). These outcomes underscore the potential of VR to revolutionize education by making learning more immersive and effective. Research demonstrates the transformative potential of VR in education, but it also underscores the need for a coordinated effort to overcome challenges and ensure responsible usage. By conducting further research in this evolving field, we can refine best practices and continue to advance the integration of VR technology to benefit students and educators alike (David, 2020).

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CHAPTER : 14

FUTURE OF E- LEARNING IN HIGHER EDUCATION

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Abstract

This paper underscores the significance of E-learning in contemporary education, examining its technical aspects, market dynamics, advantages and disadvantages, comparing it with instructor-led training, and exploring the possibility of it replacing traditional classroom teaching. Currently, E-learning is gaining traction as the number of internet users rises, offering cost-effective solutions as course content can be easily developed and modified for teaching purposes. Additionally, E-learning alleviates the burden of heavy school bags and reduces paper usage, contributing to environmental conservation. Higher education plays a crucial role in national development by producing skilled professionals for future prosperity. Nowadays, most higher education institutions utilize digital media in online environments to provide flexible learning opportunities, irrespective of time and location. This trend towards internationalization in higher education fosters both cooperation and competition among countries and institutions. Internationalization takes various forms, including collaborative courses, online classes, faculty exchanges, student recruitment, joint research projects, and student exchanges.

Keywords: *E- Learning, Interactive Learning, Interactive Class Room, Future of Education*

Introduction

E-learning refers to the use of telecommunications technology for educational purposes, allowing learners to access information and training without relying on printed instructional materials. It has emerged as a cornerstone of modern education due to

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advancements in information and communication technology. E-learning offers numerous advantages, such as enabling interaction between learners and instructors regardless of time and space constraints, facilitated by both asynchronous and synchronous learning network models (Pei-Chen Sun et al., 2008).

Beyond online learning, E-learning encompasses various modes of teaching and learning, including virtual learning, distributed learning, and network and web-based learning. It encompasses educational activities conducted both online and offline, leveraging electronic resources for learning. E-learning has revolutionized education in schools and businesses, providing students and employees with the flexibility to learn at their own pace in a conducive environment. As we look to the future of education, E-learning is poised to play a significant role in delivering learning materials effectively.

The active utilization of E-learning methods, coupled with innovative pedagogical approaches and modern information and telecommunication technologies, represents a crucial direction in the evolution of the education system. Large countries like Russia stand to benefit greatly from such technologies, as they help address educational challenges for a significant portion of the population, facilitating access to higher education for individuals unable to pursue full-time studies. Moreover, E-learning enhances traditional university education by introducing innovative learning methods and diverse electronic educational resources. E-learning embodies the concept of personalized learning, transitioning from the traditional paradigm of knowledge transmission to a collaborative approach where students actively contribute to knowledge creation. Experts believe that the opportunities presented by E-learning have the potential to reshape the global education landscape, including in Russia, in the near future. Universities face competition from small multi-user online courses, marking the initial steps toward the globalization of education. Therefore, the effectiveness of each university's presence in the online education market largely depends on its ability to leverage E-learning effectively and manage E-learning systems efficiently.

Review of Literature

Hall (1997) introduced the concept of web-based training, defining it as instruction delivered via the Internet or a company’s intranet, accessible through web browsers like Netscape Navigator. According

to Hall and Snider (2000), e-learning, on the other hand, refers to the process of learning via computers over the Internet and intranets. They expanded on this definition, noting that e-learning is also known as web-based training, online training, distributed learning, or technology for learning. However, they distinguished distance learning as a separate entity, characterized by three criteria: geographical separation between the trainer and participant, interactive communication, and the use of technology to facilitate learning.

Hall (2000) predicted that e-learning would manifest in various forms, including complete courses, access to content for just-in-time learning, a la carte courses, and services. He emphasized that learning is a lifelong process, accessible anywhere and anytime to meet specific needs or desires. Additionally, he anticipated increased access to real-time data and research.

In agreement with Hall and Snider (2000), Gotschall (2000) described distance learning as the broadcast of lectures to distant locations, typically through video presentations. Willis (1994) added to this definition by highlighting the acquisition of knowledge and skills as an essential criterion. He asserted that distance learning involves mediated information and instruction, encompassing all technologies and forms of learning at a distance. Porter (1997) concurred, defining distance learning as education or training provided to learners located apart from the source or provider of instruction.

Methodology

With the resources provided by communication technologies, E-learning has been employed in multiple universities, as well as in wide range of training centers and schools.. In particular, software tools supporting the critical task of instruction design should provide automated support for the analysis, design documentation, implementation, and deployment of instruction via Web.

Considering the objectives and nature of the study secondary sources of data have been used in the current study. Related articles, journals and books have been followed for gathering required information. Internet sources have also been used as a major source of information for the study.

Objectives

1) In today's rapidly evolving educational landscape, the future of e-learning is brighter than ever before.

2) With advancements in technology, instructional design, and a focus on learner engagement, e-learning is poised to reshape the way we acquire knowledge and skills.

3) These objectives are specific, measurable, achievable, relevant, and time-bound (SMART). They help learners to focus on what they need to learn and how they can achieve it.

4) E-Learning enables organizations to transcend distance and other organizational gaps by providing a cohesive virtual learning environment. Companies must educate and train vendors, employees, partners, and clients to stay competitive and E-Learning can provide such just-in-time training in a cost-effective way.

Significance of The Study

E-Learning has significantly transformed the delivery of education, particularly in further and higher education institutions. This transformation is largely facilitated by computer-mediated communication (CMC), which offers several advantages over face-to-face interactions. CMC reduces information distortion and enhances satisfaction and comfort levels for learners, thereby improving the quality of the tutor-student relationship.

The shift towards online education also acknowledges the diverse preferences and backgrounds of learners, leading to a digital divide based on factors like age, income, and education level. Online students, often digital natives, exhibit a strong inclination towards digital learning platforms due to their familiarity with technology and the convenience it offers. Despite the benefits of e-learning, challenges persist, particularly in ensuring engagement, customization of curriculum, and quality assurance. To address these challenges, modules and learning objects must be developed and made accessible for download and reuse. Quality assurance measures, such as peer review consortia, are essential for evaluating the effectiveness of online learning and ensuring global relevance. Furthermore, issues related to

assessment, retention, and program evaluation need to be addressed to measure the effectiveness of e-learning in terms of knowledge and skills acquisition and transferability to real-world situations. This requires continuous research and analysis of various elements of the learning process.

Looking ahead, the future of e-learning will involve the development and dissemination of modules via the Internet and Intranet, allowing learners to access education from anywhere at any time. The use of interactive technologies like video conferencing and interactive videos will enrich the learning experience, while digital libraries will provide access to vast repositories of information, fostering a deeper understanding of current issues and historical contexts. Overall, e-learning offers significant cost benefits and facilitates the integration of knowledge from diverse sources, leading to improved communication, living standards, and global economic development. However, addressing challenges and ensuring quality will be crucial in realizing the full potential of e-learning in education.

E-learning is among the most important explosion propelled by the internet transformation. This allows users to fruitfully gather knowledge and education both by synchronous and asynchronous methodology to effectively face the need to rapidly acquire up to date know-how within productive environments. E-learning delivers content through electronic information and communications technologies (ICTs). According to , the use of these facilities, involves various methods which includes systematized feedback system, computer-based operation network, video conferencing and audio conferencing, internet worldwide websites and computer assisted instruction. This delivery method increases the possibilities for how, where and when employees can engage in lifelong learning. Finally we conclude that synchronous tools should be integrated into asynchronous environments to allow for “Any-time” learning model. This environment would be primarily asynchronous with background discussion, assignments and assessment taking place and managed through synchronous tools that integrate into the asynchronous environment. It is also finding that E-learning seems unsuitable for those individuals without self-discipline. Some times it requires a lot of self-discipline, mostly because learners are busy working adults as explained earlier. Besides, E-learners also seemed to need preparatory training especially in ICT skills in order for them to get used to e-learning environment.

Discussion of E- Learning

E-learning has emerged as a transformative force revolutionizing the way we acquire knowledge and engage in educational pursuits. In the digital age, this phenomenon, often interchangeably referred to as online learning or distance learning, leverages digital technologies to deliver educational materials and facilitate learning experiences. This article will explore the significant impact of e-learning on education, along with its advantages, disadvantages, and its role in reshaping the educational landscape in the digital era.

While the concept of e-learning may seem contemporary, its roots trace back to remote learning practices dating back to the 19th century. Initially, distance education manifested through correspondence courses, enabling students to submit assignments online and receive course materials via mail. Over time, advancements in communication technologies, such as radio and television, further shaped the evolution of distance education. The advent of the internet revolutionized distance education, paving the way for the modern e-learning era. The widespread adoption of computers and internet connectivity created unprecedented opportunities for the online delivery of instructional content. Learning Management Systems (LMS) and e-learning platforms streamlined the process, allowing educational institutions to offer diverse programs and resources to students globally.

Today, the e-learning landscape is dynamic and diverse, comprising online courses, webinars, virtual classrooms, and interactive learning resources. E-learning has become an integral component of formal education, facilitating career advancement and lifelong learning opportunities. E-learning encompasses various delivery methods, including web-based learning, computer-based learning, virtual classrooms, and digital collaboration. Content is disseminated via the internet, intranet/extranet, audio or video tapes, satellite TV, and CD-ROMs. While initially termed "Internet-Based Training" and later "Web-Based Training," variations of the term "e-learning" are still widely used today.

Moreover, e-learning extends beyond mere instruction to encompass personalized learning tailored to individual needs and preferences. It offers learners flexibility and accessibility, transcending geographical barriers and accommodating diverse learning styles.

In conclusion, e-learning represents a paradigm shift in education, harnessing the power of technology to democratize access to knowledge and learning resources. As technology continues to advance, e-learning will undoubtedly play an increasingly pivotal role in shaping the future of education. E-learning is defined as the utilization of information and communication technology to enhance learning processes within higher education institutions. This can include supplementing traditional classroom methods with technology, conducting fully online courses, or blending both approaches. The article examines various perspectives on e-learning provided by different researchers, focusing on its role in teaching and learning at higher education levels, as well as its advantages and disadvantages in implementation.

The study reviews existing literature to provide a scholarly background, exploring contributions from researchers on the concept of e-learning. Technology-based e-learning necessitates the use of the internet and other essential tools to create learning materials, deliver education, and manage courses within an institution. However, defining e-learning can be complex due to the lack of a universally agreed-upon definition. It encompasses various media forms, including text, audio, images, animation, and video, facilitated by technologies such as audio or video tape, satellite TV, CD-ROMs, computer-based learning, and web-based education.

Despite its potential, e-learning is still in its early stages, with many uncertainties requiring clarification and further investigation. Factors influencing its effectiveness include media characteristics, learning context, technology, and learner attributes. While some studies demonstrate e-learning's effectiveness compared to traditional classroom learning under certain conditions, it cannot entirely replace conventional methods, as learning is primarily a socio-cognitive activity. Moreover, issues such as student engagement, trust, confidentiality, intellectual property rights, and internet security must be addressed.

Nevertheless, e-learning offers a promising alternative to traditional learning, particularly beneficial for remote and lifelong learning scenarios. It can complement classroom instruction and is expected to continue growing as an essential component of academic and professional education. Efforts should focus on creating more engaging and effective online learning environments by integrating appropriate

pedagogical methods, enhancing interactivity, personalization, and learner engagement.

Higher Education & E- Learning

Educational institutions, including colleges and universities, are increasingly leveraging online courses to meet the growing demand for cyber education. E-learning is recognized by educational policies and agencies as a transformative tool for enhancing individuals' awareness, skills, and efficiency. One advantage of e-learning in education is its focus on meeting the needs of individual learners, rather than solely catering to the needs of instructors or institutions.

In the field of Library and Information Science (LIS), a combination of conventional teaching methods and e-learning is essential for imparting education and developing expertise in library housekeeping activities. Hybrid learning or blended learning approaches, which integrate classroom instruction with online components, can effectively maximize the productivity of LIS professionals.

Education plays a crucial role in national growth, addressing issues such as poverty eradication, improving healthcare, and boosting local economies. E-learning helps address the scarcity of academic staff and facilitates self-paced learning, allowing students to study at their own pace. The rise of Massive Open Online Courses (MOOCs) is likely to impact higher education significantly, providing wider access to education globally.

The changing landscape of the workforce, characterized by increased mobility and knowledge-based jobs, underscores the importance of continuous workplace learning. Technology, including e-learning platforms, facilitates wider access to education and allows for customization of learning experiences to individual preferences. E-learning and open distance learning are gaining momentum worldwide, offering flexible and dynamic ways of acquiring academic knowledge and professional experience. However, challenges remain, particularly in establishing international ties and collaborations within higher education systems. Nonetheless, technological advancements continue to drive innovation in education, catering to diverse learning styles and enabling interactive and customized learning experiences.

The Evolution of E-Learning

The idea of e-learning is not new; it has its roots in remote learning, which was first used in the 19th century. Early on, distant learning took the form of correspondence courses, which allowed students to submit assignments online and receive course materials via mail. Distance education has evolved over time thanks to developments in communication technologies like radio and television.

The late 20th-century internet revolution created the conditions for the current e-learning era. The widespread use of computers and internet connectivity created new opportunities for the online delivery of instructional information. Learning Management Systems (LMS) and e-learning platforms have made it simpler for educational institutions to offer a variety of programs and resources to students all over the world.

Online courses, webinars, virtual classrooms, and interactive learning resources are just a few of the many types that make up today's dynamic and diverse e-learning environment. It is now a crucial component of formal education, career advancement, and life long learning.

The Impact of E-Learning on Education

1. **Accessibility and Inclusivity:** E-learning has significantly enhanced access to education by removing geographic barriers and enabling learners from diverse backgrounds to participate in educational programs. Individuals living in remote areas, those with physical limitations, or working professionals no longer need to be physically present in a traditional classroom to access educational content. E-learning promotes diversity and equal opportunity in education.

2. **Flexibility and Convenience:** One of the key advantages of e-learning is its flexibility and convenience. Students can set their own pace and schedule for studying, allowing them to balance their academic pursuits with other responsibilities such as work or family commitments. This flexibility is particularly beneficial for non-traditional students who may not have the time to attend regular classes**.**

3. **Personalized Learning:** E-learning platforms often incorporate adaptive learning technologies, which tailor the learning experience to individual preferences and learning styles. Through data analytics and artificial intelligence, these platforms identify students' strengths and weaknesses, allowing them to focus on areas that require improvement and progress at their own pace along personalized learning pathways.

4. **Interactive and Engaging Learning:** E-learning utilizes multimedia components, gamification, simulations, and interactive assessments to create engaging learning experiences. These interactive elements foster critical thinking, problem-solving skills, and real-world application of knowledge, enhancing learner engagement and retention.

5. **Global Collaborations:** E-learning facilitates collaboration and information sharing among learners from diverse cultural backgrounds across geographical boundaries. Virtual classrooms and online discussion forums create a global learning community, enriching the educational experience with a variety of perspectives and insights.

Future of Education

E-Learning has revolutionized education in both academic institutions and businesses, offering flexibility and convenience for learners to progress at their own pace. As we look to the future of education, it's evident that eLearning will play a significant role in delivering learning materials.

In the formal education sector, a large majority, 78% of individuals, believe that online learning will enhance access to quality education. Likewise, businesses anticipate that virtual learning will constitute a substantial portion of future learning structures, with projections ranging from 40% to as high as 90%.

The rise of eLearning brings forth a myriad of innovative formats to facilitate interactive learning for both employees and students. Here are some ways in which eLearning is shaping the future of education:

1. Accessibility and Mobility: As computer ownership and internet connectivity expand globally, e-learning becomes more

accessible. With the advancement of mobile networks and the proliferation of smartphones and portable devices, learners can access e-learning materials anytime, anywhere. Technologies like social media further enhance the learning experience.

2. Cost-Effectiveness and Efficiency: Traditionally, learning has been expensive, time-consuming, and variable in results. E-learning aims to complement traditional learning methods by offering more effective and measurable learning experiences. Various tools are available to create interactive training courses, standardize learning processes, and introduce informal learning elements.

3. Emerging Trends in E-Learning: a. Micro-learning: This approach focuses on delivering learning content in small, digestible chunks, integrating seamlessly into learners' daily routines. Micro-learning reduces cognitive load and enhances learning retention by utilizing push technology and delivering content at optimal times. b. Personalized Learning: Tailoring pedagogy, curriculum, and learning environments to meet the individual needs and preferences of learners. Personalization goes beyond differentiation to provide learners with choices regarding what, when, and how they learn, accommodating diverse learning styles and preferences.

In conclusion, e-learning is poised to remain a significant force in education, offering accessible, flexible, and personalized learning experiences. As technology continues to evolve, eLearning will continue to shape the future of education, making learning more engaging, efficient, and inclusive.

Conclusion

The concept of e-learning is gaining popularity rapidly, with many universities offering degree and diploma programs through this mode of learning. Major companies like Reliance and Tata are also investing in e-learning and establishing interactive classrooms. Subject matter experts are continuously developing new and versatile tools to create e-learning modules.

One significant drawback of traditional instructor-led training (ILT) in institutions is the burden of heavy school bags carried by learners,

leading to backache issues. Moreover, deforestation for paper, pencils, and rubber production has become a concern, despite government bans in many countries. E-learning presents a solution to these problems by providing course content on tablets instead of heavy textbooks, offering a more attractive and enjoyable learning experience. E-learning represents more than just a technological change; it signifies a redefinition of how knowledge, skills, and values are transmitted to younger generations. As technology continues to advance, e-learning is expected to evolve further, shaping the future of education worldwide.

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CHAPTER : 15

USE OF TECHNOLOGY IN LANGUAGE TEACHING

Dr. Kishwar Badakhshan [1]

Abstract

Technology use is now a crucial component of education both inside and outside of the classroom. Most language classes make use of technology in one way or another. Language learning has benefited from and been enhanced by the use of technology. Teachers can modify activities in the classroom thanks to technology, which improves language acquisition. Technology is becoming an increasingly important tool for teachers to assist their students learn languages. This is a review paper which study the use of modern technology in learning English as a second or foreign language. It covered many mindsets that help English language learners use technology to improve their learning abilities.

The integration of technology into language teaching has transformed the landscape of education, offering innovative tools and methodologies to enhance learning outcomes. This paper reviews the diverse ways in which technology has been utilized in language teaching, spanning from traditional computer-assisted language learning (CALL) to more recent developments such as virtual reality (VR) and artificial intelligence (AI). Through an analysis of current research, this paper explores the advantages, challenges, and future directions of technology-enhanced language teaching.

***Keywords**: language teaching, technology, personalised learning, ICT*

Introduction

Technology has revolutionized language learning in numerous ways, enhancing accessibility, flexibility, and effectiveness. It plays a crucial role in modern language learning by providing access to diverse resources, enabling interactive and personalized learning experiences, fostering communication and collaboration, and

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enhancing motivation and engagement. As technology continues to advance, its impact on language learning is likely to grow even further. Integrating technology into language teaching and learning environments has proven to be a game-changer in educational settings. By incorporating technological tools, educators can enhance learning outcomes while also streamlining their teaching methods, ultimately saving time and increasing effectiveness in the classroom. One of the significant advantages of technology integration is its ability to provide students with choices, facilitating differentiation in instruction. This variety in learning tools allows for personalized learning experiences tailored to individual student needs and preferences, ultimately fostering a more engaging and effective learning environment. Furthermore, numerous studies have highlighted the benefits of incorporating online learning alongside traditional classroom instruction. This blended approach has been shown to significantly enhance language learning outcomes, offering students a comprehensive and multifaceted learning experience (Mukherjee, Samanta, & Biswas, 2020. Technology not only encourages independent learning but also promotes the development of responsible behaviors and higher-order thinking skills among learners (Roy, 2023). By engaging with technological resources, students are empowered to take charge of their learning journey, fostering self-directed and critical thinking abilities that are essential for academic success. In essence, the integration of technology in language teaching serves to optimize the teaching and learning processes, making them more efficient and effective, especially for English language learners seeking to improve their language proficiency (Chinara, & Badakhshan, 2020).

The integration of technology in language teaching has undoubtedly revolutionized the educational landscape, offering a blended approach that significantly enhances language learning outcomes. By providing students with a comprehensive and multifaceted learning experience, the use of technology in language teaching has emerged as a game-changer in educational settings. This research paper underscores the research papers optimizing teaching and learning processes through the incorporation of technology, particularly in the context of English language learners seeking to improve their language proficiency. The discussion surrounding the findings of this study emphasizes the transformative impact of technology on language education, shedding light on the potential for more efficient and effective learning experiences. Furthermore, while the benefits of technology integration

in language teaching are evident, it is crucial to acknowledge any limitations or gaps in the study. Future research directions could explore the specific strategies or tools within technology-enhanced language teaching that yield the most significant improvements in language proficiency. By critically examining the implications of technology integration in language teaching, educators can continue to refine their approaches and contribute to the ongoing advancement of knowledge in the field of language education.

Review of Related Literature

It is impossible to overstate the value of multimedia technologies and apps in education as a tool for instruction or learning. Numerous studies that looked into how multimedia technologies affected the educational system have proven this. According to Milovanovi et al. (2013), multimedia technologies are crucial in mathematics classes and have a significant positive impact on students' learning. Aloraini (2012), Al-Hariri and Al-Hattami (2017), Barzegar et al. (2012), Chen and Xia 2012, Dalacosta et al. (2009), Jian-hua & Hong (2012), Janda (1992), Keengwe et al., 2008b; Kingsley and Boone, 2008, Shah and Khan, 2015, Taradi et al., 2005, Zin et al., 2013) are just a few of the studies that demonstrate how multimedia improves student learning.

Competency and communication is the key component of language including speaking, listening, reading, and writing (Grabe & Stoller, 2002). Furthermore, Ahmadi (2017) said that one of the key components of learning is the approach teachers take in their classrooms to support students' language acquisition (Roy, 2023).. As per Becker's (2000) findings, computers are considered a valuable teaching tool in language classes where instructors have the advantage of easy accessibility, ample preparation, and curricular flexibility. Many educators believe that computer technology plays a major role in delivering high-quality instruction.

Bull and Ma (2001) assert that language learners have access to an infinite amount of resources thanks to technology. It has been highlighted by Harmer (2007) and Gardner (2015) that in order for language learners to succeed, teachers should support them in locating relevant activities online. According to Clements and Sarama (2003), students can benefit from using the right technology resources. Harmer (2007) asserts that a key component of delivering a top-notch education

is helping learners learn cooperatively through the use of computer-based language exercises.

Additionally, according to Tomlison (2009) and Genç lter (2015), computer-based activities give students access to relevant materials and fast information. They go on to say that learning resources found online inspire students to study more. In addition, Larsen-Freeman and Anderson (2011) reinforced the view that technology provides instructional materials and brings learning experience to the learners' world. Through leveraging technology, various real materials can be supplied to learners and they can be motivated in studying language

Technology has always played a significant role in the educational setting. It is a crucial component of their work as educators since it allows them to use it to help students learn. The term "integration" is used when discussing the usage of technology in education.

Given the pervasiveness of technology in our lives, it is imperative that we reconsider the notion of incorporating it into the curriculum and instead focus on incorporating it into instruction to enhance the educational experience. That is to say, from the start of planning learning experiences to the teaching and learning process, technology becomes an essential component of the learning process and a major concern for teachers (Eady & Lockyer, 2013).

According to Pourhosein Gilakjani (2017) and TSolanki and Shyamlee1 (2012), language education methods have changed as a result of technology. The researchers went on to say that students can learn based on their interests when technology is used. Additionally, it fulfils the learners' auditory and visual senses. Technology helps students adapt their own learning process and gives them access to a wealth of material that their teachers are unable to impart, claim Lam and Lawrence (2002) and Pourhosein Gilakjani (2017).Lockyer (2013).

Pourhosein Gilakjani (2013) asserts that technology use has a significant potential to alter the ways that language instruction is currently conducted. Pourhosein Gilakjani and Sabouri (2014) highlighted that students can take charge of their own education and have access to a wealth of material that is outside the purview of their lecturers through the use of technology. Technology plays a big part in encouraging student activities and has a big impact on how teachers educate. Teachers will never be able to keep up with modern

technologies if they do not include them into their lessons. For the purpose of teaching language skills, it is crucial that teachers are well conversant with these technologies (Pourhosein Gilakjani, 2017; Solanki & Shyamlee1, 2012).

Equitable opportunity is provided by developing students' computer-related knowledge and abilities, irrespective of their educational background. Despite growing up in a technologically advanced society, students might not be proficient technology users (Bennett, Maton, & Kervin, 2008). Furthermore, merely giving people access to technology is insufficient. To maximise learning, it is important for all learners to build meaningful technology-based knowledge (OECD, 2010). The researcher will go over a few of the key concerns regarding the use of technology in English language instruction and learning in this review study. These problems are listed below: description of technology, applications of technology in education, earlier research on the use of technology to enhance English language acquisition, and suggestions for using.

Technology is a useful tool for educators. Technology utilisation by students must play a big role in their education. In order for students to increase their actual usage of technology in learning language skills, teachers should demonstrate how to use it to complement the curriculum (Costley, 2014; Murphy, DePasquale, & McNamara, 2003). Technology can help to boost learners' cooperation. One of the most vital instruments for learning is cooperation. Students collaborate to produce assignments and study one other's work to gain knowledge from one another (Keser, Huseyin, & Ozdamli, 2011).

According to Bennett, Culp, Honey, Tally, and Spielvogel (2000), using computers in the classroom improves both the way teachers teach and how much students learn. Computer technology utilisation aids educators in meeting the educational needs of their students. Bransford, Brown, and Cocking (2000) assert that teachers and students can create local and worldwide communities that foster interpersonal connections and increase learning opportunities through the use of computer technology. They went on to say that teachers' usage of computer technology in language classrooms determines whether or not it has a good impact (Biswas, 2023).

Susikaran (2013) claims that fundamental adjustments have been made to classroom procedures in addition to instructional strategies because

the traditional chalk-and-talk approach is insufficient for teaching English. According to Raihan and Lock (2012), students can learn how to study effectively in a classroom that is well-planned. A classroom with increased technology is more productive than one with lectures alone.

Even when their students have not studied technology and are not proficient computer users, teachers should nevertheless find ways to use it as a valuable teaching tool for their students.

The use of technology has significantly altered how English is taught. It offers a plethora of options for making instruction engaging and more effective in terms of progress (Patel, 2013). In a traditional classroom, educators stand in front of students and use a whiteboard or chalkboard to provide lectures, explanations, and teaching. With regard to the advancement of technology, these methods need to be modified. Multimedia texts are used in the classroom to help students get more familiar with language patterns and terminology. Print books, films, and the internet are also used in conjunction with multimedia applications to improve learners' language proficiency. Learners can gather knowledge and have access to a variety of resources for the study and interpretation of language and situations through the use of print, video, and the internet (Arifah, 2014).

Research was done in 2011 by Baytak, Tarman, and Ayas regarding the use of technology in language learning. The findings demonstrated that incorporating technology into the classroom enhanced students' learning.

Students claimed that using technology in the classroom increases their learning and makes it more fun. Additionally, students reported that technology enhances and personalises their learning experiences (Mukherjee, Samanta, & Biswas, 2020).

The use of technology improves learners' motivation, social relationships, learning, and engagement. It also gathers information and provides them with various resources for the analysis and interpretation of language and situations (Arifah, 2014, Banerjee, R. & Majumdar, 2023)). This was the other finding of the study.

A review by Liu et al. (2023) explored how language teachers integrate technology into their teaching. It identified four main themes: teachers'

perceptions, practical applications, technological pedagogical content knowledge (TPACK), and the design of technology-enhanced language education (TELE). The review emphasized the need for more research on teachers' roles as pedagogical designers to effectively integrate technology in language education.

Shadiev and Yang (2020) reviewed 398 articles on technology-enhanced language learning (TELL). They found that English was the most studied language, with a focus on writing, speaking, and vocabulary. The review identified 23 different technologies used in these studies, suggesting that technology is widely adopted but more evidence is needed on its effectiveness.

A systematic review by Sharadgah and Sa'di (2022) analyzed the use of artificial intelligence (AI) in English language teaching. The study found positive effects of AI on language skills, translation, and assessment. It also noted that AI in language teaching is still emerging, with many studies focusing on higher education and employing mixed research methods. The review highlighted the potential of AI but also pointed out the need for more detailed research on its applications.

Huang and Sun (2023) discussed the role of technology in sustaining language teaching, especially in times of unexpected disruptions. They noted that technology facilitates interactive and immersive learning experiences, which can enhance student engagement and make learning more effective. Technologies like virtual reality (VR), augmented reality (AR), and AI provide personalized learning experiences and have revolutionized traditional language teaching methods.

These reviews collectively suggest that while technology offers significant benefits for language teaching and learning, there is a need for further research to optimize its integration and effectiveness. Teachers' roles, the development of tailored educational technologies, and the exploration of AI's potential are critical areas for future studies.

Recommendations based on the Studies Reviewed

The researcher offers some suggestions in the section that follows for language learners looking to use technology to enhance their language proficiency:

1. According to Pourhossein Gilakjani, Leong, and Hairul (2013), educators should put in place a technology plan that takes integration techniques into account in addition to purchase decisions.
2. To ensure that students are learning and to alter the mindsets of teachers who are not aware of the benefits that technology offers, professional development should be given special consideration (Pourhossein Gilakjani, Leong, & Hairul, 2013).
3. The curriculum requirements and the technological plan need to be tightly matched. When incorporating technology into the classroom, teachers should be aware of the most successful teaching strategies (Pourhossein Gilakjani, Leong, & Hairul, 2013).
4. A key component of the learning process that helps students transfer skills is computer technology.
5. Teachers of languages should encourage their students to use technology to improve their language abilities.
6. Technology ought to be seen as an integral component of teaching and learning initiatives at universities.
7. Teachers who use technology to teach their English courses should receive additional support from technology professionals.
8. When it comes to using computers, teachers should provide an example for their students (MEB, 2008; Pourhossein Gilakjani, & Sabouri, 2017).
9. Teachers must to develop lesson plans that use technology. Teaching and learning should be the main focus of these resources, not only technological problems.
10. Rather than focusing on teacher-centered instruction, educators should look for ways that technology may support learner-centered instruction.
11. Teachers need to understand their responsibilities as mentors and educators (Molaei & Riasati, 2013; Pourhossein Gilakjani, & Sabouri, 2017).
12. Teachers should receive adequate support and technical help to help with the incorporation of technology.
13. Teachers should receive training so they can apply it and impart it in an efficient manner.
14. Teachers who want to use technology to improve their instruction should ask their peers for advice.
15. One of the most useful tools for language learning activities is technology, which aids students in developing their language acquisition abilities.

16. Teachers ought to motivate their students to use technology to improve their language skills.

Research findings emphasize the multifaceted nature of integrating technology into language teaching and learning. To effectively harness the benefits of technology in language education, educators should not only focus on the direct impact on learning outcomes but also consider students' perceptions, motivation, engagement, and confidence regarding technology use. Addressing technological challenges faced by students is crucial, and this can be achieved through targeted training and ensuring access to appropriate technological resources during learning activities. Moreover, designing collaborative tasks where students with varying levels of competence work together can help mitigate self-competence challenges and foster a supportive learning environment.

It is essential for educators and researchers to concentrate on the influence of technology-supported learning activities on learners' language skills and 21st-century competencies to maximize the benefits of technology integration in language teaching. By incorporating diverse teaching strategies and scaffolds to provide necessary assistance, teachers can counter negative student attitudes towards technology and enhance engagement in language learning activities. Additionally, creating clear guidelines for collaborative tasks, including division of labor and evaluation criteria, can effectively address challenges in collaborative activities and ensure equitable participation among learners. The pedagogical implications of technology integration in language teaching underline the significance of well-thought-out instructional design that aligns with educational objectives and student needs. While technology plays a pivotal role in language education, it is imperative to acknowledge that successful language teaching requires attention to both technical aspects, such as students' technology skills and devices used, and pedagogical considerations to optimize learning outcomes and experiences.

Conclusion

The researcher examined a few significant topics related to the application of technology in language acquisition in this work. Technology resources cannot ensure that teachers educate and that students learn, according to the research evaluation. Teachers need to be persuaded of the benefits and use of technology in enhancing

students' learning. In order to effectively use technology into language instruction, instructors must have assistance and training. The review found that there are several benefits that teachers and students can experience by using technology properly. It is a tool that students can use since it assists them in finding solutions to their learning challenges and strategies for applying what they have learned in meaningful and practical ways.

Furthermore, the literature research revealed that the utilisation of technology is crucial for independent language learning, aids in self-awareness, maintains teacher-student connection, and instills a strong sense of drive in language learners for successful language acquisition. Additionally, the article suggested that students should use technology to improve their language proficiency since it fosters creativity in learners and offers engaging, fun, and exciting language study alternatives. In conclusion, the results of this evaluation of the literature demonstrated that technology fosters communication between educators and students, produces intelligible input and output, and aids in the development of critical thinking abilities in students.

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CHAPTER : 16

INNOVATIVE TEACHING STRATEGIES FOR COLLEGE LEVEL PHYSICS WITH EMERGING TECHNOLOGIES

Mayukh Mazumdar [1]

Abstract

The following paper is an exploration of certain innovative teaching strategies for college level physics courses, focusing on integrating two emerging technologies: the Desmos graphing calculator and virtual laboratories, with traditional teaching methods. Drawing on the author's experiences as a college physics educator, this paper investigates how these technologies can be utilized to optimize student academic performance and enhance learning outcomes. Through a combination of practical examples and research-based evidences, this paper exhibits the effectiveness of integrating Desmos graphing calculator and virtual laboratories into the college-level physics curriculum for colleges in India. The paper also addresses some limitations in incorporating these technologies into the teaching-learning process. Through the sharing of insights from the author's teaching experiences and discussions of best practices, this paper aims to inspire educators and researchers to explore the potential of these emerging technologies in innovating physics instruction at the college level.

Keywords: *virtual laboratories, Desmos graphing calculator, emerging technologies in education, innovative pedagogies*

Introduction

Physics is a subject that studies different physical processes in the universe through both theory and experiments. While it seems to be quite innocuous at the school level, physics at the higher education level (especially undergraduate level and onwards) is often accused of being highly complicated, primarily due to mathematical verbosity. Adding insult to injury, some experiments in higher physics

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make the situation even challenging for the students. Unfortunately, these necessary evils cannot be bypassed if one wishes to understand the underlying concepts of the subject. Hence, it often becomes difficult for a college physics teacher to make the subject less hostile and engaging for their students, especially if traditional teaching methods are only adhered to. But if the teacher is willing to go above and beyond the call of duty, a lot of help awaits her/ him in the form of educational technologies (ET). One such class of ETs that has unfolded its great potential in recent times is known as emerging technologies.

Searching for a concrete definition of 'emerging technologies' has been a very tough journey for scholars as the term has often been found to be put into use without sufficient elucidation, hence one has to dive deeper into the bibliographic ocean to procure a panoramic view of the concept (Veletsianos, 2010). It is only after this we may make attempts to import this concept to the educational context. However, some really excellent literature has already walked this extra mile. Cukurova and Luckin (2018) have defined emerging technologies in education as: the ones that have the power to transform the present scenario of education, those not restricted only to augmented reality, virtual reality, mobile learning devices, physical computing devices, internet of things or other technologies that aid large-scale collaborative learning, and the ones that not only themselves metamorphose with time but also transform the learning experiences of the learners using them. Change is at the heart of emerging technologies (Curukova & Luckin, 2018).

The above short yet elaborate description of emerging technologies widens the researchers' options to select appropriate emerging technologies from. Keeping in mind the transformative potential of these technologies as mentioned above, the following two technologies have been chosen to design more effective teaching strategies for college level Physics: an online graphing calculator (Desmos graphing calculator) and a virtual laboratory (the Amrita VLab).

Objectives

The objectives of the paper are:

- to present some innovative teaching strategies for college level physics by embedding emerging technologies like Desmos graphing calculator and Amrita VLab

- to bring out the limitations of usage of the above technologies

Review of Related Literature

Emerging technologies in education have always been quite a sought after topic of research for some time now. Both its impact and feasibility with regards to different levels of formal education have been closely studied in recent years.

The nature of emerging technologies, with special regards to education, can be beautifully understood from the works of Veletsianos (2010) and Cukurova & Luckin (2018). In the analysis of the user experiences and feasibility of an application that provides a 3D virtual learning environment in the form of a combination of virtual reality-virtual laboratory as a part of a case study in a secondary school in Dublin, Ireland, Bogusevschi et al (2020) found a high user experience score, thus confirming the positive attitude of the students regarding use of modern technologies in education. Hamed and Aljanazrah (2020) concluded from their study on the effectiveness of using virtual laboratory on students' learning for a general physics laboratory that the students with these virtual components had acquired stronger concepts and were better at performing the experiments in the real setups, thereby recommending the instructors to incorporate those into their teaching. Through their study on the usage of Android physics virtual lab application for developing the understanding of the concepts of optics among future elementary school teacher students, Erfan et al (2021) brought forward the effectiveness of the application. The analysis of the Physics Education Technology (PhET) virtual laboratory in a nuclear physics course by Lutfiani et al (2023) confirmed the usefulness of virtual laboratories in physics education. The study by Asiksoy (2023) showed the effectiveness of physics experiments that are simulation based and also the positive attitude of the majority of the students toward virtual laboratory activities. Based on their study, Bhatia and Chakraborty (2024) found that teaching algebra to high school students with intervention of Desmos graphing calculator kindled the interest of algebra among the students and they started practicing algebra on a regular basis henceforth. Mungan (2021) showed how intricate concepts of higher physics that are otherwise difficult to decipher from textbooks can be easily elucidated through the same graphing calculator. Redish (2023) suggested practical ways of using this graphing calculator to understand seemingly complicated

mathematical equations, that are the gateways to important concepts of physics.

A Brief Acquaintance with the Desmos Graphing Calculator and Amrita Vlab

Before proceeding any further, it is highly sensible to have a short introduction to the two emerging technologies chosen for this paper - the Desmos graphing calculator and the Amrita VLab.

The Desmos graphing calculator is a free, online calculator that helps one to obtain very precise graphs with minimum efforts. It has a very user-friendly graphical user interface (GUI) and this online tool and can be accessed online using laptops, desktops or any smart device (visit: https://www.desmos.com/calculator). As a mobile app, this can be downloaded from the Google Play or Apple Store. It provides the users with many facilities like sharing and collaborating graphs online, plotting multiple functions in the same graph, animations, and many more.

As far as the other emerging technology is concerned, a virtual lab may be defined either as one computer program that gives the students the opportunity to perform simulated experiments through the web or a set of pre-assembled simulations (Ranjan, 2017). Such virtual environments have been created by different institutions across the globe, and in India one such relevant project is the Virtual Labs project, an initiative of the Ministry of Education, Government of India under the patronage of the National Mission on Education through Information and Communication Technology (https://www.vlab.co.in/about-us). Virtual labs have the power to effectively replace all those bulky and comparatively expensive experimental setups and help students access relevant contents through virtual experiments and learn at their own pace (Wong et al., 2020).

Using Desmos Graphing Calculator for College Physics

As identified in the literature review section earlier, there are many mathematical intricacies in physics (especially at the higher level) that cannot be properly understood from just standard textbooks and references (Redish, 2023). For instance, while studying Fraunhofer diffraction with single and double slits in optics, the diffraction patterns can be observed and analysed experimentally in the optics laboratory

but understanding the interplay of the underlying experimental parameters is difficult theoretically. How the width of the slit/ slits affects the diffraction pattern is a very sought after question in many top-tier physics examinations like Joint Admission Test for Masters (JAM), Graduate Aptitude Test in Engineering (GATE), Joint Entrance Screening Test (JEST), National Eligibility Test (NET), etc. Hence, the students need to have a crystal clear idea of this important concept through some alternative way, for which the Desmos graphing calculator is the best option at hand. The simple GUI makes it a very convenient tool to use for both the teacher and the students, with no necessity of coding. The intensity distribution pattern, i.e. the mathematical form of the diffraction pattern can be typed out in the equation bar on the left of the interface, and the range of values of the desired parameters (like, the slit width) can be chosen. By pressing/ clicking the play button accompanying the parameter range, the impact on the pattern can be beautifully understood in the form of animations.

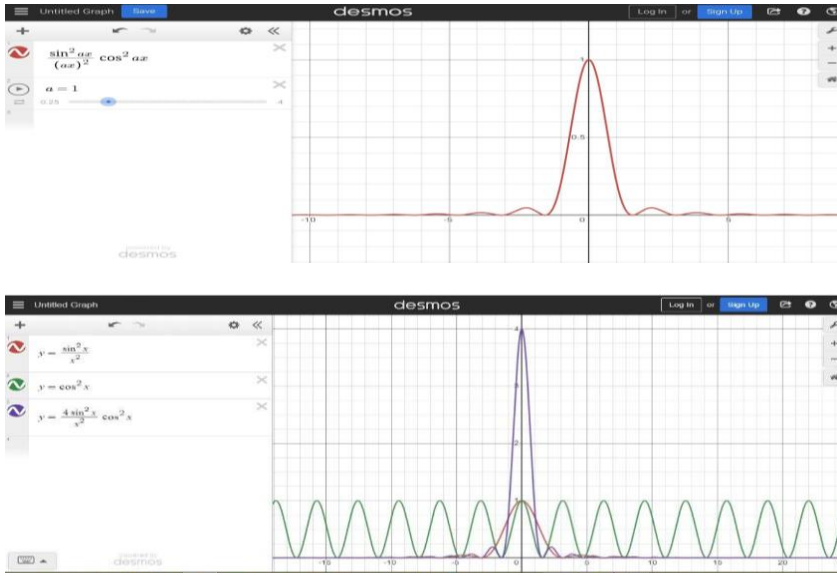


Fig. 1. Analysis of the single-slit (top) and double-slit (bottom) diffraction patterns using Desmos graphing calculator

A similar stumble awaits the students in another branch of college physics, namely quantum mechanics, where certain approximations are to be considered to conform with the experimental results. One example is the very large and very small value assumptions of the

variable during solving the radial wave equation for a hydrogen atom. Since most of the standard books do not show explicitly how these assumptions change, rather simplify the equations, students may take this as a rule in absence for sufficient arguments. However, indoctrination is detrimental to the development of scientific temper, and may trigger ‘scientific superstition’! Hence the teacher must, at all costs, show how these approximations are responsible for the simplification. This can be done by Desmos graphing calculator, where the ‘vulnerable’ portion of the equation before the approximations have been applied and the one after can be typed out, and the graphs that pop up immediately tell the full story.

4.2.1 The Radial Wave Function

Our first task is to tidy up the notation. Let

$$\kappa \equiv \frac{\sqrt{-2m_e E}}{\hbar}. \tag{4.54}$$

(For bound states, E is negative, so κ is *real*.) Dividing Equation 4.53 by E, we have

$$\frac{1}{\kappa^2}\frac{d^2u}{dr^2} = \left[1 - \frac{m_e e^2}{2\pi\epsilon_0\hbar^2\kappa}\frac{1}{(\kappa r)} + \frac{\ell(\ell+1)}{(\kappa r)^2}\right]u.$$

This suggests that we introduce

$$\rho \equiv \kappa r, \quad \text{and} \quad \rho_0 \equiv \frac{m_e e^2}{2\pi\epsilon_0\hbar^2\kappa}, \tag{4.55}$$

so that

$$\frac{d^2u}{d\rho^2} = \left[1 - \frac{\rho_0}{\rho} + \frac{\ell(\ell+1)}{\rho^2}\right]u. \tag{4.56}$$

Next we examine the asymptotic form of the solutions. As $\rho \to \infty$, the constant term in the brackets dominates, so (approximately)

$$\frac{d^2u}{d\rho^2} = u.$$

The general solution is

$$u(\rho) = Ae^{-\rho} + Be^{\rho}, \tag{4.57}$$

but e^{ρ} blows up (as $\rho \to \infty$), so $B = 0$. Evidently,

$$u(\rho) \sim Ae^{-\rho}, \tag{4.58}$$

for large ρ. On the other hand, as $\rho \to 0$ the centrifugal term dominates;[15] approximately, then:

$$\frac{d^2u}{d\rho^2} = \frac{\ell(\ell+1)}{\rho^2}u.$$

The general solution (check it!) is

$$u(\rho) = C\rho^{\ell+1} + D\rho^{-\ell},$$

but $\rho^{-\ell}$ blows up (as $\rho \to 0$), so $D = 0$. Thus

$$u(\rho) \sim C\rho^{\ell+1}, \tag{4.59}$$

for small ρ.

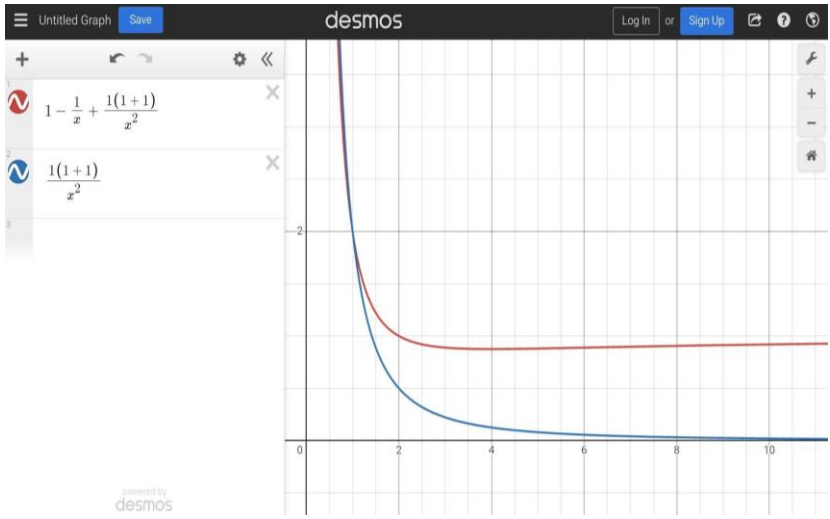


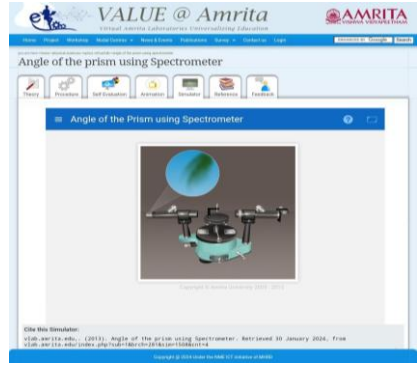
Fig. 2. Confirming the mathematical claims made in a standard text (**[**Griffiths, D.J. & Schroeter, D.F. (2018). Introduction to Quantum Mechanics (3rd Ed.). Cambridge University Press, p. 187) (left) with the help of Desmos graphing calculator (right)

Using Virtual Laboratories for College Physics

There has been enough testimony to the fact that how useful virtual laboratories can be in the previous sections of this paper. Hence, its potentials can be appreciated through further explorations. The optics laboratory is one of the most dreaded parts of a physics laboratory for more than just one reason. A standard optics laboratory has to be painted all black (walls, windows, curtains, etc.) so that no light leaks away from the room. This is what gives the laboratory the nomenclature ‘dark room’. This ‘darkness’ often with itself brings about certain physiological problems, and students turning up with complaints of headache and strained eyesight after spending time inside this laboratory is a very common sight to the concerned teacher. These are reinforced by relatively complex instruments (spectrometer, micrometer, microscope, etc.) that are essential in the optics experiments. Not only are these highly sensitive, but recording observations in the form of readings is more cumbersome with these instruments than most other physics laboratory instruments. This is not just because of the darkness, but the graduation of the markings in the scales in some of these instruments. For example, the circular scale in a spectrometer is in terms of angles (degrees, minutes and seconds)

rather than other relatively familiar units (cm, mm, m, etc.), and this is highly likely the first time that a student in its life has come across a scale with such dealings. Lastly, every experimental setup in optics is highly vulnerable to the slightest of physical perturbations (push, drag, etc.), and the margin for error is very low - utmost care has to be taken at all times while inside the optics laboratory. Thus, it is very evident that the students have to be made quite familiar, both at the cognitive and psychomotor levels, before proceeding further with the course. Else a good chunk of teaching hours will get wasted around the starting point throughout the remainder of the course. Given the apparently intimidating instruments, something more amicable and engaging must be sought after for this, virtual laboratories being the best choice.

The Amrita VLab provides an easy to use yet highly similar version of the actual experimental setups. Students can easily perform the experiments and also get acquainted with the instruments before running their hands on the actual ones. Availability is round the clock, and they can use it at their own pace on personal smart devices without any subscription.



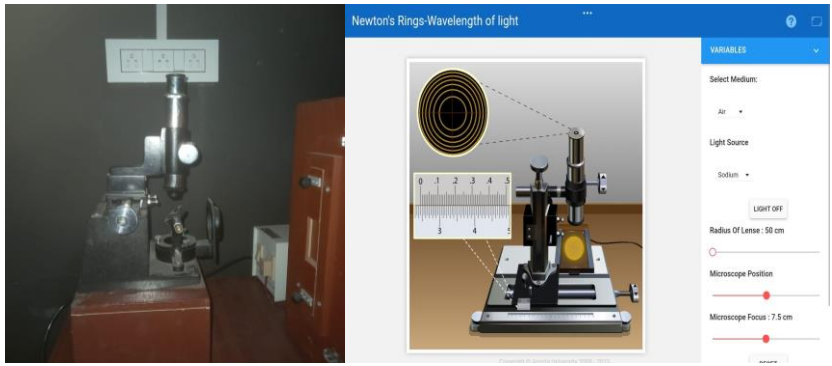


Fig. 3. Highly similar representations of different optics experimental setups in Amrita VLab (left - actual setup, right - VLab GUI)

Regarding the complexities of the scales in the instruments, a highly magnified and interactive version of the same is also available in the VLab where students can easily learn how to get going. Calculating the vernier constant using this can be a very good practice as this can boost the confidence of the students.

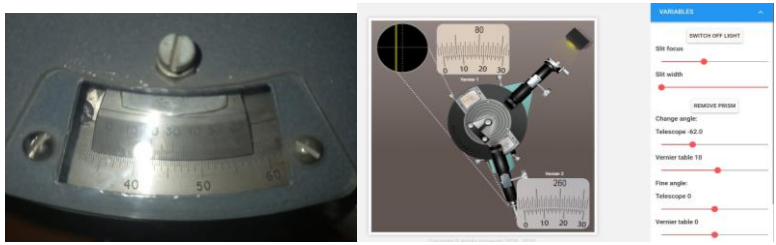


Fig. 4. Taking readings from the actual setup (left) and the virtual setup in Amrita VLab (right)

Since darkness is not a compulsion while using the VLab, students can focus more on the experiments and not get distracted due to headache and strained vision.

Discussions

The above set of applications is a non-exhaustive one and the technologies can be used for any other branch and topics of physics. Apart from having mastery over the subject, the teacher must also know the students very well - their learning styles, learning blocks, etc to effectively implement these in the teaching process. Both the

technologies being free, available round the clock and having a very simple GUI, will expectedly be liked by the students readily and help them develop a positive attitude towards learning physics (Asiksoy, 2023).

However, the teacher must be well aware of the other side of the coin as well. It has been a part of the experience of the researcher that students often become over-reliant on these technologies, especially the graphing calculator, and become too lazy to perform simple chores like plotting a set of 10-12 data points on the graph paper. They may also pick up dummy data points from virtual experiments and fill the tabulation portion of the laboratory notebooks, without performing the entire experiment. Total absence of lecture and boardwork, and just asking the students to play with these technologies may also kill the interest of the students. Thus, the teacher must not become fully reliant on these technologies and judiciously mix it with traditional teaching strategies, only when and where necessity arises.

Closing Remarks

Emerging technologies can prove to be excellent aids for the college physics teacher to make teaching-learning more effective and interactive than ever before. It must be present in the repertoire of a college Physics teacher in the current era. However, the teacher must be well aware of its limitations and do not become over-reliant on these technologies. Also, the teacher must continuously keep looking for areas in the subject where these technologies can be used to optimize the learners' experiences.

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CHAPTER : 17

BREAKING BOUNDARIES: INTEGRATING ARTS INTO STEM EDUCATION FOR HOLISTIC LEARNING

Subhankar Sadhu [1]

Abstract

This paper explores the synergistic potential of integrating arts into STEM (Science, Technology, Engineering, and Mathematics) education to foster holistic learning experiences. Traditionally viewed as distinct disciplines, STEM and the arts share common ground in promoting creativity, innovation, and problem-solving skills. By breaking down disciplinary boundaries and embracing interdisciplinary approaches, educators can cultivate a more comprehensive learning environment that prepares students for the challenges of the 21st century. It examines how activities such as creative expression, design thinking, and aesthetic exploration enhance students' engagement, motivation, and retention of STEM concepts. This study employs qualitative methods and a systematic literature review is conducted across reputable scientific databases, including SCOPUS, Science Direct, Google Scholar, and ERIC. Relevant keywords such as "arts integration," "STEM education," "holistic learning," and "educational outcomes" are utilized to identify and review articles addressing the integration of arts into STEM education. Focus group discussions with stakeholders gather qualitative data, analyzed thematically, with ethical considerations ensuring participant confidentiality. The study addresses the misconceptions and challenges surrounding the integration of arts into STEM education, including resource constraints and resistance to change. It proposes strategies for overcoming these barriers, such as collaborative teaching models, cross-disciplinary projects, and professional development opportunities for educators. Ultimately, this article advocates for a paradigm shift towards STEAM (Science, Technology, Engineering, Arts, and Mathematics) education, which embraces the holistic development of learners by fostering both analytical and creative

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competencies. By embracing the intersection of STEM and the arts, educators can empower students to become versatile thinkers, innovators, and problem-solvers equipped to navigate an increasingly complex and interconnected world.

Keywords: *Arts integration; Holistic learning; Interdisciplinary approaches; Problem-solving skills; STEM education.*

Introduction

The integration of arts into *STEM (Science, Technology, Engineering, and Mathematics)* education has emerged as a transformative approach to fostering holistic learning experiences for students. By breaking down traditional disciplinary boundaries and embracing interdisciplinary approaches, educators aim to cultivate a more comprehensive educational landscape that nurtures creativity, critical thinking, and innovation. As highlighted by *Robinson (2015),* the arts play a vital role in promoting holistic development by engaging students' imagination and emotional intelligence. This article explores the intersection of arts and STEM education, examining the multifaceted benefits of integrating visual arts, music, theater, and other artistic mediums into STEM curriculum. Through empirical research and practical examples, we delve into how arts integration enhances students' understanding of STEM concepts, fosters creativity and problem-solving skills, and promotes inclusivity and diversity in educational settings. By breaking boundaries between disciplines, educators can empower students to become versatile thinkers and lifelong learners equipped to navigate an increasingly complex and interconnected world.

Objectives

1. Assess the effectiveness of specific *arts-based teaching methods*, such as visual arts, music, or theater, in enhancing students' understanding and application of STEM concepts within a holistic learning framework.
2. Identify potential *challenges and barriers* faced by educators when integrating arts into STEM education, including resource limitations, curriculum alignment issues, and resistance to interdisciplinary approaches, and propose strategies to address these challenges.
3. Explore the role of arts integration in *promoting inclusivity and diversity* in STEM education, particularly in engaging students

from underrepresented groups and fostering a supportive learning environment that accommodates diverse learning styles and backgrounds.

Research Questions

Questions
Research Questions for Objective 1: How do different arts-based teaching methods, such as visual arts, music, and theater, impact students' understanding and application of specific *STEM* concepts, and how does this contribute to holistic learning outcomes?
Research Questions for Objective 2: What are the primary challenges and barriers faced by educators when integrating arts into *STEM* education, and how do these challenges vary across different educational settings and contexts?
Research Questions for Objective 3: In what ways does arts integration in *STEM* education promote inclusivity and diversity, and how do educators effectively address the needs of diverse learners through interdisciplinary approaches?

Material and Methods

This study employs a multidimensional approach with qualitative methods to investigate the integration of arts into *STEM* education. *A systematic literature review is conducted across reputable scientific databases, including SCOPUS, Science Direct, Google Scholar, and ERIC.* Relevant keywords such as "arts integration," "*STEM* education," "holistic learning," and "educational outcomes" are utilized to identify and review articles addressing the integration of arts into *STEM* education. Qualitative data are gathered through focus group discussions with educators, administrators, and students to elucidate perceptions and strategies related to arts integration. Thematic analysis is used to identify patterns and themes in the qualitative data. Ethical considerations, including informed consent and data anonymization, are prioritized throughout the study to ensure participant confidentiality and welfare.

The Impact of different Arts-Based Teaching Methods on STEM Learning

To analyze how different arts-based teaching methods impact students' understanding and application of specific *STEM* concepts, as well as

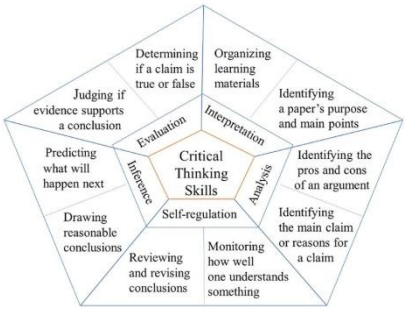
their contribution to holistic learning outcomes, we can delve into several key areas:

Visual Arts: Building on the research by *Milbrandt and Downing (2017),* the integration of visual arts into *STEM* education offers multifaceted benefits beyond enhancing spatial reasoning skills. When students engage in drawing, painting, or sculpting to represent STEM concepts, they not only visualize abstract ideas but also develop a deeper understanding through hands-on exploration and creativity. For instance, consider a biology lesson on the human circulatory system. Rather than relying solely on textbook diagrams, students can create three-dimensional models of blood vessels using clay or craft materials. This tactile experience allows them to manipulate and interact with the structures, reinforcing their understanding of how blood flows through the body. The he act of crafting these models encourages students to think critically about the spatial relationships between different components of the circulatory system, such as arteries, veins, and capillaries. The process of artistic representation can spark interdisciplinary connections and facilitate cross-disciplinary learning. For example, in a physics class studying the principles of motion, students could use stop-motion animation techniques to illustrate concepts like velocity, acceleration, and inertia. By animating objects in various states of motion, students not only apply their knowledge of physics but also hone their storytelling skills and digital literacy. By providing a range of learning modalities, educators can ensure that all students have access to meaningful learning experiences and can showcase their understanding of *STEM* concepts in ways that resonate with their individual strengths.

Music: Research by *Schellenberg (2004)* underscores the cognitive benefits of music, particularly its positive impact on mathematical reasoning and problem-solving skills. For instance, learning music notation and rhythm, as highlighted by *Vaughn (2000),* can reinforce mathematical concepts such as fractions, patterns, and ratios. Consider a music composition activity where students create melodies based on mathematical sequences or equations. This exercise not only reinforces mathematical concepts but also encourages creativity and critical thinking as students explore the relationship between mathematics and music. By engaging in such interdisciplinary activities, students develop a deeper appreciation for both disciplines and strengthen their ability to transfer knowledge across domains, ultimately enhancing their holistic learning experience.

Theater: *Cornett (2014)* emphasizes the transformative potential of theater and drama techniques in STEM education, particularly through role-playing and improvisation. These methods enable students to embody various perspectives, immersing themselves in the context of scientific discoveries or engineering challenges. For instance, by reenacting historical events like the discovery of the double helix structure of *DNA* or the invention of the steam engine, students gain insight into the motivations, challenges, and ethical considerations faced by scientists and engineers. Through these immersive experiences, students not only deepen their understanding of *STEM* concepts but also develop empathy towards real-world applications. By grappling with the social and ethical implications of scientific innovations, students cultivate critical thinking skills and ethical reasoning abilities. For example, role-playing scenarios involving debates on climate change policies or the regulation of emerging technologies prompt students to consider the broader societal impact of *STEM* advancements. In essence, theater and drama techniques serve as powerful catalysts for holistic learning in *STEM* education, fostering empathy, critical thinking, and ethical awareness among students as they engage with complex scientific and technological issues.

Incorporating these arts-based teaching methods into STEM education contributes to holistic learning outcomes in several ways: Critical Thinking and Problem-Solving: Arts integration in STEM education fosters critical thinking and problem-solving by providing students with opportunities to explore concepts through diverse perspectives and creative exploration. For example, when tasked with designing a sustainable energy solution, students might use artistic mediums like collage or



Source:https://images.app.goo.gl/5dmJwxgimizfPxB67[1]and,https://images.app.goo.gl/BeziRyhL1GguB5oMA[2].

mixed media to envision innovative designs that address environmental challenges. Through this process, students not only apply *STEM* principles but also develop resilience and adaptability as they navigate the iterative process of creation and experimentation. Research by *Hetland et al. (2007)* supports this, highlighting how arts integration enhances students' ability to approach complex problems with creativity and analytical reasoning, ultimately contributing to holistic learning outcomes.

Enhanced Engagement: Arts integration in STEM education enhances engagement by tapping into students' diverse interests and learning styles. *Walker et al. (2011)* found that incorporating arts-based activities increases student motivation and leads to deeper learning experiences. For example, a physics lesson on sound waves could include a music composition project where students create original pieces using principles of wave frequency and amplitude. By connecting *STEM* concepts to artistic expression, students become more invested in their learning and develop a deeper appreciation for the relevance and applicability of *STEM* subjects in their lives. This heightened engagement fosters a more dynamic and interactive learning environment conducive to holistic learning outcomes.

Interdisciplinary Connections: Arts integration in *STEM* education facilitates interdisciplinary connections by bridging the gap between seemingly disparate fields, fostering a holistic approach to problem-solving. For instance, a project combining biology and visual arts might task students with creating a mural depicting ecosystems and the impact of climate change. Through this project, students apply their understanding of biological concepts such as biodiversity and ecological relationships while honing their artistic skills to communicate scientific ideas visually. By engaging in such interdisciplinary activities, students develop a deeper appreciation for the interconnectedness of knowledge and are better prepared to tackle complex real-world challenges across various academic and professional domains.

After that, incorporating visual arts, music, theater, and other arts-based teaching methods into *STEM* education enriches students' learning experiences, deepens their understanding of *STEM* concepts, and cultivates essential skills for success in the *21st century*. By embracing interdisciplinary approaches, educators can nurture well-

rounded learners who are equipped to thrive in an increasingly complex and interconnected world.

Understanding Variations in Challenges: Integrating Arts into STEM Education across Educational Settings and Contexts

Integrating arts into *STEM* education poses several challenges for educators, which can vary depending on the educational setting and context:

Resource Constraints: Resource constraints pose a significant challenge for educators integrating arts into STEM education. Research by the National Endowment for the Arts (*NEA)* highlights disparities in arts education access, particularly in low-income communities. For example, schools in underserved areas may lack funding for basic art supplies, such as paints, instruments, or digital media tools, limiting opportunities for arts integration in *STEM* lessons. This disparity exacerbates inequities in educational experiences and outcomes.

Curriculum Alignment: Curriculum alignment presents a significant challenge for educators integrating arts into *STEM* education *(Conner, 2014)*. For instance, in a study by Milbrandt and *Downing (2017)*, teachers reported difficulty reconciling the need for arts integration with mandated STEM curriculum standards. In practice, finding time for arts-based activities while ensuring coverage of essential *STEM* content may require creative scheduling and collaboration among educators across disciplines.

Teacher Training and Professional Development: Teacher training and professional development in arts integration are critical for overcoming challenges in *STEM* education. According to a study by Arts Education Partnership (2019), ***only 3% of K-12*** educators feel "very well-prepared" to integrate arts across the curriculum. *For example, workshops on STEAM (Science, Technology, Engineering, Arts, and Mathematics)* pedagogy, like those offered by organizations such as the Kennedy Center's Arts Integration Institute, provide educators with the necessary skills and strategies to effectively integrate the arts into *STEM* instruction.

Resistance to Change: Resistance to change, particularly from stakeholders prioritizing traditional *STEM* instruction, poses a significant barrier to arts integration. According to *Wagner (2012)*, this

resistance can stem from a narrow focus on standardized testing and academic performance. For example, educators may face skepticism from administrators and parents who perceive arts-based activities as detracting from valuable instructional time, hindering efforts to implement interdisciplinary approaches in STEM education.

Cultural and Institutional Factors: In certain cultural contexts, socio-cultural attitudes may prioritize *STEM* subjects over the arts, leading to challenges in integrating arts into *STEM* education. For instance, in countries with strong emphasis on standardized testing in *STEM* fields, educators may face pressure to prioritize *STEM* instruction at the expense of arts integration. Research by *Robinson (2015) highlights* how cultural perceptions of academic rigor can influence educational policies and funding allocations, impacting the implementation of arts integration initiatives.

Addressing these challenges requires a multifaceted approach that acknowledges the diverse needs and contexts of different educational settings. Providing adequate funding and resources for arts education, offering ongoing professional development opportunities for educators, and fostering a supportive school culture that *values* interdisciplinary learning are crucial steps towards successful integration of arts into STEM education. Additionally, partnerships with community organizations and arts institutions can provide valuable resources and expertise to support arts integration initiatives in schools.

How do these challenges vary across different educational settings and contexts?

The challenges of integrating arts into *STEM* education can vary significantly across different educational settings and contexts due to factors such as funding, curriculum priorities, teacher training, and cultural attitudes towards the arts and sciences.

Resource Availability: In affluent districts, access to art supplies, technology, and professional development for arts integration is more abundant, enabling educators to implement comprehensive arts-based *STEM* programs. For example, a study by Payne and *Biddle (1999)* found that schools in high-income areas were more likely to have dedicated art teachers and well-equipped art studios. In contrast, educators in low-resource settings may struggle to access basic

materials and training, limiting their ability to effectively integrate the arts into STEM education.

Curricular Flexibility: In educational settings with rigid curriculum guidelines or standardized testing requirements, integrating arts into *STEM* education may be challenging due to pressure to prioritize core content. For instance, a study by *Ruppert and Kiernan (2011)* found that schools with stringent accountability measures faced difficulties in allocating time and resources for arts education. Conversely, schools with flexible curriculum frameworks, like project-based learning models, have successfully integrated arts into *STEM* lessons without compromising essential content coverage *(Newell & Newton, 2018).*

Teacher Preparation: Teacher preparation for arts integration in *STEM* education varies widely across educational settings. According to Smith and *Thomas (2019),* schools with comprehensive professional development programs and arts education specialists offer better support for educators. For example, schools like the Arts Integration Institute provide intensive training and ongoing support for teachers to integrate the arts seamlessly into STEM instruction. Conversely, schools lacking resources for teacher training struggle to effectively implement arts integration strategies.

Community Support and Cultural Attitudes: Cultural attitudes toward arts integration in *STEM* education can significantly impact its acceptance across different communities. For example, in a study by *Smith and Smith (2018),* schools in regions with a strong emphasis on standardized testing in *STEM* subjects faced greater resistance to incorporating arts into the curriculum. In contrast, communities like those highlighted by *Jones et al. (2020),* which prioritize creativity and interdisciplinary learning, may exhibit more enthusiasm and support for arts integration initiatives, thereby reducing barriers to implementation.

Fostering Inclusivity and Diversity through Arts Integration in STEM Education; Strategies for Interdisciplinary Teaching:

Arts integration in *STEM* education promotes inclusivity and diversity by accommodating diverse learning styles, fostering cultural relevance, and providing opportunities for creative expression. According to a study by *Walker et al. (2011),* integrating arts into *STEM* subjects can enhance engagement among students from diverse backgrounds,

including those who may feel marginalized or disengaged in traditional *STEM* learning environments. For example, incorporating culturally relevant art forms, such as indigenous storytelling or folk music, into *STEM* lessons can make content more accessible and relatable to students from different cultural backgrounds. Interdisciplinary approaches in arts-integrated *STEM* education allow for personalized learning experiences that cater to the diverse needs and interests of students. By providing choice and autonomy in project-based learning activities, educators can empower students to explore *STEM* concepts through mediums that align with their individual strengths and preferences *(Cornett, 2014).* For instance, a physics project might offer options for students to demonstrate their understanding through visual art, music composition, or theatrical performance, allowing for diverse modes of expression and assessment. Arts integration promotes inclusivity by valuing multiple forms of intelligence and talent beyond traditional academic measures. By recognizing and celebrating students' artistic abilities alongside their *STEM* competencies, educators can create a more inclusive learning environment that validates diverse forms of intelligence and expertise *(Hetland et al., 2007).* This approach not only enhances academic achievement but also fosters a sense of belonging and self-efficacy among students from diverse backgrounds.

How do Empowering Diverse Learners through Interdisciplinary Teaching Strategies?

Educators can effectively address the needs of diverse learners through interdisciplinary approaches by employing inclusive teaching strategies and providing differentiated instruction. Research by *Tomlinson and Allan (2000)* emphasizes the importance of recognizing and accommodating students' diverse learning styles, abilities, and backgrounds.

Differentiated Instruction: Educators can tailor their instructional methods and materials to meet the varying needs and interests of diverse learners. For example, in an interdisciplinary project-based learning unit, students may have the option to choose from a range of tasks or activities that align with their individual strengths and preferences. This approach allows students to engage with the content in ways that are personally meaningful and relevant, fostering a sense of ownership and agency in their learning (*Tomlinson & Allan, 2000).*

Collaborative Learning Communities: Creating collaborative learning communities where students work together in diverse groups can enhance peer learning and support. By incorporating cooperative learning structures such as group discussions, peer tutoring, and collaborative projects, educators provide opportunities for students to learn from each other's diverse perspectives and experiences. This not only promotes academic achievement but also fosters social-emotional growth and empathy *(Tomlinson & Allan, 2000).*

Culturally Responsive Pedagogy: Recognizing and valuing students' cultural backgrounds and identities is essential for creating an inclusive learning environment. Educators can incorporate culturally relevant content, examples, and references into interdisciplinary lessons to ensure that all students feel represented and respected. By acknowledging and affirming students' cultural diversity, educators demonstrate their commitment to equity and inclusion in the classroom *(Gay, 2010).*

Ongoing Assessment and Feedback: Continuous assessment and feedback mechanisms allow educators to monitor students' progress and adjust instruction accordingly. By employing formative assessment strategies such as quizzes, discussions, and portfolio reviews, educators can gather data on students' learning needs and tailor their instructional practices to provide targeted support. Additionally, providing timely and constructive feedback helps students recognize their strengths and areas for growth, empowering them to take ownership of their learning journey *(Black & Wiliam, 1998).*

By implementing differentiated instruction, fostering collaborative learning communities, incorporating culturally responsive pedagogy, and utilizing ongoing assessment and feedback, educators can effectively address the needs of diverse learners through interdisciplinary approaches. These evidence-based practices promote equity, inclusivity, and academic success for all students.

Findings:

- ***Based on the objective number one,*** the integration of visual arts, music, and theater into *STEM* education offers diverse benefits for students' holistic learning. Visual arts enhance spatial reasoning and deepen understanding through hands-on exploration. Music reinforces mathematical concepts and fosters

creativity. Theater promotes empathy and ethical reasoning by immersing students in real-world scenarios. These interdisciplinary approaches cater to diverse learning styles, enabling students to showcase their understanding of *STEM* concepts through various modalities, ultimately enhancing their overall educational experience.

- ***As per 2nd objective,*** the challenges of integrating arts into *STEM* education vary across educational settings and contexts due to factors such as resource availability, curricular flexibility, teacher preparation, and community support. Affluent districts may have more resources and flexibility to implement comprehensive arts-based *STEM* programs, while low-resource settings struggle with limited access to materials and training. Schools with rigid curriculum guidelines may face pressure to prioritize core content over arts integration, whereas those with flexible frameworks embrace interdisciplinary approaches more readily. After that, cultural attitudes towards the arts and sciences influence community support for arts integration initiatives, impacting acceptance and implementation across different regions.
- ***Findings of last one objective,*** Arts integration in *STEM* education fosters inclusivity by accommodating diverse learning styles and promoting cultural relevance. Providing options for creative expression, such as through visual arts, music, or theater, empowers students to engage with *STEM* concepts in ways that resonate with their strengths and interests. Collaborative learning communities and culturally responsive pedagogy further enhance inclusivity by valuing students' diverse backgrounds and identities. By implementing these interdisciplinary strategies, educators create an inclusive learning environment where all students feel supported and empowered to succeed.

Conclusion

In conclusion, the integration of visual arts, music, and theater into *STEM* education offers multifaceted benefits for students, enhancing their holistic learning experience. These interdisciplinary approaches cater to diverse learning styles and promote inclusivity by accommodating students' strengths and interests. The challenges of arts integration vary across educational settings, highlighting the need for equitable access to resources and support. Despite these challenges,

collaborative learning communities and culturally responsive pedagogy play crucial roles in fostering inclusivity and empowering all students to succeed in *STEM* education. By embracing interdisciplinary strategies, educators can create a more inclusive and engaging learning environment where students thrive academically and creatively.

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CHAPTER : 18

TRANSFORMATIVE STRATEGIES FOR STEM EDUCATION IN HIGHER EDUCATION

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Abstract

STEM education in higher education acts as a bedrock for cultivating the future generation of STEM professionals, researchers, and innovators. This summary presents a broad overview of significant considerations, obstacles, and transformative approaches to improving STEM education within the higher education realm. This segment provides a thorough explanation of the current state of STEM education in higher education institutions, highlighting the significance of preparing students for STEM careers, addressing workforce needs, and advancing scientific knowledge through research and innovation. The summary explores the challenges that STEM education encounters in higher education, including concerns about retention, diversity, equity, and the ever-changing nature of STEM disciplines. It additionally recognizes possibilities for creativity and improvement, like utilizing technology, encouraging interdisciplinary collaboration, and advocating hands-on learning. The summary reveals the challenges that STEM education encounters in higher education, such as concerns about retention, diversity, equity, and the constantly changing nature of STEM disciplines. It additionally recognizes potential customers for invention and advancement, like utilizing technology, encouraging interdisciplinary cooperation, and advocating experiential learning. Effective pedagogical approaches are crucial in engaging students and fostering profound learning in STEM disciplines. This segment explores diverse instructional strategies, including active learning, flipped classrooms, problem-based learning, and undergraduate research experiences, highlighting their advantages and implementation considerations. The integration of research and teaching is a defining characteristic of effective STEM education in higher education. This summary examines approaches to

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incorporating research experiences into undergraduate and graduate curricula, fostering a culture of inquiry, discovery, and innovation among students and faculty. Faculty development is pivotal in enhancing teaching effectiveness and cultivating excellence in STEM education. This segment discusses strategies for providing professional development opportunities for faculty, including workshops, seminars, mentoring programs, and incentives for innovative teaching. In conclusion, this summary underscores the significance of transformative approaches in enhancing STEM education in higher education. By solving problems, embracing new teaching methods, combining research and education, supporting faculty growth, and implementing effective evaluation techniques, institutions can empower students to excel in STEM fields and make significant contributions to society and the global knowledge economy.

Keywords: *Contextualizing STEM Education in Higher Education, Pedagogical Approaches, Integration of Research and Teaching, Challenges and Opportunities, Professional Development for Faculty.*

Introduction

As we approach the beginning of the twenty-first century, the liveliness and swift progression of STEM fields have emerged as evident catalysts for economic growth, societal progress, and global innovation. Now, more than ever, it is crucial to have a robust, competent, and imaginative STEM workforce. Educational institutions are not at the forefront of this mission, as they need to have the dual responsibility of nurturing the next generation of STEM leaders, thinkers, and problem solvers while imparting cutting-edge knowledge. Nevertheless, countless barriers are impeding the achievement of top-notch and varied STEM education at the postsecondary level. Overcoming these challenges requires a multifaceted and nuanced approach that addresses the complexity of reforming STEM education, ranging from enhancing student engagement and retention to bridging gaps in diversity and equality.

Additionally, to guarantee that students not only excel in their respective fields but also possess critical thinking, creativity, and interdisciplinary collaboration skills, an adaptive and forward-thinking curriculum is crucial, considering the rapid pace of technological advancements and the ever-evolving landscape of STEM professions. Recognizing these barriers and opportunities, this discussion commences by examining innovative approaches to STEM education

in higher learning. It underscores the importance of employing cutting-edge teaching strategies, integrating research and instruction, empowering faculty through professional development, and implementing rigorous yet supportive assessment and evaluation procedures. The objective of transforming STEM education in higher learning is not solely an academic pursuit but also a societal imperative. Institutions of higher education can unlock the immense potential of STEM disciplines in order to tackle urgent global challenges, promote technological innovation, and shape a sustainable future by creating an atmosphere that fosters exploration, creativity, and inclusivity. This introduction sets the groundwork for an exhaustive examination of the approaches, procedures, and ideologies that hold the potential to transform STEM education and render it more effective, inclusive, and captivating for the upcoming generation of innovators and leaders.

Literature Review

Academic investigation has little to contribute when it comes to the landscape of STEM (Science, Technology, Engineering, and Mathematics) education in higher learning, which presents a mosaic of limitations, stagnation, and setbacks. A body of literature has emerged as scholars, educators, and policymakers delve into the intricacies of STEM teaching and learning. This literature offers ideas and insights for transforming STEM education to meet the expectations of the 21st century. This study synthesizes significant themes and contributions from the literature, highlighting the diverse approach needed to enhance STEM teaching in higher learning. As per Freeman et al. (2014), the difficulties of the contemporary world are seldom restricted to one field of study, demanding graduates who possess adaptability, versatility, and the capacity to think across various disciplines. It is for this reason that "active learning strategies and interdisciplinary teaching methods are crucial for effectively educating STEM students, cultivating skills such as problem-solving, critical thinking, and the application of knowledge in complex and unfamiliar situations.." The literature reviewed in this paper has shown that integrating digital tools and resources with the classroom can improve student learning by offering them new ways to engage with STEM. Rainey, Dancy, Mickelson, Stearns, and Moller argue that "creating inclusive classroom environments and designing pedagogical approaches that recognize and respect the diversity of students are critical constructs for developing, enhancing, and sustaining access, participation, and

retention in stem." Sun et al. argue that "simulations, virtual laboratories, and online collaboration systems can eliminate the gap between knowledge and practice, making STEM accessible to more people." Therefore, this review of the literature has provided new insights and evidence-based methods to bring much-needed changes to the STEM education domain. Henderson, Beach, and Finkelstein (2011) argue that "sustained professional development opportunities, including workshops, mentoring, and collaborative communities of practice, are crucial for enabling educators to implement innovative teaching practices and stay abreast of developments in their fields." Freeman et al. (2014) poignantly quote, "To prepare students for the challenges of the 21st century, STEM education must be reimagined and revitalized."

Objectives

In order to better prepare students for the complexity of the modern world, transformative strategies for STEM (Science, Technology, Engineering, and Mathematics) education in higher education aim to evolve the teaching and learning settings. These tactics seek to solve present issues, take advantage of new opportunities and lay the groundwork for ongoing innovation in STEM disciplines. The following are the five primary goals:

1. To Improve Multidisciplinary Education.
2. To Encourage Intense and Active Learning.
3. To promote inclusion and equity in the STEM fields.
4. To incorporate digital literacy with technology.
5. To Encourage Educators' Ongoing Professional Development.

Research Question

By studying these research problems, we may obtain critical information that will help us build, execute, and examine methods that will transform the STEM education landscape in higher education. As a result, the findings may build choices about the support system, teaching methodologies, curriculum design, and statute that eventually enhance the quality and variety of STEM education. These research questions are:

1. What is the effect of incorporating an interdisciplinary course on the value of STEM education at the university level?

2. What impact does technology have on changing the teaching techniques employed in STEM learning at the college level?

3. How can diversity and inclusivity be completely integrated into the STEM learning curriculum at higher education institutions?

4. What are the long-term impacts of project-based learning on the academic achievements of STEM learners in college?

5. How do the school's guidelines and educational standards at the university level enable and/or inhibit the development and spread of new ways of teaching STEM?

Method: We devised the techniques for this literature review based on the preceding discussion, carefully following a step-by-step process to pick journals and then finding and choosing STEM education research articles published in these journals between January 2023 and the end of 2020. The techniques should enable us to get a thorough picture of the state and directions of STEM education research based on a methodical examination of relevant papers spanning a longer time frame and a wide variety of journals.

Contemporary Aspects of STEM Education

1. **Integration of Digital Technologies**: The combination of digital technology in STEM education is gradually advancing, incorporating different tools such as virtual reality, simulations, coding platforms, and data analytics. These technological advancements assist students in preparing for technology-driven careers, fostering interactive exploration of STEM concepts, and facilitating experiential learning opportunities.

2. **Emphasis on Computational Thinking**: Computational thinking has gained significant attention in STEM education because of the surging prominence of computing and data science. By employing problem-solving approaches based on abstraction, algorithmic logic, and pattern recognition, students are equipped to analyze complex systems and devise innovative solutions with the aid of computational tools.

3. **Interdisciplinary Collaboration**: In acknowledgment of the requirement for a multidisciplinary strategy for real-world problems,

contemporary STEM education encourages interdisciplinary collaboration. Collaborative projects and team-based learning experiences promote effective communication, cooperation, and the integration of diverse perspectives from various STEM fields.

4. **Inclusivity and Diversity**: Efforts to promote exclusion and uniformity in STEM education have lost momentum, aiming to ignore inequalities based on gender, ethnicity, socioeconomic background, and other characteristics. Initiatives such as outreach campaigns, diversity-focused curricula, and mentorship programs aim to enhance opportunities for women and minorities in STEM professions and increase their participation.

5. **Project-Based and Experiential Learning:** Project-based and experiential learning are indispensable strategies in modern STEM education, allowing students to apply theoretical knowledge in authentic settings. Through practical projects, research opportunities, internships, and maker spaces, active participation, critical thinking, and innovation are fostered.

6. **Global Perspectives and Societal Relevance:** STEM education is increasingly emphasizing global perspectives and social relevance, connecting STEM concepts to contemporary issues such as healthcare disparities, renewable energy, and sustainable development. This contextualized approach encourages students' civic engagement, environmental stewardship, and ethical decision-making.

7. **Professional Development for Educators:** Ongoing professional development is essential for educators in the modern STEM classroom, particularly STEM educators. Training programs, workshops, and communities of practice are available to support educators in adopting evidence-based approaches, integrating new technologies, and staying abreast of current trends and research in STEM education.

8. **Assessment for Learning Outcomes:** Authentic, competence-based assessments that evaluate students' ability to apply their knowledge and skills in practical contexts have become the cornerstone of assessment practices in STEM education. Performance tasks, toolkit assessments, and developmental appraisals offer valuable perspectives to both educators and learners concerning their inventive thinking, problem-solving abilities, and collaborative skills.

Strategies for Promoting active and engaged learning

1. Problem-Based Learning (PBL): Problem-Oriented Learning (POL): Incorporate POL into STEM curricula to allow students to evaluate, integrate, and create resolutions to practical problems or situations using their acquired knowledge. PBL promotes inquiry-based learning, teamwork, and active engagement.

2. Flipped Classroom Approach: The flipped classroom approach replaces customary lectures with interactive exercises, discussions, and hands-on experiments conducted during class time. Content delivery occurs outside the classroom through readings, films, or online modules, allowing for more interactive learning experiences. With this method, students can work through the content at their speed and then apply what they've learned in group situations.

3. Active Learning Strategies: Incorporate problem-solving exercises, think-pair-share sessions, idea mapping, and peer instruction into lectures and lab sessions. These methods encourage student participation, engagement, and a deeper comprehension of STEM subjects.

4. Use of Technology: To create immersive and captivating learning experiences, make use of technology-enhanced learning resources, including virtual simulations, interactive software, and online platforms. With the help of these resources, students can work with classmates to complete virtual experiments, investigate difficult ideas, and improve their comprehension of STEM subjects.

5. Inquiry-Based Laboratories: Create lab experiences that support inquiry-based learning, where students plan and carry out experiments, evaluate data, and come to their own or in small groups' conclusions. Inquiry-based laboratories give students practical exposure to scientific methods and techniques while fostering curiosity, critical thinking, and problem-solving abilities.

6. Active Assessment Methods: Use evaluation techniques like peer and self-assessment as well as authentic assessments (like projects and portfolios) to gauge students' comprehension and abilities based on their application of knowledge, critical thinking, and active engagement rather than merely memorization of facts.

Advance equity and inclusion in STEM education 1. Encourage Access and Opportunity: Make ensuring that students from a variety of backgrounds, such as women, underrepresented minorities, low-income families, and people with disabilities, have fair access to high-quality STEM education programs. This entails offering tools to promote involvement and lower obstacles to entrance, such as outreach campaigns, mentorship programs, and scholarships.

2. Create Inclusive Learning Environments: Encourage inclusive learning settings that embrace and assist students with a range of experiences and viewpoints. This entails developing educational environments that value diversity, confront unconscious prejudices, and encourage cooperation, respect, and empathy between teachers and students.

3. Deal with unconscious Bias and prejudices: Deal with any unconscious biases and prejudices that might be present in STEM fields and educational environments. Give educators chances for professional growth and training so they can identify and lessen prejudices, dispel myths, and design inclusive classroom strategies that uphold the importance of diversity.

4. Supportive Policies and Practices: Enact supportive policies and procedures at the institutional and systemic levels to encourage fairness and inclusivity in STEM education. In order to prioritize diversity and inclusion, this may entail making revisions to tenure policies, recruiting procedures, and admissions standards. It may also entail creating resources and support services for underrepresented students.

5. Empowerment and Representation: Give underrepresented groups in STEM leadership, visibility, and representation chances to strengthen their positions. To encourage and mentor kids from comparable backgrounds and highlight different role models and success stories in STEM disciplines. Additionally, actively involve underrepresented groups in initiatives and decision-making processes that advance equality and inclusion in STEM education.

Integrating technology and digital literacy:

1. Curriculum Integration: Create a STEM curriculum that effectively incorporates digital literacy and technology into all subject areas. Finding pertinent technological tools, programs, and materials that

improve educational opportunities and advance digital competency is part of this. Include practical exercises, projects, and real-world applications where students must use technology to solve issues, evaluate information, and present their conclusions.

2. Digital Resources and technologies: Make a variety of digital resources and technologies available to support STEM learning objectives. Multimedia tools, virtual laboratories, interactive simulations, online tutorials, and instructional software are all examples of this. In order to foster technological proficiency, digital fluency, and creative thinking in their students, please encourage them to investigate and try out various technologies.

3. Digital Literacy Skills: To guarantee that students are competent in utilizing technology effectively and ethically, explicitly teach digital literacy skills alongside STEM topics. Information literacy, digital citizenship, critical thinking, media literacy, cybersecurity awareness, and ethical technology use are a few examples of these abilities. Include exercises and tests that evaluate students' proficiency with digital literacy while offering chances for introspection and criticism.

4. Project-Based Learning with Technology: Utilize project-based learning (PBL) strategies that make use of technology to get students involved in real-world, inquiry-driven research projects and group problem-solving exercises. Encourage students to gather, analyze, visualize, and present data using digital technologies. Projects should be scaffolded to progressively develop in complexity, giving students the freedom and creative freedom to use technology to solve real-world problems.

5. Professional Development for Teachers: Give teachers regular opportunities to improve their pedagogical approaches and technology integration abilities. Provide chances for peer collaboration, online courses, workshops, and training sessions that center on utilizing technology to enhance STEM education. Assist teachers in adjusting to new technology, assessing online resources, and implementing research-proven teaching techniques that foster digital literacy and student involvement.

Continuous Professional Development for Educators in STEM

1. Tailored Training Programs: develop CPD courses specially created for STEM teachers' needs and preferences. These classes should cover a wide array of topics relevant to STEM education, like innovative pedagogies, curriculum development, appraisal methods, technology utilization, and inclusion strategies. Make sure to offer choices for both virtual and in-person classes to cater to a variety of schedules and learning styles.

2. Collaborative Learning Communities: foster the creation of collaborative learning communities where STEM instructors may share best practices, participate in peer-to-peer instruction, and cooperate on the creation and implementation of curricula. Subject-specific networks or online chats or professional learning communities are examples of this type of resource. They allow educators to socialize, be inspired, and assist each other in developing professionally.

3. Mentoring and coaching: aid new STEM instructors in honing their teaching abilities by pairing them with skilled school mentors or coaches that can offer guidance, reviews, and motivation. Promote ongoing mentorship relationships that enable educators to reflect on their work, identify progress targets, develop a plan for goal achievement, and get individual assistance tailored to their specific development needs.

4. Access to Tools and Resources: provide instructors with easy access to a large variety of materials and resources to advance their professional development in STEM disciplines. Curriculum guides, lesson plans, instructional videos or segments, online courses, research resources, and professional publications, among other tools, might all be included in this collection. Establish an online platform or digital library where educators can easily find and contribute an extensive range of excellently rated and endorsed tools in line with STEM criteria and suggested techniques.

5. Research and Evidence-Based Practices: The professional development of educators in STEM must also focus on proof and research-based best practices. Encourage educators to keep themselves abreast with the most recent developments in the discipline by requiring them to engage in conferences, journal critiques, and action research projects that focus on the most up-to-date findings in STEM

education. Educators should be able to test out new methods' impact on student learning results and include this knowledge in their classroom instruction.

Challenges of STEM Education

1. Access and Equity: Depending on a person's socioeconomic background, color, gender, place of residence, and level of handicap, there may be differences in their capacity to receive a high-quality STEM education. In order to overcome structural disparities in educational attainment and workforce involvement, all students must have fair access to STEM programs.

2. Perceived Difficulty and Disengagement: Students who find STEM subjects difficult or intimidating may become disengaged and less inclined to pursue professions in the field. Encouraging pupils to choose STEM areas can be achieved through dispelling negative preconceptions and fostering a growth mentality.

3. Teacher Preparation and Professional Development: In order to effectively engage students and foster active learning, many STEM educators may need more expertise in cutting-edge teaching techniques and may need to continue their professional development. It is essential to give educators the chance to get training and assistance in putting inquiry-based, practical teaching methods into practice.

4. Relevance and Curriculum Alignment: STEM programs may sometimes be in line with the changing demands of the labor market or provide students with the necessary skills for employment in quickly evolving fields. To ensure that students are prepared for success in STEM disciplines, STEM curricula must remain current, relevant, and in line with industry demands.

5. Resource Constraints: To provide high-quality STEM education, there must be sufficient funding, instructional materials, lab equipment, and technological infrastructure. However, a lack of funding prevents many educational institutions from investing in STEM programs and giving students practical learning experiences.

6. Diversity and Inclusion: Due to the underrepresentation of women, minorities, and people from low-income backgrounds in STEM disciplines, diversity and inclusion continue to pose serious issues. It is

imperative to tackle institutional obstacles, implicit prejudices, and cultural stereotypes in order to provide inclusive learning environments that embrace students with a range of experiences and viewpoints.

7. Assessment and Evaluation: Students' grasp of STEM subjects and their aptitude for using what they have learned to solve real-world issues may need to be sufficiently captured by conventional evaluation techniques. To evaluate student learning outcomes in STEM education, authentic assessment tools that measure critical thinking, problem-solving, and collaborative skills must be developed.

8. Technology Integration: Although technology can improve STEM education by offering online resources and interactive learning opportunities, incorporating technology successfully into the curriculum necessitates careful preparation and assistance. For STEM educators, ensuring fair access to technology and closing the digital literacy gaps among pupils are constant problems.

Pros and Cons of STEM education Pros :

1. Preparation for a Future Professional Career: STEM education majors provide students with the knowledge, abilities, and skills they will need for a variety of job opportunities in technology, medicine, engineering, research and are ready to adapt to constantly changing industries. The goal of this discipline is to prepare specialists to actively contribute to innovation development and economic growth;

2. Development of Critical Thinking and Problem-Solving: STEM education helps students learn to address complex issues, develop hypotheses, and apply the scientific method to find solutions. This instills the capability in them to solve a real problem in the physical world and to extend scientists’ knowledge;

3. Promotion of Innovation and Creativity: The innovation and creativity are achieved through experimental work, design projects, as well as group problem solving. This discipline forms entrepreneurial thinking, preparing students to develop their solutions to technology and society’s problems. Creation skill;

4. Opportunities for Interdisciplinary Learning: By integrating ideas across disciplines, STEM education allows for interdisciplinary learning and provides topical groups and organizations. This means

that students have the opportunity to understand the relationship between different STEM subjects and solve complex problems using a range of perspectives;

5. STEM Professionals High Demand: Increased globalization, technological progress, and the need for innovation have boosted demand for STEM experts in a wide range of sectors. This prepares students for high-paying jobs and provides employment prospects.

Cons:

1. Access and equity issues: depending on one's socioeconomic status, race, gender, and place of residence, a student has vastly different opportunities to receive high-quality STEM education. This gap limits the chances provided to underrepresented groups in STEM and strengthens the existing educational disparities.

2. Perception of difficulty and alienation: people who feel that STEM subjects are too hard or unapproachable may feel alienated from the focus on professions in this field. This separation may result in a lack of diversity in STEM and prevent the perspective of multiple visionaries from addressing global issues.

3. Limited development of soft skills: despite focusing greatly on STEM skills, the current education standard may devote too little time to fostering soft skills such as collaboration, communication, and adaptability. Such skills should be part of the STEM knowledge because they are vital for successful work in the STEM professions.

4. Teacher shortage and quality: there is a critical lack of qualified STEM teachers, especially in high-need school districts in underprivileged areas. Variability in STEM quality adds challenges to the learning opportunities available to students.

5. A narrow view of success: success in STEM education tends to be defined by academic achievements and technical competence, which could limit the perception of wisdom and available career paths. Such a narrow definition might overlook the diversity of students' interests and talents and restricts well-rounded personal development .

Therefore, although STEM education is beneficial in terms of job preparation and fostering creativity and logical thinking, fixing access

and equity concerns and advocating for broad and inclusive learning are necessary to unlock the full potential of STEM education.

Conclusion

In conclusion, innovative approaches to STEM education at the postsecondary level offer the opportunity to completely redesign the approach science, technology, engineering, and math are taught and learned. Technology integration, diversity and inclusion, multidisciplinary collaborations, active learning, and job preparedness all contribute to a dynamic and engaging learning environment that enables schools to prepare their students for success in a rapidly evolving global world. These strategies emphasize the need for children to develop critical and problem-solving abilities and a passion for innovation while advancing equity and providing all students with the opportunity to participate in STEM education. By making learning about practical applications, engaging students with problem-solving projects, and enabling students to take ownership of their educational path, educators can help students develop these abilities to solve complicated problems and make contributions to society. However, for STEM education to be accessible, equitable, and inclusive, issues such as the difficulty of education, access disparities, and the need for soft skill training must be addressed. Institutions that invest in skilled teachers, innovative teaching methods, and enabling learning environments can undertake enormous efforts to help STEM education fulfill its potential to prepare students for successful careers and continued learning in an ever-changing world.

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CHAPTER : 19

STEM EDUCATION @ NEP- 2020: NEXUS OF SUSTAINABLE DEVELOPMENT IN 21ST CENTURY

Sekh Nur Hossain [1], Dr. Subhankar Ghosh [2]

Abstract

Now day's the most buzz word is STEM (Science, Technology, Engineering, and Mathematics) education, which play a pivotal role to prepare students for accepting the global challenges of the 21st century. STEM education, as envisioned in the National Educational Policy (NEP) 2020, may contribute to Sustainable Development Goals (SDGs). The various alignments of STEM education initiatives with the NEP 2020 can pave the way for excellence in education, innovation, and societal progress. This paper explains how STEM education as envisioned in the NEP 2020, may contribute to Sustainable Development Goals (SDGs) through a comprehensive examination of the literature and analysis of policy frameworks. It is also highlights the key strategies, challenges, and opportunities for integrating STEM education within the NEP 2020 framework for achieving Sustainable Development Goals.

Keywords: *STEM Education, NEP-2020, SDGs, 21st century*

Introduction

In the year of 2020, a notable significant milestone in India's education scenery with the covering of the National Educational Policy (NEP) which is a widespread skeleton aimed at transforming the educational system in India. Concurrently, the global given stress on sustainable development has underscored the enthusiasm of equipping future generations with the knowledge and skills required to address multifaceted societal challenges. Governments of worldwide are revising their educational policies to bring into line with the

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evolving desires of society. In India, the National Educational Policy (NEP) of 2020 has given importance of a holistic and multidisciplinary approach to education. In this context, there has been growing confession of the fundamental role of STEM education in preparing students for the challenges of the 21st century. STEM education has emerged as a prominent way for fostering innovation, critical thinking, and problem-solving skills among students. However, to realize its full potential of STEM education initiatives must be closely associated with the NEP 2020 in India. Therefore, this research article looks up to explore the nexus between STEM education and the NEP 2020, bring out the pathways through which this alliance can contribute to sustainable development.

Stem Education: Conceptual Framework

STEM (Science, Technology, Engineering and Math) was developed to answer challenges in the 21st century; where students are not only smart in terms of cognitive, but also skilled. STEM in education has the aim of develop students to be competitive and ready to work according to their preferred fields (Widya et.al. 2018). STEM education establishes a correlation between a real life problem and the content and endeavors to combine science, technology, engineering and mathematics disciplines. Students have developed a sense of internalizing the work they have done and their thoughts and they felt better, more successful and more creative in STEM education (Kaleci, D. & Korkmaz, O. 2018). The benefits of applying STEM Education are to improve critical thinking skills and be creative, logical, innovative, productive and directly related to real conditions (Widya et.al. 2018).

Education contains the six interrelated key components (*Integrate Curriculum Design, Teacher Professional Development, Hands-on Learning Experiences, Technology Integration, STEM Identity, Diversity and Inclusion*) that given a transformative opportunity to fostering quality, novelty, and sustainability in educational system. It is a multifaceted approach, which help to stakeholders to promote their students in a transparent manner for keep his/her proper impression from inner world to globally. Therefore, STEM education plays a pivotal role in preparing students for success in the modern workforce and equipping them with the skills necessary to addressing the global challenges.

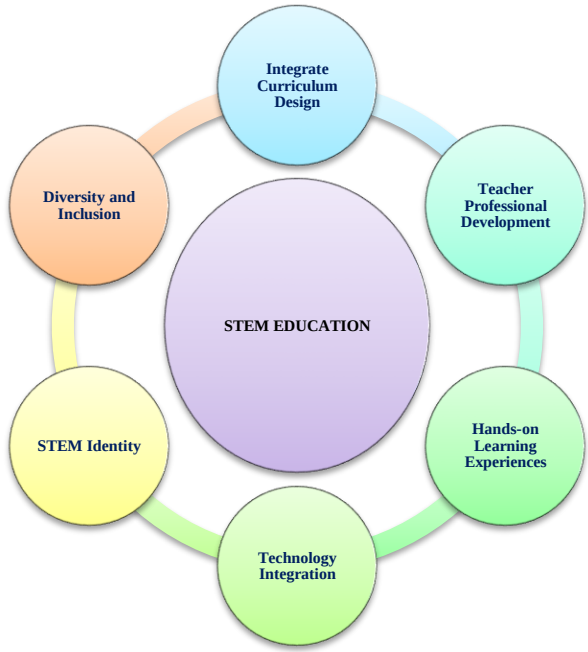

Fig-1: STEM Education Framework

Fundamental Elements of STEM Education

STEM discipline is described by four elements, namely, Science by Science Inquiry, Technology by Technological Literacy, Engineering by Engineering Design, and Mathematics by Mathematical Thinking (Sujarwanto, E. et.al. 2021). Thus, conceptual framework draws on various theoretical perspectives, including constructivism, inquiry-based learning, and situated cognition. Constructivism emphasizes the importance of active learning and hands-on experiences in constructing knowledge and understanding scientific concepts. Inquiry-based learning promotes curiosity, critical thinking, and problem-solving skills by engaging students in authentic investigations and discovery processes. Situated cognition highlights the role of social and cultural contexts in shaping learning experiences and emphasizes the importance of real-world connections in STEM education.

Integrate Curriculum Design	Teacher Professional Development	Hands-on Learning Experiences	Technology Integration	STEM Identity	Diversity and Inclusion
• The framework advocates for the development of interdisciplinary STEM curricula that integrate concepts from science, technology, engineering, and mathematics. • Curricula should emphasize project-based learning, problem-solving tasks, and real-world applications to foster students' creativity, innovation, and collaboration skills.	• Effective STEM education requires well-trained and supported educators who are proficient in STEM content knowledge and pedagogical practices. • Professional development programs should provide teachers with opportunities for ongoing learning, collaboration, and reflection to enhance their instructional effectiveness and confidence in teaching STEM subjects.	• The framework emphasizes the importance of hands-on, experiential learning activities that allow students to explore STEM concepts in a tangible and meaningful way. • Hands-on experiences, such as laboratory experiments, engineering design challenges, and coding projects, can deepen students' understanding of STEM principles and enhance their problem-solving abilities.	• Integrating technology into STEM education can enhance learning experiences, facilitate inquiry-based instruction, and provide access to resources and tools for exploring complex scientific phenomena. • The framework encourages the use of digital simulations, modeling software, data visualization tools, and online resources to support STEM teaching and learning.	• Cultivating a strong STEM identity is essential for motivating students to pursue STEM careers and persist in STEM fields. • The framework highlights the importance of providing students with opportunities to engage in authentic STEM practices, interact with STEM professionals, and see themselves as capable and competent learners in STEM disciplines.	• Promoting diversity and inclusion in STEM education is critical for addressing equity issues and ensuring that all students have access to opportunities and resources for success. • The framework emphasizes the importance of creating inclusive learning environments, challenging stereotypes, and providing support and mentorship for underrepresented groups in STEM fields.

TABLE-1: **Fundamental Elements of STEM Education**

STEM Education and NEP 2020

STEM education has received substantial worldwide attention as governments understand the value of these subjects in generating innovation, economic growth, and competitiveness in today's world. STEM education has become a major point in India in recent years, especially after the National Education Policy (NEP) 2020 was implemented. The National Education Policy 2020 in India is a comprehensive framework aiming at reforming the country's education system to meet the challenges of the twenty-first century. It supersedes the preceding National Policy on Education, which was drafted in 1986 and revised in 1992. The NEP 2020 highlights various key aspects which related to STEM education:

- **Early Childhood Care and Education (ECCE):** The National Educational Policy 2020 given importance on integration of Early Childhood Care and Education into the formal education system in India. This includes a focus on introducing foundational literacy and numeracy at an early age, which lays the underpinning for STEM learning in later years.

- **Curriculum Reforms:** The NEP 2020 emphasizes for a more holistic and flexible approach into the curriculum design, with an importance on multidisciplinary learning and the amalgamation of STEM subjects. This provides the opportunities to students to explore connections between different disciplines and encourages critical thinking and problem-solving skills.

- **Promotion of Science and Mathematics:** The National Education Policy 2020 promotes the concepts of instilling scientific temper and quantitative thinking in pupils from an early age. It recommends steps to increase the quality of science and mathematics education, such as teacher training and capacity building, providing hands-on learning experiences, and using the innovative pedagogical approaches.

- **Teacher Training and Professional Development:** The NEP 2020 much stress on the need for comprehensive teacher training and professional development programs that recognizing the critical role of teachers in delivering quality STEM education. This provides the training in innovation teaching methodologies, Information & Communication Technology and content knowledge enhancement.

- **Promotion of Research and Innovation:** The policy highlights the need of creating a culture of research and innovation in educational institutions. It recommends steps to foster collaboration among academics, industry, and research organizations, as well as programs to encourage student entrepreneurship and innovation.

- **Use of Technology:** The NEP 2020 acknowledges the revolutionary impact of technology in education and argues for the use of digital tools and resources into teaching and learning processes. This involves leveraging internet platforms, instructional software, and multimedia resources to improve STEM education delivery.

Overall, the National Education Policy 2020 in India places a strong emphasis on STEM education as a key driver of socioeconomic development and aims to equip students with the knowledge, skills, and mindset needed to thrive in an increasingly complex and technology-driven world. By prioritizing STEM education and implementing the proposed reforms, India aims to nurture a new generation of innovators, scientists, engineers, and problem solvers who can contribute to the country's growth and development.

STEM Education in Sustainable Development

STEM education plays an essential role in preparing students for the stress of the 21st century by providing them with the knowledge and skills desired to flourish in a rapidly budding world. STEM education equips students with the knowledge and skills required to attend to imperative global challenges such as climate change, renewable energy, and healthcare. For instance, research by Prinsloo and Small (2019) Stress that how STEM education promotes critical thinking and problem-solving skills essential for addressing complex environmental issues. By integrating concepts from science, technology, engineering, and mathematics, STEM education promotes interdisciplinary thinking, creativity, and innovation. More, studies by Czerniak and Metz (2018) express the role of STEM education in nurturing environmental literacy and fostering sustainable practices among students. Moreover, it cultivates problem-solving skills and encourages students to apply scientific principles to real-world challenges, thereby empowering them to become active contributors to sustainable development.

Strategies for implementation of STEM Education

Strategies for implementing STEM education aligned with the NEP 2020 include curriculum reform, teacher training, infrastructure development, industry-academia collaboration, and community engagement. Research by Banerjee and Mukherjee (2020) underscores the importance of industry partnerships in providing students with hands-on learning experiences and fostering innovation. Moreover, studies by Rao and Venkatesh (2021) emphasize the role of community involvement in promoting STEM education and fostering a culture of scientific inquiry among students. Therefore, here are several pathways to implementing STEM education which are as below:

- ***Curriculum Reform:*** Aligning STEM curricula with the competency-based approach outlined in the NEP 2020, while ensuring flexibility and adaptability to local contexts.
- ***Teacher Training:*** Providing professional development opportunities for teachers to enhance their pedagogical skills, content knowledge, and proficiency in STEM disciplines.
- ***Infrastructure Development:*** Investing in the creation of state-of-the-art STEM laboratories, maker spaces, and digital learning resources to support hands-on experiential learning.

- ***Industry-Academia Collaboration***: Fostering partnerships between educational institutions and industry stakeholders to facilitate knowledge transfer, skill development, and innovation.
- ***Community Engagement:*** Engaging parents, community members, and civil society organizations in supporting STEM education initiatives and promoting a culture of scientific inquiry and innovation.

Challenges and Opportunities

While the integration of STEM education within the framework of the NEP 2020 holds immense potential, it also poses several challenges. These include:

- **Equity and Access:** Ensuring equitable access to STEM education opportunities for students from diverse socio-economic backgrounds, gender identities, and geographic locations.
- **Teacher Capacity:** Addressing the shortage of qualified STEM teachers and providing ongoing professional development to enhance their pedagogical practices and content knowledge.
- **Infrastructure Constraints:** Overcoming resource constraints, particularly in rural and underserved areas, to ensure adequate infrastructure for STEM education delivery.
- **Assessment and Evaluation:** Developing robust mechanisms for assessing student learning outcomes in STEM subjects that align with the competency-based approach outlined in the NEP 2020.

Despite the potential benefits, aligning STEM education with the NEP 2020 poses several challenges, including resource constraints, teacher capacity issues, and assessment challenges. However, these challenges also present opportunities for innovation and collaboration among stakeholders to overcome barriers and advance the goals of both STEM education and the NEP 2020. And also the integration of STEM education within the framework of the NEP 2020 presents a transformative opportunity to foster excellence, innovation, and sustainable development in India's education system.

Conclusion

STEM education stands as a cornerstone for fostering sustainable development in the 21st century, offering a multifaceted approach to address complex global challenges. Through its emphasis on problem-solving, innovation, environmental awareness, sustainable infrastructure development, data-driven decision-making, and global collaboration, STEM education equips individuals with the knowledge and skills necessary to contribute meaningfully to sustainable development initiatives. By integrating STEM principles into curricula and promoting interdisciplinary approaches, educators can empower future generations to become catalysts for positive change in their communities and beyond. As we navigate the intricacies of sustainable development, investing in STEM education emerges not only as a strategic imperative but also as a moral obligation to safeguard the planet and ensure a prosperous future for all. In this research paper has examined the nexus between STEM education and the National Educational Policy 2020, highlighting the pathways through which this alignment can contribute to sustainable development. By leveraging synergies between educational policy and practice, policymakers, educators, and stakeholders can work collaboratively to realize the vision outlined in the NEP 2020 and equip future generations with the knowledge, skills, and values needed to address the complex challenges of the 21st century. Through strategic implementation of STEM education initiatives, India can pave the way for excellence, innovation, and societal progress on the path towards sustainable development.

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CHAPTER : 20

EXPLORING CAREER OUTLOOK OF STUDENTS UNDER STEM EDUCATION: A STUDY OF SELECTED STEM SCHOOLS IN DELHI

Ramesh Harish [1], R.R. Patil [2]

Abstract

In India, with its growing economy and emphasis on technological advancement, the importance of STEM ('Science', 'Technology', 'Engineering' and 'Mathematics') education is increasingly recognized with numerous schools and institutions adopting STEM-centric curricula to prepare students for careers in STEM fields. This research paper aims to investigate the career outlook of students under STEM education in selected STEM schools of Delhi. The study is quantitative in nature and is based on descriptive research design. Close ended questionnaire was used to get responses from the students who were selected using simple random sampling technique. By exploring students' interests in STEM fields, their perception of career opportunities and the role of STEM education in their career choices, this study seeks to provide insights into the efficacy of existing STEM educational practices and potential areas for improvement. The study also looks for the presence of gender stereotypical thoughts amongst the students with respect to STEM fields. Results showed that STEM education has a positive impact on developing interests for STEM fields thereby empowering students to pursue STEM related careers ahead. Also, there were no gender stereotypical thoughts with respect to STEM fields amongst the students. The implications of this study extend to educators, policymakers and stakeholders involved in STEM education. Understanding the career outlook of students under STEM education can inform curriculum development, career guidance programs and policy initiatives aimed at enhancing the alignment between STEM education, students' needs and workforce market dynamics.

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Keywords: *STEM education, Career outlook, STEM schools*

Introduction

STEM education is an interdisciplinary approach to learning where rigorous academic concepts are coupled with real-world lessons as students apply science, technology, engineering and mathematics in contexts that make connections between school, community, work and the global enterprise enabling the development of STEM literacy and with it the ability to compete in the new economy" **(Tsupros et al., 2009)**. STEM's fundamental aspect involves applying scientific, mathematical, technical and engineering knowledge to address every day or societal challenges. This approach aims to instill the learning of 'science, technology, engineering and mathematics' with greater significance and context **(Soo Boon Ng, 2019).**

STEM education equips students with foundational knowledge in STEM fields from an early age, aiding informed career choices. The interdisciplinary nature of STEM encourages students to integrate knowledge from various fields, mirroring the collaborative nature of many professional environments. Exposure to real-world problem-solving scenarios in STEM fosters resilience and a capacity to navigate challenges, enhancing students' overall preparedness for their future careers **(National Research Council, 2014).** Through hands-on learning experiences, experimentation and exposure to real-world applications, it enables students to explore their interests, strengths and aptitudes in various STEM fields. By engaging in problem-solving activities and project-based learning, students gain valuable skills such as critical thinking, creativity and collaboration which are highly sought after in today's workforce **(Soo Boon Ng, 2019).** Exposure to STEM concepts through interactive experiments and projects ignites interest and enthusiasm, laying the foundation for future career exploration **(Becker & Park, 2011).** Moreover, exposure to STEM fields fosters a sense of curiosity and innovation, encouraging students to pursue careers aligned with their interests and passions **(Empowering the nation through discovery and innovation, 2011).** By integrating innovative teaching methodologies and emphasizing the relevance of STEM disciplines in addressing global challenges, educators can inspire the next generation of scientists, engineers and innovators **(National Research Council, 2014).** With respect to female gender, there are multiple and overlapping factors influencing girls' and women's interest and engagement with STEM, all of which

interact in complex ways. Gender norms, parental pressure, peer influence and mismatched goals deter girls from STEM. Also, feeling misfit in STEM classes, outnumbered by males and lacking female role models lead women to shun or quit STEM careers **(Dasgupta & Stout, 2014).** Engaging girls in STEM from an early age and ensuring that their overall education experience – the teaching-learning process, contents and environment – are gender-responsive and free from gender discrimination and stereotypes are very crucial **(UNESCO, 2017).** Media depictions of STEM experts serve as vital information for girls in adolescence as they contemplate future identities. Diversifying portrayals of female STEM professionals is essential to challenge the prevailing masculine stereotype **(Steinke, 2017).**

Thus, the reviewed literature provides insight into STEM education, highlighting its benefits in fostering positive attitudes towards STEM careers. However, careful planning is necessary for effective implementation at the school level. Additionally, the sources identify gender inclusion issues, with girls often feeling excluded from STEM education, potentially leading to lifelong disengagement from STEM fields.

In this backdrop, the research aims to explore the career outlook of students under STEM education. By investigating students' interests in STEM fields, their perception of career opportunities, role of STEM education in their career choices and presence of any gender stereotypical thoughts amongst the students with respect to STEM fields, this study seeks to provide insights into the efficacy of existing STEM educational practices and potential areas for improvement.

Methodology

Objectives:

The objectives of the study are as follows:

Primary Objective:

- To explore career outlook of students under STEM education.

Secondary Objective:

- To highlight the infrastructural components of STEM education in schools.

Research questions:

1. How does STEM education generate interest in STEM fields amongst the students?
2. How do students perceive career opportunities ahead under STEM education?
3. What is the role of STEM education in career decisions of students?
4. Which gender is suitable to perform STEM job roles?

Research Design: The study is quantitative in nature and is based on descriptive research design.

Inclusion criteria:

- STEM schools under the jurisdiction of Government of NCT of Delhi referred to as Dr. B.R. Ambedkar Schools of Specialised Excellence (ASOSEs).
- Students of 10th class attending STEM education.

Sample Size and Technique: A total of 40 students studying in class 10^{th} participated in the study from 4 schools i.e.10 student per school.

Table 1:

Sample	***No. of samples per school***	***Total No. of samples (No. of samples per school multiplied by 4 schools)***
Students (5 Male and 5 females per school)	10	40
Total sample size		***40***

Simple random sampling technique was used to randomly select 10 students (5 Male and 5 females) out of the whole class in each school.

Tool of Data collection: Close ended questionnaire was prepared and used, to get responses from the students.

Data Analysis: The quantitative study utilized IBM-SPSS software for data coding and analysis, presenting results via tables, charts and descriptive writing.

Findings

The findings from the study are as follows:

1. Socio-Demographic background:

Table 1, highlights socio-demographic background of the respondents. The study consisted of male and female students in equal proportion i.e. 20 each. Majority of the respondents belonged to Hindu religion i.e. 85% while 15% were Muslims. On an average, the students belonged to the age group of 14-15 years. Socially, 50% belonged to the general category, 35% were OBC, 10% SC and 5% ST. Economically, 70% were middle class, 15% upper middle class, 10% lower middle class and 5% belonged to rich class. Also, 30% of respondents reported their family income between Rs. 50001 to Rs. 100000 while 27.5% are unaware of their family income.

Table 1: Socio-Demographic background of the respondents

	Frequency	*Percent*	*Total*
Gender			
Male	20	50	40
Female	20	50	
Religion			
Hindu	34	85	40
Muslim	6	15	
Age (in years)			
14-15 yrs.	37	92.5	40
16-17 yrs.	3	7.5	
Social Background			
General	20	50	
OBC	14	35	40
SC	4	10	
ST	2	5	
Economic Background			
Lower middle class	4	10	
Middle class	28	70	40
Upper middle class	6	15	
Rich class	2	5	
Family Income (per month)			
Less than Rs. 1286	1	2.5	
Rs. 1286 to Rs. 5000	2	5	
Rs. 5001 to Rs. 25000	7	17.5	40
Rs. 25001 to Rs. 50000	5	12.5	
Rs. 50001 to Rs.100000	12	30	
Rs. 100001 and above	2	5	
Don't know	11	27.5	

2. STEM infrastructural components:

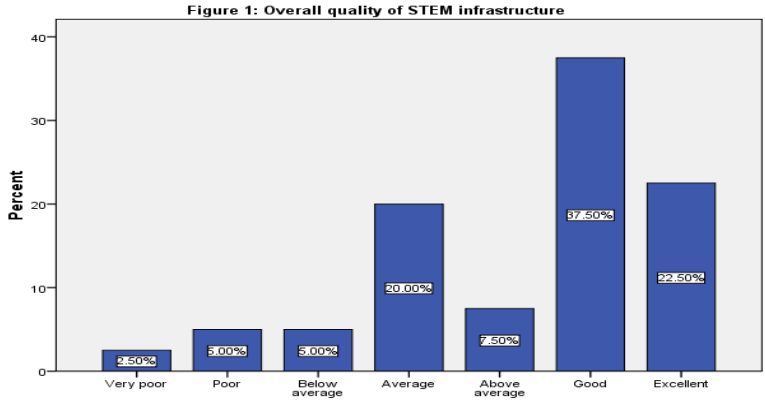
Table 2, highlights STEM infrastructural components in schools, where out of the 4 schools, 2 schools i.e. ASOSE Kalkaji and ASOSE Dwarka, sector 10 had 3 components of STEM infrastructure which were STEM Lab, Tinker Lab and Do-it-yourself activities. The remaining 2 schools i.e. ASOSE Dwarka, sector 6 and ASOSE Madanpur khadar had the presence of only STEM lab and Do-it-yourself activities. Additionally, it was reported that Tinker Lab would be established in their schools soon.

Table 2: STEM infrastructural components in the STEM schools

School Name	*STEM Lab*	*Tinker Lab*	*Do-it-yourself activities*
ASOSE Kalkaji	Available	Available	Available
ASOSE Dwarka sector 10	Available	Available	Available
ASOSE Dwarka sector 6	Available	Not-Available	Available
ASOSE Madanpur khadar	Available	Not-Available	Available

3. Overall quality of STEM infrastructure:

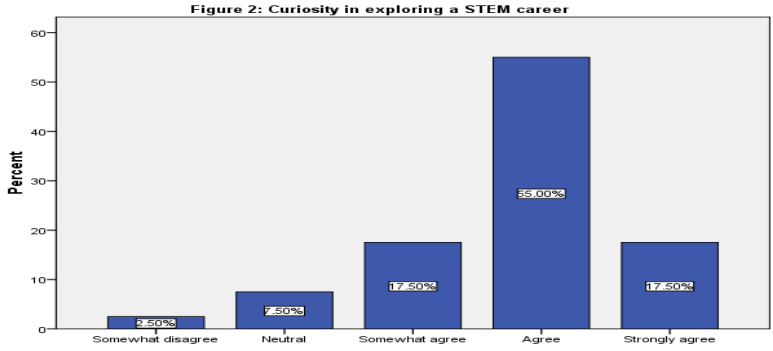
Figure 1 illustrates students' views on the overall quality of STEM infrastructure in their schools. Here 22.5% rate it excellent, 37.5% as good, 7.5% above average, 20% average and 5% each below average and poor. Also, 2.5% rate it very poor. Overall, 60% of the respondents are satisfied with the overall quality of STEM infrastructure in their schools.



4. Curiosity in exploring a STEM career:

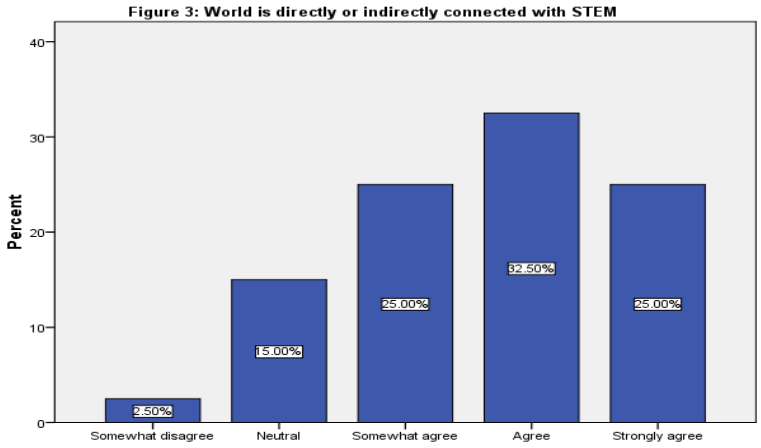
Figure 2 illustrates students' response on the statement that STEM education has made the process of teaching-learning simpler thereby generating curiosity to explore a career in STEM fields. Here 17.5% strongly agree, 55% agree, 17.5% somewhat agree, 7.5% are neutral and 2.5% somewhat disagree with the statement. Overall, 90% of the respondents agree in different capacities that STEM education has made the process of teaching-learning simpler thereby generating curiosity to explore a career in STEM fields. The results highlight that

students under STEM education are curious to explore their career in STEM fields itself.



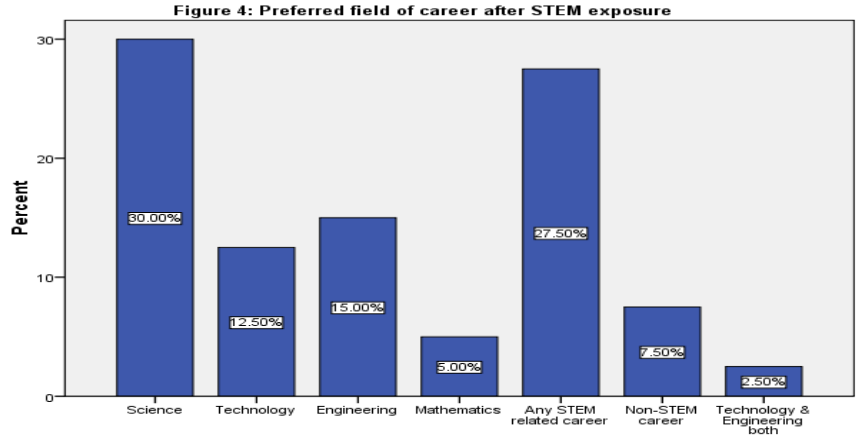
5. Perception that the world is directly or indirectly connected with STEM:

Figure 3 illustrates students' response on the statement that STEM education has created an image in their mind that the world around them is directly or indirectly connected with STEM fields. Here 25% strongly agree, 32.5% agree, 25% somewhat agree, 15% are neutral and 2.5% somewhat disagree with the statement. Overall, 82.5% of the respondents agree in different capacities that STEM education has created an image in their mind that the world around them is directly or indirectly connected with STEM fields. The figure reveals a mixed outcome: students connect classroom knowledge to real-world issues, fostering interest in STEM careers, yet risking disinterest in non-STEM fields, potentially limiting career exploration.



6. Preferred field of career after STEM exposure:

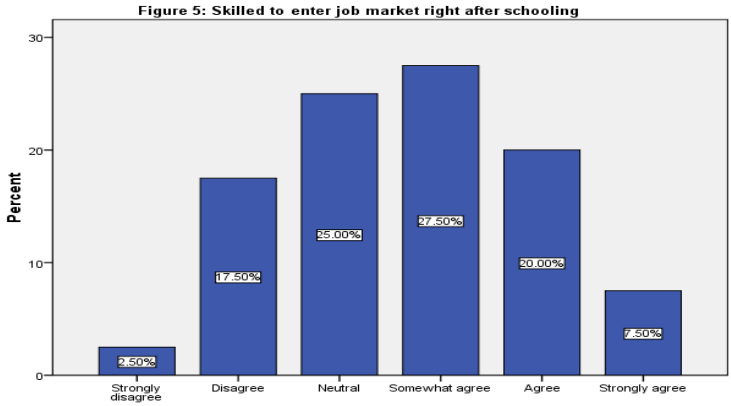
Figure 4 illustrates students' career choices after being exposed to STEM education right from the school level. Here 30% prefer science, 12.5% opt for technology, 27.5% are open to any STEM field, 15% choose engineering and 5% select mathematics. 2.5% are interested in both technology and engineering, while 7.5% opt for non-STEM paths. Overall, 92.5% of the respondents aim for STEM careers. This highlights STEM education's role in shaping career choices and retaining students in STEM fields.



7. Early entry in job market:

7.1 Skilled to enter job market right after schooling:

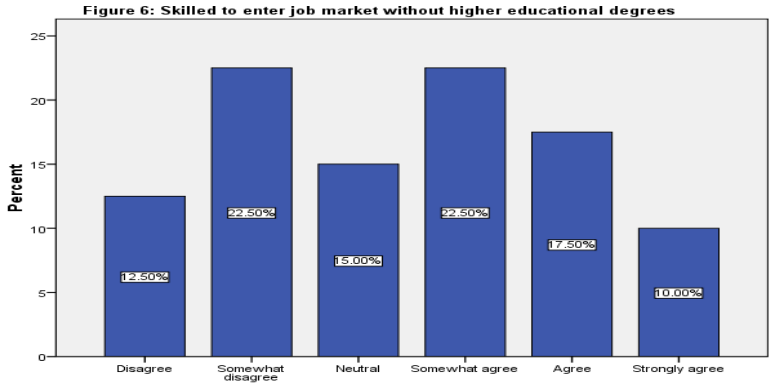
Figure 5 illustrates students' response on the statement that exposure to STEM education right from the school level has skilled them enough to enter the job market right after completing their schooling. Here 20% agree, 17.5% disagree, 27.5% somewhat agree and 7.5% strongly agree with the statement. While 25% hold a neutral view, 2.5% strongly disagree with the statement. Overall, 55% of the respondents agree in different capacities that STEM education equips them for the job market, emphasizing its role in skill development from school. This suggests that STEM education is not just a method to strengthen the teaching-learning process but also is a mean to develop skilled workforce right from the school level.



7.2 Skilled to enter job market without higher educational degrees:

Figure 6 illustrates students' response on the statement that as a result of exposure to STEM education from the school level, they will enter the job market sooner than before i.e., without opting for higher educational degrees. Here 10% strongly agree, 17.5% agree, 22.5% somewhat agree, 15% neutral, 12.5% disagree and 22.5% somewhat disagree with the statement. Overall, 50% of the respondents agree in different capacities that as a result of exposure to STEM education from the school level, they will enter the job market sooner. This is of importance as STEM education can prove to be beneficial for students

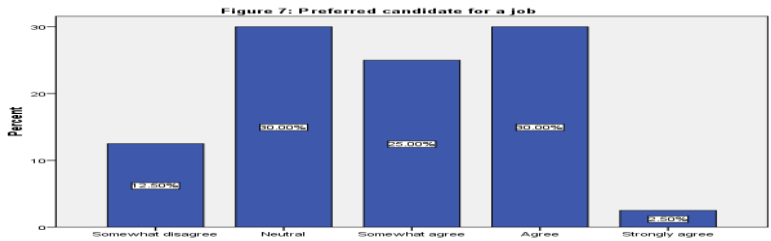
belonging to economically poor background who cannot afford to pursue higher educational degrees.



8. Competitive edge over non-STEM educated students:

8.1 Preferred candidate for a job:

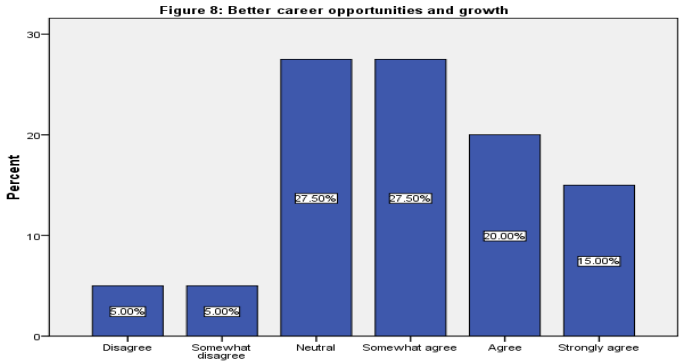
Figure 7 illustrates students' response on the statement that as a result of exposure to STEM education from the school level, they will be the preferred candidate for a job in comparison to students exposed to non-STEM education. Overall, 57.5% of respondents express varying degrees of agreement, with 30% agreeing, 25% somewhat agreeing and 2.5% strongly agreeing with the statement. Additionally, 30% hold a neutral stance, while 12.5% somewhat disagree.



8.2 Better career opportunities and growth:

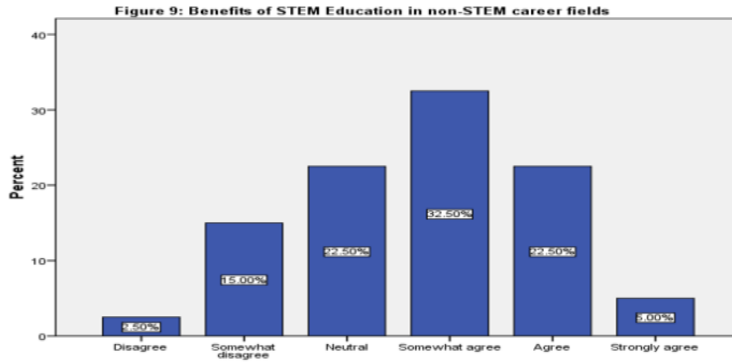
Figure 8 illustrates students' response on the statement that as a result of exposure to STEM education from the school level, they will enjoy better career opportunities and growth in comparison to students exposed to non-STEM education. Here 15% strongly agree, 20% agree, 27.5% somewhat agree, 27.5% are neutral and 5% each disagree and

somewhat disagree with the statement. Overall, 62.5% of the respondents agree in different capacities that STEM exposure leads to better career prospects compared to non-STEM education.



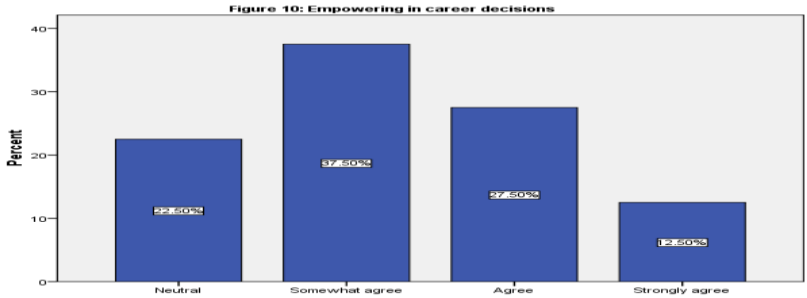
9. Benefits of STEM education in non-STEM career fields:

Figure 9 illustrates students' response on the statement that the benefits of STEM education can also be reaped fully or partially in non-STEM career fields. Overall, 60% of the respondents agree in different capacities that STEM education's advantages extend to non-STEM careers. This includes 32.5% who somewhat agree, 22.5% who agree and 5% who strongly agree with the statement. Neutral opinions account for 22.5%, while 15% somewhat disagree and 2.5% disagree. It is a good sign that students are looking at this aspect of STEM education also because STEM focuses on developing skills like problem solving, creative and critical thinking, collaboration etc. which can be utilised in any career field whether STEM or non-STEM.



10. Empowering in career decisions:

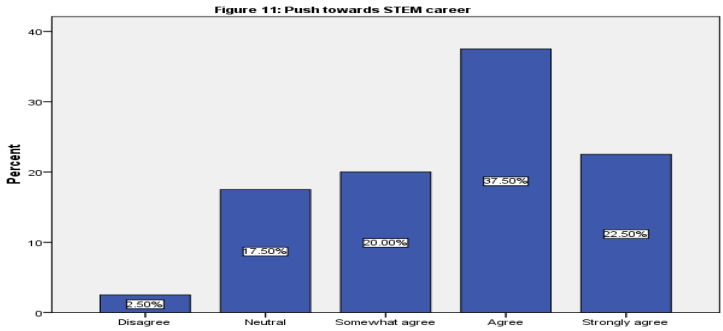
Figure 10 illustrates students' response on the statement that STEM education will empower them to take career related decisions on their own without any peer, parental and other influence. Here 12.5% strongly agree, 27.5% agree, 37.5% somewhat agree and 22.5% hold a neutral view. Overall, 77.5% of the respondents believe that STEM empowers independent career choices, signalling a positive shift from parental influence in decision-making. This is indeed a positive sign as normally at school level, career related decisions are mostly imposed or taken by the parents.



11. Push towards STEM career:

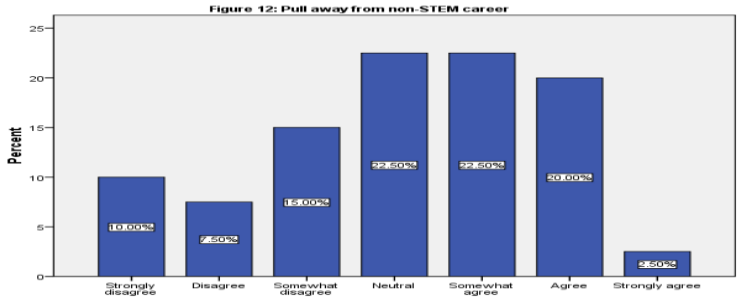
Figure 11 illustrates students' response on the statement that STEM education is pushing them towards exploring a career in STEM fields. Here 22.5% strongly agree, 37.5% agree and 20% somewhat agree. Also, 17.5% hold a neutral view, while 2.5% disagree with the statement. Overall, 80% of the respondents agree in different capacities

that STEM education is pushing them towards exploring a career in STEM fields. This push can be attributed as a 'positive push' as findings from figure 10 clearly highlights that student feel empowered to take career decisions independently. Also, findings from figure 2 and figure 4 highlights that students are curious to explore a STEM career after STEM exposure.



12. Pull away from non-STEM career:

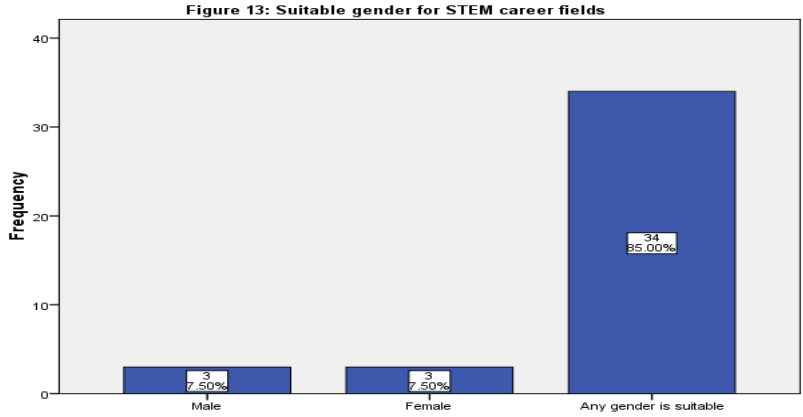
Figure 12 illustrates students' response on the statement that STEM education is preventing them from exploring their career in non-STEM fields. Here 22.5% somewhat agree, 20% agree, 2.5% strongly agree, 22.5% are neutral and 15% somewhat disagree with the statement. Furthermore, 7.5% and 10% disagree and strongly disagree respectively with the statement. Overall, there is a mixed response with 45% agreeing in different capacities while 32.5% disagreeing in different capacities with the statement that STEM education is preventing them from exploring their career in non-STEM fields. Students seem to have contrasting views suggesting complex interplay of variety of factors when deciding upon a career field.



13. Suitable gender for STEM career fields:

Figure 13 illustrates students' general impression about which gender is more suitable to perform job roles in STEM fields. Here 85% are of the view that any gender is suitable to perform job roles in STEM fields. Further, 7.5% feel that males are more suitable whereas another 7.5% feel that females are more suitable to perform job roles in STEM fields. From the figure, it is clear that the students are not stereotyping the job roles in STEM fields to one specific gender.

Figure 13a segregates gender wise responses from figure 13. Out of 20 male responses, 16 feel that any gender is suitable for STEM job roles. Similarly, out of 20 female responses, 18 feel that any gender is suitable for STEM job roles.



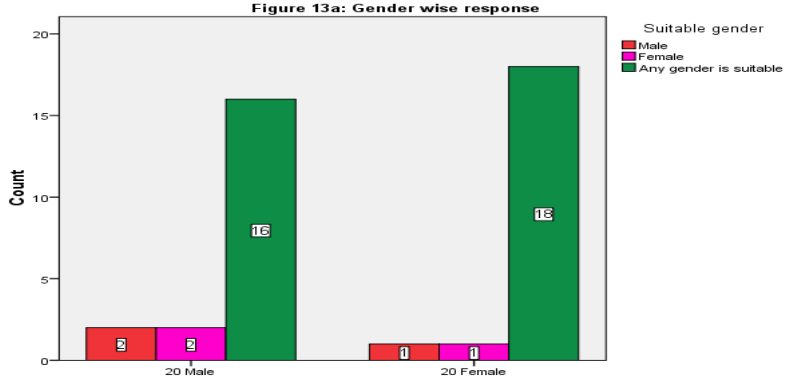


Table 3 summarizes the results of figure 13 and 13a. The results are important considering the presence of gender divide in STEM fields with the male gender dominating the job roles and also stereotypes associated with a particular gender i.e. male being preferred/capable to perform STEM jobs.

Table 3: Suitable gender for STEM career fields

Suitable gender	Frequency	Percentage	Gender wise response	
			Male	Female
Male	3	7.5%	2	1
Female	3	7.5%	2	1
Any gender is suitable	34	85%	16	18
Total	40	100%	20	20

Discussion

1. Generating interest in STEM fields: The study reveals key points about STEM education's impact on students' views and career ambitions. Firstly, it shows that STEM education enhances learning and sparks interest in STEM careers, suggesting its effectiveness in engaging students. Secondly, it emphasizes the importance of STEM literacy in understanding the world, which can lead to a more scientifically literate society capable of addressing modern challenges. Lastly, it highlights a significant shift in students' career aspirations towards STEM fields, indicating the success of early STEM education efforts in shaping vocational interests, which bodes well for meeting the demand for STEM professionals and driving innovation and economic growth.

2. Career opportunities: Analysis of the data reveals a strong consensus among students that STEM education is a direct pathway to employment, with many agreeing that it significantly enhances job readiness. This belief is rooted in the idea that STEM skills are in high demand by employers, potentially leading to quicker job placement. Furthermore, students view their STEM background as giving them an edge in the job market, with expectations of improved career prospects and advancement. Another key finding pertains to the perception of students regarding the transferability of STEM skills to non-STEM career fields. The adaptability of STEM skills is also acknowledged,

with students recognizing their value in both STEM and non-STEM careers, suggesting that STEM education is seen as a versatile tool for innovation and problem-solving in various fields.

3. Positive role of STEM education in career decisions: The study illuminates how students view STEM education's influence on their career choices. Most respondents believe STEM education empowers them to decide their careers independently, aligning with its goal of fostering critical thinking and problem-solving skills for future career autonomy. The consensus among respondents regarding STEM education's role in stimulating interest in STEM careers highlights the efficacy of STEM programs in cultivating engagement in these fields. This is promising amid the increasing demand for STEM professionals globally, indicating successful efforts to inspire students toward STEM careers. However, differing views on STEM education's impact on exploring non-STEM careers signal a need for deeper examination into factors shaping students' career aspirations, such as personal interests and societal expectations. Further research could offer insights for more inclusive educational strategies.

4. Suitable gender for STEM job roles: The study also explored the gender dynamics in STEM education and found no significant gender bias among students towards STEM fields. This finding is encouraging for two reasons. Firstly, it suggests that both genders are equally interested and capable in STEM which is crucial for achieving gender equality in STEM fields and secondly, the finding is in sharp contrast from the current literature available which points out at the prevalent gender stereotypical thoughts amongst the students wherein both the genders feel that STEM job roles are not for females.

Recommendations

1. Enhance STEM Infrastructure: The study reveals that not all schools have a fully equipped STEM infrastructure. It is recommended that schools should invest in developing comprehensive STEM labs and incorporate more hands-on activities to foster practical learning. Also, there is further scope of improving the overall quality of STEM infrastructure. The schools should continue to work for strengthening the current STEM infrastructure and also ensure proper maintenance of the same. This should be done by engaging with STEM experts and also taking continuous feedback from the students.

2. Career Guidance Programs: Given that a significant number of students expressed interest in pursuing STEM careers, schools should consider implementing robust career guidance programs. These programs can help students understand the diverse opportunities available in STEM fields and guide them in making informed career decisions.

3. Integration with Non-STEM Fields: While STEM education is crucial, it is also important to integrate it with non-STEM fields. The study found that a majority of students believe the benefits of STEM education can be reaped in non-STEM fields as well. Therefore, schools should consider interdisciplinary approaches that combine STEM with arts, humanities, and social sciences.

4. Early Career Exposure: The study indicates that exposure to STEM education at the school level has equipped students with skills to enter the job market right after schooling. Schools should leverage this by providing students with early career exposure through internships, industry visits and interactions with professionals in the field.

5. Inclusive Learning Environment: The study found no significant gender bias among students towards STEM fields, indicating that both genders are equally interested and capable in STEM. Schools should strive to maintain this balance and ensure an inclusive learning environment that encourages all students, regardless of gender, to explore STEM fields.

Conclusion

In conclusion, the study provides valuable insights into the impact of STEM education on students' career outlook. It underscores the importance of STEM education in preparing students for the workforce and highlights the need for continuous evaluation and improvement of STEM education practices. The findings of this study can inform curriculum development, career guidance programs and policy initiatives aimed at enhancing the alignment between STEM education, students' needs and workforce market dynamics.

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CHAPTER : 21

SOCIAL MEDIA FOR EDUCATION

Dr. Raju Shah [1]

Abstract

Human always tries to live in social networks to fulfil his biological and sociological needs. The driving force that sustains livelihood in these social networks is communication. Human strives to develop such media which can ease fasten one's communication with his near and far ones. Social media is result of such striving. It is one of the fastest communication channels used by individuals for exchanging information from one part to other part of the world within a fraction of second. This social media has touched each sphere of life social, political, economic and educational. This research article brings into light the role of social media in education.

Social media with the advent of technology, offline medium of communication and interaction has got replaced by online communication medium named as social media. The Merriam-Webster dictionary defines social media as "forms of electronic communication (as Web sites for social networking and blogging) through which users create online communities to share information, ideas, personal messages, and other content (as videos)." Social media encapsulates digital tools and activities that enable communication and sharing across the net. This media has made it possible for one to create and easily transmit content in the form of pictures, videos, audios and word. The kind of services available with social media include blogs, wikis, social bookmarking, social networking sites, virtual world content (online gaming sites) and media sharing sites i.e. Youtube, Instagram etc.

Keywords: *Social media, education, services, communication, information*

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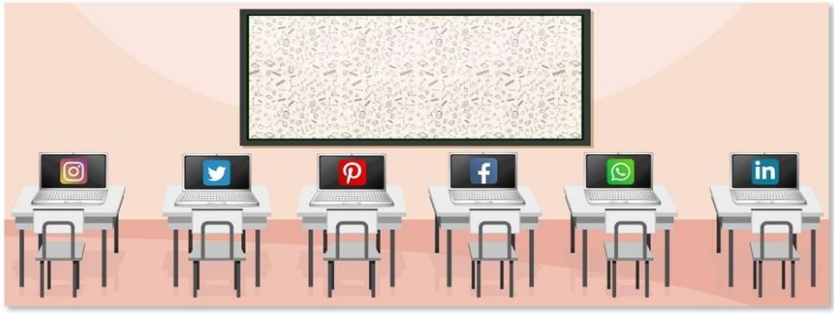
Introduction

In today's digital era, we can see many educational institutions adapting social media developments into their systems to improve students' life. The use of social media in education enables students, teachers, and parents to get helpful information easily, connect with other learning groups, and understand other educational systems. And all these are reasons why social media plays a key role in making education convenient these days. This is why educators who see the value in social media have begun to embrace it and use its many benefits fully. This article will explore using social media in education and how it may benefit student's learning experiences and lives. Social media in education states the drill of using social media platforms as an approach to augment the learning of students. Technology incorporation can be defined as encompassing students' needs rather than revolving around the needs of teachers. In a teaching space with a whiteboard and a computer, the education will spin around the instructor. With the use of technology, the learning environment can be expanded. This is another way that social media and the classroom can come together by shifting the approach to educating through social media to make it easier for both the teacher and the student to comprehend.

How Does Social Media Help in Education?



Due to students' familiarity with several platforms, integrating technology into the classroom has never been simpler. Some of the numerous ways that social media may be used in the classroom are to disseminate notifications and give live lectures to the students. Using social media for communication, question-and-answer sessions, and grading and commenting on student work might be beneficial for teachers, parents, and students. In addition, students might get

experience with distant cooperation thanks to the use of social media. Students in today's increasingly digital society must have the ability to thrive independently and adapt quickly to new contexts. Although there are many things to think about before bringing social media into the classroom, we know that doing so will help pupils develop more sophisticated technological abilities. Even within the context of the role of social media in education, a mechanical engineering degree stands as a testament to the interdisciplinary potential of these platforms, fostering collaborative learning, industry insights, and professional networking within the realm of technical education.

Implementation in Schools

When it comes to social media, schools tend to adopt different positions. It's a general consensus that they're useful when it comes to sharing information or organizing the school tasks. And at the same time, the social networking is blamed for the lack of attention in students during classes. But an increasing trend of adopting social media in school is starting to show. And since students already devote a lot of time for social media and connecting with others outside school hours, why not do it during school as well? It's a matter of practicability, really, because it makes perfect sense to use the online universe to communicate with your students since they're already there most of the time. There's no need for another case study about the usage of social media in schools. You simply need to walk through the hallways of any school or colleague to see kids of all ages totally immersed in their smartphones. Browsing their news feed, sharing photos on Instagram of sending Snapchat messages has become a part of their daily routine.

Top Benefits of Social Media in Education

Here are some of the top benefits of social media that describe its important role in education; 1. Helps in learning actively rather than passively
2. Helps in Gaining access to many educational resources
3. Helps in Developing good communication skills
4. Helps in connecting and collaborating outside the classroom
5. Makes building networks easy
6. Provides credibility in the social domain.
7. Keeps parents and teachers informed.
8. Marketing platform for educational institutions.

Impact of Social Media on Education

These days, a significant portion of students have access to smart gadgets and social media daily and spend their spare time scrolling through them. Therefore, it is a great way to utilise that time, learn, and draw something productive out of it. Social media apps and sites have modified themselves to coordinate and cater to the requirements of educational institutions. Teachers, parents and students benefit immensely from the resources and the online study material.

1. **LinkedIn**– It is a well-known site for building a professional profile to look for jobs and find updates regarding various industries and topics. But do you know it also provides courses to upskill yourself and boost your learning? It offers free and paid course material to help students learn more.

2. **YouTube–** Students have used YouTube to access educational and other entertainment videos ever since. But it was a concern of students regarding the limited availability of study material on the app. After the lockdown, many teachers and educational firms uploaded videos related to diverse topics. So now, it has become easier for students to utilise YouTube as an educational resource.

3. **Instagram–** It took some time for Instagram to gain the popularity it deserved. Recently, students can find educational videos, upload their projects and innovations and reach a global crowd using hashtags. It is an effective way of connecting with people and communities that share the same interest as your child.

4. **Quora**– Apart from various other functions, the primary utility of Quora for students is to post questions and get answers. Students can also look for related topics on Quora and check out pre-uploaded answers or articles. Since it's a social networking site, it is available for building new connections online.

5. **Zoom, G-meet and Ms-Teams**– These are not social media sites but video-conferencing apps. But their popularity grew immensely between parents, teachers and students as the means of connecting hundreds of people anywhere worldwide with just one link. Educational institutions actively use it to hold classes, exams, and programmes.

How Can Teachers Penetrate the Online World?

Moodle and Blackboard are just two examples of learning management system that involves online learning for more than 10 years now. Slowly but steady, such systems will lead to the actual implementation of social media within classrooms. And the best tool available for teachers is social media itself. Only by being open-minded and using the technology themselves will they be able to really reach out to students. "The best teachers I've ever had have used technology to enhance the learning process, including Facebook pages and events for upcoming projects" – Katie Benmar, Freshman As the above statement emphasizes, students also react very positively when a teacher is willing to use their methods and adapt them as part of the educational process. And it makes perfect sense since a homework has a certain strictness about it, but an online chat discussing a certain book gives students the ability to open up and share their opinions. Of course, the examples of teachers already implementing social media in classes are far numerous that we can know of, however, there are a few that did such a great job that their students almost made them viral. For example, a biology teacher from Bergen County proposed a challenge to his students. They had to debate over the subject of meiosis on Twitter by using a specific hashtag. This is a great opportunity for students to have fun and learn at the same time. As you need to know your meiosis in order to compress it into 140 characters.

Best Practises to Use Social Media for Learning

1. **Avoid distractions**– It is very common for students to get muddled up with different social apps the very second any new notification pops up. Try to focus and mute any other notifications while studying.
2. **Appropriate social media selection–** Multiple social media sites are available for learning. It is necessary to align the choice of social apps with your learning needs. If you want video graphics information, you may choose YouTube over LinkedIn.
3. **Follow relevant people**– Students must look for social media accounts that offer valuable educational content. You may come across plenty of profiles and communities related to the expert in your field of learning. Follow them to be updated with any new information or developments.
4. **Save important information**– Social media apps like Instagram, Twitter, and YouTube allow you to curate new

folders and collections to store relevant content. Create folders to save important posts, videos, and links you find useful. It may help personalise your saved folders.

5. **Follow Hashtags**– The most likely way to come across relevant educational content is to follow your field of interest hashtags. It displays optimised posts, trends, and highlights related to your hashtag.
6. **Improve critical thinking–** Social media is a breeding ground for misinformation and controversies. Finding reliable and fact-checked information to filter through irrelevant sources is crucial. Critical thinking helps in judging the credibility of information received.
7. **Sieve all resources–** The social world has many educational resources to be taken advantage of. Students must review podcasts, audiobooks, and live streams for a better learning experience.

A Stronger Community Through Social Media

The benefits of social media in the education process doesn't have to stop at the teacher-student relationship. There are a lot of other benefits that can be extracted from the use of social networking at higher levels as well. For example, principals or administrators can find a new way to integrate social media. Like sharing school news via social networks, holding online meeting with the parents or even starting fundraising for different projects. And social media can quickly become the only channel of communication since we're living fast-paced lives, parents are usually busy with work and cannot attend school meetings. But this doesn't mean they shouldn't be in touch with events or be able to check on their kids every once in a while. Just like in every other field, communication is vital and if it can be done easily with the help of social media, why not go for it? It may not be criteria just yet, but soon enough questions like 'Does this school have a Facebook page?' could become just as important as the things that parents are asking right now. Like, how well equipped the library is or what are the optional classes their child can be part of.

Conclusion

The bottom line is that social media is a big part of our day-to-day life and there's no point of keeping it away from the education process. School, college and university staff should be encouraged to make use

of technology for student and parent communication. This could easily turn into an argumentative essay topic for college. But the benefits are obvious, starting with healthier parent-teacher relationships and all the way to permanently changing the way our children will learn. The success of collaboration may depend on how well people are educated and how well they use social media. In the last few decades, social media have become more popular as a free way to get and share information and ideas. Every social media platform can be used in various ways, from making it easier for parents and teachers to talk to each other and for students and professionals to work together across borders. In addition, teachers are increasingly using social media to help students learn and improve the classroom environment. The bottom line is that social media is a big part of our day-to-day life and there's no point of keeping it away from the education process. School, college and university staff should be encouraged to make use of technology for student and parent communication. The benefits are obvious, starting with healthier parent-teacher relationships and all the way to permanently changing the way our children will learn.

CHAPTER : 22

IMPACT OF SOCIAL MEDIA ON EDUCATION

Suchitra Giri [1]

Abstract

Social media has become an integral part of the daily lives of the present time. Use of social media is being increasing during the last few years. It is use to communicate with friends and family share information and stay updated on current events social media is not only being used by the working people but also heavy rise the use of social media in educational field. This paper studies the usefulness of social media in the education and presents the impact of social media on education, student and the impact on young people. The study's major goal was to determine social media's effect on education both positive and negative. The study occurs a critical review study with in depth reviews and a qualitative research approach that is best on secondary data gathered from electronic source which includes book chapters to assist Journals, articles, research, the internet, and the Google Search engine. Analytical methods were used to conduct the literature review then an assortment of choices was made after carefully reviewing all the data. The result shows that the impact of social media has many positive and negative effects on education. The result shows that the impact of social media may be good for students but if we take a closure look at the real impact of social networks it can have bad effect on them. Social media sites like facebook, twitter, whatsapp and instagram etc are constantly disturbing in students in their studies As a last resort all citizens are used to the social media's positive elements and avoid it's negative ones so that we might benefit from these brand new technologies. So, social media and education can complement one another if it used effectively.

Keywords: *Social media, Google Search engine, Education, technologies, Impact*

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Introduction

Social media has been an integral part of the daily lives of the present time. Use of social media is increasing in the last few years. It profoundly influencing various aspects of society. In the present time social media has emerged as a powerful force that has redefined the way we communicate. Share information and connect with others. Initially designed as platforms for social interaction and networking, this digital spaces have performed every aspect of our lives, including education. In present time in the worlds of connecting learning the impact social media on education is becoming a driving factor. The world is smaller and by the use of technology such as social media the way we get an education in changing. Social media and education can complement one another if used effectively. Social media is continually developing new educational possibilities for students. Every day 90% college students visit a social networking site. Many universities and school around the world. These days a significant portion of student have access to smart gadgets and social media daily and spend their spare time. Therefore it is a great way to utilize that time learn draw something productive out of it. Social media apps and sites have modified themselves to coordinate and cater to the requirements of educational institutions. Teachers, parents and students benefit immensely from the resources and online study material. Social media has many positive effects on education. But the same has some negative effects. Here know the many positive and negative effects of social media on education (Akram,& Kumar, 2017).

What is Social Media

According to the Dictionary definition, "Social Media is websites and applications that enable users to create and share content or to participate in social networking." Social media is not just limited to posting pictures about holidays online. Social media has gained credibility over the years as a reliable source of information and platform where organizations can interact with audiences.

What is education?

Education is the process or act of learning or teaching, i.e acquiring or imparting knowledge. It includes the preparation of children for mature life. The term's meaning can vary depending on its context, who says it, and where. According to Cambridge Dictionary The process of teaching learning, especially in a school or college or the knowledge that you get from this.

Objectives

Studies suggest that the high use of social media applications outside formal educational environments offers new opportunities for innovation and modernization of education and training institutions and to prepare students for the 21st century by opening the whole World of information, salute the relevance in the educational field. Social media networks are considered crucial to the development of educational and professional skills today, as it removes geographic and temporal barriers that provide ample room for a broad community that shares information and interests. It also provides access to explicit knowledge. The use of social networks by students of higher educational level is undoubtedly a fascinating part of research for educators and social scientists. Different reasons appear to justify the use of social media in education. Therefore, to study the interrelationship of social media and education and the impact of social media on education have an important place in the field of advanced educational technology (Akram, & Kumar, 2017).

1. To Study the impact of social media on educational efforts.
2. To Study the purpose of using social media by students.
3. To point out the positive and negative effects of social networks on education.
4. To determine how social networking websites affect a student's academic performance.
5. To understand the impact of social networking sites on the education system.
6. To explore the consequences of social networking sites in education system. Purpose behind the usage of social networking sites.

Different types of social media and education

YouTube - It is only known that one of the best video viewing platforms in the whole of the internet is YouTube. YouTube lets a person feed as many videos as they want. Teachers now use this platform to upload pre-recorded lesson videos that help students learn their daily lessons. Besides, YouTube is also a platform where students can find answers to anything they want. So even if they have a lesson plan, they can go ahead and start learning. The comment section on YouTube also helps students post their queries to which their teachers or the guide can revert with answers. YouTube also has a separate section called 'education' that is dedicated to teach this, the tool teaches how best teachers can use it for tutoring their students.

TedEd :- TedEd is a part of TED that offers various TED Talks that are short and animated and are on subjects like science, technology, social studies, literature and so on. It also creates a hub or a platform for students and speakers to connect making a better place for collaboration.

Facebook:- - Facebook is one platform that all students are excited about. Here they connect with their friends and Facebook for education can be used by creating pages for various subjects and asking students to post and comment on relevant topics. It is also a site where one can find all students (Akram,& Kumar, 2017).

Twitter: - What a lot of people know is that Twitter is a platform used for tweeting on random topics. But what one forgets is that it can be used as an effective tool for education. Teachers can now tweet exam schedules or call out a student to sub their assignments or can even use it for sharing inspirational and motivational quotes.

Instagram: - Another big player in social media is Instagram. Teachers can use this tool to post short lessons as pictures or even conduct campaigns or contests relevant to their subject and encourage students to participate. They can also post stories with updates on their next lesson plan. This will help students prepare for their next set of learnings. » Education Websites: - Numerous educational websites are now finding ways to get into students' and teachers' books by offering the simplest and the easiest form of education and learning on various topics. While most of these sites are free, some of them are paid to view advanced and quality learning material. Some of the top sites that students frequently use in India are:

1.Edx 2.Udemy 3.Coursera 4.Learn Next 5.Academy earth & 6 .Khan academy

Research Design and Methodology

It is a critical review study with in-depth reviews and a qualitative research approach that is based on secondary data gathered from electronic resources, which include book chapters, journals, articles, research, the internet and the Google search engine Analytical methods were 1sed to conduct the literature review, and after carefully reviewing every piece of information, a conclusion is drawn.

Impact of social media on education

Education is very essential part of an individual's life for every teenager education is more important than anything. Today teenager shows a lot of interest in using social networks but unfortunately social networks badly affect education. Technology has demonstrated rapid development by producing small communication devices, but these small communication devices can be used to access social network anytime anywhere .Social media impact on education both positively and negatively. Some positive and negative effects on education are given below:

Positive impact of social media on education

In present time social media is very important in our life. It uses is also important in education. There are many positive effects of social media on education.

1. **Gains more extensive knowledge**
students can gain additional education by using social media and other online platforms to study in their field of interest. In addition to regular classroom education, they can attend online courses of their interest that can help them in their careers. Students stay updated about the latest news as positive effects of social media on students is very dySnamic. People also use social media to generate brand awareness. It also enables you to study any site. There's no need to follow a timetable. Students saves their lot of time by used of social media.

2. Helps to stay connected
Social Media let's us stay linked with family, friends, and relatives. Students can communicate and share their views through various social networking sites, irrespective of their location. Students can connect to professors from different schools and colleges for lectures and seminars. In addition, students can take online guidance and support from well-known coaches across the globe who are masters in their field (Choinfield. & Amne, 2007).

3. Increases understanding
Students also understand human behavior more closely. On social media, people share their points of view and have discussions. As a result, it enhances the social intelligence of students as they observe and communicate with various kinds of people on social media. It

increases a student's understanding by encouraging self-learning that lets them make decisions liberally. It increases the understanding level of the student.

4. Learning from various sources

The long-range interpersonal communication advancements are designed in such a way that students will be able to choose the group, movement, or person they would like to follow on daily updates, There are many different ways to learn.

5. Being Prepared

The social media is to display global trends. By keeping track of the changes that are posted, shared, talked about, or updated on social networking sites, students can draw up a strategy for that might be expected of them in the future.

6. More innovative

Positive effects of social media on education are that students can innovate new things. It helps us to development new product by accessing knowledge, co creating ideas, and implementing them. It opens up new avenues for researching, encouraging students to get creative and think outside the box which in an age where innovation is highly prized, can go far! Students learn more from graphics and images, and through social media. As a result, students' imagination enhances, and they find their studies more interesting.

7. Helps to stay connected

Students can communicate and share their views through various social networking sites, irrespective of their location. Students can connect to professors from different schools and colleges for lectures and seminars. In addition, students can take online guidance and support from well-known coaches across the globe who are masters in their fields. Therefore, social media also helps you stay connected and is thus included in one of the 10 positive effects of social media (Choinfield. & Amne, 2007).

8. It helps to enhance communication

Social media help students to improves their communication skills. Positive effects of social media on students also supports students to unite with other students from different schools and colleges, and they Can share their knowledge and friendship over the virtual system. It also helps the students to know about what's happening around the

world by making them aware. Social media's impact on communication also students learn new languages.

9. To accomplish career goals

To accomplish career goals, social media helps you in many ways like locating new concepts in the socity and helping us seek a job through apps like Linkedin. Through online platforms, they Can study and complete various courses of their requirement that helps them get jobs in the future.

10. Additional opportunities for teachers

Can stream live classes and discussions conveniently. Teachers get opportunities to reach out to a large number of students through online mediums. Students far away can reach out to teachers through online mode to discuss various topics. Teachers can also assign homework, and make announcements via social media, which can also be an opportunity for students to complete it. Teachers can prepare online video lectures that are accessible on YouTube and other online platforms. Through which they can also earn money. Online teaching can also be a career option Teachers get more for young educators.

11. Promotes social upliftment

Promoting social upliftment helps you in doing a social change, many people raise issues that are of concern. Various posts, articles, and, reports are there on social uplifting by writers to raise an issue like social inequality, racism, gender inequality, etc (Choinfield. & Amne, 2007).

Negative impact of social media on education

Besides positive effect social media has many negative effects on students and their education. It badly impact on students mind, waste time, effects on privacy etc. Negative of social media on education are-

1. Academic Distraction

Excessive involvement in social media diverts students mind from their academics. They spend their long hours on social media which causes a lack of time management in their studies and they don’t even focus on their studies. Students get to know more on social media platforms but it is also a huge distraction for their academics.

2. Cyberbullying
Cyberbullying is one of the major concerns worldwide that happens on social media a lot to manipulate, humiliate and cause harm to another person online. It has become the reason students are getting mentally tortured and emotionally unwell. Hence, it is imperative for the parent to teach their child not to bully anyone in any way.

3. **Excessive Addiction**
Involvement in social media can make students addicted. Addiction to social media can be very dangerous and harmful for young minds. Parents must be attentive towards their kids, they shouldn't let their children become addicted.

4. **Privacy Issues**
Social media not only entertains us but also gathers our sensitive data and personal information. Teach your kid not to share any personal information with any strangers online. It can be harmful as someone can use personal or sensitive information against them.

5. **Lacking Self-Confidence**
Social media has affected students' lives a lot in many ways. Nowadays, students are actively engaged in social media and see many influencers who attract them. They start to compare their lives to those of social media influencers which forms a lack of self-confidence.

6. Spreading False
We all know that social media is a huge platform that not only shares informative news but also spreads rumors, misinformation and lies about certain incidents or a person. Spreading wrong information about someone is completely wrong, it can affect them mentally emotionally.

7. Reduced learning and capabilities: Students now rely more on the web and the material that is readily available on these social media platforms. Their capacity for learning and study is so diminished.

8. **Reduction in real human contact**
The more time kids spend on these social networking sites; the fewer moments they will spend interacting with others in person. This weakens their interpersonal skills. They won't be able to interact and communicate effectively in person. Because of this, employers are becoming more and more dissatisfied with the interpersonal skills of

recent graduates. To succeed in reality, one needs strong connection skills (Elison, 2007).

9. **Reduces command over language use age and creative writing skills**

On long-distance interpersonal communication venues, students frequently use slang words or abbreviated word types. They initially rely on the spelling checker's highlights and the language structure of the PC. Their control over the language and their capacity for experimental writing arc diminished as a result.

10. Waste of time

While scratching and concentrating online, students are occasionally drawn into using social networking sites and forget why they are using the internet. Sometimes students' time wastes prevent them from completing their assignments within the deadline.

11. **Poor grades**

Students who lack the desired information and writing skills recessive negative assessments in school.

12. **Pupils' loss of motivation**

The employment of these long-distance interpersonal contact sites lowers the student's motivation level. Instead of increasing suitable education from this current reality, they rely on the virtual state.

13. Effect on health

The unwarranted usage of these websites affects both mental and physical health. Students fail or get enough rest. The misuse of these locations once a day has numerous negative effects on students' physical and psychological health, making them sluggish and unwilling to interact with the general public in person. Parents should monitor and correct their children's online behavior. They need to question if they are using it appropriately.

14. Mood Disorders

Regular use of social media can lead to an increase in the level of mood disorders in students as it causes dissatisfaction and insecurity among students.

15. Sleeping Deprivation

One of the major negative effects of social media is that students do not get as much sleep as they need. Lack of sleep directly affects mental and emotional health. Healthy sleep is mandatory, especially for students to maintain good health.

Conclusion

Social media is very widely used by the students. Social media largely affects students and their education. Social media have become an essential need today, but one should not be addicted to it. It could ruin the future of adolescents and children and can have a very negative impact on education as discussed above. This study strongly recommended to check the activities of children involved in social media and do not let use social media. It is also a strong recommendation for the government. On the other hand, social media like Facebook, YouTube are very much involved in study activities. Students too are very much active on these sites, using both for entertainment and study purpose (Elison, 2007). ICT has brought together the mass from every corner to exchange one's ideas and thoughts and students, research scholars are greatly benefitted from it to access and furnish their work precisely. Students are able to clear their doubts regarding any topic and can get help from the top educators which has positive attitude towards study through social media. So, unauthorized use of social media badly impact on the students and their education. So, we can avail the benefits of these latest and emerging technology.

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CHAPTER : 23

SOCIAL MEDIA FOR EDUCATION

Sacheta Bhattacharjee [1]

Abstract

In recent times we can found social media tools everywhere- in a simple word now it is ubiquitous in nature. Among them most popular tools are Face-book, wiki, you tube, bulletin board, blogging, twitter, etc. The main aim of this work is to explore the major advantages of utilizing social media in education. In- depth analysis of different types of online tools uncovered that social media have different types of educational benefits. It has been identified that theses web reliant applications can enhance communication or inter-personal relationships among pupils and teachers. We are very much thankful towards these technologies because both teachers and students can talk with each other within a fraction of seconds. Social media can also boost up student's involvement. Students who are suffering from boredom through the traditional classroom now they can share their feelings freely in a conducive environment. Through this study we can also identify that through this social media application in education students will learn how to work on the basis of co-operation and collaboration to fulfil their common goal. With the advent of internet various applications are available which can be accessed easily which allow users to create, edit, share new forms of textual, visual and audio content. It has a very strong effect on our lives as it helps a lot in every spheres of life. On the basis of these educational improvements we are suggesting that these online social tools should be used in a student friendly environment.

Keywords*: communication, social media, involvement, co-operation, collaboration.*

Introduction

Social networking websites covers different types of devices that combine technology, social communication and videography (movie making, filming, film editing etc.) in this study we will

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mainly focus on the positive sides of the social media or social networking sites, face book, you tube, wikis, LinkedIn, podcasts etc.

a) To present evidence from various researchers that precisely demonstrate the advantages of these devices have in education.
b) To highlight how the students will learn to do some project work on the basis of co-operation and collaboration from theses social networking sites.

Methodology

The study will be made by referring several other literatures on 'utility of social media on education' published by various sources. In the above context a qualitative study will be conducted on 'social media for education'. This being a non-empirical study the analysis will be made from the contents collected from various articles published by various authors and released through various sources.
Discussion

Face book: According to Face book web site statistics there are more than 3.065 billion active users on a monthly basis- it makes it the most used social media platform worldwide. Face book has following features such as- users profile, friends, news feed, wall, discussion boards, photo tagging, applications, events, photographs, messengers, news. On the basis of these features face book becomes a beautiful device for a life long learning and social network and forming a long-lasting community based learning environment. There are different types of communities on face book. Individual users have the choices to advertise their events. Face book events are procedures for members to let other friends know about upcoming events in their community and to arrange social gathering meetings. Through the photo edit options we can allow face book users to upload photos and attach them to albums and live video broadcasting to our profile for all our friends to see. Through the face book messenger app we can chat one-on-one or in a private group settings. Through the face book profile we can add our name, photo, address, workplace, hobbies, educational back ground, interest area and so on. We can make our profile private or public when we are giving the option private then our information is not being publicly visible. There is an option of newsfeed where all our friends posts will come and our posts will also appear in this newsfeed zone so our friends can also notice them. There is also an option which is also known as timeline. This timeline zone keeps our personal record

of all the posts we have shared and posts we have interacted with. Friends can also see our timeline by default if they search our name unless we have set our private settings. Next the important feature is algorithm. Mainly it is a series of computations which face book servers do every second to calculate which type of content we want to see, communicate with and click on next. It uses the dwell time (that is how much time we are spending to see a post and the type of content which we like to see).

Advantages

Teacher or instructor can take the benefit of this open learning environment where students can actively participate into it and they can construct their knowledge on the basis of co-operation and collaboration. For example for any social incidents or projects students can expand the discussion forum or activities to the public to identify not only what others students think about but also what is the common peoples opinion towards any social issues. Teacher can give proper guidance to the students to analyze and synthesize data and to encourage higher level of thinking and to nurture critical and divergent skill. Traditional learning mainly differentiating between the classroom knowledge and the applicability of knowledge. What students are acquiring is not useful for what society needs . Engaging community in the learning process enhances the capacity of the students to identify the useful and applicable knowledge. There are some advantages of using face book for educational purposes but it should not be used as the most important educational tool yet we can capitalize on face books ubiquity and collaboration capabilities (Guess, 2008). Face book helps people to interchange their information on the basis of co-operation and collaboration in a pre delimited virtual communities. (Irwin, Bail, Desbrew and Laveritt, 2012). Face book helps individuals to extend their social networking (Boyd and Ellison, 2008). Bosch (2009) has classified face book research into four parts- “social networking and social capital, identity construction, concerns with privacy and the potential use of face book for academic purposes’’. Karakayali and Kilic (2013) identified three different features of face book . Firstly it helps us to recollect the old memories . secondly it helps people to notice others activities thirdly, it provides us chances for users to bring its different segments of users networks on one place. Selwyn (2009) five times of themes about students interaction on face book a) interchange of practical information, b) perception regarding university experience. c) communicate with each other about academic

information. D) interchange of humour. Bicen's and Uzunboylu's (2013) focused that virtual classroom environment enhances students performance by sharing videos, documents and power point slides. But some characteristics of face book like acceptance and rejection for a friend request could affect person's self-confidence and satisfaction of life. (Valenzuela, Park and Kee, 2009). "Face book is a network that connects students with other students, indirectly creating learning community – a vital component of student education" (Baker, 1999,). One of the most interesting articles that explains how a teacher can utilize face book is "face book for Education" which gives us seven ways to educators as follows (Phillips, Baird, Derek and Foggy, 2011). A) motivate students to act accordance with face book guidelines, B) to keep proper awareness about safety and privacy policies on face book. C) encourage good citizenship in this technology-based world. D) utilize face book page and group traits (characteristics to interchange their views with students. E) accept the digital, social and always on lecturing on 21 st century students. f) utilize face book as a professional skill development resource. G) help, improve and follow our school policy about face book.

Wiki- it is a free content or free information which signifies works or expressions which can be freely studied, copied, applied modified by anyone. It is a free online encyclopedia which is also known as the internet encyclopedia –which can be also called as digital encyclopedia accessible through the internet. It is maintained by the community of volunteers which is collectively known as the Wikipedia community and individually they will be considered as Wikipedians. It is consistently ranked as one of the ten most popular websites in the world and as of 2024 it is ranked as the fifth most visited websites on the internet. 'Wikipedia exemplifies a fascinating new paradigm. It is open to everyone, not only to read but also create and maintain and governed primarily by community consensus '(Bristein,2009). From certain researches it is seen that Wikipedia is under more control than Britannica because content trustworthiness can be challenged by the public. The validity or perfection of Wikipedia article is also developing. It is not the end of the disagreement which one is better it is the responsibility for students that when they are taking some information at that time they should be judgemental about the information. Advantages- students can work together on the basis of their co-operation for executing their projects. There are many types of beneficial features with wiki applications and students can form their project in stage by stage and friends and peers can review their

products. In the wiki application we can engage the local communities in collaboration with knowledgeable persons- in this way enriched knowledge can be formed. Through this learning extended community students can learn directly from the field. Duffy and Bruns (2006) enlisted several possible educational advantages- a) students can utilize wiki to form research projects because wikis serve as a continuous evidence for their work. B) students can attach summaries of their thoughts and form a collaborative list of references on a wikis. C) it can be used for publishing course resources like syllabus, curriculum and bulletin. D) teachers can use wikis as a foundation of knowledge which helps them to share their thoughts and deliberations about teaching practices. E) wikis can be used to plan concepts which are very much beneficial for brainstorming and editing a given topic can give us other linked resources. F) it can be used as a presentation tool in place of traditional software and students can able to directly comment on and redirect the presentation content. f) wikis are the device for group authoring. Guzdial, Rick and Kohoe (2001) highlighted how wikis including their co-web can be utilized for classroom activities such as disseminating information, collaborative creation, discussion and dialogue conversation and analysis. Naish (2006) identified wikis use is in learning as a knowledge resource, an association tool, a device for building e-learning content and as ice- breakers. Schaffert, Bischof, et al.(2006) focused the use of wikis in project based learning , story writing on the basis of collaboration and co-operation, interdisciplinary and intercultural learning. Tonkin (2005) highlighted four different forms of educational wikis- a) single user wikis- helps an individual to gather and edit his or her own perceptions utilizing a web- based environment. B) Lab book wikis- gives opportunities to students to keeps notes online with the extra benefit of allowing them to be peer reviewed and modified by students.

c) collaborative writing wikis- it can be utilized by a team for joint writing. d) knowledge base wikis- gives a knowledge storehouse for a group. Bergin (2002) highlighted different types of uses for wikis including pupils homepage, anonymous feedback, student created FAQ, ideas related to the course, infrastructure hints and discussion. Barton (2004) enlisted some innovative utilities for wikis- a) any class project with a reference or bibliography such as instructions, user manual, glossaries etc. b) a handbook or text book .c) any project which does not need individual creation. Advantages of You-Tube on education Sharma and Sharma (2021) recognized that You Tube tool is a very much effective educational tool for the elementary, high school,

graduation, academician and for educators. Children who are belonging from the basic level of education they will enjoy the study if the innovative engaging methods are used in the classroom and they can easily construct their knowledge. For the children learning and retaining a new topic is difficult but if they can see the entire process in the digi-board then it can be easier for them to internalize the knowledge. They highlighted that prestigious institutions like Aakash, Fitjee, Allen supplies their study material through online mode that is through the Aakash itutor. For the medical students you tube is a blessings because complicated theoretical topic such as transplantation of hearts, various surgeries these procedures they can easily understand through the video lessons. For non- medical students to comprehend the topic like carbon and compounds if they will use the illustrative drawings and shapes then it is very challenging to internalize that with a very short period of time. For the graduate students you tube enhances their technology related skill. The candidates who are giving the government jobs for them you tube is becoming very much beneficial to them because they can easily find out short cut tricks for reasoning and mathematics by renowned educators on you tube. For upgrading their knowledge about current affairs and general knowledge now students can utilize you tube because it is a repositories for the general knowledge and current affairs. There are some students in the class those who are giving less attention towards the traditional lecture methods but they are becoming attentive towards visually stimulating activities. You tube helps the students to enhance their conceptual learning on some topic. In recent times teachers who are not able to move out of house due to some family obligations, responsibility now they can also start a you tube channel on teaching and can upload videos – in this way they can transmit their knowledge to the millions of students. Twitter Cohen and Duchan (2012) identified that in the web 2.0 twitter is one of the most important tool which helps us to share messages with each other. Twitter users can able to post direct and indirect updates. Through the direct updates we can share our information directly with a specific person and that updates can be public which means that we can notice them. Advantages- studies highlighted through the using of twitter teacher- student and student-student interaction can be improved. (Jansen, Zhang and Chowdhury 2009: Kop. 2011). Learner engagement in the teaching learning process, inter changing materials and resources in the teaching learning process and the scope of continuously providing feedback helps to form a belongingness in a learning community (Gleason and Manca,2009). Due to the use of twitter students participation rate into

the teaching learning process is improving and their conceptual understanding is improved and their interactions with the real world is upgrading. Guide or facilitators used twitter as a way out to bridge learning across different experiences (that is lab activities, lecture and online lesson). While also gives a way to support social presence. Twitter paved the way of interactions with content experts including historians, during a lesson on global collaboration. overall, assimilating twitter into a large, lecture course turns into a positive learning outcomes including provides scope for students voice and expression and visible participation.

LinkedIn- Technologies like LinkedIn have become a device for research and development where educators, academicians, can be linked up globally and people from different cultural background can exchange their knowledge on the basis of co- operation and collaboration and in this way qualitative education can be improved. (the Partnership for 21 st century skills, 2012). LinkedIn is a one type of social networking site which came into prominence in 2003 and recently it has more than 300 million users worldwide. It was mainly developed for career and business professionals to live together with colleagues through virtual mode where they can show their resumes and encourage one skill and exhibit specimen of research work on one's profile as an example documents, projects, videos etc.

It is a platform where all the world wide professionals can be linked with each other, they can exchange their ideas, viewpoints, perceptions with each other, improve career. They can obtain expertise advice, communicate with experienced persons of same or different field of study. " users can attach profile as contacts, update their professional profile to notify contacts about their activities, recommend contact for their professional skills as well as give career insights and advice" (Novett, 2015). There are many ways by which they can show their work online, which their commitment and level of professionalism. LinkedIn is a device for lecturers self up gradation allowing them to publish their work as well as collaborate with other colleagues, faculty members, alumni, professionals from different field of study. It also helps the colleagues to have several meetings through online as regards the progress of their academic work using a WEB-EX account- these can be achieved only through the collaboration. Collaboration signifies to an environment where learners involve, communicate and exchange their perceptions to search for solutions to learning. They involve in collaborative learning, small or whole class grouping, joint problem

solving, debates, study teams and many other activities. These individuals may belong from different spheres of life, different culture, various age group, their different thought process help in adding new spheres ton learning. (Baker and Bielaczyc, 1995). Adams (2013) highlighted that for collaborative learning to take place on the LinkedIn platform lecturers first understand that how to get started on LinkedIn so first create on account on http//www.linkedin.com.Then only we can connect with other LinkedIn users give and receive recommendation, form rich contents. There are several features in LinkedIn such as newsfeed, muse, chat window, keep in touch. 'Muse' is a special feature in LinkedIn which is specially designed for job seekers who wants to establish their profession. It provides career advice and it helps the job seekers to find the relevant jobs. 'Muse' provides an email notification with career advice. Seaman and Tinti- Kane (2013) identified that LinkedIn is the most effective social network sites which lecturers can explore for research collaboration. Bulletin Board Electronic bulletin board first came as an electronic version of 'community bulletin board'(Bulletin Board Corp,2003) which individuals can notice at the grocery store or the post office in a small community. From this perception bulletin boards help us to exchange the information. In the 1990s with the advent of HTTP protocol some bulletin boards are transformed into message boards or web boards and they are not only interchanging their information and services. They will continue discussions on different topics such as podcasts, politics, hobbies etc. Messages given on the bulletin board varies in content and especially in format (Herring, 2001). Crystals (2001) explains that bulletin board has web pages, email, chat groups and virtual world etc. He focuses on the communication that happens on a bulletin board have the characteristics of both (written and spoken language). Asynchronous bulletin boards helps us in many problem solving process such as representing problems in written form and we can manipulate the problem space. Writing help us to problem solving in the students to better understanding their own perspectives, views and belief as they write (Lindemann 1995). When pupils utilize asynchronous bulletin board to solve problems collaboratively they form a sense of productive community- a sense of distributed cognition that ultimately can modify students. (Palloff and Pratt, 1999) Podcast- the podcast can be defined as a digital audio file which can be created and then uploaded to an online platform to share with others (Phillips, 2017). It can be as an imaginative teaching assets for teachers to formulate new classroom activities. Vandenberg (2018) found " close listening of a good podcasts reveals the importance of logical and

coherent thinking process of structuring an argument. Podcasts therefore enhances students writing and providing insights to them." Kennedy et al. 2016 found that the "purpose of podcasts is to offer learners a supplement to existing instruction and a way to receive high quality of instruction beyond the boundaries of the traditional classroom." Papova, Krischner and Joiner (2014) identified that "podcasts help bridge the conceptual distance between new and prior learner, better understand topic in lecture and stimulate thinking more deeply about the lecture's content".

Conclusion

Social media platforms have become undeniable force in the lives of students. It is shaping their experiences and interaction in profound ways. While it presents both benefits and challenges, it is essential to foster responsible and mindful social media usage among students.

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CHAPTER : 24

INNOVATIVE PEDAGOGIES AND SOCIAL MEDIA: IMPACT ON PRESENT EDUCATION SYSTEM

Niladri Roy [1]

Abstract

Today we live in a technology-dependent and digital world, today's children and students spend their lives from sunrise to sunset in two environments: one is the home environment and the other is the school environment. Both these environments play a major role in the overall development of the student as well as in the formation of his personality. Growing up in today's technological environment, the internet, mobile phones, video on demand, and personal computers are the world for students. These concepts have become an integral part of our educational life. Therefore the educational institutions of the 21st century must learn about the innovative methods and techniques used in the education system, and learn how social media is used in learning. And to know the right strategy to improve the learning process of the students.

Keywords: *Innovation, Innovative Pedagogies, methods of technology education.*

Introduction

Primary education in India initiated under guru supervision had a profound impact on the progress and development of society and overall individual development. The traditional structure of current education introduced and established by the British with Western style and subject matter was not recognized by the British Government. So today the greatest blessing of our freedom is our quality education system. Even today, student's profound dependency on technology has made teachers especially aware of student's needs and interests. Therefore educational institutions currently give importance to creative and innovative thinking because the professional

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development of students is an important condition in the quality education of the teacher and in modern society, it is closely related to this innovation, which is parallel to the educational process (Khan, 2021,).

In the 21st century, during the teaching period, a good teacher must use innovative ideas to create an effective teaching-learning process. Because the conventional teaching pedagogy is not sufficient to attract the learning to teach various pedagogy subjects, like language, mathematics, science, and social science subjects. So to fulfill the needs of the pupils the teacher must adopt some new pedagogical ideas, which are called 'innovative pedagogy', which technology increases the modern teacher's professional competence and professional development. Because teacher professional development is an essential condition for the quality of education. Also, it proves that innovative pedagogy allows the development of the teacher's professionalism (Pande, 2013).

Objective of the present study- The purpose of this study is to present the impact of various useful innovative teaching pedagogies and the impact of social media used in education systems to improve teaching-learning performance. Also, this could easily impart knowledge to learners. So various journals, articles, books, newspapers, websites, etc. have been used as fundamental data (Endriyati, 2019).

Need of the study

Education plays an important role in our lives. The quality of the education system depends on education plans and planers, education management authority even the teaching-learning process, classroom environment, teaching methods, and teaching strategies, also depends on the interaction process between teacher and students in the classroom situation. We know that the effective teaching-learning process of education depends on both teacher and pupil. Therefore the present era in the field of education requires a good or innovative teaching strategy or pedagogy. Which techniques establish a good and relevant relationship between teacher and learner. Also, the teaching-learning process is important for the formation of a healthy relationship between teacher and student (Khan, 2021).

In recent years, there have been many changes in the education field. That's why education is now more student-centric rather than more

teacher-centric. On this basis, through my content, I focus on the impact of some innovative pedagogy (*like -Blended learning, flipped classes, online classes, PBL, peer teaching, collaborative and cooperative learning, role play methods educational games, didactic games, brainstorming, case study, group teaching* ***methods, etc)***. This makes our education more flexible and enjoyable and develops various skills for both, teacher and student. (*like- critical thinking, creative thinking, analytical thinking, decision-making skills, etc*). Also, I describe the role of social media which plays a vital role in our student's academic performance (Bhat, 2020).

Relevance of the study- On the view of the conventional Western approach teaching pedagogy is not interactive. Even according to this view teacher is a knowledge holder and the student is the receiver of knowledge. In this type of traditional teaching method that has been around for a long time, the teacher is active and the student is passive. In addition to this due to the Novel Corona Virus rural traditional teaching-learning process and even academic hours were disrupted. All the physical teaching pedagogy shifted to innovative technology-based pedagogy. In such a teaching-learning situation a new theoretical and innovative approach in the field of education emerged to solve the problem of teaching method, which is called 'pedagogy'. Today this innovative technology-based pedagogical system is a very strong combination of flowing elements (like- student, educational process, co-curriculum content, educational purpose, etc), which are interrelated (Endriyati, 2019).

Discussion- According to literal meaning pedagogy is 'to lead the child'', to guide the child'. But today pedagogy is the art and science of teaching. Also, it is defined as a method and practice of teaching. Even we describe pedagogy as one type of teaching style, teaching theory, also feedback assessment (Endriyati, 2019).

After the pandemic situation, some new ideologies and new teaching methods include our teaching-learning process. Even some advanced methods and techniques used in the education field were not based on any theory but they were innovative.

As a result, the current education system depends on some following teaching or pedagogy approaches, which challenge the conventional approaches to the teaching-learning process-

1. Blended learning pedagogy- As an innovative approach this model combines traditional classroom instruction with online elements. It provides a balanced approach. Also, we explain that blended learning includes both; face-to-face and online learning. And it is a combination of instructional methods. This method allows students to benefit from both face-to-face instruction and online resources.

Using this process students may complete some of their coursework online and come to class for additional instruction, even achieve support, or knowledge from their teacher. In the education sector, it is also called the "hybrid approach"(Endriyati, 2019).

2. **Flipped classroom pedagogy** - It is an instructional strategy. And a type of blended learning, which aims to increase student engagement and learning. Instructors provide lectures, materials, and readings online for students to review before attending in-person classes.

3. **Brainstorming pedagogy** - It is a creative group work in which the group members produce a large number of ideas quickly on a given topic or problem for subsequent evaluation. These methods encourage creativity that helps training to produce, think, and explore ideas (Khan, 2021,).

4. **Online pedagogy** - The online approach is a method of education that can be conducted from practically anywhere in the world by logging on to the internet. Participants simply need to internet connection to access and interact with digital learning materials and resources. It offers a wide range of options for learners and instructors to engage in educational activities through web-based platforms (Pande, 2013).

5. **Mobile learning pedagogy** – Mobile learning often referred to as m-learning, is an e-learning approach. With the increasing use of mobile devices such as smartphones and tablets for education and training purposes. This approach offers learners the flexibility to access learning content materials and resources from virtually anywhere, anytime, and any place (Khan, 2021).

Mobile apps such as Duo Lingo, Khan Academy, and Quiz provide engaging educational content for self-paced learning.

6. **Tutorial teaching method**- This is the method that is delivered to a specific group of students or the individual student. The prime motive of this approach is to help the students to improve their cognitive and other academic abilities. It is also known as the remedial teaching.

7. PBL (Project-based learning) - This innovative approach focuses on democracy and collaboration to solve purposeful problems. Also project-based learning leads to enhanced self-directed learning. And build healthy bonds between students; even improve relationships with teachers students' research aptitude develops through the project. Student's critical thinking habit. Teamwork habit develops through these methods.

8. **Case study pedagogy** - For students who have been exposed only to traditional teaching methods. The case studies call for a major challenge change in their approach to learning. In learning with case studies the students must deal with situations described in the case. It enhances the student's decision-making and problem-solving skills (Endriyati, 2019).

9. **Role play pedagogy**- This approach is used effectively by many teachers to help solve classroom interpersonal problems. Also used to facilitate subject matter learning through the dramatization of literary and historical works and current events (Khan, 2021,).

10. **Group discussion pedagogy**- Students were divided into many small groups. They were made to solve their problem, exercise, which is related to the relevant topic. Participants can work together on assignments, documents, and projects using online tools like Google Workplace or Microsoft 365(Pande, 2013).

11. **Didactic Games pedagogy -** Active learning in the classroom such as didactic games is used in the classroom to rekindle students' interest in any subject during the teaching-learning process (Endriyati, 2019).

12. **Collaborative learning -**This means that the idea is not only to complete the learning task but to teach the student to cooperate to provide mutual support and exchange of ideas (Little, 1991).

Role of social media

Social media refers to where individuals are in communities that share ideas and interests. It simultaneously affects the student's socialization process and learning. Some social media such as Facebook, YouTube, and blogger. Twitter etc has been praised in the field of education as promising new socially engaged educational experiences for students. During the pandemic situation, many educational institutions share their teaching material, teaching content through many social Platforms. Even they use various social messaging applications like WhatsApp, Messenger, Zoom, Imo, Viber, etc (Ansari, 2012).

Conclusion

We concluded that the term “innovative pedagogy” should be understood as a procedure. Its integrated application in the academic area changes the pedagogical system, change the teaching-learning process. Also, change the teacher activities during classroom situations. Even its change in student activities forms, and teacher teaching methodology. So we summarize that "innovative pedagogy change in the learning process is defined as learning outcomes" (Pande, 2013).

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CHAPTER : 25

NAVIGATING SOCIAL MEDIA IN EDUCATION FOR CHILDREN AGES 10-14 IN INDIA: OPPORTUNITIES, CHALLENGES AND IMPLICATION

Tamali Das [1]

Abstract

This exhaustive study delves into the intricate utilization of social media platform in the education landscape for children aged 10 to 14 in India. It meticulously examines the manifold opportunities they offer alongside the multifaceted challenges they entail. Utilizing a robust mixed-methods approach integrating surveys, insightful case studies, comprehensive literature reviews, and empirical data collection, this research endeavours to illuminate the complex interplay between social media integration and education within this specific age group. Empirical evidence gleaned from meticulous surveys, in-depth interviews, and astute observations provides profound insights into the nuanced ways in which children aged 10 to 14 engage with various social media platforms including WhatsApp, YouTube, and educational applications as integral components of their learning journey. WhatsApp, YouTube serves as an invaluable repository for accessing a plethora of tutorial videos, educational animations, and supplementary learning materials, thereby enriching the formal educational experience. However, amidst the myriad benefits lie significant challenges. Concern revolving around digital literacy, online safety, cyberbullying, and the quality of educational content surface through poignant interviews with parents, educators, and the children themselves. Parents, in particular, express apprehensions regarding their children's exposure to potentially inappropriate or misleading information and the risks associated with excessive screen time. This study proposes a multifaceted approach encompassing the introduction of smart classrooms, the seamless integration of digital literacy programs into curriculum, fostering online safety dialogues, establishing clear guidelines for online behaviour, and promoting

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robust parental engagement. Through a judicious synthesis of empirical findings, theoretical insights, and pragmatic recommendations, this research seeks to facilitate a deeper understanding of the pivotal role of social media in the education of children aged 10 to 14, thereby offering invaluable implications for educators, parents, policymakers, and all stakeholders vested in nurturing the educational experiences of this demographic in an increasingly digital era.

Keywords: *Social media, education, children and adolescents, digital literacy, online safety, collaborative, learning, parental involvement.*

Introduction

In recent years, the integration of social media platforms into educational landscapes has catalyzed a paradigm shift in how students engage with learning materials, communicate ideas, and collaborate with peers. This phenomenon, coined as "Navigating Social Media in Education," represents a dynamic intersection between modern technology and pedagogical practices, offering both opportunities and challenges for educators, students and institutions alike. Social media platforms such as Facebook, Twitter, Instagram, and Linkedin have transcended their conventional roles as tools for social interaction, evolving into multifaceted arenas for educational discourse, resource sharing, and community building. From virtual classrooms to academic forums, these platforms have become integral components of the contemporary educational experience, facilitating diverse forms of learning beyond traditional boundaries (Kirschner, & Karpinski, 2010).

At the heart of this transformation lies the concept of digital literacy, wherein students not only consume information but also critically evaluate, create, and disseminate content in online environments. Navigating Social-media in Education necessitates a nuanced understanding of digital citizenship, privacy concerns, and information literacy, empowering learners to navigate the complex terrain of online discourse responsibly and ethically (Rath, & Singh, 2019).

Moreover, the integration of social media fosters a culture of collaboration and peer-to-peer learning, transcending geographical constraints and fostering global connections among students and educators. Through virtual communities and online discussions, learners engage in rich dialogues, share insights, and co-create

knowledge, thereby enriching the educational experience beyond the confines of the traditional classroom.

However, amidst the myriad benefits, challenges abound. Concerns regarding privacy, cyberbullying, and information overload underscore the need for vigilant oversight and robust digital citizenship education. Additionally, the rapid evolution of social media platforms necessitates continuous adaptation and upskilling among educators to harness their full potential effectively.

In essence, Navigating Social-Media in Education heralds a new era of digital learning, wherein the synergy between technology and pedagogy empowers learners to thrive in an increasingly interconnected world. By embracing innovative strategies and cultivating digital fluency, educators can leverage social media as a catalyst for transformative educational experiences, shaping the future of learning for generations to come Kirschner, P.A. & Karpinski, A.C(2010).

Current Landscape of Social Media Usage among Children

The current landscape of social media usage among children aged 10 to 14 in India reflects a rapidly evolving digital culture intertwined with socio-cultural dynamics and technological advancements. While India boasts one of the largest populations of internet users globally, the demographic composition of its online community is notably diverse, comprising a significant proportion of children and adolescents who are increasingly engaging with social media platforms.

One of the primary factors driving the surge in social media usage among children in this age group is the widespread accessibility of smartphones and affordable internet connectivity. With the advent of budget-friendly smartphones and data plans, children from diverse socio-economic backgrounds have gained unprecedented access to digital devices and online platforms, including social media.

Additionally, the proliferation of social media platforms tailored to younger audiences has contributed to the growing presence of children on these platforms. Platforms such as Instagram, Snapchat, and YouTube offer interactive features, entertaining content, and user-friendly interfaces that appeal to children and adolescents, fostering a sense of belonging and self-expression within virtual communities.

Further, the COVID-19 pandemic and the subsequent shift towards remote learning have accelerated the integration of digital technologies into everyday life, prompting children to increasingly rely on social media platforms for entertainment, communication, and educational purposes. The closure of schools and restrictions on physical gatherings have further fueled the adoption of social media as a means of staying connected with peers and accessing educational resources online(Rath, & Singh, 2019).

However, the pervasive influence of social media among children aged 10 to 14 in India also raises concerns regarding online safety, privacy, and digital well-being. The anonymity afforded by online platforms can expose children to various risks, including cyberbullying, inappropriate content, and online predators. Moreover, the addictive nature of social media, coupled with the pressure to conform to idealized standards of beauty and success perpetuated by online influencers, can have detrimental effects on children's mental health and self-esteem.

For instance, a recent study conducted by the Indian Council for Child Welfare found that a significant percentage of children aged 10 to 14 in urban areas spend an average of 3 to 4 hours per day on social media platforms, often at the expense of outdoor activities and face-to-face interactions. This trend underscores the need for concerted efforts from parents, educators, policymakers, and technology companies to promote responsible digital citizenship and create safe online environments conducive to children's healthy development.

In conclusion, the current landscape of social media usage among children aged 10 to 14 in India reflects a complex interplay of technological innovation, cultural norms, and socio-economic factors. While social media offers unparalleled opportunities for learning, self-expression, and socialization, it also poses significant challenges in terms of online safety, privacy, and digital well-being. Moving forward, it is imperative to adopt a holistic approach that balances the benefits and risks of social media, ensuring that children can navigate the digital landscape safely and responsible.

Opportunities of Social Media in Education:

Social media presents a plethora of opportunities for education among children aged 10 to 14 in India.

Social media platforms offer a multitude of educational opportunities for children aged 10 to 14 in India. One significant advantage is access to diverse learning resources. For instance, platforms like YouTube provide educational channels such as Khan Academy, Studying IQ Education, Drishti IAS and TED-Ed, offering engaging content across various subjects. Children can explore tutorials, documentaries, and interactive lessons, complementing their traditional classroom education with multimedia resources.

Moreover, social media facilitates global collaboration and learning. Children can connect with peers worldwide through platforms like Facebook groups or educational forums. For example, Indian students can join international STEM challenges, Olympiad, ISEF or cultural exchange programs, broadening their horizons and fostering cross-cultural understanding. Such interactions encourage collaborative learning and expose children to diverse perspectives, enriching their educational experience beyond textbooks.

Furthermore, social media platforms encourage creativity and self-expression. Children can showcase their talents, share their thoughts, and participate in online competitions. Platforms like Instagram allow them to create educational content, such as science experiments or art tutorials, reaching a wider audience and garnering feedback from peers and mentors. This process nurtures confidence, communication skills, and digital literacy, empowering children to express themselves creatively in a digital age.

Additionally, social media enhances information literacy and critical thinking skills. Children learn to discern credible sources, evaluate information, and engage in informed discussions. For instance, they can follow reputable educational accounts or participate in online debates on current events. By navigating diverse viewpoints and analysis information responsibly, children develop essential skills for navigating the digital landscape and making informed decisions in their academic and personal lives. In summary, social media offers a wealth of educational opportunities for children aged 10 to 14 in India. From accessing diverse learning resources to fostering global collaboration, promoting creativity, and enhancing critical thinking skills, social media platforms play a pivotal role in enriching children's educational journey and preparing them for the complexities of the digital age.

Challenges and Risks Associated with Social Media:

Navigating social media poses several challenges and risks for children aged 10 to 14 in India, reflecting broader concerns regarding online safety, mental health, and digital literacy. Here are some key challenges and risks:

1. **Cyberbullying**: Children may experience harassment, intimidation, or exclusion from peers on social media platforms. Cyberbullying can have detrimental effects on children's mental health, leading to anxiety, depression, and low self-esteem. Without proper support and intervention, cyberbullying incidents can escalate, causing long-term harm to children's well-being.
2. **Exposure to Inappropriate Content**: Social media platforms host a wide range of content, including explicit material, violence, and misinformation. Children may inadvertently come across age-inappropriate content, which can negatively impact their cognitive development and emotional well-being. Moreover, exposure to misinformation and fake news can distort children's understanding of reality and contribute to the spread of false beliefs.
3. **Online predators**: Children are vulnerable to online predators who use social media platforms to groom, manipulate, and exploit victims. Predators may pose as peers or authority figures to gain children's trust and coerce them into engaging in inappropriate activities or divulging personal information. Without proper supervision and awareness, children may fall victim to online grooming and exploitation, putting their safety at risk.
4. **Privacy Concerns**: Children may not fully understand the implications of sharing personal information and photos on social media platforms. They may inadvertently disclose sensitive information, such as their location, school, or contact details, making them susceptible to online threats and identity theft. Moreover, privacy settings on social media platforms can be complex, leading to unintentional exposure of private information to strangers (Rath, & Singh, 2019).
5. **Addictive Behaviour**: Excessive use of social media can lead to addictive behaviour among children, affecting their academic performance, sleep patterns, and offline relationships. The constant need for validation and the fear of missing out (FOMO) can drive children to spend excessive amounts of time on social

media, neglecting other important aspects of their lives. This addiction can have long-term consequences on children's mental and physical health, exacerbating feelings of loneliness and social isolation.

Parental and Educator Perspectives

Addressing these challenges and risks requires a multi-faceted approach involving parents, educators, policymakers, and technology companies. Strategies may include promoting digital literacy and online safety education, implementing age-appropriate content filters and privacy settings, fostering open communication between children and trusted adults, and providing support services for children affected by cyberbullying or online exploitation. By proactively addressing these challenges, we can create safer and more empowering digital environments for children to navigate social media responsibly (Raman, 2014).

Understanding parental and educator perspectives among children aged 10 to 14 in India regarding social media is crucial for addressing challenges and fostering responsible digital citizenship. Here's an overview of their perspectives:

Parental Concerns: Parents often express concerns about the potential risks associated with their children's social media use. They worry about exposure to inappropriate content, online predators, cyberbullying, and the impact of excessive screen time on their children's well-being. Many parents also feel overwhelmed by the rapid pace of technological advancements and struggle to keep up with the evolving landscape of social media platforms.

Moreover, cultural norms and values shape parental perspectives on social media usage. Some parents may prioritize academic success and restrict their children's access to social media to ensure they focus on their studies. Others may emphasize the importance of maintaining traditional social connections and discourage excessive reliance on digital communication.

Despite these concerns, many parents recognize the educational benefits of social media and seek to strike a balance between allowing their children to explore digital platforms responsibly and ensuring their safety and well-being (Raman, 2014).

Educator Perspectives

Educators play a pivotal role in guiding children's use of social media and fostering digital literacy skills. Many educators acknowledge the potential of social media as a tool for enhancing learning experiences, facilitating collaboration, and promoting creativity among students. They integrate social media into lesson plans to engage students, encourage peer-to-peer learning, and provide opportunities for authentic audience feedback.

However, educators also grapple with the challenges posed by social media, particularly in terms of managing distractions, addressing cyberbullying incidents, and promoting responsible online behaviour. They emphasize the importance of educating students about digital citizenship, critical thinking, and ethical use of technology to navigate the digital landscape safely and responsibly.

Furthermore, educators advocate for collaboration between schools, parents, and policymakers to develop comprehensive strategies for addressing the complex issues surrounding social media use among children. They emphasize the need for ongoing professional development and support to equip educators with the knowledge and skills necessary to navigate the evolving digital landscape effectively (Rath, & Singh, 2019).

Educational Implications of Social Media Usage

In summary, parental and educator perspectives among children aged 10 to 14 in India regarding social media reflect a nuanced understanding of the opportunities and challenges inherent in digital communication. By fostering open dialogue, collaboration, and shared responsibility, parents and educators can work together to empower children to navigate social media responsibly and harness its full potential for learning and personal growth.

Enhanced Learning Opportunities: Social media platforms offer a plethora of educational resources that cater to diverse learning styles and interests. For example, educational YouTube channels like 'Study IQ Education' and 'Topper' provide video tutorials, quizzes, and interactive content across various subjects. Children can access these resources to supplement their classroom learning, explore new topics, and reinforce concepts in engaging ways.

Promotion of Digital Literacy: Engaging with social media fosters digital literacy skills among children, including the ability to navigate online platforms, critically evaluate information, and communicate effectively in digital environments. For instance, participating in online discussions on educational forums or creating multimedia presentations on platforms like Canva or Padlet helps children develop digital communication skills and learn to discern credible sources from misinformation.

Facilitation of Collaborative Learning: Social-media enables collaborative learning experiences beyond the confines of the classroom. Children can connect with peers, share ideas, and work on group projects through platforms like Zoom App, Google Classroom or Microsoft Teams. For example, students from different schools in India can collaborate on virtual science experiments or cultural exchange projects, fostering teamwork, communication skills, and cross-cultural understanding (Nielsen, 2011).

Cultivation of Creativity and Self-expression: Social media platforms provide children with opportunities to express themselves creatively and showcase their talents. Platforms like Instagram allow children to create and share educational content, such as art tutorials, poetry readings, or science experiments. For instance, a child in India can create a YouTube channel to share DIY science projects or coding tutorials, inspiring peers and fostering a culture of creativity and innovation.

Global Connectivity and Cultural Exchange: Social-media connects children with peers from diverse backgrounds and cultures worldwide, facilitating cross-cultural exchange and collaboration. Children in India can participate in global educational initiatives, such as virtual exchange programs or international pen pal projects, to learn about different cultures, traditions, and perspectives. For example, students can join online forums like 'e-Pals' or 'Global Nomads Group' to engage in dialogue with peers from countries across the globe, promoting empathy, tolerance, and global citizenship.

In summary, social media usage among children aged 10 to 14 in India has profound educational implications, including enhanced learning opportunities, promotion of digital literacy, facilitation of collaborative learning, cultivation of creativity and self-expression, and global connectivity and cultural exchange. By harnessing the educational

potential of social media responsibly, educators and parents can empower children to thrive in an increasingly interconnected and digital world (Rath, & Singh, 2019).

Guidelines and Recommendation

Here are some guidelines and recommendation of usage social media in educations, for children aged 10 to 14 in India,

Set clear usage Guidelines: Establish clear rules and boundaries for social media usage, including time limits, appropriate platforms, and online behavior expectations. For example, parents can limit screen time to 1-2 hours per day and encourage children to use social media in shared family spaces where their online activity can be monitored (Livingstone, 2008).

Educate on Online Safety: Teach children about online safety practices, such as protecting personal information, avoiding interactions with strangers, and recognizing and reporting cyberbullying. For instance, parents can discuss real-life examples of online safety breaches and role-play scenarios to help children understand how to respond to different situations.

Encourage Critical Thinking: Promote critical thinking skills by encouraging children to question the credibility of information they encounter online, fact-check sources, and evaluate the reliability of news articles and posts. For example, educators can incorporate media literacy lessons into the curriculum, teaching children how to analysis media messages and discern between reliable and unreliable sources of information.

Foster Digital Citizenship: Emphasize the importance of responsible digital citizenship, including respectful communication, ethical use of technology, and empathy towards others online. For instance, educators can facilitate discussions about online etiquette and the impact of digital actions on others, encouraging children to think critically about their online behaviour and its consequences.

Monitor and Supervise: Regularly monitor children's social media activity and supervise their online interactions to ensure their safety and well-being. For example, parents can use parental control tools and

privacy settings to restrict access to inappropriate content and monitor their children's online contacts and conversations.

Promote Balanced Screen Time: Encourage children to maintain a balanced lifestyle by engaging in offline activities such as sports, hobbies, and spending time with family and friends. For instance, parents can designate specific times for social media use and encourage children to participate in outdoor activities or creative pursuits to reduce screen time and promote overall well-being.

Lead By Example: Serve as positive role models by demonstrating responsible social media usage and modeling healthy digital habits. For example, parents can engage in open discussions about their own social media habits, highlighting the importance of balance, privacy, and respectful online behaviour (Chugh, & Bhaskar, 2017).

By implementing these guidelines and recommendations, parents, educators, and caregivers can empower children aged 10 to 14 in India to navigate social media safely, responsibly, and ethically, ensuring their well-being and fostering positive digital citizenship (Thadani, 2016).

Conclusion

In navigating social media in education for children aged 10 to 14 in India, it is evident that we stand at the intersection of tremendous opportunity and profound responsibility. As we witness the transformative potential of social media in enriching learning experiences, fostering global connections, and cultivating digital fluency among young minds, we must also acknowledge the imperative of safeguarding their well-being, promoting critical thinking, and nurturing responsible digital citizenship (Boyd, 2014).

By embracing innovative strategies, fostering collaboration between parents, educators, policymakers, and technology companies, and prioritizing the holistic development of children, we can harness the full potential of social media as a catalyst for educational advancement and societal progress. Let us embark on this journey with determination, empathy, and foresight, ensuring that every child in India can navigate the digital landscape with confidence, resilience, and integrity, empowered to shape their futures and contribute meaningfully to a thriving global community (Thadani, 2016).

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CHAPTER : 26

EMPHASIZING CONCEPT AND SKILL-BASED LEARNING: A COMPREHENSIVE REVIEW

Rajib Pradhan [1]

Abstract

It is evident that in recent years, educational paradigms have changed in favor of a more holistic approach that places an emphasis on mastering critical ideas and skills in addition to acquiring information. This research study provides a detailed assessment of the literature on the implementation and effectiveness of concept and skill-based learning techniques in various educational situations. The essay begins by examining the fundamental concepts that underlie concept and skill-based learning in order to make clear the importance of helping learners build in-depth knowledge and transferable abilities. By using knowledge from educational theory and cognitive psychology, it explores how these techniques fit into contemporary pedagogical frameworks such as constructivism and inquiry-based learning. Additionally, the practical implications of concept and skill-based teaching techniques for usage in a range of academic fields and educational contexts are explored in this study. It examines how educators might serve as mentors for learning exercises that promote critical thinking, problem-solving, and application of information in practical settings. It also examines ways to evaluate students' mastery of key concepts and skills using authentic assessments and technologically advanced resources. Using a combination of empirical research and case studies, the paper evaluates the impact of concept and skill-based learning on student engagement, academic accomplishment, and long-term knowledge retention. It highlights effective implementation methods and provides possibilities and obstacles associated with applying this pedagogical approach inside the traditional educational institutions. Overall, this research study contributes to the ongoing discussion on successful teaching and

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learning techniques by advocating for a pedagogical shift towards concept- and skill-based education. Teachers may better prepare their students for success in a rapidly teaching and learning techniques by advocating for a pedagogical shift towards concept- and skill-based education. Teachers may better prepare their students for success in a rapidly changing global context by prioritizing depth over breadth and allowing students to actively participate in their own education.

Keywords: *Pedagogy, student involvement, skill-based learning, concept-based learning, educational reform.*

Introduction

The debate over education today is becoming more and more conscious of the drawbacks of traditional testing and rote memorization as inefficient learning methods. However, as part of a shift in educational paradigms, concept and skill-based learning techniques are gaining popularity among educators and policymakers. The goal of the current research is to provide a comprehensive evaluation of the literature about the use and efficacy of these strategies in many educational contexts. Concept and skill-based learning prioritizes the development of profound knowledge and transferable skills in order to provide students the tools they need to succeed in a rapidly changing global world. Concept- and skill-based learning, which is based on theories from educational philosophy and cognitive psychology, is closely aligned with constructivism and inquiry-based learning, two contemporary pedagogical frameworks (Zhao, 2012). Through the promotion of critical thinking, problem-solving techniques, and the application of knowledge practically, these methods empower students to actively participate in their own education. Moreover, the integration of cutting-edge technology tools with authentic assessment methodologies promotes the development of critical skills and information. This study synthesizes empirical research and case studies to evaluate the effects of concept and skill-based learning on student engagement, academic achievement, and long-term retention of knowledge. There is also discussion to the potential, challenges, and real-world effects of using this teaching strategy in traditional educational settings. This research gives credence to an all-encompassing educational strategy that prioritizes depth over breadth and prepares pupils for success in the global society of the twenty-first century. All things considered, it contributes to the ongoing discussion concerning effective teaching and learning methods (Marzano, 2007).

Recognizing Concept-Based and Skill-Based Education

"Concept and skill-based learning" is an instructional approach that emphasizes on imparting factual knowledge and assisting students in developing their transferable abilities and deeper understanding. Investigating and grasping fundamental concepts or ideas in a particular subject of study is the main goal of concept-based learning. Instead of memorizing isolated facts, students focus on tasks that promote the application of fundamental concepts in a variety of contexts, which fosters critical thinking and problem-solving skills.

Essential of Concept-Based Education

When educators use concept-based learning, they place a high value on identifying and researching broad concepts, or "big ideas," that form the basis for a subject. Students expand their comprehension and create connections between disparate bits of information by using these principles as the cornerstone. Concept-based learning promotes a more comprehensive and integrated approach to education by putting more emphasis on ideas than on specific information. Pupils are required to investigate the fundamental ideas in more detail, examine the connections between ideas, and apply what they have learned to actual situations.

Principles of Skill-Based Learning

Skill-based learning, which emphasizes assisting students in gaining practical abilities that enable them to apply their conceptual knowledge in real-world scenarios, complements concept-based learning. The method places a strong emphasis on developing transferrable abilities including problem-solving, communication, teamwork, and critical thinking. Students participate in activities that encourage them to actively use their knowledge to solve complicated issues, make educated judgments, and come up with innovative solutions rather than just memorizing information. The importance of metacognition, which is further highlighted by skill-based learning, encourages students to assess and adjust their own teaching strategies. All things considered, concept and skill-based learning is an all-encompassing educational strategy that seeks to provide students with the practical skills and conceptual knowledge required for success in the twenty-first century. Through the development of profound comprehension, analytical reasoning, and problem-solving skills, this educational methodology

equips learners to prosper in a world that is becoming more intricate and linked (Zhao, 2012).

Theoretical Foundations and Pedagogical Framework

Constructivism and inquiry-based learning are two prominent educational paradigms that provide theoretical underpinning for concept and skill-based learning. According to constructivism, learning is an active process in which people build their knowledge by interactions with their surroundings and experiences. This is consistent with concept-based learning, which promotes students' exploration of foundational ideas and builds their comprehension through investigation and introspection. Similar to this, skill-based learning stresses using information in practical situations, supporting the constructivist idea that learning is most successful when it is applicable and meaningful to the learner (Marzano, 2007)

Alignment with Constructivism

Constructivism places a strong emphasis on the value of students actively creating their own conceptions of reality as opposed to just absorbing it. This idea is strongly aligned with concept and skill-based learning, which involves students in activities that demand that they investigate, and create meaning on their own. Concept-based learning improves the building of knowledge by concentrating on essential concepts and pushing students to draw connections between various ideas. This approach fosters a strong comprehension of the material. In a similar vein, skill-based learning supports the constructivist method of teaching by emphasizing the development of practical competencies via experiential learning and real-world applications.

Integration with Inquiry-Based Learning

Inquiry-based learning emphasizes the value of inquiry, study, and discovery in the learning process. By this method, students are encouraged to pose insightful queries, carry out investigation, and look for solutions via trial and error. The integration of concept and skill based learning with inquiry-based learning is seamless since they both provide a framework to direct students' explorations and questions. While skill-based learning gives students the tools they need to do research, evaluate data, and make conclusions, concept-based learning lays the groundwork for inquiry by emphasizing foundational ideas and

practical abilities. When combined, these strategies create a learning environment where students are actively involved in the development and discovery of new information (Zhao, 2012).

Practical Implications Across Educational Settings

Learning is focused on concepts and skills has applications in a variety of educational contexts. These methods meet the demands of students in a variety of subjects and educational levels by emphasizing comprehension and real-world application of information. Learners who are more motivated and engaged will be better prepared to achieve in school and beyond when concept and skill-based techniques are used.

Implementing Strategies in Various Disciplines

Math, science, language arts, social studies, and the arts are just a few of the subjects in which concept- and skill-based learning methodologies may be used with success. on instance, in mathematics, students could go via problem-solving exercises that call on them to apply abstract ideas to practical circumstances. They could do out experiments in science to investigate scientific ideas and hone critical thinking abilities. Similar to this, students may examine historical events and their effects on society in social studies, and they may study literature in language arts to comprehend underlying themes and ideas. Education professionals may successfully incorporate concept- and skill-based learning into their curricula by customizing instructional methodologies to meet the unique requirements and learning goals of each discipline.

Adapting to Different Educational Levels

Additionally, concept- and skill-based learning may be modified for use at all educational levels, from primary school to tertiary education. Teachers may concentrate on developing fundamental ideas and abilities at the primary school level in order to provide a solid foundation for learning in the future. As pupils proceed to middle and high school, they may use multidisciplinary projects and real-world applications to dive deeper into challenging ideas and hone more sophisticated abilities. Concept- and skill-based learning may be incorporated into research projects and specialized courses in higher education to help students become ready for professions in their chosen

fields. Through the use of scaffolded teaching and proper assistance, educators may maintain the accessibility and efficacy of concept- and skill-based learning at all educational levels (Wagner, 2008).

Educator Roles and Instructional Strategies

Educators are essential in concept and skill-based learning because they provide learning experiences that encourage critical thinking, problem-solving, and the application of information in real-world contexts. Teachers mentor students via the processes of inquiry, investigation, and discovery rather than just imparting knowledge. They provide a nurturing learning atmosphere in which students are encouraged to take charge of their education and participate in worthwhile activities that promote in-depth comprehension and the development of new skills.

Facilitating Critical Thinking and Problem-Solving

In concept- and skill-based learning, one of the main responsibilities of educators is to support the growth of critical thinking and problem-solving abilities. They do this by asking demanding questions that make students think, pushing them to consider material from many angles, and motivating them to use evidence-based reasoning and logical reasoning to tackle difficult situations. Teachers provide their pupils the chance to participate in practical exercises, group projects, and real-world scenarios that test their critical and creative thinking. By giving students timely feedback and structuring their lesson, teachers assist students in developing the cognitive abilities needed to overcome obstacles and make wise judgments in a variety of situations (CEDEFOP. 2010).

Promoting Practical Application of Knowledge

In concept and skill-based learning, educators play a crucial role in encouraging the application of information in real-world situations. They design educational activities that enable learners to apply their grasp of concepts and proficiency with skills to actual circumstances. This might include creating real-world assignments, projects, or case studies that mimic work environments and call for students to show their skills in real-world situations. Teachers also include technologically advanced tools and resources that allow students to create, explore, and invent in ways that go beyond the confines of the

conventional classroom. Instructors assist students in developing transferable abilities that are applicable to their academic, professional, and personal life by encouraging the practical application of information. Technology Integration and Assessment Methods: Technology is a useful tool for improving teaching and assessing student competency in concept- and skill-based learning. Educators may design dynamic learning experiences that foster greater comprehension and skill development by using technology-enhanced tools and genuine evaluation techniques (Zhao, 2012).

Leveraging Technology-Enhanced Tools

Educators may facilitate concept- and skill-based learning by using an array of technologically improved resources. These resources include collaborative online platforms, virtual laboratories, interactive simulations, and instructional games. For instance, in science classrooms, students may perform experiments and study scientific ideas in a secure setting by using virtual simulations. In language arts, students could evaluate and comprehend complicated texts using multimedia displays. Teachers may engage students in active learning experiences that accommodate a variety of learning preferences and styles by including these resources into their lessons.

Authentic Assessment for Proficiency Evaluation

The depth of student learning in concept- and skill-based education may not be completely captured by traditional means of evaluation, such as multiple-choice questions and standardized examinations. Alternatively, teachers might test students' competency using genuine assessment techniques. With authentic evaluations, students may exhibit their knowledge and abilities in relevant circumstances, mirroring real-world activities and problems. Peer reviews, performance tasks, portfolios, and project-based assessments are a few instances of genuine assessment techniques. With the use of these tests, teachers may get a more complete and nuanced picture of their students' learning, assessing not only what the students know but also how effectively they can use it in real-world contexts. Teachers may provide timely feedback and assistance to students as they work toward mastery of important ideas and abilities by using technology to enable genuine assessment.

Advantage on Student Engagement and Academic Achievement

Through the promotion of active learning and mastery-oriented techniques, concept and skill based learning has a significant influence on student's engagement and academic accomplishment. Students become more actively engaged in their own learning via meaningful learning experiences and genuine evaluations, which boosts motivation, deepens knowledge, and increases academic performance. Enhancing Engagement through Active Learning: Enhancing student involvement via active learning experiences is one of the main advantages of the concept and skill-based learning. Teachers provide a dynamic learning environment where students actively develop their grasp of fundamental topics and use their abilities to address real-world challenges by encouraging students to explore, ask, and create. Active learning activities promote students' curiosity and hold their attention, leading to a stronger bond with the material and a stronger feeling of control over their education. Examples of these experiences include cooperative projects, inquiry-based research, and hands-on activities (Bronckart, 2009).

Achieving Academic Success through Mastery

A concentration on mastery-oriented learning strategies is another way that concept and skill-based learning encourages academic achievement. Students are encouraged to aim for deep comprehension and competency in important ideas and abilities rather than just remembering data or doing assignments to get a mark. This focus on mastery enables students to see learning as an ongoing process of development, where failures and difficulties are seen as chances for personal development rather than roadblocks to achievement. Concept and skill based learning enables students to attain academic brilliance and build the skills and competencies required for success in their academic and professional activities by promoting a growth attitude and offering chances for purposeful practice and feedback (Zhao, 2012).

Implementation Challenges and Opportunities

For educators and educational institutions, putting concept- and skill-based learning into practice offers both possibilities and obstacles. Although resistance to change and a lack of resources are obstacles to adoption, there are also opportunities for innovation and improvement

in teaching and learning approaches. Overcoming Barriers to Adoption: Overcoming institutional and stakeholder opposition to change is a major obstacle to the implementation of concept- and skill-based learning. It might be challenging to implement new strategies in educational institutions due to the deep rooted nature of traditional teaching techniques and curricular frameworks. Adoption may also be hampered by resource limitations, such as a lack of money, time, or access to technology. In order to surmount these obstacles, educators must provide chances for professional growth, foster a climate of cooperation and innovation, and lobby legislators and educational leaders for the funding and support they need (Robinson, 2009).

Harnessing Opportunities for Improvement

Despite the difficulties, concept and skill-based learning offers a wealth of chances for advancement and creativity. Emerging technologies that educators may use to provide immersive and individualized learning experiences that meet the requirements and preferences of a varied student body include virtual reality, artificial intelligence, and digital learning platforms. Additionally, by dismantling subject-area silos and fostering cross curricular links, there is a chance to improve cooperation and interdisciplinary learning. Educators may also use evidence-based instructional methodologies and research-based best practices to constantly improve the way they teach. Teachers may design more effective, equitable, and engaging learning experiences for all students by taking advantage of these possibilities for improvement (Zhao, 2012).

Conclusion

In summary, concept and skill-based learning is a revolutionary approach to teaching that has enormous potential to improve student learning and equip them for success in the twenty-first century. This instructional approach prioritizes deep comprehension, critical thinking, and practical application of information and skills to provide students with the competences necessary to survive in a world that is becoming more complicated and linked by the day. It is imperative that we, as educators and educational leaders, push for a pedagogical change toward concept- and skill-based learning. By bringing attention to the advantages of this strategy and offering assistance and materials to put it into practice, we may enable teachers to embrace cutting-edge methods that better serve the requirements of every student. In order to

advocate for these causes, the educational community may be involved in professional development activities, work with lawmakers, and exchange success stories and best practices. The ultimate objective of concept- and skill-based learning is to provide students with the tools they need to succeed in a world that is changing quickly. Through the cultivation of a profound comprehension of fundamental ideas and the advancement of transferable abilities like critical thinking, communication, teamwork, and problem-solving, we can enable learners to effectively handle intricate situations and grasp chances for advancement and creativity. Concept and skill-based learning may help that all students are ready to succeed in the twenty-first century and beyond by emphasizing depth over breadth and enabling them to take an active role in their own learning process (Ingersoll, & Strong, 2011).

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CHAPTER : 27

LEADERSHIP SKILLS OF THE SCHOOL HEADS OF SCHOOLS IN WEST BENGAL WITH REFERENCE TO THEIR DIFFERENT AGE GROUPS

Mr Sankha Jana [1], Dr. Ahibendu Bandyopadhyay [2]

Abstract

Schools have been one of the main essential social creatures that need innovative leadership skills of the leaders since they prepare the leaders of tomorrow. A school Head like a leader is not an innovative idea because he/she is a transformational along transactional head of the school. Many studies are conducted on the leadership skills of the heads of the schools. The studies usually revealed the constructive impact of leadership skills on the general alteration of the educational institution. The leadership skills of School Heads play a very important role in the institution of a School education. The progress of a School very much depends on the leadership skills of the School Heads. The present paper is being aimed to measure the leadership quality of the School Heads of various colleges in West Bengal. The study was conducted on a sample of 250 School Heads randomly selected from the two districts namely South 24 Parganas and Purba Medinipur. A tool with 50 items was mead to do this research. There were six types of elements of leadership skills in this tool. These dimensions are 1. Dealing with students 2. Time table 3. Class allotment 4. Incidental issues 5. Dealing with teachers 6. Administrative work. This study focuses on the above-mentioned six dimensions of leadership skills. Four categories of age groups have been adopted in this study. These are 1. Below 40 years age group, 2.40 to 50 years age group, 3.50 to 60 years age group, 4. Above 60 years age group.

Keywords: *Leadership Skills, School Heads, Class allotment, Different age Groups*

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1. Introduction

Leadership skills are a progression, where an individual influences a cluster of people to achieve a universal objective. It is a purpose of significance and having a healthy idea communicates the construction of faith between age groups, with achievement to understand own leadership skills potential. Leadership is a combination of strategy and character. Leadership skill is a very important subject in school educational institutes. The leader of a school is the School head. All the performance of a school educational organization is conducted with the assistance of the School Heads. The achievement of a school's education depends very much on the success of dynamic School Heads. The School Head is capable of productively running the institution with leadership skills. The research study was conducted on a sample of 250 School Heads randomly selected from the two districts namely South 24 *Parganas* and Purba Medinipur. Leadership skills have become an imperative issue in the present circumstances. It has turned out to be almost impossible to run a school educational institute effectively without a skilled leader. So the achievement of an Educational institution depends entirely on the skill of the School Heads. It has become a supplementary complex to manage the school educational institute designed for the privatization of education. In this circumstance, the leadership skills of School Heads can be an essential factor in the supervision of a school educational institute.

2. Review of Related Literature

- **Patil (2016)** conducted a study on the leadership behavior of principals and the Organizational Commitment of teacher educators of colleges of education about their awareness of total superiority organization. From this study, the Researcher creates that the measurement of organizational commitment that is, touching commitment of teacher educators of the college of education and leadership behavior of principals and its dimensions are dependent relative on each other.

- **Vembu. A. (2000)** conducted a study on the leadership behavior of polytechnic college principals in Tamilnadu. The researchers established that three main factors reason for the appearance of leadership. They are 1. Leader role dynamics 2. Organizing mechanism 3.Work and worker integration.

- **Kumaradas (2009)** conducted a study on the managerial skill of the principals of colleges of education as perceived by teacher educators in Kerala state. The researcher establishes that there is an important relationship between managerial skills – benevolent autocracy dimension- and Interpersonal relations of principals of colleges of education as perceived by teacher educators.

3. Statement of the Problem

The problem selected for the present study is **"Leadership skills of the school heads of schools in West Bengal with reference to their different age groups."**

4. Objectives of the Study:

The following objective was research study. –

1. To compare the leadership skills of the School Heads working in school educational institution in respect of their different age groups.

5. Hypotheses of the study

The following hypothesis and Sub hypothesis were set forth for the study.

H1: There is no significant difference in leadership skills among the School Heads with different age groups working in different school educational institution.

Sub Hypothesis

H1a: There is no significant difference in leadership skills between the School Heads with below 40 years age groups and School Heads with 40 to 50 years age groups.

H1b: There is no significant difference in leadership skills between the School Heads with 40 to 50 years age groups and School Heads with 50 to 60 years age groups.

H1c: There is no significant difference in leadership skills between the School Heads with 50 to 60 years age groups and School Heads with above 60 years age groups.

H1d: There is no significant difference in leadership skills between the School Heads with below 40 years age groups and School Heads with above 60 years age groups.

H1e: There is no significant difference in leadership skills between the School Heads with 40 to 50 years age groups and School Heads with above 60 years age groups.

6. Variables of the Study

The most important dependent variable of the study was "Leadership skills of the school heads of schools in west Bengal with reference to their different age groups." The independent variables of the study were diverse age groups of the working School Heads.

7. Method of the Study

Descriptive survey technique was used to conduct the research study.

8. Population of the study

The research study was conducted on a sample of 250 School Heads of government Teachers' in West Bengal randomly selected from the two districts namely South 24 *Parganas* and Purba Medinipur.

9. Sample of the study

A total of 250 samples were taken randomly from two districts of West Bengal for the study. All the samples were divided into four age group categories. The names and numbers of the samples of these categories were respectively, 1. Bellow 40 age group, 2. 41 to 50age group, 3. 51 to 60 age group, and 4. Above 60 age group.

10. Tools:

A 5 point leadership skills inventory for the School Heads was developed and standardized for the present study by the investigator. There were a total of 50 items and six dimensions in the tool.

11. Statistical method of the study:

The following statistical method were used for the Analysis of data-

1. Mean
2. Standard Deviation
3. Critical ratio test (t)

12. Analysis of Data and Interpretation:

Analysis Pertaining to H 1

H1a: There is no significant difference in leadership skills between the School Heads with below 40 years age groups and School Heads with 40 to 50 years age groups.

Age group of School Heads	N	Mean	SD	SED	t TEST	Level of Significance
Below 40 years	63	270.21	20.69	2.74	9.03	0.01
40 to 50 years	78	288.36	20.35			

Interpretation

Above table indicates that the value of 't' between the School Heads with bellow 40 years age group and the School Heads with 40 to 50 years age group is significant at 0.01 level. It means the School Heads with bellow 40 years age group and the School Heads with 40 to 50 years age group is differing significantly on the basis of their Leadership skills score.

H1b: There is no significant difference in leadership skills between the School Heads with 40 to 50 years age groups and School Heads with 50 to 60 years age groups.

Age group of School Heads	N	Mean	SD	SED	t TEST	Level of Significance
40 to 50 years	78	288.36	20.35	4.023	1.35	NS
50 to 60 years	87	281.58	22.81			

Interpretation: Above table indicates that the value of 't' between School Heads with 40 to 50 years age group and School Heads with 50 to 60 years age group is not significant at 0.05. It means the School

Heads with 40 to 50 years age group and School Heads with 50 to 60 years age group is not differ significantly on the basis of their Leadership skills score.

H1c: There is no significant difference in leadership skills between the School Heads with 50 to 60 years age groups and School Heads with above 60 years age groups.

Age group of School Heads	N	Mean	SD	SED	t TEST	Level of Significance
50 to 60 years	87	281.58	22.81	5.45	0.315	NS
Above 60 years	22	289.21	16.23			

Interpretation: Above table indicates that the value of 't' between School Heads with 50 to 60 years age group and School Heads with above 60 years age group is not significant at 0.05 level. It means the School Heads with 50 to 60 years age group and the School Heads with above 60 years age group is not differ significantly on the basis of their Leadership skills score.

H1d: There is no significant difference in leadership skills between the School Heads with below 40 years age groups and School Heads with above 60 years age groups.

Age group of School Heads	N	Mean	SD	SED	t TEST	Level of Significance
Below 40 years	63	270.21	20.69	5.21	4.32	0.01
Above 60 years	22	289.21	16.23			

Interpretation

Above table indicates that the value of 't' between School Heads with bellow 40 years age group and School Heads with above 60 years age group is significant at 0.01 level. It means School Heads with bellow 40 years age group and the School Heads with above 60 years age

group is differing significantly on the basis of their Leadership skills score.

H1e: There is no significant difference in leadership skills between the School Heads with 40 to 50 years age groups and School Heads with above 60 years age groups.

Age group of School Heads	N	Mean	SD	SED	t TEST	Level of Significance
40 to 50 years	78	288.36	20.35	5.12	0.685	NS
Above 60 years	22	289.21	16.23			

Interpretation

Above table indicates that the value of 't' between School Heads with 40 to 50 years age group and School Heads with above 60 years age group is not significant at 0.05 level. It means the School Heads with 40 to 50 years age group and the School Heads with above 60 years age group is not differ significantly on the basis of their Leadership skills score.

13. Findings of the study

1. There was significant difference in leadership skills between the School Heads with age group bellow 40 years and the School Heads with age group 40 to 50 years. The Results indicates that the principal with 40 to 50 years age group have more high leadership skills than the School Heads with bellow 40 years age group.

2. It was found from the study that there is no significant difference in leadership skills between the School Heads with age group 40 to 50 years and the School Heads with age group 50 to 60 years. So the result says that the School Heads with 40 to 50 years age group and the School Heads with 50 to 60 years age group have same leadership skills.

3. There was no significant difference in leadership skills between the School Heads with 50 to 60 years age group and the School Heads with above 60 years age group. So the result says that the principal with 50

to 60 years age group and School Heads with above 60 years age group have same leadership skills (Abbellajay, 2014).

4. There was significant difference in leadership skills between the School Heads with bellow 40 years age group and the School Heads with above 60 years age group. So the result says that the School Heads with above 60 years age group have more high leadership skills than the School Heads with bellow 40 years age group.

5. There was no significant difference in leadership skills between the School Heads with 40 to 50 years age group and the School Heads with above 60 years age group. It means the School Heads with 40 to 50 years age group and the School Heads with above 60 years age group have same leadership skills.

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CHAPTER : 28

LEARNING THE NEW AGE SKILLS: 21ST CENTURY EDUCATION

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Abstract

Educationists often raise the question what Education should aim to achieve. In traditional society, Education acted as a means of transmitting knowledge across generations to preserve social and cultural heritage. Scope of Education broadened with passage of time to encompass co-curricular subjects breaking the realms of cognitive dimension. Healthy mind resides in healthy body is the motto of modern educationists emphasizing psychomotor dimension. Scope of Education kept on enlarging with addition of affective elements. 21st century educationists believe that until holistic development is attained, aim of education remains unfulfilled. The New Age learners should be equipped with skill sets which include creativity, critical thinking, and initiative (cognitive skills), collaboration, communication, flexibility, and social skills (affective skills), technological skills and media literacy (psychomotor skills). New Age learners must possess 21 century skills which are classified into Learning skills, Literacy skills and Life skills. NEP 2020 recommends that educational institutions should prepare learners for 21st century by equipping them with these skills so that they can become socially and professionally successful. This manuscript is a descriptive qualitative approach based on secondary information from articles of peer reviewed journals, blog sites, websites and NEP policy document. Author tries to sheds light upon the strategies by which 21st century skills can be taught to young learners. This paper is significant in presenting the relation between 21st century skill inculcation and NEP 2020 recommendation on ways of doing it.

Keywords: *21st century, NEP 2020, skill, development, holistic*

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The societal demands are ever changing and dynamic so the skills of past century are no longer relevant today. The 21st century lifestyle has its own demands and to handle them successfully strategic plans of schools should envision curriculum to teach these skills (Buckle, 2024). The advocates of 21st century skills concept feel learners must be taught the skills to equip them for 21st century competitive society and believe schools are yet not emphasizing upon inculcation of these skills (Great Schools Partnership, 2014). The curriculum should combine core subjects such as English, Mathematics, Science, History, Geography with applied skills such as critical thinking, problem solving, creativity, collaboration, innovation, leadership and so on (Biswas, 2019; Fadel, 2008). In 21st century classroom, learners are prepared for jobs and technologies that will exist in the future and learners are equipped to solve problems that are yet to unfold (Leming, 2019). 21st century skills can be defined as the combination of knowledge, skills, traits, habits and qualities considered essential by teachers, professors, employers, policy makers and all stakeholders of education for excelling in present world- be it academic or personal (Buckle, 2024; Great Schools Partnership, 2014).

Delors Report (1996) prepared by the International Commission Education for the Twenty-first Century was the pioneer in highlighting the skills required in 21st century and mentioned four pillars of Education for the 21st century -Learning to Know, Learning to do, Learning to Live together and Learning to Be (Central Board of Secondary Education, 2020; Mukherjee et al., 2020). Learning to Know focuses on how a person learn, Learning to do focuses on applying the learnt knowledge in practical life, Learning to Live together prepares the learner to become a good citizen and Learning to Be emphasizes on holistic development of the person (Wirthlin, 2018).

Holistic development of a learner is aiming at physical development, social development, emotional development, intellectual development and moral development (Mcllroy, 2023). Simply speaking, areas of holistic development are interdependent and interconnected, developing in parity (Biswas, 2019). Holistic approach to education is not about cognitive development of the child but concerned with overall wellbeing (HEI schools, 2022). Holistic approach to education aims growth of multiple abilities of learners unlike the traditional approach to education aiming at intellectual capabilities only (Sarkar, 2020). Holistic approach is important because it encourages individual differences, it is a natural way as per environment, it helps the child to

reach their full potential, all kinds of learning are basically connected, holistic learning is meaningful, it is useful in future work and personal life and it helps people to handle numerous roles in life (Mcllroy, 2023).

Learning skills, Literacy skills and Life skills

Learning skills are those skills which teach learners about how to develop their cognitive processes for functioning in modern society. Learning skills encompass four major skills such as Critical thinking, Creativity, Collaboration and Communication which is essential for any career the individual pursues (ICEV, 2022). *Critical thinking* is the ability to find solutions to problems through complete analysis of any situation and evaluating alternative opportunities (Buckle, 2024). *Creativity* is having a divergent thinking and finding new meanings of known concepts. It fosters imagination and innovation and help to adapt one's thinking to understand that every process is susceptible to change (Mentocrafts, 2018). *Collaboration* teaches teamwork, compromising self-interest for achieving greater goals, and achieves optimum solution to problems. Willingness is a key to achieve collaboration as every member has to sacrifice for social benefit (Southwest Charlotte STEM Academy, 2024). *Communication* helps learners to disseminate their ideas across peers, teams, groups and grades. Communication can eliminate confusion and conflict in any organization and effective communication with subordinates can build trust (Thoughtful Learning, 2024).

Literacy skills emphasizes on the learner's ability to identify the trusted sources of online information and discard the fraud sources. These skills are otherwise known as IMT skills, dealing with separate areas of digital technology such as: *Information literacy* which is the skill or ability to understand all kinds of data, figures, statistics, available online (Buckle, 2024). The learners are taught to identify which of the statistics are true and which are not. Online resources provide a vast array of information alongwith that it brings the risk of misinformation. Learners in 21st century require the skills to separate the false data from the pool of information (Thoughtful Learning, 2024). *Media literacy* where one can realize the authentic methods and sources of disseminating information that is discarding the fake and fraudulent information providers (Southwest Charlotte STEM Academy, 2024). As in the previous case this 21st century skill is required to judge not only the information but also credibility of the

source it is coming from. *Technology literacy* is where knowledge about hardware and machines are understood by learners (Mentocrafts, 2018). To gain access to online information, the learners must be proficient in handling computers and mobile devices and understand how these gadgets work (Roy, 2021). When a learner can handle gadgets with ease then only they will delve into the world of e-resources. So, this skill is preceding factor to the earlier skills.

Life skills are also known as FLIPS and are intangible skill sets dealing with personal and professional qualities a learner must possess to adjust in 21st century society. There are five categories in 21st Century life skills starting with *Flexibility* where the learner has to be open and accept that their perspective may not be the best and they may be wrong in some cases (Chinara & Badakhshan, 2020). Flexibility requires being able to adapt to changing circumstances and understand that they still have to learn a lot and learning never ends. Flexibility is needed to be successful in professional life as change is part of 21st century dynamic life and it is crucial for learners to know when and how to change. *Leadership* skills are essential among all 21st century skills as world needs good leaders today. Leaders have the responsibility of setting targets, guiding their teams on how to achieve targets and motivating them to achieve these goals as a team (Mentocrafts, 2018). Even those who may not become leaders in their future lives, learning leadership skills will ensure they understand managerial decisions and company goals so that they can lend support whole heartedly. Leadership skills teach values where one stands for subordinates and value team work. In present day society every citizen must be self-less and learn to live together, be tolerant towards all. Leadership skills also develop ambition among bright learners who aspire to become future leaders. *Initiative* is a skill which every individual do not possess and so it is difficult to learn (Southwest Charlotte STEM Academy, 2024). This is the drive on part of a learner to start a project or venture by himself. It drives a person to push himself and work after regular hours. This is intrinsic motivation and the reinforcement can vary from good grades to good career. This 21st century skill is essential for work efficiency and professional progress. *Productivity* is a skill related to work completion in scheduled time eliminating all kinds of distractions (ICEV, 2022). This 21st century skill is a judgement of efficiency and learners need to know how to work well and produce quality output in time. In competitive job market not only quality but quantity also matters. Career progress is often assessed in terms of how productive one is.*Social skills* are

essential in each and every profession because we live in a global era (Mentocrafts, 2018). Networking is the way to reach out and prosper in any career. Networking and rapport building is an art which can create mutual benefit for both parties involved. In the era of social media, human interaction has become easier and difficult at the same time. Virtual bonds are taking place of real human relations filled with emotions. Moreover, the informal society and workplace are getting formalized and learning basic social skills has become mandatory.

21st century skill inculcation and NEP 2020

NEP 2020 highlights the characteristics of education in 21st century which is multidisciplinary, holistic, flexible, creative, and individualized (Sharma, 2023). Grounded in experiential learning, 21st century skills are all about observation, practice, experience and not rote memorization (Central Board of Secondary Education, 2020).

NEP 2020 envisions an education system where learners are taught how to learn and which discards rote memorization. 21st century skill inculcation is the main goal of this education system which encourages holistic development instead of cognitive development. The education system should unfold latent potentialities and for this curriculum reorganization is called for. National Curriculum Framework for school education will ensure 21st century skills are taught in every stage of learning (Ministry of Human Resource Development, 2020).

In case of higher education, General Education Council (GEC), which is under Higher Education Commission of India (HECI) will identify the required 21st century skills and incorporate them into curriculum with help of National Higher Education Qualification Framework (NHEQF) and National Skills Qualifications Framework (NSQF) (Mehta & Tejaswi, 2020).

The assessment process will be comprehensive to measure all round development of individuals and will judge whether the learners are equipped with 21st century skills. For the purpose of uniformity in assessment, National Assessment Centre or PARAKH, School Boards, NTA will be entrusted and assess learners through portfolio, rubrics, standardized tests, and assessment analytics (Singh & Kaur, 2023). Performance based examination help to assess the skills learners have gathered, projects and simulations provide opportunities of real world

experience, technology based tools can judge the online cooperation of learners (Chauhan, 2023).

Building 21st century skills

For teaching 21st century skills, it is essential that teachers are first trained through professional development courses and made capable so that they can inculcate these skills (Mete & Roy, 2020). The classroom environment should be free and allow inquiry based learning so that learners can voice their queries. Learning should be collaborative and team spirit should be motivated so that learners can act as good citizens in future. Learning in 21st century should foster critical thinking and creativity in learner so that they can move beyond their books. Assessment should be continuous and holistic as the purpose is not inculcation of knowledge but assimilation and application of knowledge (Bordia, 2023).

Challenges in incorporating 21st century skills in education

21st century skills encompass higher-level skills as critical thinking, reasoning, creativity which can be assessed through tests which measure not only cognitive knowledge but creativity, problem solving skill and teamwork. But these tests are costly and difficult to construct for novice teachers. Moreover, such tests are mostly technology based and incompatible with traditional examination system which therefore needs to be modified (21K school, 2023). Though 21st century skills emphasize on critical thinking, flexibility, creativity but it must be remembered that these skills will only develop after learners have received content knowledge (Rotherham &Willingham, 2009). To teach 21st century skills, the main role lies with the teacher who should be trained to use innovative learner centered teaching strategies. Apart from that teachers need whole-hearted support from their institution in the form of fund, infrastructure and autonomy (Aul Marbella, 2023).

Conclusion

Challenges will be many but one has to understand that we need to move forward and embrace change with time. In order to survive on the tough competitive terrain of 21st century we have to equip our learners with 21st century skills. NEP 2020 advocates holistic development of learners and envisions future citizens who are competent in every skill domain. The learners are foundation of a

society and only a strong foundation will build a powerful nation. 21st century skills does not only prepare for the evitable but also for the inevitable and unimaginable.

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CHAPTER : 29

INVESTING THE BENEFITS OF PROJECT BASED LEARNING IN SCIENCE EDUCATION

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Abstract

Scientific literacy is essential for keeping up with technological advances in the twenty-first century. Science education uses educational practices to help students become scientifically literate. One strategy utilized in scientific education is project-based learning (PBL). The study has been carried out to know about the principles of Project Based Learning and to understand how the project-based learning matters in science education. It also discusses the benefits of project-based learning in the science education. Since this is conceptual study the researcher has followed the secondary sources of information in terms of books, journals etc. In order to achieve this goal, science education aims to help students develop skills such as critical thinking, observation, analysis, and the ability to apply what they have learned in the classroom to real-world situations. Training both future and current educators to react to the need for a project-based learning strategy in scientific education is being seen as a viable option, thanks to the significant and novel learning flexibility that can be achieved via the correct use of PBLA.

Keywords: *Science education, literacy, teachers, project-based learning.*

Introduction

Project-Based Learning (PBL) "is a groundbreaking approach in education that involves teaching through assembly of strategies and has been promising in the current era dominated by rapidly developing technologies worldwide. This learning approach necessitates students to work cooperatively, collaborate towards fruitful project creation, and come up with research results from their own work. The project based learning involves self-directed learning,

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investigation and exploration of the concepts, which all facilitate the learning in permanent coding of the concepts that could enhance easy retention and conceptualization process. The project-based learning takes the move of predict-observe-explain-conclude and this foster the students' prediction abilities and critical thinking that support the process of understanding complex concepts presented in science subjects according previous study". (Alfiyanti & Jatmiko 2020) Additionally, "the project-based learning involves problem solving tasks that enhances the student's creativity and innovation which in turn promotes logical capacities in science education (Twahirwa & Twizeyimana.,2020), and involves practical tasks such as manipulating activities that could raise the hands on and minds efficacy".

The successful design and implementation of "project-based learning approach in science subject teachings involves various steps. Some of them are for example, (1) identification of the issue, (2) formulation of the issues and associated hypothesis, (3) searching and gathering related data, (4) proving the data through experiments to test the reality, (5) resenting and defending the tested reality, (6) clarifying the wrong results, (7) summarizing the process, and drawing conclusion" (Usmeldi ,2018). It follows that instructors have, to some degree, stifled project-based learning owing to a number of limitations. There is a lack of experimental tasks, insufficient teacher training and workshops, an overemphasis on teacher-centered instruction, and not enough time devoted to scientific classes. It should be mentioned that in many schools, a major obstacle to implementing project-based learning techniques is the absence of imagination and originality when it comes to creating supplemental resources.

Theoretical Background

The roots of project-based learning extend back over a hundred years, to the work of educator and philosopher John Dewey (1959), "who's Laboratory School at the University of Chicago was based on the process of inquiry. Dewey argued that students will develop personal investment in the material if they engage in real, meaningful tasks and problems that emulate what experts do in real-world situations. In the last two decades, learning sciences researchers have refined and elaborated Dewey's original insight that active inquiry results in deeper understanding. New discoveries in the learning sciences have led to new ways of understanding how children learn".(Bransford, Brown, & Cocking, 1999) We build on four major learning sciences ideas: (1)

active construction, (2) situated learning, (3) social interactions, and (4) cognitive tools.

Active Construction

Learning scientists have discovered that passively taking in information from a teacher, computer, or book results in superficial learning, whereas active construction of meaning based on one's experiences and interactions with the world leads to deep understanding (Sawyer introduction, this volume). Students constantly build and rebuild their knowledge as they interact with new information, ideas, and their own experiences; this process is known as understanding growth. Learners construct their own knowledge by active engagement with the world around them, observation and interaction with phenomena, absorption of new ideas, and construction of links between new and old concepts, discussion and interaction with others, and not relying on teachers and materials to disclose information. To solve issues and create artefacts, students in project-based learning actively build their knowledge by engaging in real-world activities that are comparable to those professionals do.

Situated Learning

According to studies conducted in the field of learning sciences, students retain more information when taught in a realistic, real-world setting. Scientists methodically monitor the natural environment and derive conclusions from their findings in certain scientific fields, while in others they do experiments in controlled environments. Students would engage in a range of scientific practices—including planning studies, explaining phenomena, modelling, and presenting ideas to others—as they engage in situated learning in science. Situated learning has several advantages, one of which is that it helps pupils better understand the significance of what they are doing.

If students do a scientific experiment according to the textbook's exacting standards, it's not much better than sitting quietly and taking notes. No matter how they slice it, they can't seem to make sense of their actions. However, kids have a better understanding of the practical applications of science when they develop their own inquiry to address a community- or personally-relevant concern. Second, according to Kolodner (this volume), contextual learning seems to generalize better across a broader variety of contexts.

Students struggle to generalize their comprehension to new contexts when they learn material via rote memorizing of facts that aren't relevant to real-world problems. Students don't acquire real-world application of scientific concepts when they follow textbook experiments to the letter.

However, “when students acquire information in a meaningful context (Blumenfeld et. al., 1991) and relate it to their prior knowledge and experiences, they can form connections between the new information and the prior knowledge to develop better, larger, and more linked conceptual understanding”.

Social Interaction

“One of the most solid findings to emerge from learning sciences research is the important role of social interaction in learning (Collins, this volume; Greeno, this volume; Sawyer, this volume). The best learning results from a particular kind of social interaction: when teachers, students, and community members work together in a situated activity to construct shared understanding. Learners develop understandings of principles and ideas through sharing, using, and debating ideas with others”. (Blumenfeld et al., 1996) This back-and forth sharing, using, and debating of ideas helps to create a community of learners.

Cognitive Tools

Learning sciences research has demonstrated the important role of tools in learning. (Salomon, Perkins, & Globerson, 1991) “Cognitive tools can amplify and expand what students can learn. A graph is an example of a cognitive tool that helps learners see patterns in data. Various forms of computer software can be considered cognitive tools because they allow learners to carry out tasks not possible without the software’s assistance and support. For instance, new forms of computer software allow learners to visualize complex data sets. In such situations, we refer to the computer software as a learning technology”.

“Learning technologies can support students (1) in accessing and collecting a range of scientific data and information; (2) by providing visualization and data analysis tools similar to those used by scientists; (3) by allowing for collaboration and sharing of information across sites; (4) by planning, building, and testing models; and (5) by

developing multimedia documents that illustrate student understanding" (Novak & Krajcik, 2004). These enhancements broaden the scope of inquiry that students may pursue and the variety of phenomena that they can encounter. While there is no shortage of cognitive tools available to students in project-based learning, our primary emphasis is on the utilisation of learning technology.

Research Problem: In addition, learner-centered learning replaces teacher- or subject-centered learning as a result of project-based learning (Handelzalts, 2019; Shin, 2018). In contrast to traditional classroom instruction, a number of earlier research highlighted the value of project-based learning in piqueing students' cognitive interest. Alzahrani, Alshammary, & Alhalafawy, 2022; Guo et al., 2020; Mahasneh & Alwan, 2018; Alanzi & Alhalafawy, 2022b; Alshammary & Alhalafawy, 2023) Nevertheless, there is a lack of information about the effectiveness of project-based learning in developing students' critical thinking abilities in investment optimisation. This makes the question "What is the effectiveness of project-based learning in science education?" a suitable formulation for the study topic.

Objectives of the Study: The purpose of this research was to get a better understanding of project based learning (PBL) and its guiding principles as they pertain to scientific education. Also covered are the positive aspects of using projects as a teaching tool in scientific classes.

Key Principles for Designing Project Based Learning: Good project-based learning (PBL) teaching is based on the four design principles outlined in this paper. The research makes it obvious that PBL must have the following:

Purposeful and authentic experiences

Students must actively participate in the process by asking pertinent questions in order for PBL to be effective. An appropriate, valuable, contextualized, significant, and ethical issue should serve as the driving force behind a unit of study. Research by Krajcik and Shin (2014) The lives of students, the communities in which they live, and current events outside of school should inform these inquiries. Questions like how to construct affordable housing create a park that supports native flora, or address a public-health issue is all examples of the kinds of things that projects might tackle. Work on projects should be organized

in a logical fashion and adhere to industry standards, procedures, and instruments used in the actual world.

Deep integration with course content

Students should be able to expand and strengthen their understanding of key subjects via projects that are deeply integrated with course material and have their roots in fundamental areas of study. Students may enhance their comprehension of math concepts, scientific phenomena, and literacy abilities all at once via projects that use PBL's multi-dimensional approach to interdisciplinary learning.

Meaningful and supportive relationships

In education, and especially in project-based learning, it is important to have meaningful and supporting partnerships. In order to provide an optimal setting for project-based learning (PBL), schools should prioritise students' social and emotional development, have a strong culture of cooperation, and encourage students for taking risks. Trusting student-teacher connections and collaborative peer-to-peer interactions are key components of high-quality PBL.

Evidence-based teaching and assessment practices

It is critical to depend on evidence on what works and to learn from study. Research on project-based learning (PBL) is reviewed in this paper, which also emphasizes assessment and teaching strategies supported by evidence and shown to improve student results. Among these methods are the following: allowing students to reflect on their own learning, giving them opportunity to share what they've learned, and giving them strategic and timely feedback. Even though there is a lot we don't know yet, we do know a lot about the practices that help PBL education according to research. Teachers may confidently use rigorous PBL when they are supported in adopting these techniques via professional-learning opportunities, collaborative teaching settings, and excellent materials.

Does the implementation of Project-Based Learning really matter?

Having strong teacher-learner contact is crucial for excellent project-based learning, even if Morrison et al. (2020) argue that learning only via teacher-learner and learner-learner interaction cannot provide

meaningful learning. In keeping with the research of Sunarno (2019), the development of robust teacher-student interactions is the only means by which students' regular attendance and outstanding academic achievement may be enhanced.

The study carried out by Choi, Lee, & Kim (2019), "indicated that the students who have health interaction with their teachers were likely to develop positive attitudes, research spirits and perform better towards the subject whereas the students with poor interaction with teachers tend to develop disruptive behaviors and negative interests. In another study, it has been demonstrated that the quality interaction between teachers-learners determine students' motivation and engagements; whereas the conflicting relationship with the instructor or teacher leads to the feeling of insecurity in learners".(Zadok ,2019) This has been also supported by Guo, Saab, Post & Admiraal (2020), "the friendship environment and positive interaction are the powerful weapons to shape quality research-based learning which ultimately influence both students' Conceptualization and academic achievements".

Project-Based Learning Benefits

Due of the great variation in implementation, studying the effects of PBL is notoriously challenging. But there are several advantages that are shown via better academic achievement, studies that have been published, and classroom observations.

Helps students build 21st-century skills: Collaborative problem-solving, research, time management, information synthesis, use of technological tools, personal and social responsibility, visualizing, decision-making, and project management are all important life skills that may be honed via project-based learning.

Teaches critical thinking: Students are encouraged to think critically in order to solve complicated issues and make educated choices via PBL, which is perhaps another important life skill.

Connects students to the world beyond the classroom: By linking classroom instruction with real-world scenarios, PBL helps students make the transition from theoretical to practical knowledge **Improves student attitudes toward education:** Having the opportunity to apply their skills to tangible projects increases student engagement and enthusiasm for learning.

Builds motivation: PBL increases students' enthusiasm to study and explore new concepts and ideas—a skill they'll use throughout their lives—by giving them meaningful and pertinent assignments.

Reinforces social and emotional learning (SEL): PBL fosters the development of social and emotional skills including teamwork, communication, empathy, and self-awareness in addition to the academic or "hard" abilities.

Sparks creativity and curiosity: Students are inspired to think creatively, explore their interests, and follow their curiosity via project-based learning, which results in a higher level of engagement.

Supports in-depth understanding: PBL assignments push students to study a topic in-depth, increasing their chances of acquiring and holding onto a thorough comprehension of the material.

Supports long-term retention: PBL's practical approach helps students retain information and skills better by having them apply what they've learned to real-world situations.

Empowers students: PBL supports students' autonomy, fostering self-confidence, skills mastery, and a sense of purpose.

Encourages perseverance: Students gain resilience, persistence, and a growth mentality via PBL interactions where they overcome difficulties and hurdles.

Allows for differentiation: The experiential nature of PBL accommodates diverse learning styles and abilities, allowing for individualized learning experiences and tailored instruction.

Promotes lifelong learning: PBL fosters a love of learning and gives pupils the disposition and abilities necessary for outside-of-the-classroom inquiry.

Conclusion: In short, there is a need to debate with the scientific community over the place of project-based learning in science education. Owing to the essential and distinctive potential learning flexibility created by the appropriate application of project-based learning in scientific education, we propose that pre-service and in-service teachers be prepared to react to the requirement for project-

based learning approach implementation. Through project-based learning, students are encouraged to build their own knowledge and abilities, which will help them in their future Endeavour.

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CHAPTER : 30

GENDER EQUALITY IN EDUCATION

Asim Mahata [1]

Abstract

Despite decades of progress, gender equality in education is still a significant issue worldwide. Gender equality has long been fought in education, where there are institutional barriers to enrolment, success, and access. Gender hurdles continue to impede inclusive and equitable education systems, notwithstanding advancements. To comprehend these inequalities, it is necessary to look at sociocultural norms, institutional biases, economic disparities, and overlapping discrimination. In order to achieve gender equality in education, an environment free from discrimination, prejudice, and gender stereotypes must be established so that all students are free to pursue their interests, aspirations, and potentials without facing societal pressures. This study uses a wide range of academic research and empirical data to explore the many facets of gender equality in education. Examining the historical context of gender disparities in education as well as the history of efforts to address them, the research highlights significant achievements as well as persistent issues.

The primary focus of the study is gender equality in education, including access, retention, academic achievement, and leadership. The study looks at intersectional identities, structural impediments, and sociocultural norms to provide light on the complex processes influencing women's, men's, and girls' educational results in various circumstances.

The study also reviews efforts and approaches in gender equality education. Successes and failures in policy frameworks, teaching strategies, and community-based initiatives are analyzed. In order to find important insights and lessons gained for gender mainstreaming in

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educational policies and practices, this article examines case studies and best practices from different places.

The report highlights how important gender equality in education is to achieving goals related to sustainable development, socioeconomic progress, and individual empowerment. Through the integration of theory and research, the project advances our understanding of gender, education, and social change.

Keywords: *Gender equality, leadership, community-based initiatives, socioeconomic progress, social change.*

Introduction

A long-standing objective in education is global gender equality, which reflects social justice, human rights, and fairness. Even after decades of progress, disparities persist, creating complex issues that need a variety of approaches. In order to prepare the reader for a critical study, this introduction provides a succinct overview of gender equality in education.

Gender equality has long been fought in education, where there are institutional barriers to enrollment, success, and access. Gender hurdles continue to impede inclusive and equitable education systems, notwithstanding advancements. To comprehend these inequalities, it is necessary to look at sociocultural norms, institutional biases, economic disparities, and overlapping discrimination (Buckler, 2015).

Beyond its inherent value, gender equality in education is essential for promoting social progress, long-term economic growth, and stable peace. By addressing gender disparities in education, nations may optimize human capital, create inclusive communities, and fulfill the Sustainable Development Goals.

Defining Gender Equality in Education

To really define gender equality in education as fairness, inclusion, and empowerment, enrollment parity alone is insufficient. Equitable opportunities, resources, and outcomes for all students constitute gender equality in education. This entails removing institutional barriers and discriminatory practices that restrict the educational opportunities and rights of women. A thorough definition of gender equality in education also acknowledges the intersections between

gender and other social identities, such as race, class, ethnicity, disability, and sexual orientation, acknowledging that individuals encounter various forms of privilege and oppression that exacerbate educational disparities. In order to achieve gender equality in education, an environment free from discrimination, prejudice, and gender stereotypes must be established so that all students are free to pursue their interests, aspirations, and potentials without facing societal pressures. Therefore, a thorough knowledge of gender equality in education has to include the institutional, cultural, and personal factors that influence learning outcomes in a variety of contexts.

Historical Context of Gender Disparities in Education

Gender disparities in education have been formed throughout millennia in a variety of cultural and geographic contexts by marginalization, discrimination, and resistance. In the past, formal educational institutions have kept women and girls out of the classroom in order to uphold patriarchal norms and power dynamics. Gender norms and hierarchies that subjugated women were perpetuated in ancient civilizations by the educational benefits enjoyed by male elites. During the Middle Ages, women could only get an education in convents or in the homes of nobles. There, they acquired basic literacy and household skills to help them in their roles as wives and mothers. Even while women's education made significant strides throughout the Renaissance—especially among the nobility—access remained restricted by social position and familial customs. Women's education and empowerment movements were fueled by the promotion of equality and human rights by modernity and the Enlightenment. Female equality in education was hampered by institutionalized sexism and deeply rooted societal conventions, thus progress was uneven and slow. In the late 19th and early 20th centuries, women's suffrage and higher education were greatly advanced by the Seneca Falls Convention and women's colleges. Despite these successes, women were still confined to secondary roles in academia and society due to institutional barriers and ingrained preconceptions that hindered their access to higher education. Understanding the historical context of gender disparities in education so emphasizes the unfairness that still exists now and the need of removing barriers to provide inclusive, equitable educational environments for all genders.

Current State of Gender Equality in Education

Access to Education: Disparities in Enrolment Rates

There are differences in gender equality in education, with progress in certain areas being counterbalanced by persistent disparities in access. Even while enrollment rates have grown globally, gender disparities still exist, particularly in areas with strong cultural norms and low socioeconomic status. Poverty, child marriage, gender-based violence, a lack of schools, and poor sanitation all impede the education of girls. Vulnerable people are marginalized by a number of factors that compound these problems, such as location, race, and disability. Reducing gender enrolment disparities requires infrastructure, teacher training, community engagement, family incentives, and scholarships. For there to be gender equality in education, structural injustices including poverty and gender stereotypes must be addressed.

Retention and Completion Rates: Understanding the Dropout Gender Gap

Statistics on education completion and retention indicate that both boys and girls face different challenges throughout their time in school. Girls face several obstacles in their educational journey, while men have higher rates of dropout and completion, particularly in secondary and tertiary education. The dropout gender gap is influenced by a number of factors, including cultural expectations, financial limitations, a lack of support for higher education, and gender-specific difficulties including early marriage and job market engagement. Understanding the gender disparity in dropout rates requires addressing issues such as poverty, discrimination, and limited opportunities for men in certain situations. Programs that are gender-sensitive and provide individualized guidance, mentorship, and life skills instruction may also lower dropout rates and improve academic performance for students of both genders.

Gender Stereotypes and Bias in Educational Settings

The experiences, opportunities, and outcomes of students are significantly impacted by gender stereotypes and biases in Indian education. By maintaining gender roles and cultural norms, educational institutions may contribute to the perpetuation of discrimination and power dynamics. From a young age, children are socialized into limiting definitions of masculinity and femininity, which shapes their

conduct, passions, and aspirations. Girls are often encouraged to take domestic courses and take on submissive roles in the classroom, while guys are trained to take the lead and use force. Women still face barriers to academic success because of early marriage, taking on household responsibilities, and having little money. In schools, patriarchal viewpoints marginalize female students by fostering stereotypes that undermine their sense of self-worth, independence, and community. In order to combat negative stereotypes and provide inclusive learning environments in schools, curriculum reform, teacher preparation, and community involvement are required. To remove ingrained inequalities and establish gender-equitable educational institutions in India, support gender-sensitive pedagogy, empower female educators, and integrate feminist perspectives into educational practices. By addressing gender stereotypes and biases in education, India can make the most of its human resource, advance social justice, and build a more equitable and inclusive society (Bardhan, & Klasen, 1999*).*

Challenges and Barriers to Gender Equality
Sociocultural Factors Influencing Gender Disparities

Sociocultural factors impact beliefs, behaviours, and opportunities for gender parity in a range of contexts. Gender norms that have their roots in history, society, and religion may sometimes restrict the autonomy and agency of women and perpetuate inequality. Social norms establish male and female roles, responsibilities, and behaviours from a young age. While females are taught to prioritize caring for others and household duties above education and professional goals, men are often encouraged to dominate and assume masculine roles in many societies. Gender-based violence, child marriage, and female genital mutilation all contribute to the maintenance of gender inequality by preventing marginalized genders from obtaining opportunities and rights. To address sociocultural barriers to gender equality, transformative interventions that challenge harmful norms, encourage gender-equitable attitudes and behaviours, and empower people to question constrictive gender roles and expectations are required. Societies can achieve social justice and gender equality by fostering welcoming environments that value diversity and promote respect for all genders (Rosa, Drew , & Canavan, 2020).

Structural and Systemic Barriers

Structural barriers impede gender equality and limit opportunities for those who identify as gender non-conforming. Social, economic, and political institutions, behaviours, and policies that support power disparities and marginalize minority genders are deeply embedded. Structural barriers in education include discrimination based on gender in admissions, inadequate facilities for menstrual hygiene, and a dearth of curriculum materials and resources that are gender sensitive. Inequality is made worse as women's leadership opportunities are restricted by gender wage gaps, glass ceilings, and discriminatory hiring practices. People with many identities are marginalized by intersecting forms of discrimination based on sexual orientation, disability, race, ethnicity, and class that exacerbate structural barriers.

Strategies for Promoting Gender Equality in Education

Policy Interventions and Legal Frameworks

Legal and legislative frameworks that provide guidelines, requirements, and rewards for removing structural barriers and promoting inclusive behaviors are essential to achieving gender equality in education. Governments and educational institutions may encourage gender equality in education by implementing gender-responsive planning, budgeting, and monitoring. Institutions are obligated under anti-discrimination and gender equality laws to protect the rights of all individuals, irrespective of gender identity or expression. Gender disparities in access, retention, and achievement may also be addressed by implementing gender quotas, scholarships, and incentives specifically for female instructors. Governments may support fair and inclusive educational systems and gender equality in education by coordinating policies with international commitments such as the SDGs and CEDAW.

Gender-Responsive Pedagogy and Curriculum Development

In order to develop inclusive learning environments that cater to the needs and experiences of all students, gender-responsive pedagogy and curriculum construction are necessary for promoting gender equality in education. Students who get gender-responsive education are empowered to challenge gender norms, foster critical thinking, and confront prejudices.

In addition to teaching students how to communicate respectfully and equally, a curriculum that tackles gender roles, stereotypes, and social justice may also help them gain a critical awareness of gender issues. Teachers may find it easier to create welcoming and encouraging learning environments where all students may thrive with the assistance of professional development focused on gender-responsive pedagogy and curriculum development.

Creating Gender-Inclusive Learning Environments

All students experience a sense of respect, safety, and belonging in gender-inclusive learning environments. Educators may contribute to the creation of gender-inclusive learning environments by addressing discrimination and harassment, tackling stereotypes, and modelling inclusive conduct. By fostering a sense of acceptance and belonging for all students, schools may enhance social-emotional growth, academic performance, and overall wellbeing while also promoting equality and inclusivity in society.

Empowering Girls and Women Through Education

Education is the key to empowering girls and women and promoting gender equality as well as social and economic progress. Girls and women are empowered by education because it provides them with the knowledge, abilities, and opportunities to overcome barriers, combat discrimination, and realize their dreams. Investing in girls' education may help governments and stakeholders decrease poverty, improve health, and advance gender equality. Girls and women may be empowered via education through scholarships, leadership, mentorship, and addressing issues like child marriage, gender-based violence, and resource shortages.

Engaging Boys and Men in Gender Equality Efforts

Activities promoting gender equality must involve men and boys in order to dismantle harmful gender stereotypes and advance social justice. By challenging masculinity, defending women's rights, and opposing discrimination and violence against women, boys and men contribute to the advancement of gender equality. Moreover, including boys and men as collaborators and allies in gender equality initiatives may lessen resistance to change, foster inter-gender solidarity, and create a shared vision for a society that is more equitable and inclusive.

Case Studies and Best Practices

Successful Initiatives and Programs Promoting Gender Equality

Amartya Sen, who is often credited with founding the idea of "human development," brings to mind a statement made by H.G. Wells that states, "Human history becomes more and more a race between education and catastrophe." According to Sen, "we make the world less just and less secure if we continue to leave vast sections of the people of the world outside the orbit of education." According to Sen, illiteracy and women's security are directly related to the gender component of education. Consequently, there is a discernible relationship between gender socialization and sociocultural ideals (and practice). This only partially explains why women's "domestic" tasks and obligations are consistently prioritized above public ones in many emerging cultures. The majority of young girls are conditioned to believe that their socially prescribed future responsibilities as mothers are "biologically inevitable." In many comparatively conservative societal circumstances, this is strongly related to the need of ensuring marriage as a condition. In many papers, the World Bank, UNICEF, and the United Nations Population Fund emphasize the advantages of women's education for future generations. As 2005 approaches, the global education community is attempting to evaluate the extent of advancements made in the areas of equity and gender parity in the classroom. One of the six EFA aims outlined in the Dakar Framework for Action (UNESCO, 2000) incorporates the concepts of gender equality and gender parity. It reads as follows: attaining gender equality in education by 2015, with an emphasis on ensuring girls have full and equal access to high-quality basic education and succeed in it, and eliminating gender inequities in primary and secondary education by 2005. Goal 3 of the Millennium Development Goals, which aims to "promote gender equality and empower women," includes the elimination of gender disparities in primary and secondary education as an objective that must be achieved (Bardhan, & Klasen, 1999*).*

Impacts and Outcomes of Gender Equality Initiatives

Socioeconomic Benefits of Gender Equality in Education

Gender equality initiatives in education contribute to social progress, economic growth, and the decrease of poverty. By boosting women's and girls' education, these initiatives help individuals who were previously marginalized to participate more fully in the labor market

and support their families and the national economy. Since educated women are more inclined to work, create enterprises, and take care of their families, education has been proven to boost incomes, productivity, and economic stability. Reducing the gender gap in education fosters worker diversity, innovation, and creativity, which strengthens inclusive and resilient economies. Knowledgeable women are more likely to make investments in the health, education, and nutrition of their offspring, which enhances the outcomes for next generations (Bardhan, & Klasen, 1999*).*

Empowerment of the Individual and Community

Gender equality in education increases agency, autonomy, and decision-making, which in turn empowers individuals and communities. Girls and women are empowered by education because it provides them with the knowledge, abilities, and chances to combat discrimination, overcome challenges, and accomplish their objectives. Critical thinking, self-assurance, and leadership abilities are acquired via education, enabling individuals to stand up for their rights, get resources, and participate more actively in social, political, and economic spheres (Anand, Hunter, Carter, Dowding, Guala, & Van Hees, 2009).

Contributions to Sustainable Development Goals

The Sustainable Development Goals (SDGs) of gender equality in education, inclusive economic development, poverty eradication, and high-quality education are all aided by gender equality in education. By giving girls and women inclusive and equal learning opportunities, these initiatives support SDG 4 (Quality Education). Equal rights, opportunities, and representation for all genders are fostered by gender equality in education, which is essential to SDG 5 (Gender Equality). Gender equality in education contributes to SDG 1 (No Poverty) by ending cycles of poverty and giving economically marginalized people a voice. In addition, gender equality in education fosters inclusive and equitable communities, supporting SDG 10 (Reduced Inequalities) via addressing social identities such as race, ethnicity, class, and gender. The SDGs' contributions from gender equality in education show how important they are globally as catalysts for positive social change and sustainable development.

Future Directions and Recommendations
Emerging Issues and Areas for Further Research:

In order to impact practice, advocacy, and policy, more research on a range of emerging subjects and areas is necessary for the future of gender equality in education. The intersections of gender with sexual orientation, disability, racism, and class impact educational opportunities and experiences. Understanding how overlapping forms of privilege and bias impact educational outcomes is essential for developing targeted solutions for different groups. It is challenging to provide equitable access and participation in education given the growing reliance on technology and the digital divide, particularly for underprivileged groups with limited access to and knowledge of digital resources. Research on innovative strategies for bridging the digital gap and using technology for inclusive education is necessary to advance digital literacy and end educational disparities. In order to address gender-based violence and harassment in schools, comprehensive steps must be taken to provide all kids a secure and supportive learning environment (Acai, Mercer-Mapstone, & Guitman, 2022).

Policy Recommendations for Advancing Gender Equality in Education

As a human right and a catalyst for sustainable development, gender equality in education must be supported by upcoming politicians. National education plans and strategies should include gender-responsive teaching practices that prioritize the needs and rights of women and girls in order to advance gender equality in education. This comprises broad legal frameworks that prohibit discrimination in education on the basis of gender and promote equal opportunity for all students, irrespective of gender identity or expression. Additionally, funding schemes for mentorship, scholarships, and teacher preparation that support curriculum development and gender-sensitive pedagogy may be provided by policymakers. To monitor gender equality in education and pinpoint areas for action, policymakers should place equal emphasis on the gathering and analysis of sex-disaggregated data. Since many challenges are cross-border, international cooperation and alliances are necessary to achieve gender equality in education. Through the implementation of these policy proposals and the adoption of gender-responsive practices, policymakers may foster conditions that empower both genders in education and contribute to the

achievement of sustainable development objectives (Abu Moghli, 2020).

Conclusion

Gender equality in education is a difficult goal that calls for multifaceted social action. Over time, access, retention, and academic performance for girls and women worldwide have all increased as a result of gender equality in education. Nonetheless, persistent disparities and issues highlight the need of removing institutional barriers, societal expectations, and systemic injustices that support discrimination and marginalization based on gender. When it comes to addressing issues such as gender-based violence and the digital gap, as well as historical legacies of injustice, gender equality in education calls for creative and flexible solutions. In order to provide evidence-based treatments and policy recommendations for gender equality in education, intersectionality, digital inclusion, and gender-based violence prevention must be given top priority in research. In addition to social justice and human rights, gender equality in education is necessary for sustainable development and inclusive societies.

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CHAPTER : 31

GENDER ISSUES IN TECHNICAL AND VOCATIONAL EDUCATION PROGRAMS IN INDIA

Tuhin Ghosh [1], Jayanta Mete [2]

Abstract

Introduction*: The paper examines gender disparities within technical and vocational education programs in India, highlighting the socio-economic barriers that hinder women's access to these programs.*

Objectives*: The study aims to identify the factors contributing to gender issues in technical and vocational education and to explore strategies for promoting female participation.*

Methodology*: Utilizing a descriptive approach, the research synthesizes information from various secondary sources, including journal articles, reports, and government policies.*

Conclusion*: The paper concludes that addressing gender inequality in technical and vocational education is crucial for economic development and women's empowerment. It advocates for policy reforms and increased awareness to ensure equal opportunities for all genders in technical and vocational training.*

Keywords: *Gender Issues, Technical Education, Vocational Education, Access to Education, Enrollment, Women Empowerment.*

Introduction

Economic growth in India has gained international attention and recognition. As a nation's economic growth and social development depend on its workforce, increasing the employability of the workforce through technical and vocational education is important. Through these projects, the workers of the country will acquire skills and mobility to move through economic and

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industrial sectors. First, in the 18th century, the importance of women's education was recognized. Later on, UNESCO has highlighted the importance of access for girls and women for economic and social development of technical and vocational education. Technical and Vocational Education leads to an improvement in the quality of life as it helps people become economically productive and thus reduce poverty and marginalization. When people have the expertise, they become businessmen, employers, and informed citizens who contribute to a nation's economic growth. Educated and professional individuals to stimulate economic growth and development. The widely recognized role of Technical and Vocational Education was to develop skills required for improving productivity, increasing revenue, and facilitating access to jobs. The production of human resources by Technical and Vocational Education not only leads to economic development and poverty reduction but also increases social inclusion. Women are supposed to take into consideration one-half of the population of the earth. Women with a lesser financial background can not access those programs, because of the gender disparities and socio-economic status within society that prevents their career development and economic independence. Over the last decade, technical and vocational training in India has become more relevant. Technical vocational education refers to deliberate steps that would improve the effectiveness of citizens in certain areas of economic activity. Over the last decade, technical and vocational training in India has become more pertinent. This helps self-reliant people and contributes directly and efficiently to the development of the national economy. Technical and vocational education must start with a broad base that makes it easier to articulate both horizontally and vertically within and between schools and the world of work, and thus to eliminate any form of discrimination. Developing and developing countries will increase awareness of gender issues at the institutional level of Technical and Vocational Education, growing their human capital, which leads to the economic progress of a nation. Knowledge and skills are coupled with human capital and gained in the collective process of learning in families, schools, working environments, local communities, and networks of civil society. If someone is a member of these groups, they are traditional symbols of collective capital inventory. Technical and vocational education equips men and women with the skills necessary to fulfill their personal and societal obligations. Individual, technical, and vocational education offers the skills and attitudes necessary to live a more productive life and make a more meaningful contribution to the development of society. The discourse on gender inequality has been a

central aspect of regional, national, and local policy discussions on the subject of economic growth in the last few decades. The socio-cultural and labour market preconceptions have exacerbated gender inequality. In these situations, human and social resources can be seen to mutually improve and have beneficial effects on economic growth and other crucial areas such as socio-control, migration, education, governance, institutions, and democratic empowerment. The government of India has given vocational and technical training a great deal of importance. Technical and vocational education helps disadvantaged sections of society to improve employability. Such sections of society, however, often have limited access to training skills offered by allowed technical and vocational institutions. Technical and vocational education is a decisive variable for fostering sustainable economic and socio-economic growth in countries with advantages for individuals, their families, local communities, and society at large. Given its low education and job quality, India's strategy has focused on developing skills through technical and vocational education and industry. The principal aim of these initiatives is to raise the level of engagement of young people and young adults. There is, however, no evidence of work on technical and vocational education in India. Therefore, if gender awareness concerns are raised at the institutional level of Technical and Vocational Education, the participation of women is increased, leading to an overall improvement in a country's economic development. Psycho-social structures can, therefore, possibly, be regulated owing to gender stereotyping and cultural inhibitions, helping to bring about economic development and growth, a reality evident in India in terms of low participation of women in Technical and Vocational Education fields.

Operational Definitions of the terms Used

Technical Education

Technical education is a term for schools, institutions, and educational programs, which focus on professional, applied, modern technology, and preparation for jobs. It means training in the science and art concepts common to business and the application of specific industries and employment of different branches of science and art. Technical Education covers engineering, technology, administration, architecture, urban planning, pharmaceuticals, applied sciences, hotel management, and catering technologies.

Vocational Education

Vocational education is training that prepares students to serve in a particular business, craft, technical, or professional vocation, including engineering, accountancy, nursing, medicine, architecture, or the law. Vocations like jewellery or metalwork such as silverwork are usually based on manual or practical tasks and are not usually academic but are linked to a specific trade or occupation.

Gender Equality

Equality between women and men is defined as having equal opportunities, rights, and responsibilities in all areas of life. Gender equality will occur when women and men have equal rights and opportunities in all sectors of society and when the specific actions, interests, desires of women and men are equally valued and promoted, including economic participation and decision-making.

Women Empowerment

A system that allows women to get equal access to economic independence, political participation, social development and make positive contributions to society. Empowerment allows individuals to acknowledge their identity and strength throughout life. It includes better access to knowledge and resources, greater independence in decision-making, and freedom from customs, beliefs, and practices imposed on them by society.

Review of Related Literature

The following are the studies that are reviewed by the researchers from various journals, abstracts, books:

The researcher **Mufadi Al-Momani (2019)** spoke of participating through vocational education. The author studied 50 unemployed female trainees with bachelor's or diploma degrees, which were put through the long-term (2015-2017) nine-month educational program during two 25-trainee meetings. The results showed that female trainee's business has a high proportion of 84 percent because of the reinforcement of these women who expand their psyches and open up new paths and work openings for them by preparing them for the specialized information and skills required to be qualified official

secretaries. Besides, this program positively affects the social and financial existence of trainees.

The researcher **Kushmakar Bhatta (2016**) addressed gender equality in vocational education and training and social inclusion. It is found that information from the CTEVT established school was collected and analyzed to find out the current situation of inclusion. It is found that most VET programs are highly inclusive of women, particularly in traditional occupations, although low participation in non-traditional trades has appeared. There is still a need for women to carry out awareness-raising activities to increase their participation in TVET programs, especially in non-traditional occupations.

Eunice Kanaga Najoli (2019) addressed the success of WITED's Technical and Vocational Education and Training Women Enrollment Program. The work is aimed at improving women's access to technical education and vocational training. The researchers analyzed the impact of the WITED initiative on women's participation in technical and vocational education and training. The study showed that in technical and vocational education and training there is a gender disparity in enrollment, access, retention, and completion rates. The key barriers to women's enrollment and outstanding success in STEM courses include; cultural stereotypes, lack of role models, and others.

Ms. Khaing Zin Win (2018) discussed gender equality in Myanmar's access to technical vocational training (TVET). In her paper, the author found that the development of education and vocational skills in the rising sector of Myanmar is crucial for sustainable development and growth. Myanmar's technical and vocational enrollment is far below the rates of its neighbouring countries, partly because of the government's lower allocation of budgets for education. The researcher mentioned Employment and Skill Development legislation aims to modernize Myanmar's TVET system and boost workplace and unemployment TVET development, while constitutional law mentions that people must be free from discrimination and have fair access to education.

Agbara Williams (2016), a case study by the Federal College of Education (Technical), examined women's problems in technical and vocational education. The findings showed that the main issues facing female students in technical and vocational education are financial constraints, sexual harassment, and insufficient educational facilities.

Those who are married face a childbearing dilemma during their studies. Parents' level of community and income have a major impact on female students' educational performance in technical and vocational education. Through technical and vocational education, these obstacles faced by women have a negative impact on their search for vocational skills.

Okwelle, P. Chijioke et al. (2018) examined gender participation in technical and vocational education and training among students at Rivers State Technical Colleges. A descriptive survey model for the research has been adopted. The study used a total sample of one hundred and twenty-seven (127) students. Gender involvement in Technical and Vocational Education and Training at Technical Colleges in Rives State was found to be affected by a societal belief in early marriage, parental preference and priority for each child, as well as the willingness of the teacher to have sex with the student. It was recommended that enrollment in technical and vocational education and training should be made free at all levels; on the consequences of gender inequality, society needs to be informed.

The Problem

The present study attempted to find out about the problems, the progress, and the factors that show gender inequalities in Technical and Vocational education in India. In addition, the researchers attempt to determine current trends in Technical and Vocational education in India. So, the researcher entitles the paper as the "GENDER ISSUES IN Technical And Vocational Education Programs In India".

Purpose of the Study

The purpose of the study is to identify the factors affecting gender issues in the Technical and Vocational educational system in India. The study was developed to find out the factors that promote female participation in Technical and Vocational Education in India. The study points out the barriers that women face in studying Technical and Vocational education in India.

Research Questions

The following research questions guided this study:

- What are the courses that fall under Technical and Vocational Education in India?

- What are the factors that contribute to increased female participation in technical and vocational education in India?
- What are the challenges that women face in Technical and Vocational Education?
- What are the current trends in enrollment of girls in the Technical and Vocational Education fields?

Methodology

This is a descriptive study, and the analysis is based on documents. Secondary sources are used for the analysis based on multiple journal papers. The study's result was found based on secondary sources like articles, newspapers, websites, newsletters, internet, books, etc. written by multiple authors and academics from India and overseas. These sources are used to understand gender issues in technical and vocational education in India.

Discussion

1 Technical and Vocational Education in India

Technical and Vocational education remains a vital form of education that serves as the basis for the creation of small and medium-sized enterprises, which are the starting point of an industrial economy. Technical and vocational education is a distinct branch of higher education that aims to provide students with opportunities to choose study programs to obtain a career. Two separate branches of Technical and Vocational Education in India are referred to as' vocational education 'and' vocational training, 'but are typically used interchangeably. Vocational education courses are delivered as part of the formal education process, while vocational training programs are outside the formal school cycle. Vocational education and training play an important part in fostering sustainable economic growth and countries' socio-economic development, with benefits for individuals, their families, local communities, and, in effect, the entire society. Technical and vocational education plays a vital role in the development of the country's human resources through the production of skilled labor, rising economic productivity, and improving the quality of life. The term is often used synonymously with technical education and vocational training. Moreover, as usual, the term "Technical Education" refers to post-secondary research and practical training programs aimed at preparing technicians to serve as supervisory staff. The word "Technical and Vocational Education"

applies to lower-level training and training in different trades for the population of skilled or semi-skilled workers and does not raise their overall learning level. Ultimately, vocational education consists of practical courses through which in the future one acquires skills and experience directly related to a career. This helps students to be eligible and, besides, provides better job opportunities. These training courses are parallel to other conventional study courses (such as B. Sc., M. Sc., etc.). Time management and meeting deadlines play a major role in the performance of a vocational program, and students usually create a portfolio of proof (plans, documents, sketches, photos, placements) during their studies, which is taken as a measure of the willingness of students to work. Students are often offered job placements after completion of the course. Formal vocational training adheres to a structured training system and contributes to state/central government, public sector, and other reputable organizations' recognized qualifications, diplomas, or degrees. Non-formal vocational training leads to the acquisition of some marketing knowledge that allows a person to perform his/her ancestral trade or career. A person receives vocational training in the form of non-formal vocational training through 'hereditary' sources. Non-formal 'vocational education' is often provided from another source. ‘In such cases, the education obtained by a person to pursue a vacation is not ancestral and is distinct from his or her ancestors' trade or occupation. In India, the implementation of the National Education Policy (NPE 1986) and the recent Program of Action (POA) resulted in several technical and vocational programs providing access to women and girls in more than 8,000 institutions, such as Industrial/Technical Schools; Agricultural/Veterinary/Animal Farming/Fisheries/Forestry Schools; Pharmacy/Nursing/Pars-Medical Schools; Commerce/Accounting/Secretary Practice Schools; Arts/Crafts/Dress-Making Schools; Industrial Training Institutes; Technical Institutes (Polytechnics) and Colleges of Engineering and Technology. Vocational training in a way that gives students some of the work-related experience that many employers are looking for. India has now emerged as one of the world's rapidly growing economies. India's GDP is expected to grow by about 8 percent annually by 2022, and India's economy is likely to create more than 500 million jobs over the next decade, of which 75 percent will be skilled. Because of its affordability and accelerated completion, technical and vocational education has become quite common in developing countries. Various institutions that provide vocational training may be classified into five categories: (i) government, (ii) local authority, (iii) private aid, (iv) private aid, and (v) not known. In India, trends such as graduate-

postgraduate, engineering-technologists follow through training colleges, polytechnic diploma, and certificate level training in ITIs through formal apprenticeships, technical education, and vocational training processes. The vocational training of two types of organizations in India:

- Public Industrial Training Institutes (ITIs)
- Private owned Industrial Training Centers (ITCs)

The Indian government has invested heavily in skill development through ITIs. These ITIs and ITCs are governed at the national level by the DGE&T and implement policies for vocational training. In 1956, the Indian Government set up an advisory body, the National Council for Education and Learning. The National Council is chaired by the Minister of Labor, with members from various Central and State Departments, Employers and Workers, Professional and Learned Organizations, All India Technical Education Council, Scheduled Castes and Scheduled Tribes, All India Women's Organization, and so on. State Vocational Training Council was established at the state level and trade committees to assist the NCVT. According to DGE&T, the NCVT's key mandate is to develop and award National Trade Certificates in Engineering, Non-Engineering, Construction, Textile, Leather Trades, and other trade that the Government of India has brought within its scope. It also sets standards for syllabi, facilities, accommodation levels, length of courses, and training methods. It also conducts exams in various trade courses and sets the skill levels required to pass the exam leading to the National Trade Certificate award etc. Technical education contributes significantly to the economic growth of developing countries through the sufficient production of manpower in keeping with the needs of the business society, and the entire global community. In today's scientific and technical era, it's time to create professional workers/knowing technocrats. Problems of industrialization in self-reliance have been discussed by polytechnic education. Technical Education includes engineering, technology, marketing, design, urban planning, pharmacy and applied for arts & crafts, hotel management and catering technology courses and programs. The political, technological, and administrative capacities of India are on an equal footing with the best countries in the world. The technical education system in India can be divided into three groups–institutions supported by the central

government, institutions funded by the state, and institutions funded through self-financing.

2 Factors Contributing to Increased Female Participation in Technical and Vocational Education in India

In many parts of the world, women's participation in technical and vocational training was relatively small compared to men, and several countries have progressed globally. Curricula and learning content should be examined from the viewpoint of gender comprehensively at the educational level, so that gender stereotypes are not maintained. To ensure a unique perspective, this would ideally involve a representative group of stakeholders with experts. Therefore, the promotion of gender equality in technical education would also include sex curricula, teaching methods, career counseling, and scholarship programs. Female students need quality promotion in Technical and Vocational Education, particularly when they're from their peers, teachers, parents, or employers. This affects the psycho-social aspect of sexual involvement in the fields of Technical and Vocational Education research. This cannot be overlooked. Also, this is an essential component of career advice. This factor should encourage and provide practical advice for both women and men, as they shape their career choices. The psychosocial aspect also needs attention so that the ongoing gender gap is properly addressed. The aim of promoting equal access of girls to technical and vocational training courses is to provide a more efficient structure for educational and professional support services and counseling services in schools and the need to produce materials to inform them carefully and attractively about new and non-traditional/male domain fields. Transition to Work is the last but not the least important area. It is the culmination of all the efforts and investments in the earlier phases. To ensure smooth and successful transitions to work upon the completion of the Technical and Vocational Education programs, the government must collaborate with the private sector. Their participation is not only necessary to develop and update curricula but also to ensure which curricula are gender-transformative. This will lead to balancing curricula with business requirements and also to the need for social change that facilitates gender equity. The government has also allowed the private sector, through changes to labor laws and regulations, to make the workforce attractive and friendly to women and free from gender distinctions. Supporting and encouraging equal rights and opportunities for men and women, NGOs play a supportive role. Therefore, the government

encourages families to invest in the education of girls, especially in Technical and Vocational Education, and to inspire girls to enter Technical and Vocational Education programs, using role models. To help girls complete the course, financial and technical support is given to institutes and programs. The Government analyzes and plans measures to address the defined constraints of the role of young women in the job market. Promoting entrepreneurial women and encouraging self-employed women. It will ensure an equal opportunity for work and career growth, prohibit the sexual separation of jobs from the labour laws and regulations to create a favourable environment for women in the labour market.

3 Challenges of Women in Technical and Vocational Education

Women, especially female children, are viewed by the community as having persistent disparities between them and their male counterparts regarding access to certain basic development opportunities. One such opportunity is in education. Because parents believe that they will transmit to their children, their beliefs are reflected in their female children's educational aspirations. A wide range of activities traditionally dominated by women were offered training for women. There has also been relatively limited training in social and business skills, especially for women. Fees and indirect costs of technical and vocational education are a barrier to the disadvantaged and often a complete barrier to the young, particularly women. Parents are obstacles to girls because they are unaware of technical and vocational educational opportunities and unable to provide career guidance to boys. Girls and women get less support, expertise, and resources in these fields because it is perceived by teachers and school managers to be a 'male' topic for which women lack knowledge, understanding, or potential. Girls are consequently discouraged from adopting what is traditionally regarded as' male 'subjects in science, engineering, technology, or math subjects. Girls have limited career options. It is only perceived by men who have access to girls, who are taken on stereotypical gender courses such as nursing, caring, beauty and cosmetology and customization, etc. The teachers' attitude, the atmosphere of the school, and learning methods all help to develop gender stereotypes in which teachers and students both reproduce. There are gaps between males and women in occupations and job opportunities. Women are mainly found in informal and non-qualified sectors. The less qualified women find themselves in low-earning jobs. Most rural women are illiterate and girls attend school and do not finish

higher education at different levels and the few who are good do not have jobs as managers and decision-makers. In contrast, there are very few lecturers in higher education institutions, engineering, and the sciences. Second-class education in Technical and Vocational Education is considered for poor and disadvantaged people, and women alone are not permitted to participate in Technical and Vocational Education for men. It assists them to take advantage of the opportunities that Technical and Vocational Education could have given them. The prevailing attitude that girls should restrict themselves to house and family activities and not to growing activities historically dominated by males hampers their involvement in the fields of science and technology. The rigid division of labour early allocated to men and women often affects the selection of topics later on in class. Girls do not choose technological or scientific subjects which are extremely complicated, complex, and time-consuming, but prefer short courses or extension classes to be complete when engaging in their family activities. Girls are now encouraged to join the area of study which was the domain of men because of this traditional practice. The progress of reducing gender gaps in Technical and Vocational Education depends mainly on the efforts and funding of governments. At the national level, every country's government should tackle gender-sensitive institutionalization in various sectors to enhance the participation of women in Technical and Vocational Education. These can include gender-sensitive employment approaches and labour market policies. Specified campaigns to support and raise awareness may also include the implementation of gender-related actions. This is needed to attract more women and girls into fields relevant to Technical and Vocational Education. The Government must also take steps to make sure that policies relating to education, sex, and collaboration among the various ministries are enforced and strengthened effectively. This will ensure the equal opportunity provision of male and female participation in education in Technical and Vocational Education, and then economic growth and development are provided for human and social capital.

4 Current Trends in Enrolment of Girls in the Technical and Vocational Education Fields

Religious traditions, social structures, cultural norms, and value systems have created disparities in many sectors of society in many countries around the world, limiting women's chances of effective participation in socioeconomic work. Women have progressively realized their role in the processes and activities of national

development, in particular those relating to economic development and the crucial and necessary technical and vocational education. Technical schools are traditionally open mainly to male students. Girls were encouraged to participate only in different fields of study, such as secretarial and women's vocations. In secondary schools, some areas were specifically designed for girls, like secretarial and home economics, while practical topics like industrial arts, mechanical drawing, automobile mechanics and electricity were designed for boys. Even if the girls were concerned about the latter section, in the relevant subjects for admission to these schools, they found it difficult to fulfill the academic requirements of high grades. Cultural views and beliefs surrounding male/female career dichotomy have discouraged girls from enrolling, and parents have prevented their daughters from attending technical vocational schools. In terms of job status, more men are found to be working compared to their females in those who earned or got formal vocational training. However, in urban areas instead of rural areas, the jobs of professionally trained or trained people are higher, suggesting greater absorption of qualified workers in these areas. They are therefore allowed to choose fields of technical training such as accounting and secretarial courses. Technical vocational schools do not provide housing facilities and parents are reluctant to send their daughters away from home. Typically, these technical vocational schools are in zonal or provincial cities and accommodation facilities are not easily accessible. Low self-assessment and the fear of competition in the performance of technical/vocational subjects and low teacher standards of girls' success in subjects that are traditionally male students' domains have been an obstacle. While in secondary schools, girls and women were left out of technical subjects. Girls are now being encouraged to attend these courses, however. Women are now in administration and management positions. They are now appointed as administrators and assistant directors in universities. They are being trained as therapists for guidance. They enter various fields of study and job opportunities with a better chance for women workers are now feasible. Increasing trends are female participation in technical and vocational education and training, but there is little encouraging data on the participation of women in non-traditional trades. There are many technically qualified employees, on the one hand, and businesses are searching for skilled workers, on the other. In this context, women have become increasingly aware of their position in nation-building, especially economic development processes and activities that are vital and crucial to technical and vocational education.

Conclusion

Gender inequality means unequal treatment or gender perceptions of people. It results from traditionally constructed and biological variations in gender roles by genes, brain development, and hormonal differences. Gender structures are also dichotomous and hierarchical; gender binary structures may represent the differences in various facets of everyday life. Gender systems Gender inequality comes from differences, whether empirically or socially based. Technical and vocational education has now been recognized as an established development necessity in every country. It is very significant in countries such as India, where the youth share of the total population is expected to rise, resulting in a large skilled workforce; India will be on the list of highly skilled labour countries suitable for the country's development. Offshore manufacturing industries in developing countries have lucrative markets for skilled workers. The effect of working together to produce a better and more skilled workforce would lead to domestic growth and help to break the cycle of poverty. It is important to concentrate again on academic gender-responsive approaches. At the secondary level, teachers must be accountable for how they convey the message or use technology. In pre-training, the teachers should be inculcated. The engineering course will be of considerable importance to the implementation. The need for support and encouragement is, therefore, necessary for female students to train for engineering or those already studying. More education and training opportunities need to be provided to women to meet the knowledge-based economic demand and also to help their mobility towards higher-paid jobs. Education for girls has obvious advantages, such as socio-economic development and the empowerment of women. Education affects the ability of women to make informed choices. This is aimed at addressing the strategic needs of the race. There are still social and cultural expectations appropriate for professions that are called "women's work." Such perceptions of gender have a great influence on boys' and girls' selection of fields of study. Women are marginally represented in the more technical professions, resulting from their low enrollment in secondary education. To encourage more women to continue their education in unconventional fields such as science, engineering, and vocational and technical training, and career counselling services need to be provided to educate and promote awareness among female students and their parents of career opportunities in the professional and technical fields. The challenges of developing the sector of vocational and technical education require that

the various actors (government, private sector, non-profit organizations) function in complementary roles in a well-structured, integrated ecosystem. This alone can address the ability, quality, and use of vocational and technical education throughout the country. To order to minimize gender disparity in technical and vocational education, society should provide equal treatment for both men and women. In any context, women are no less than men. In every field of work, they compete with men, whether they are pilots, loco pilots, technicians, doctors, labour, etc. Regardless of gender inequality, women must be provided with equal opportunities and training to make them and the economy of our country more effectively. Developing skills through vocational training will be very successful for women, particularly for rural women who perform traditional crafts or manual labour. The Indian Government has taken effective action to encourage and provide women with vocational training. Qualification through vocational training is important because it improves women's economic empowerment. Technical education is an important development field since it helps generate literate, numerate, and innovative employees at lower-middle levels. If a gender imbalance occurs, the academic objectives and priorities cannot be reached. The main goal of technical training is to enable women and girls through the learning of technical skills to take part in national development. Gender segregation must not restrict involvement and achievement in academic and technical training. Harassment or obstacles preventing women and girls from self-sufficiency or carrying out careers that will make them economically independent must be abolished. The Government has created a broad policy statement stating that the involvement of women in technical education must be promoted. To understand the needs, desires, and experiences of men and women alike in the process of social development and to look at the role of men and women, gender inequalities, and current inequalities, special gender-specific programs including women in economic activities were drawn up and organized. The study concluded that sex representation will slowly be reduced by our education system if students receive equal opportunities from their families. Sustainable development is critical to gender equality, which cannot be achieved without women's full involvement and participation. Women and girls must have fair access to high-quality training, economic resources, and involvement and equal employment opportunities, leadership, and decision-making at various levels with men and boys.

Delimitation of the Study

The researcher conducted his research only on gender inequality in technical and vocational education in India only.

Limitations of the Study

The research lacks primary data, time and it describes gender inequalities in the technical and vocational education sector.

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CHAPTER : 32

GENDER EQUALITY IN EDUCATION

Pinki Gupta [1]

Abstract

Commonly, Education is recognized to benefits individuals and contribute to national development. Numerous studies has shown that, our society often treat boys and girls in a different manner. Although, gender inequalities in terms of education have changed much in recent decades. Despite progress in recent years, gender inequality in education remains a pervasive issue around the world. Gender equality is important for the development of societies and nations. Educating males and females leads to similar increases in their subsequent earning and develop future opportunities and selection for both boys and girls. Gender equality in education can help in economic growth by increasing the number of educated and skilled workers in the labor force. In turn, it can result into higher productivity and innovation. Additionally, educated women in leadership positions in private and public sector can boost performance by increasing diversity and promoting better decision-making. The main purpose of this research paper is to understand the importance of gender equality in education, the benefits of investing in girls' education and the strategies for promoting gender equality in education. Providing equal education to girls has numerous benefits for both individuals and society as a whole. Through a variety of strategies, gender equality in education can be achieved. Overall, there is still much work to be done in the region to achieve gender equality and progress is being made and that policymakers are taking steps to address the issue. By continuing to work towards the gender equality in education, we can create a more equitable and just society for all.

***Keywords**: Gender equality, Education, Teaching and learning process, students, Educational institutions, National development.*

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Introduction

Gender equality in education is a multifaceted issue that extends far beyond just access to schooling. It encapsulates the idea that everyone, regardless of their gender, should have equal opportunities to learn, grow, and succeed academically. This concept is rooted in the belief that no individual should be discriminated against or limited in their educational pursuits based on their gender identity. Historically, education has been an area where gender disparities have been glaringly evident. In many parts of the world, girls were denied access to education or were given inferior quality education compared to boys. These perpetuated cycles of inequality, limiting the potential and opportunities of countless individuals simply because of their gender. Initiatives focusing on girls' education, such as scholarships, mentorship programs, and awareness campaigns, have helped increase enrolment and retention rates among girls in many regions. Additionally, policies and legislation aimed at promoting gender equality in education have been implemented globally, laying the groundwork for a more inclusive and equitable educational system. One of the key pillars of gender equality in education is ensuring equal access to educational opportunities. This includes not only enrollment but also factors such as the quality of education, availability of resources, and support systems in place. It also involves challenging societal norms and stereotypes that may discourage certain genders from pursuing specific fields of study or career paths. Moreover, addressing gender-based violence and discrimination within educational institutions is paramount. Creating safe and inclusive learning environments where all students feel respected and valued is essential for achieving true gender equality in education. Another critical aspect is promoting gender-sensitive curricula and teaching practices. This involves incorporating diverse perspectives, challenging stereotypes, and highlighting the contributions of women and girls throughout history and across disciplines. By doing so, education can become a powerful tool for challenging gender norms and fostering critical thinking and empathy among students. Achieving gender equality in education requires a comprehensive and intersectional approach that addresses access, quality, safety, and inclusivity. It requires collaboration among governments, educational institutions, civil society, and communities to dismantle barriers and create a more equitable and empowering educational landscape for all.

Objectives of the Study

The objectives of study are-

- To understand the importance of gender equality in education.
- To find out the causes of gender inequality in education.
- To know the benefits of investing in girl's education.
- To study the impact of gender equality in education on our society.
- To find out the strategies for promoting gender equality in education.

Methodology of the Study

The present study is a qualitative study. The researcher here collected data from different secondary Sources like books, magazines, journals, various government organizations, websites etc.

Meaning of Gender Equality in Education

Gender equality in education means ensuring that individuals of all genders have equal opportunities, rights, and access to education. It involves eliminating barriers, discrimination, and biases based on gender, providing equal access to quality education, treating all students fairly, and creating inclusive and safe learning environments. Gender equality in education aims to empower individuals to pursue their educational aspirations, develop their skills and talents, and contribute to society without limitations or constraints based on their gender.

Importance of Gender Equality in Education

Gender equality in education is not just a matter of fairness; it is a fundamental human right and a cornerstone of sustainable development. Ensuring equal access to education for all genders is crucial for achieving social, economic, and political progress. Let's delve into the importance of gender equality in education across various dimensions.

- Empowering Individuals and Communities: Gender equality in education empowers individuals, particularly girls and women, by providing them with knowledge, skills, and opportunities for personal and professional growth. Education serves as a tool for

empowerment, enabling individuals to make informed decisions about their lives, health, and future aspirations.

- Breaking the Cycle of Poverty: Education is a powerful tool for breaking the cycle of poverty, and gender equality in education plays a crucial role in this process. When girls and women have equal access to education, they are more likely to secure better employment opportunities, earn higher incomes, and contribute to economic growth.
- Promoting Social Justice and Human Rights: Gender equality in education is a fundamental human right enshrined in international conventions and treaties. It promotes social justice by ensuring that all individuals, regardless of gender, have equal opportunities to access and benefit from education. Education is not just about acquiring knowledge; it is about fostering a culture of respect, dignity, and equality for all members of society.
- Fostering Inclusive Societies: An education system that promotes gender equality fosters inclusive societies where diversity is embraced and celebrated. By challenging stereotypes, biases, and discriminatory practices, education cultivates a culture of inclusivity, respect, and mutual understanding. Inclusive education environments benefit everyone, promoting cooperation, empathy, and social cohesion.
- Driving Economic Growth and Innovation: Gender equality in education contributes to economic growth and innovation by harnessing the full potential of human capital. When both genders have equal access to education and employment opportunities, it leads to a more diverse and skilled workforce. Diverse perspectives and talents drive innovation, creativity, and competitiveness in various sectors, fueling economic progress and sustainable development.
- Addressing Global Challenges: Education is essential for addressing global challenges such as climate change, health crises, and social inequalities. Gender equality in education ensures that all individuals have the knowledge and skills to contribute meaningfully to solving complex problems and building resilient communities. Educated individuals are more equipped to adapt to change, advocate for sustainable practices, and participate in decision-making processes.
- Promoting Gender Equity in Leadership and Decision-Making: Education plays a crucial role in promoting gender equity in leadership and decision-making roles. When girls and women

have equal access to education, they are better positioned to pursue careers in leadership, politics, and governance.

What are the Causes of Gender Inequality in Education?

Gender inequality in education persists due to a complex interplay of social, economic, cultural, and institutional factors. These factors often intersect and reinforce each other, leading to disparities in access to education, quality of education, and educational outcomes between genders. Here are some key reasons for gender inequality in education:

- Cultural Norms and Expectations: Many societies have deeply ingrained cultural beliefs and expectations regarding gender roles. These norms often prioritize boys' education over girls', leading to disparities in access and opportunities. Girls may be expected to prioritize household chores or caregiving duties over education, reinforcing traditional gender roles.
- Early Marriage and Pregnancy: In some communities, girls are married off at a young age, cutting short their educational opportunities. Early marriage is often followed by early pregnancy, which further hinders girls' ability to continue their education. Lack of access to reproductive health services and comprehensive sexuality education can contribute to this cycle.
- Gender Bias in Curriculum and Teaching: Educational materials, curricula, and teaching practices can sometimes perpetuate gender stereotypes and biases. For example, textbooks may depict boys in active roles and girls in passive roles, reinforcing notions of male dominance and female subordination. Biased teaching practices can also affect girls' confidence and participation in class.
- Economic Barriers: Poverty and economic disparities play a significant role in limiting access to education, especially for girls. Families facing financial constraints may prioritize educating boys over girls, perceiving boys' education as a better investment for future earnings. Costs associated with schooling, such as tuition fees, uniforms, and transportation, can also be barriers for families with limited resources.
- Lack of Safe and Inclusive Learning Environments: Girls may face various forms of discrimination, harassment, and violence in educational settings, including from peers, teachers, or school administrators. This can lead to dropout rates among girls, as parents may withdraw them from school to protect their safety.

Lack of separate and functional sanitation facilities for girls can also be a deterrent to their education.

- Social and Legal Barriers: In some contexts, discriminatory laws and policies restrict girls' right to education. These may include laws that limit girls' access to certain subjects or levels of education, laws that require parental consent for girls to attend school, or laws that permit child labor, preventing children, especially girls, from attending school.
- Limited Role Models and Mentors: The lack of visible female role models and mentors in educational leadership positions can impact girls' aspirations and confidence. When girls don't see women in positions of authority within the education system, they may struggle to envision themselves pursuing higher education or non-traditional fields of study.

The Benefits of Investing in Girls' Education

Investing in girls' education yields numerous benefits, both at the individual and societal levels. Some of the key advantages are-

- ✓ Economic Empowerment: Educated girls have better opportunities for employment and higher incomes, contributing to their economic independence and reducing poverty levels. Studies show that every additional year of schooling for girls can increase their future earnings by up to 20%. This economic empowerment extends beyond the individual, positively impacting families and communities by lifting them out of poverty cycles.
- ✓ Health Improvements: Education equips girls with knowledge about health, hygiene, and nutrition, leading to better health outcomes for themselves and their families. Educated girls are more likely to seek healthcare services, adopt healthy practices, and make informed decisions about their well-being, resulting in lower mortality rates among children and improved overall community health.
- ✓ Reduced Child Marriage and Early Pregnancy: Education acts as a protective factor against child marriage and early pregnancy. Educated girls are more likely to marry later and have fewer children, contributing to better family planning and healthier pregnancies.
- ✓ Empowerment and Gender Equality: Education empowers girls to challenge societal norms, advocate for their rights, and participate actively in decision-making processes. It promotes

gender equality by challenging stereotypes and promoting equal opportunities in education, employment, and leadership roles. Empowered girls become agents of change, driving progress and development in their communities.

- ✓ Social and Cultural Benefits: Educated girls are more likely to promote positive social change, including advocating for inclusive policies, supporting community development initiatives, and fostering social cohesion. They become role models, inspiring other girls to pursue education and strive for their goals, creating a ripple effect of empowerment and progress.
- ✓ Long-Term Development Impact: Investing in girls' education has long-term developmental benefits. Educated girls are more likely to invest in their children's education, creating a generational impact that breaks cycles of poverty and illiteracy. They also contribute to economic growth, innovation, and sustainable development through their skills, knowledge, and leadership contributions.
- ✓ Resilience and Crisis Response: Educated girls are better equipped to face and respond to crises, such as natural disasters, conflicts, or health emergencies. They have the knowledge and resilience to adapt, recover, and contribute to rebuilding efforts, ensuring community resilience and sustainable recovery.
- ✓ Global Impact: The benefits of investing in girls' education extend globally, contributing to achieving international development goals such as the Sustainable Development Goals (SDGs).

What are the Impact of Gender Equality in Education on our Present Society?

Gender equality in education has far-reaching impacts on our present society that span various critical domains. Economically, it enhances productivity and innovation by broadening the talent pool with diverse perspectives. This not only strengthens workforce capabilities but also fuels economic growth through informed decision-making. Moreover, education for girls and women directly correlates with reduced poverty rates by improving health outcomes, decreasing fertility rates, and expanding economic opportunities, thereby breaking the cycle of poverty in families and communities. From a health perspective, gender-equal education empowers individuals to make informed choices about their well-being, leading to better health outcomes,

particularly for women and children. Educated women are more likely to seek prenatal care, resulting in healthier pregnancies and childbirths. Politically, gender equality in education cultivates leadership skills and civic engagement among both genders. Socially, it promotes mutual respect, understanding, and cooperation among individuals of different genders, leading to greater social cohesion and inclusivity. By challenging harmful stereotypes and promoting respect for gender equality, education plays a pivotal role in reducing gender-based violence and fostering a safer environment for everyone. Lastly, education fosters innovation and creativity by providing diverse educational experiences that encourage individuals from various backgrounds to bring unique perspectives and ideas to the table. These impacts collectively contribute to building a more equitable, inclusive, and prosperous society, where everyone has the opportunity to thrive and contribute meaningfully.

Strategies for promoting Gender Equality in Education

Here are several comprehensive strategies for promoting gender equality in education:

i. Policy Frameworks: Develop and enforce comprehensive policy frameworks that prioritize gender equality in education. These policies should address issues such as equal access to education, the elimination of gender-based discrimination and violence in schools, and the promotion of gender-responsive teaching and learning practices.
ii. Teacher Training: Provide specialized training for teachers and educators on gender-sensitive pedagogy. This training should focus on identifying and challenging gender stereotypes, creating inclusive classroom environments, and integrating gender perspectives into the curriculum.
iii. Curriculum Revision: Review and revise educational curricula to ensure they are gender-inclusive and reflect diverse perspectives. This includes incorporating contributions from women and marginalized genders in various fields, addressing gender stereotypes in textbooks, and promoting critical thinking about gender roles and norms.
iv. Promoting Girls' Education: Implement targeted interventions to promote girls' education, particularly in regions where cultural norms or economic factors may hinder their access to schooling. This may include providing scholarships, improving infrastructure (such as separate sanitation facilities for girls), and

addressing barriers related to child marriage and early pregnancy.

v. STEM Education for Girls: Encourage girls' participation in science, technology, engineering, and mathematics (STEM) fields through specialized programs, mentorship opportunities, and exposure to female role models in STEM careers. Promoting girls' interest and confidence in STEM subjects can help bridge gender gaps in these fields.

vi. Parent and Community Engagement: Engage parents, caregivers, and communities in efforts to promote gender equality in education. Provide information and workshops on the importance of girls' education, address misconceptions and biases, and involve community leaders in advocating for gender-inclusive policies and practices.

vii. Safe and Inclusive Schools: Create safe, inclusive, and gender-responsive learning environments where all students feel valued and supported. This includes implementing zero-tolerance policies for gender-based violence, providing counseling and support services for survivors, and promoting respectful relationships among students.

viii. Financial Support: Provide financial support and incentives for marginalized students, including girls, to ensure they can afford to stay in school. This may include scholarships, stipends, transportation assistance, and access to free or subsidized learning materials.

ix. Monitoring and Evaluation: Establish robust monitoring and evaluation mechanisms to track progress towards gender equality in education. Collect and analyze data on enrollment rates, retention rates, academic performance, and school climate indicators to assess the impact of interventions and identify areas for improvement.

x. Advocacy and Awareness: Conduct advocacy campaigns and awareness-raising activities to mobilize support for gender equality in education. Use media, social networks, and community events to highlight the importance of girls' education, challenge stereotypes, and promote positive role models.

Findings of the study

The following are major findings of the study-

- The present study shows that Gender disparities persist, especially in regions with cultural and economic barriers.
- This study shows that Primary and secondary school enrollment rates have improved, but challenges remain, particularly for girls in certain regions.
- This study shows that girls' educational attainment has increased, yet disparities exist in higher education and leadership roles.
- This study reveals that Gender-sensitive policies have a positive impact on promoting equality, highlighting the importance of policy frameworks.
- This study shows that from a health perspective, gender-equal education empowers individuals to make informed choices about their well-being, leading to better health outcomes, particularly for women and children.
- The present study reveals that social and cultural factors play a significant role in shaping educational opportunities and outcomes, requiring broader societal shifts.

Recommendations

Some of the recommendations are mentioned below-

- Government should implement teacher training programs focused on addressing gender biases and creating inclusive classrooms.
- Government should foster community partnerships and awareness campaigns to support girls' education and challenge societal norms hindering gender equality.
- It is also necessary for Government to advocate for comprehensive policy reforms at all levels to ensure gender equality in education.

Conclusion

Gender equality in education is not just a matter of fairness; it is a fundamental human right and a key driver of social and economic progress. Over the years, significant strides have been made in advancing gender equality in education, yet there are still persistent challenges that need to be addressed. One of the major achievements in promoting gender equality in education is the increased enrollment of girls in schools worldwide. Efforts to eliminate gender disparities in access to education have resulted in more girls attending primary and secondary schools, narrowing the gender gap in educational attainment.

Moreover, initiatives aimed at improving the quality of education for both girls and boys have played a crucial role in promoting gender equality. Providing equal opportunities for learning, ensuring gender-sensitive curricula, and training teachers in gender-responsive teaching methods have helped create inclusive learning environments where all students can thrive regardless of their gender. However, despite these advancements, challenges persist, particularly in certain regions and communities. Socio-cultural norms and practices, economic barriers, lack of infrastructure, and gender-based violence continue to hinder progress towards achieving full gender equality in education. Furthermore, promoting gender equality in education requires a multi-stakeholder approach involving governments, civil society, academia, and the private sector. Collaboration and coordination among these stakeholders are essential to identify and implement effective strategies that address the root causes of gender disparities in education. In conclusion, while there have been significant achievements in promoting gender equality in education, much more needs to be done to ensure equal opportunities for all. By addressing systemic barriers, fostering inclusive learning environments, and promoting collaborative efforts, we can create a future where every individual, regardless of gender, has access to quality education and the opportunity to fulfill their potential.

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CHAPTER : 33

SUSTAINABLE DEVELOPMENT IN TEACHERS

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Abstract

Education for Sustainable Development is a dynamic educational approach aimed at empowering individuals and communities to actively engage in building a more sustainable and equitable future. This holistic framework goes beyond traditional academic subjects to foster critical thinking, problem-solving skills, and an understanding of the interconnectedness between social, economic, and environmental aspects. Recognizing the urgency to address global challenges such as climate change, poverty, and social inequality, Education for Sustainable Development equips learners with the knowledge, values, and skills necessary to contribute to a sustainable society. In recent years, Education for Sustainable Development has gained prominence as societies recognize the need for a sustainable future. Formal education institutions, non-formal settings, and community-based initiatives are crucial in implementing Education for Sustainable Development through interdisciplinary approaches and experiential learning. Integrating Education for Sustainable Development into teacher education programs is essential to ensure educators are equipped to promote inclusivity, diversity, and equity, address social inequalities, and in still values of environmental stewardship and responsible citizenship. This abstract underscore the significance of teacher education in fostering sustainable development and emphasizes the role of educators in shaping a generation capable of addressing complex global challenges.

Keywords: *Education, Teachers, Sustainable development, global challenges*

Introduction

Education for Sustainable Development is a dynamic and holistic approach to learning that empowers individuals and communities to actively engage in creating a more sustainable

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and equitable future. This educational framework goes beyond traditional academic subjects, aiming to foster critical thinking, problem-solving skills, and a deep understanding of the interconnectedness between social, economic, and environmental aspects of our world. It's recognizing the need to address pressing global challenges such as climate change, biodiversity loss, poverty, and social inequality. The goal is to equip learners with the knowledge, values, and skills necessary to contribute to building a more sustainable society. This educational paradigm emphasizes the importance of ethical decision-making, responsible citizenship, and a sense of shared responsibility for the well-being of both present and future generations.

In recent years, the concept of education for sustainable development has gained prominence as societies grapple with the urgency of creating a sustainable future. Formal education institutions, non-formal learning settings, and community-based initiatives play crucial roles in implementing education for sustainable development. Through interdisciplinary approaches and experiential learning, it’s encouraging individuals to explore innovative solutions, promote social justice, and embrace a global perspective.

As we navigate complex and interconnected challenges, the integration of Education for Sustainable Development becomes increasingly vital. By fostering a sense of environmental stewardship, social responsibility, and a commitment to sustainable practices, it’s serves as a catalyst for positive change, shaping a generation capable of building a resilient and harmonious world. Education is a powerful weapon to change the behaviour of an individual. Education is a planned process with certain gaols in mind, like facilitating learning or developing abilities as well as morality among these objectives could be the growth of comprehending reason, generosity, as well as fairness. The dissemination of knowledge is the primary goal of education.

Objectives of the study

- To incorporate sustainable development principles into their teaching practices.
- To promote inclusivity, diversity, and equity within teacher education programs.
- To address social inequalities and promote inclusive teaching practices that contribute to social sustainability.

- To address specific sustainability challenges, fostering a sense of community responsibility and resilience.
- To Provide ngoing professional development opportunities for teachers to stay updated on sustainability trends, research, and best practices.
- To train teachers to incorporate mindfulness, stress reduction techniques, and mental health awareness into their classrooms, contributing to the holistic development of students.

Importance of Education

1. Education equips individuals with critical thinking and problem-solving skills, enabling them to address challenges related to environmental degradation, climate change, and social injustice.
2. Education empowers communities to actively participate in sustainable development initiatives.
3. Through education, individuals are exposed to alternative and sustainable lifestyles.
4. Education builds the capacity of individuals, communities, and nations to respond effectively to current and future sustainability challenges.
5. Education promotes the concept of global citizenship, encouraging individuals to recognize their interconnectedness with the rest of the world.
6. Education plays a key role in promoting inclusivity, diversity, and social cohesion, addressing inequalities and ensuring that sustainable development benefits all members of society.
7. Education enables citizens to engage in informed discussions, participate in decision-making processes, and influence policies that promote sustainable development.
8. Education provides individuals with a holistic understanding of these interconnected aspects, preparing them to address complex, multifaceted challenges.

Need of Teacher Education

Teacher education is crucial for several reasons, as it directly impacts the quality of education provided to students and influences the overall development of a society. Here are key reasons highlighting the need for teacher education:

1. Quality of Instruction: Effective teacher education programs equip educators with the pedagogical skills, content knowledge, and instructional strategies needed to deliver high-quality education. Well-trained teachers are more likely to create engaging and effective learning environments.
2. Student Achievement: Teacher quality is a significant factor influencing student achievement. Teachers who undergo comprehensive education and professional development are better equipped to meet the diverse needs of students, leading to improved academic outcomes.
3. Pedagogical Innovation: Teacher education introduces educators to innovative teaching methods, technologies, and educational research. This enables teachers to adapt to evolving educational trends, incorporate new technologies, and employ varied instructional approaches to enhance student learning.
4. Inclusive Education: Teacher education programs emphasize inclusive teaching practices, preparing educators to address the diverse needs of students with varying abilities, backgrounds, and learning styles. This fosters a more inclusive and equitable learning environment.
5. Classroom Management Skills: Effective teacher education provides training in classroom management techniques, helping teachers create a positive and conducive learning atmosphere. Well-managed classrooms contribute to better student engagement and a more productive learning environment.
6. Understanding Educational Psychology: Teacher education includes the study of educational psychology, helping educators comprehend the cognitive, emotional, and social development of students. This knowledge enables teachers to tailor their instructional methods to students' individual needs.
7. Continuous Professional Development: Teacher education is not a one-time event but an ongoing process. It encourages teachers to engage in continuous professional development, staying updated on educational research, teaching strategies, and best practices throughout their careers.
8. Ethical and Professional Standards: Teacher education programs instill a strong foundation in ethical and professional standards for educators. This includes principles of fairness, integrity, and a commitment to the well-being and development of students.
9. Effective Communication Skills: Teachers need strong communication skills to convey information clearly, facilitate discussions, and build positive relationships with students,

parents, and colleagues. Teacher education programs focus on enhancing these crucial skills.

10. Leadership and Advocacy: Teacher education prepares educators to take on leadership roles within schools and communities. It empowers them to advocate for educational policies and practices that promote student success, equity, and the overall improvement of the education system.

In summary, teacher education is vital for producing skilled, knowledgeable, and motivated educators who can positively impact the learning experiences and outcomes of students, contributing to the overall improvement of education systems.

Sustainable Development

Sustainable development in teacher education refers to the integration of principles and practices that ensure the long-term well-being of both current and future generations through effective teacher training programs. This approach recognizes the interconnectedness of economic, social, and environmental aspects and aims to equip teachers with the knowledge, skills, and attitudes necessary to promote sustainable development in their classrooms and communities. Here are key aspects of sustainable development in teacher education:

Holistic Curriculum: Develop a curriculum that integrates sustainability concepts across subject areas, emphasizing the interconnectedness of environmental, social, and economic issues. Include real-world examples, case studies, and interdisciplinary projects that demonstrate the practical application of sustainable development principles.

Pedagogical Approaches: Encourage learner-centered and participatory teaching methods that foster critical thinking, problem-solving, and creativity. Promote experiential learning, outdoor education, and community-based projects to connect theoretical knowledge with practical applications and real-world challenges.

Inclusive Education: Emphasize inclusivity and diversity in teacher training to ensure that educators are equipped to address the needs of all learners, regardless of their backgrounds, abilities, or socio-economic status. Train teachers to create inclusive and supportive

learning environments that celebrate cultural diversity and promote social justice.

Technology Integration: Provide training on the effective use of technology to enhance teaching and learning while minimizing its environmental impact. Foster digital literacy skills and responsible use of technology to empower teachers to leverage digital tools for sustainable development education.

Global Perspectives: Equip teachers with a global perspective on sustainable development to help students understand and appreciate the interconnectedness of local and global issues. Facilitate international collaboration and exchange programs to broaden teachers' perspectives and expose them to diverse approaches to sustainable education.

Professional Development: Offer ongoing professional development opportunities for teachers to stay updated on current research, best practices, and emerging trends in sustainable education. Foster a culture of collaboration and peer learning within the education community, encouraging the sharing of successful strategies and experiences.

Community Engagement: Encourage teachers to engage with local communities, promoting partnerships between schools and community organizations to address sustainability issues. Involve parents and community members in educational initiatives that contribute to the overall well-being of the community and environment.

Assessment and Evaluation: Develop assessment tools that measure students' understanding of sustainable development concepts and their ability to apply them in real-world scenarios. Implement evaluation mechanisms for teacher education programs to ensure they are effectively integrating sustainable development principles.

Resource Efficiency: Model and promote resource-efficient practices within teacher education programs, considering energy consumption, waste reduction, and sustainable procurement.

How to Achieve Sustainable Development

Achieving sustainable development within the classroom necessitates the integration of sustainability principles into both instructional methods and the curriculum. Teachers can adopt several strategies to advance

sustainable development in their classrooms. Firstly, they can integrate sustainability into the curriculum by identifying opportunities to infuse sustainability concepts across various subjects, utilizing real-world examples and case studies to highlight the impact of human activities on the environment and society, and facilitating discussions on the United Nations Sustainable Development Goals (SDGs) in relation to different subjects. Secondly, teachers can promote critical thinking by encouraging students to critically assess the environmental and social implications of their actions, fostering discussions on ethical considerations, and exploring the long-term consequences of different choices. Additionally, hands-on learning experiences, such as field trips and projects related to environmental conservation, renewable energy, or sustainable agriculture, provide students with practical engagement in sustainable practices. The incorporation of technology is also encouraged to explore and discuss global environmental issues through online platforms and resources. Teachers can further model sustainable behavior by reducing waste, conserving energy, and making environmentally conscious choices in their own practices while sharing personal experiences related to sustainable living to inspire students. Collaborative projects that require students to find sustainable solutions to real-world problems enhance teamwork and simulate the interdisciplinary nature of sustainability challenges. Environmental education programs, including partnerships with local environmental organizations and participation in workshops or training programs, can provide valuable insights and resources. Assessment and evaluation methods can be developed to gauge students' understanding of sustainability concepts and assess the environmental impact of their projects and assignments. Encouraging community involvement through initiatives like community service projects related to sustainability helps students connect classroom learning to local initiatives and engage in activities that benefit the community. Finally, teachers should prioritize continuous learning by staying informed about current sustainability issues and adapting their teaching methods as new information becomes available. By implementing these strategies, teachers can play a pivotal role in nurturing a sense of responsibility and awareness among students, preparing them to make positive contributions to a more sustainable future.

Sustainable Development Goals

Teachers play a vital role in contributing to the achievement of the United Nations Sustainable Development Goals (SDGs) through their

influence on education, awareness, and the development of students. Here's how teachers can align with the SDGs:

1. Quality Education 2.Gender Equality 3. Good health and well-being 4. Clean Water and Sanitation 4.No poverty 5. Zero hunger 6. Affordable and Clean Energy Decent 7. Sustainable Cities and Communities 8. Responsible Consumption and Production9.Work and Economic Growth Industry, 10.Innovation, and Infrastructure Reduced 11. Inequality 12. Climate Action 13. Life below water life on land Peace, 14. Justice, and 15. Strong Institutions Partnerships for the Goals.

By integrating these principles into their teaching practices, teachers contribute significantly to the realization of the Sustainable Development Goals, fostering a generation of informed and responsible global citizens.

Role of B.Ed. And B.Ed. Teachers in Sustainable Development

B.Ed. (Bachelor of Education) programs and B.Ed. teachers play a crucial role in fostering sustainable development through education. B.Ed. programs equip future educators with the knowledge and skills to integrate sustainability principles into their teaching practices. Teachers trained through B.Ed. programs become instrumental in shaping the mindset and behaviors of students towards sustainable living. By incorporating sustainability into the curriculum, fostering critical thinking, and promoting values of environmental responsibility, B.Ed. teachers contribute to creating a generation that is aware of global challenges and empowered to address them. Their role extends beyond imparting subject knowledge to instilling values that align with the United Nations Sustainable Development Goals (SDGs). In essence, B.Ed. and B.Ed. teachers serve as catalysts for sustainable development by nurturing a sense of responsibility, awareness, and active citizenship in the students they educate.

Conclusion

In conclusion, integrating these components into teacher education programs allows institutions to significantly contribute to the preparation of educators who possess not only subject expertise but also a dedicated commitment to cultivating sustainable development within their classrooms and communities.

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CHAPTER : 34

ASSESSMENT OF SUSTAINABLE LIFESTYLES PRACTICES OF STUDENT TEACHERS

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Abstract

The realization of the pressing need to save the planet from imprudent exploitation of the depleting natural resources has impressed upon the collective consciousness of the countries of the world and brought into focus an intensifying thrust on sustainable development. In an age defined by environmental challenges and a rapidly changing planet, the need for sustainable lifestyles has never been more urgent. The aim of this study is to assess the sustainable lifestyles practices of student teachers in various domains such as social, economic, environment and personal. Survey method was used in the study. The sample of study consists of 71 student teachers who are third year students of Regional Institute of Education, Mysuru. In order to collect data about student teachers' sustainable lifestyles practices and preparedness to integrate sustainable development into science education as well as the barriers and challenges in adopting a sustainable lifestyle, focus group discussion consisting of questions and a questionnaire consisting of 5-point Likert scale type of 25 items and 7 multiple choices was used. Descriptive statistics was used to get a dimension wise analysis of social, economic, environment and personal of the sustainable lifestyles of student teachers. The study findings revealed that 19.7%, 60.6% and 19.7% student teachers were good, average and poor in practicing sustainable lifestyles. Qualitative analysis from the Focus Group Discussion revealed student teachers were poor in practicing sustainable lifestyles. Though the NEP 2020 emphasizes that students have to equipped with the knowledge, skills and values of sustainable development, it can only be possible when the future teachers practice

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sustainable lifestyles and have an comprehension about sustainable development.

Keywords: *Sustainable Lifestyle, Science Education, Sustainable Development, Student teachers, NEP 2020*

Introduction

The world is being overextended by our existing lifestyles, which are marked by excessive spending, an excessive reliance on fossil fuels, and a frequently inadequate use of resources. The evidence is clear-cut: pollution, deforestation, biodiversity loss, and rising global temperatures all contribute to a concerning picture. These problems are linked together, and they will have disastrous effects if nothing is done about them. The idea of sustainable living has transformed from an idealistic goal to an urgent necessity in an era of climate change, depleting resources, and expanding populations. It involves making deliberate decisions in our day-to-day lives to reduce our environmental footprint and guarantee a habitable Earth for coming generations. However, achieving sustainability is not without challenges.

The Sustainable Development Goals (SDGs) were introduced by the UN in September 2015, and they set forth immediate objectives for the member countries to meet. The majority of these goals require altering one's behaviour, goals, and perspective on ownership, sharing, and the role of citizens. In order to meet the goals and cultivate the ideal mindset for critical thinking, education must be an essential component. The critical role of education is underlined by the fact that responses to climate change and sustainable development involve more than technological and financial policies. It requires “broader structural, cultural, perceptual, behavioural and ideological shifts (MoChizuki and Bryan, 2015).

Education for Sustainable Development first gained momentum during the Decade of Education for Sustainable Development (2005–2014), which also brought together practitioners from around the globe to share ideas, breakthroughs, and success stories. Acknowledging the importance of education in India's environmental strategy, the Ministry of Environment and Forests established the Centre for Environment Education (CEE) in 1984 to spearhead EE and ESD at the same time as the Ministry was set up. For a nationwide outreach, the Ministry of Environment introduced programmes including the National Green

Corps (NGC) in 2001–2002 and the National Environmental Awareness Campaign (NEAC) in 1986. NGOs and educational institutions participated in regional mass awareness campaigns as part of the National Environmental Awareness Campaign, which resulted in a wide range of awareness initiatives. Schools create eco-clubs as part of the NGC, and these groups participate in extracurricular activities both within the school and in the community.

The landmark judgement of the Supreme Court of India (2002) made it obligatory for the States and UTs to comply with the implementation of environmental aspects through education, wherein the strategies of infusion, integration or making it as a separate subject area were adopted by the States. The responsibility of overseeing the States' incorporation of environmental issues into the curriculum fell to the National Centre of Educational Research and Training (NCERT), which develops the National Curriculum. The National Curriculum Framework (NCF), a thorough document created by the NCERT in 2005, serves as a roadmap for incorporating environmental issues within the formal education curriculum. It is essential that teachers receive training on ESD approaches and methodologies in addition to the textbooks.

Sustainable Lifestyles

Sustainable lifestyles are patterns of action and consumption, used by people to either associate or differ from others through their means of meeting their basic needs and striving to have a better quality of life. When individuals follow sustainable lifestyles they tend to minimize the use of resources and emissions of waste and pollutants and not jeopardise the needs of future generations (UNEP). Understanding lifestyles is crucial if we are to solve some of the environmental challenges we face today. A sustainable lifestyle means rethinking our ways of living, how we buy and what we consume every day. It also includes rethinking how we organize our daily lives, altering the way we socialize, exchange, share, educate and build identities. Enabled both by individual actions and efficient infrastructures, sustainable lifestyles play a key role in minimizing the use of natural resources, emissions, waste and pollution while supporting equitable socio-economic development. Education for sustainable development and education for sustainable lifestyle play a crucial role to equip students with knowledge as well as the behaviours to live sustainably. Students exposed to sustainability concepts and practices early in their education

are more likely to integrate them into their lives, contributing to a more sustainable future.

A study conducted by UNESCO has found that teachers who embody sustainable practices have a stronger influence on students' environmental attitudes and behaviours compared to those who don't. UNESCO also emphasized the critical role of education in achieving the Sustainable Development Goals (SDGs) and called for teachers to be equipped with the knowledge and skills to promote sustainability education. Teachers with personal experience in sustainability have a deeper understanding of its complexities, leading to more effective teaching strategies and engaging lessons and showed that teachers who integrate their own sustainability practices into their teaching are more confident and passionate about the subject, fostering student engagement and learning (Loughran et al., 2014; Rickinson, 2009)

Science Education for Sustainable Lifestyles

Science education plays a pivotal role in equipping individuals with the knowledge and skills needed to make informed decisions and adopt practices that safeguard the planet's well-being. Science education provides a strong foundation in understanding complex environmental issues like climate change, biodiversity loss, and resource depletion. By learning about the underlying scientific principles and data, individuals can grasp the severity and interconnectedness of these challenges. Science education equips individuals to critically evaluate information, recognize misinformation, and make informed decisions. This is crucial in a world saturated with conflicting voices and opinions regarding sustainability. By fostering critical thinking skills, science education enables individuals to adapt to changing environmental conditions and contribute to innovative solutions for achieving sustainability. This awareness can empower the students and student teachers to take responsible decisions regarding consumption, waste management, energy use, transportation and contribute to a sustainable lifestyle.

Outlines the critical role of science education in equipping individuals with the knowledge, skills, and values needed to live sustainably. It emphasizes learning about renewable energy, resource conservation, and responsible consumption patterns (UNESCO). Studies show that science education can increase knowledge about environmental issues and foster positive attitudes towards

sustainability. A study found that students participating in a sustainability-focused curriculum demonstrated improved understanding of climate change and increased willingness to engage in eco-friendly behaviours (Martin & Carter, 2015). Students who participate in science education programs focused on sustainability are more likely to adopt environmentally friendly behaviours, like reducing energy use and recycling (Rickinson, 2009). National Research Council emphasizes the importance of scientific literacy for making informed decisions on issues like climate change, energy choices, and resource consumption. Science education empowers individuals to analyse information, discern fact from fiction, and choose sustainable options.

Effective science education equips students with critical thinking and problem-solving skills, empowering them to analyse environmental challenges and identify solutions. Pedagogies like Inquiry based learning can engage students in active learning through investigations, experiments, and project-based work can deepen their understanding of sustainability concepts and encourage personal connections to environmental issues. Connecting science education to real-world issues through community partnerships and service learning allows students to apply their knowledge in meaningful ways and understand the local impact of sustainability actions.

Rationale of the study

Sustainable Lifestyles is crucial if we are to solve some of the environmental challenges we face today. A sustainable lifestyle means rethinking our ways of living, how we buy and what we consume every day. It also includes rethinking how we organize our daily lives, altering the way we socialize, exchange, share, educate and build identities. Enabled both by individual actions and efficient infrastructures, sustainable lifestyles play a key role in minimizing the use of natural resources, emissions, waste and pollution while supporting equitable socio-economic development. For a better understanding of sustainable lifestyles and consumption patterns, more research and education are needed to help in the shift towards sustainable lifestyles. Schools, professional training and awareness raising have an important role to play in building capacities for sustainable lifestyles. Existing initiatives and networks that focus on research and education for sustainable lifestyles should be improved and replicated. This will help advance sustainable lifestyles and create

new visions for sustainable lifestyles. (UNEP, Global Survey). In order to empower all students to contribute to a sustainable future, NEP 2020 encourages schools to encourage sustainable lifestyles on campus and raise student awareness of eco-friendly practices. It also emphasises the importance of providing equitable access to high-quality science education that incorporates sustainability concepts, as well as providing teachers with the tools, resources, and knowledge they need to effectively integrate sustainability into the curriculum through integration of multiple subjects.

Statement of the problem

The rate of development in the past fifty years of our country have led to irresponsible exploiting of the available resources on our land, these have contributed to unsustainable development. There are problems with the environment like climate change, extreme heat, rising sea levels etc. We have developed at the cost of the biodiversity around us by deforestation, habitat destruction, pollution and reduced soil fertility. We are using up the Earth's resources at an unsustainable rate. This includes things like fossil fuels, freshwater, and minerals. If we continue to use these resources at our current rate, we will eventually run out of them. There are rise in inequalities in terms of availability of resources and conflicts among states in a country and between countries because of these resources. The day-to-day choices an individual makes have a huge impact on the environment, social and economic dimensions. This can include their choice of food to consumption patterns to transportation choices and decisions they take regarding the use of available resources. Education can help foster students the required knowledge, awareness, skills and values for sustainable living. Teachers are needed to evolve and start to integrate their subjects with sustainable development concepts to help citizens of the country to live sustainably, so fostering sustainable lifestyles is no longer a personal choice but a collective responsibility. A study conducted by UNESCO has found that teachers who embody sustainable practices have a stronger influence on students' environmental attitudes and behaviours compared to those who don't. The present study aims at “Assessing the sustainable lifestyle practices of student teachers.”

Objectives

1. To assess the sustainable lifestyles practices among student teachers based on social, environment, economic and personal dimensions.
2. To study the preparedness of student teachers to integrate sustainable lifestyles through science education.
3. To find out the barriers and challenges of student teachers to adopt a sustainable lifestyle.

Methods and Procedures

The study was conducted to assess the sustainable lifestyles practices of student teachers. In order to achieve the above objectives descriptive survey method was adopted. The sample consisted of 71 student teachers who were pursuing four year and six year integrated course in teacher education programme.

Tools and techniques

The researcher developed a questionnaire of 30 items consisting of 5-point Likert scale and multiple-choice questions 25 and 5 respectively to assess the sustainable lifestyle practices of student teachers. The questions consisted from the various aspects of social, environment, economic and personal. Questions were also included to find out the barriers and challenges faced by students to adopt sustainable lifestyles. Both positive and negative questions were included and scoring was given ranging from 5 to 1 for Likert scale accordingly. Focus Group Discussion was also conducted with 12 students of both four year and six-year integrated teacher education programmes which consisted of 15 questions about the sustainable lifestyle practices of them in various dimensions of social, environment economic and personal aspects. The questions about the student teacher preparedness to integrate sustainable development through science education were also included.

Data collection

The data was initially collected through Focus Group Discussion with 12 students from four year and six-year integrated teacher education programmes. Then data was collected with the help of the questionnaire containing 30 items using google form. The data was then transferred to SPSS and analysed based on the objectives.

Descriptive statistics was used to analyse the sustainable lifestyle practices of student teachers with measures of central tendency and graphs and frequency tables. Qualitative data was interpreted as narratives of student teachers.

Results and Discussion

Objective 1: To assess the sustainable lifestyles practices among student teachers based on social, environment, economic and personal dimensions.

In order to achieve the first objective of the study namely "To assess the sustainable lifestyles practices among student teachers based on social, environment, economic and personal dimensions." A questionnaire was administered to the four year and six year integrated teacher education programmes student teachers and the scores are calculated according to the scoring key and recorded. The results are indicated in the following tables.

Table 1.1

Descriptive statistics of student teacher's sustainable lifestyle practices

Statistic	**Value**
Mean	101.8
Median	102
Mode	102
Std. Deviation	7.2

The results from Table 1.1 indicate the mean, median, mode values of the total scores of student teachers sustainable lifestyles practices of six and four year integrated teacher education programmes are 101.8, 102 and 102 respectively. The standard deviation value is 7.2, which shows that the total scores are packed within the distribution. Figure 1.1 indicates a near-normal distribution of the total scores of the sustainable lifestyle practices of student teachers.

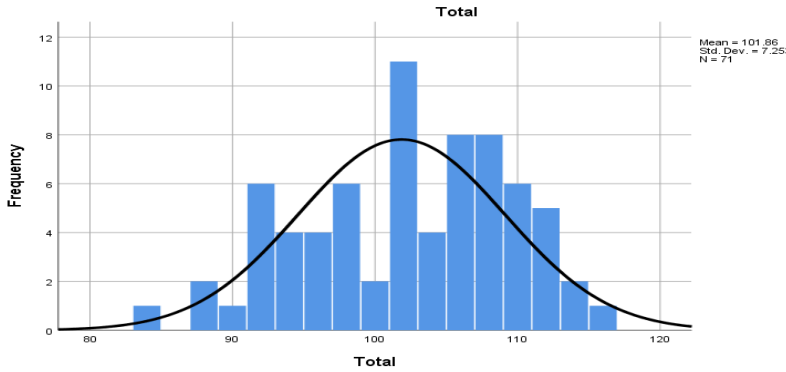


Fig 1.1 Descriptive Statistics of sustainable lifestyle practices of student teachers

Table 1.2

Frequency and percentage of sustainable lifestyle practices of student teachers

Sustainable lifestyle practices	**Frequency**	**Percentage**
Good	14	19.7%
Average	43	60.6%
Poor	14	19.7%

The results from the table 1.2 indicate that there are 19.7% of student teachers are good at practicing sustainable lifestyles where as 60.6% of student teachers are average in practicing sustainable lifestyles and 19.7% of student teachers are poor in practicing sustainable lifestyles.

Table 1.3

Descriptive statistics of student teacher's sustainable lifestyle practices dimension wise

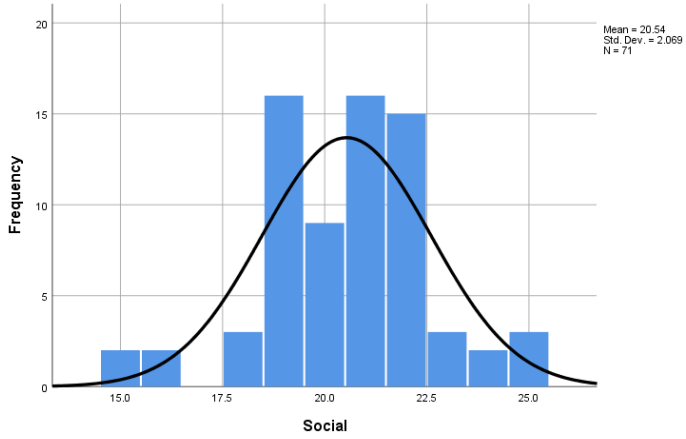
Statistic	**Social**	**Environment**	**Economic**	**Personal**
Mean	20.5	29.3	30.3	183.7
Median	21	30	30	183
Mode	19	30	29	193
Std. Deviation	2.1	2.6	2.8	12.6

The results from Table 1.3 indicate the mean, median, mode values of the total scores of student teachers sustainable lifestyles practices of six and four year integrated teacher education programmes in social domain are 20.5, 21 and 2.1 respectively. The standard deviation value is 2.1, which shows that the total scores are packed within the distribution.

The mean, median, mode values of the total scores of student teachers sustainable lifestyles practices of six and four year integrated teacher education programmes in Environment dimension are 29.3, 30 and 30 respectively. The standard deviation value is 2.6, which shows that the total scores are packed within the distribution.

The mean, median, mode values of the total scores of student teachers sustainable lifestyles practices of six and four year integrated teacher education programmes in Economic dimension are 30.3, 30 and 29 respectively. The standard deviation value is 2.8, which shows that the total scores are packed within the distribution.

The mean, median, mode values of the total scores of student teachers sustainable lifestyles practices of six and four year integrated teacher education programmes in personal dimension are 183.7, 183 and 193 respectively. The standard deviation value is 12.6.



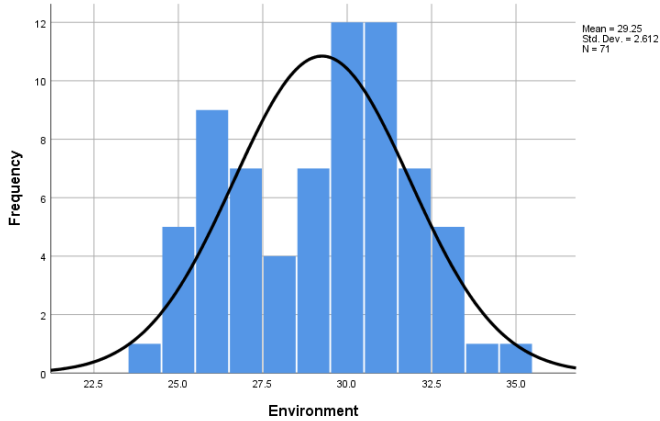


Fig 1.2 Descriptive statistics of sustainable lifestyle practices of student teachers in Social and Environment dimensions

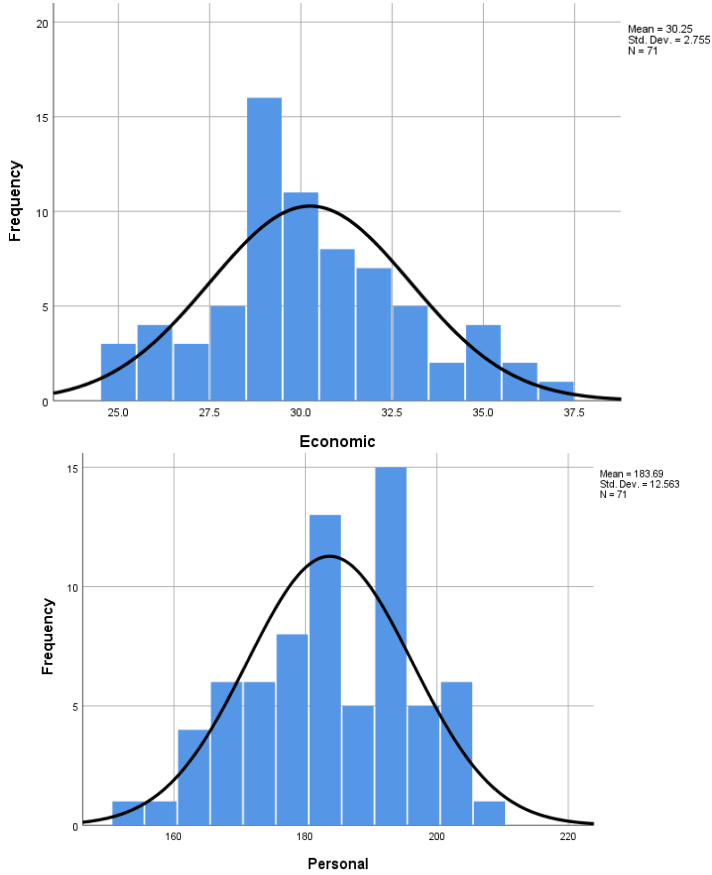


Fig 1.3 Descriptive statistics of sustainable lifestyle practices of student teachers in Economic and Personal dimensions

The results show that most of the student teachers to be practicing a sustainable lifestyle, but the results are very different from the responses through Focus Group Discussion. The data from the student teachers was initially collected through FGD, the questions included about their preferred mode of transport, consumption of food, waste management, energy use, sharing of resources and responsible spending and consumption. The student teachers have responded that they would prefer a vehicle to travel than walk to short distances and were not judiciously using the resources like food, water and energy and are not responsible in spending and sharing the resources. Student teachers have reported individuals can change and practice sustainable lifestyles.

Discussions

As the studies quote that Student teachers with personal experience in sustainable living develop a deeper understanding of its principles and challenges. This translates into more effective teaching, allowing them to connect sustainability concepts with real-world experiences and engage students in meaningful learning (Rickinson, 2009). So, there is need for student teachers to gain the knowledge and awareness about sustainable development and practice sustainable living.

Objective 2: To study the preparedness of student teachers to integrate sustainable lifestyles through science education.

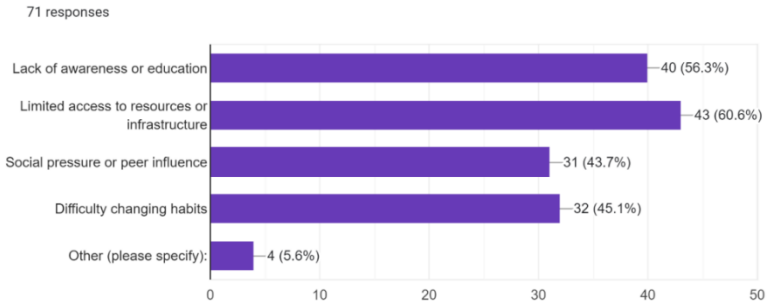
In order to attain this objective Focus Group Discussion was carried out with 12 students of four year and six year integrated teacher education programme student teachers. The questions asked included knowledge and awareness regarding sustainable development and the possibility of teaching sustainability concepts through science education. Discussion was also carried out whether they would like to integrate sustainable development concepts into science education. The discussion ended with issues regarding how the present teacher education programmes can help the future teachers to gain the necessary pedagogies and effective strategies for integrating sustainable development into science education. The discussion was recorded with the consent of the student teachers.

The student teachers of four year and six-year integrated teacher education programmes were aware about the term sustainable development and their answers were limited only to environment

dimension. They were not aware about interplay of social, environment and economic aspects in sustainable development. When questions were posed about the need for every one to live in a sustainable manner student teachers responded that teachers have to teach these concepts in school to the students. Student teachers responded that sustainable development concepts can be integrated with the subjects such as science, maths and social science and even languages. Student teacher responded that they would teach concepts in subjects like science and maths by integrating sustainable development concepts where ever possible. Discussion was carried on whether the present pedagogy classes or the curriculum of the programme has any provision for equipping the student teachers with the necessary teaching strategies and pedagogies for integrating sustainable development in science, they responded that there is a need for evolving and learning the necessary teaching strategies and pedagogical techniques to cater to the needs of the present generation. Student teachers also added that they need better understanding about the concept of sustainable development.

Objective 3: To find out the barriers and challenges of student teachers to adopt a sustainable lifestyle.

To attain this objective questionnaire was used where student teachers have stated the barriers and challenges to adopt a sustainable lifestyle. The challenges for student teachers to practice a sustainable lifestyle are as follows



Some student teachers mentioned as not interested and not motivated to practice a sustainable lifestyle. Focus Group Discussion also shed light on the fact that Student teachers did not have a comprehensive idea about sustainable development.

Conclusion

Sustainable Lifestyles isn't just about personal choices, it's about shaping a future where education empowers individuals to become responsible stewards of the planet. Student teachers, stand at a unique crossroads - equipped with knowledge and the potential to ignite positive change. Student teachers serve as powerful role models, their personal choices and behaviours significantly impact their future students, shaping their attitudes and perceptions towards sustainability. By embodying sustainable practices, they inspire and motivate students to adopt similar habits. Personal engagement with sustainability empowers student teachers to become responsible citizens, actively contributing to positive environmental and social change. The process of adopting and practicing sustainable lifestyles involves critical thinking, problem-solving, and decision-making, valuable skills for both personal and professional life. Through this study it was found that most of student teachers showed their sustainable lifestyles practice to be average but when Focus Group Discussion was done their responses were not matching to the results obtained. The study also found student teachers to be interested in understanding about sustainable development and also to integrate the concepts in science topics. Teacher education programs can play a crucial role in providing resources, support, and positive reinforcement for student teachers pursuing sustainable practices. The concepts of Education for Sustainable Development components can be integrated to the already existing environment studies. Student teachers can also be familiarised with the pedagogies and the skill of integrating sustainable concepts with science concepts. Science education fosters scientific literacy and critical thinking skills, to empower individuals to understand the challenges they face and contribute meaningfully to solutions that ensure a thriving planet for generations to come. Science education, when imbued with the concept of sustainability, becomes a powerful force for good. It becomes a catalyst for innovation, collaboration, and action, fostering a generation equipped to not only understand the world, but to heal and protect it for generations to come.

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CHAPTER : 35

THE ROLE OF HIGHER EDUCATION IN ADVANCING SUSTAINABLE DEVELOPMENT

Dr. Md. Afroz Alam [1]

Abstract

Sustainable development, characterized by the harmonious integration of economic growth, social equity, and environmental preservation, stands as one of the most pressing global imperatives of the 21st century. Higher education institutions play a pivotal role in nurturing the knowledge, skills, and values necessary to tackle the complex challenges inherent in sustainable development. This paper explores the multifaceted contributions of higher education in fostering sustainable development, encompassing research, curriculum development, community engagement, and institutional practices. Through a comprehensive review of existing literature and case studies, the paper highlights the transformative potential of higher education in shaping a more sustainable future.

Keywords: *Sustainable development, Higher education, Curriculum development, Research, Community engagement, Institutional practices.*

Introduction

Sustainable development, as defined by the Brundtland Commission in 1987, is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Achieving sustainable development requires a comprehensive and integrated approach that addresses environmental, social, and economic dimensions. Higher education institutions are uniquely positioned to advance this agenda by cultivating the intellectual, human, and social capital necessary to address complex sustainability challenges. Sustainable development

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refers to a mode of development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It involves finding a balance between economic growth, social progress, and environmental protection.

Key principles of sustainable development include

- **Environmental sustainability:** Ensuring that natural resources are used efficiently and conserved for future generations. This involves reducing pollution, minimizing waste, and preserving biodiversity.
- **Social equity:** Promoting social justice and ensuring that all people have access to basic resources such as clean water, education, healthcare, and economic opportunities. It also involves empowering marginalized communities and promoting inclusivity.
- **Economic viability:** Fostering economic growth and development that is both sustainable and inclusive. This includes promoting fair trade, investing in renewable energy and green technologies, and creating jobs that support sustainable practices.

Achieving sustainable development requires collaboration and coordination among governments, businesses, civil society organizations, and individuals. It also requires long-term thinking and a commitment to finding innovative solutions to complex challenges.

Objectives of the Study

1. To examine the multifaceted contributions of higher education institutions in addressing the complex challenges of sustainable development.
2. To analyze the role of higher education in conducting interdisciplinary research aimed at generating innovative solutions for sustainability issues.
3. To investigate the integration of sustainability principles and practices into higher education curricula and pedagogical approaches.
4. To explore the impact of community engagement initiatives facilitated by higher education institutions on local and global sustainability efforts.

5. To assess the adoption of sustainable practices and governance structures within higher education institutions and their influence on broader societal sustainability transitions.

1. Contributions of higher education institutions in addressing the complex challenges of sustainable development

Higher education institutions play a crucial role in addressing the complex challenges of sustainable development through their multifaceted contributions across various domains:

- **Research and Innovation:** Higher education institutions conduct research to advance knowledge and develop innovative solutions to sustainability challenges. They explore areas such as renewable energy, climate change mitigation and adaptation, sustainable agriculture, conservation biology, green technologies, and sustainable urban planning.
- **Education and Training:** Universities and colleges educate students about sustainability issues, equipping them with the knowledge, skills, and values needed to become responsible global citizens and future leaders. They offer degree programs, courses, and workshops on sustainability-related topics across disciplines such as environmental science, sustainable business, public policy, engineering, and social sciences.
- **Community Engagement:** Higher education institutions engage with local communities and stakeholders to address sustainability challenges at the grassroots level. They collaborate on projects such as community-based research, service-learning initiatives, and outreach programs focused on environmental conservation, social equity, public health, and economic development.
- **Policy Advocacy:** Universities contribute to shaping public policy and influencing decision-making processes at local, national, and international levels. They conduct research, provide expertise, and advocate for evidence-based policies and regulations that promote sustainability, including climate action plans, sustainable development goals (SDGs), and environmental protection measures.
- **Partnerships and Collaboration:** Higher education institutions form partnerships and collaborations with government agencies, non-profit organizations, businesses, and other stakeholders to

leverage resources, share knowledge, and implement sustainable development initiatives. These partnerships facilitate interdisciplinary research, joint projects, and knowledge exchange platforms aimed at finding holistic solutions to complex sustainability challenges.

- **Campus Operations:** Universities strive to model sustainability in their own operations by implementing environmentally friendly practices and reducing their ecological footprint. This includes initiatives such as energy and water conservation, waste reduction and recycling, sustainable transportation options, green building design and construction, and sourcing of local and organic food.
- **Global Engagement:** Higher education institutions foster global collaboration and exchange through international research partnerships, study abroad programs, and cross-cultural initiatives focused on sustainability. They promote dialogue, mutual understanding, and cooperation among students, faculty, and researchers from diverse backgrounds to address shared sustainability challenges on a global scale.

Thus, higher education institutions play a vital role in advancing sustainable development through their integrated efforts in research, education, community engagement, policy advocacy, partnerships, campus operations, and global engagement. By harnessing their collective expertise and resources, universities contribute to building a more sustainable and resilient future for all.

2. Role of higher education in conducting interdisciplinary research aimed at generating innovative solutions for sustainability issues

Research conducted within higher education institutions plays a critical role in advancing knowledge and innovation for sustainable development. Interdisciplinary research initiatives focused on sustainability issues contribute to the development of solutions for environmental conservation, social equity, and economic prosperity. Through partnerships with government agencies, industry, and civil society organizations, universities facilitate the translation of research findings into real-world applications, driving positive change at local, national, and global scales.

Case Study: The Sustainable Development Solutions Network (SDSN), a global network of universities, mobilizes academic expertise to address sustainable development challenges through research, education, and policy advocacy.

The role of higher education in conducting interdisciplinary research for sustainability is pivotal due to its ability to bring together diverse expertise, perspectives, and methodologies to address complex sustainability challenges. Here's an analysis of its significance:

- **Integration of Diverse Perspectives:** Higher education institutions serve as hubs for various academic disciplines, including environmental science, engineering, social sciences, economics, public health, and humanities. Interdisciplinary research in these institutions enables the integration of diverse perspectives and approaches, fostering holistic understandings of sustainability issues and facilitating the development of comprehensive solutions.
- **Holistic Problem-Solving:** Sustainability challenges, such as climate change, biodiversity loss, water scarcity, and poverty, are inherently interconnected and multifaceted. Interdisciplinary research allows scholars to examine these issues from multiple angles, considering environmental, social, economic, and cultural dimensions simultaneously. This holistic approach is essential for devising effective and sustainable solutions that address the root causes of complex problems.
- **Innovation and Creativity:** By transcending disciplinary boundaries, interdisciplinary research fosters innovation and creativity in tackling sustainability issues. It encourages scholars to think outside the box, explore unconventional ideas, and apply insights from one field to another. This cross-pollination of ideas often leads to breakthrough innovations and novel solutions that would not have been possible within traditional disciplinary silos.
- **Translational Research:** Higher education institutions serve as conduits for translating research findings into real-world applications and solutions. Interdisciplinary research teams can bridge the gap between academic knowledge and practical implementation by collaborating with policymakers, industry partners, community organizations, and other stakeholders. This translational approach ensures that research outcomes have

tangible impacts on sustainability practices, policies, and technologies.

- **Capacity Building:** Interdisciplinary research projects in higher education institutions provide valuable learning opportunities for students, faculty, and researchers. By participating in collaborative research endeavors, students gain exposure to diverse methodologies, interdisciplinary teamwork, and real-world problem-solving skills. Faculty members also benefit from interdisciplinary collaborations by expanding their networks, enhancing their expertise, and fostering interdisciplinary teaching and mentorship.
- **Addressing Wicked Problems:** Sustainability challenges are often characterized as "wicked problems," which are complex, dynamic, and resistant to simple solutions. Interdisciplinary research is well-suited to tackle wicked problems because it acknowledges the inherent uncertainties, trade-offs, and value conflicts involved. By engaging stakeholders from different disciplines and sectors, interdisciplinary research endeavors can navigate the complexities of wicked problems more effectively and generate innovative, context-specific solutions.

Therefore, higher education institutions play a crucial role in conducting interdisciplinary research aimed at generating innovative solutions for sustainability issues. By fostering collaboration, integration, innovation, and translational impact, interdisciplinary research contributes to advancing knowledge, informing policy and practice, and promoting sustainability transitions at local, national, and global scales.

3. Integration of sustainability principles and practices into higher education curricula and pedagogical approaches

Integrating sustainability principles and practices into higher education curricula is essential for preparing students to become effective agents of change in a rapidly evolving world. By offering courses, programs, and majors focused on sustainability, universities empower students with the knowledge, skills, and values needed to address sustainability challenges across diverse fields and disciplines. Experiential learning opportunities, such as service-learning projects and internships, enable students to apply theoretical concepts to real-world contexts, fostering critical thinking and problem-solving skills.

Case Study: Arizona State University's School of Sustainability offers undergraduate and graduate programs that equip students with interdisciplinary knowledge and skills to address complex sustainability challenges.

The integration of sustainability principles and practices into higher education curricula and pedagogical approaches has become increasingly important as society recognizes the urgency of addressing environmental, social, and economic challenges. Here's an investigation into how this integration is occurring:

- **Curricular Integration:** Many higher education institutions are revising their curricula to incorporate sustainability concepts across various disciplines. This integration can take the form of standalone courses focused explicitly on sustainability or the infusion of sustainability themes into existing courses. For example, engineering programs might include modules on sustainable design, business schools might offer courses on corporate social responsibility and sustainable business practices, and humanities courses might explore issues related to environmental ethics and social justice.
- **Interdisciplinary Programs:** Some universities are establishing interdisciplinary programs or majors specifically dedicated to sustainability studies. These programs bring together insights from multiple disciplines to provide students with a comprehensive understanding of sustainability issues and solutions. Students in these programs often have the opportunity to engage in interdisciplinary research, experiential learning, and community-based projects that address real-world sustainability challenges.
- **Experiential Learning:** Higher education institutions are incorporating experiential learning opportunities into their sustainability curricula to provide students with hands-on experiences outside the classroom. This may include internships, service-learning projects, field studies, and sustainability-focused study abroad programs. These experiential learning opportunities allow students to apply theoretical knowledge to practical situations, develop critical thinking skills, and engage with local communities to address sustainability issues.
- **Project-Based Learning:** Project-based learning approaches are gaining popularity in sustainability education, where students work collaboratively on real-world projects related to

sustainability. These projects often involve interdisciplinary teams and require students to analyze complex problems, develop innovative solutions, and communicate their findings effectively. Project-based learning fosters creativity, teamwork, and problem-solving skills while addressing pressing sustainability challenges.

- **Innovative Pedagogical Approaches:** Higher education institutions are exploring innovative pedagogical approaches to enhance sustainability education. This may include flipped classrooms, where students engage with course materials online before attending interactive class sessions focused on discussions and activities. Other approaches may involve using case studies, simulations, role-playing exercises, and multimedia resources to immerse students in sustainability issues and encourage active learning.
- **Institutional Commitment:** The integration of sustainability principles into higher education curricula often requires institutional commitment and support. Universities may establish sustainability offices or committees tasked with coordinating sustainability initiatives, developing curricular guidelines, and providing faculty training and resources. Institutional support is essential for fostering a culture of sustainability across campus and ensuring that sustainability education remains a priority.

Thus, the integration of sustainability principles and practices into higher education curricula and pedagogical approaches is essential for preparing students to address the complex challenges of the 21st century. By providing students with the knowledge, skills, and values needed to create a more sustainable future, higher education institutions play a crucial role in advancing sustainability education and fostering global citizenship.

4. Impact of community engagement initiatives facilitated by higher education institutions on local and global sustainability efforts

Higher education institutions engage with local communities to address sustainability issues through collaborative initiatives and partnerships. By leveraging their resources and expertise, universities contribute to community development efforts, promote environmental stewardship, and foster social inclusion. Community-based research projects,

outreach programs, and capacity-building initiatives facilitate knowledge exchange and co-creation of sustainable solutions, strengthening the resilience and well-being of communities.

Case Study: The University of Cape Town's Office for Inclusivity and Change works with local communities to address social inequality and promote inclusive development through research, advocacy, and community engagement initiatives.

Community engagement initiatives facilitated by higher education institutions have a significant impact on both local and global sustainability efforts in several ways:

- **Local Capacity Building:** Higher education institutions often collaborate with local communities on sustainability projects, ranging from environmental conservation to social development. These initiatives empower community members by providing them with knowledge, skills, and resources to address sustainability challenges effectively. For example, universities may partner with local NGOs and government agencies to implement programs focused on sustainable agriculture, renewable energy, waste management, and water conservation, thereby enhancing local capacity for sustainable development.
- **Knowledge Exchange and Transfer:** Community engagement initiatives facilitate the exchange of knowledge and expertise between higher education institutions and local communities. Researchers and students contribute scientific insights, technical know-how, and innovative solutions to address local sustainability issues, while community members provide valuable insights, traditional knowledge, and lived experiences. This collaborative exchange enriches both academic scholarship and local practices, leading to more effective and contextually appropriate sustainability interventions.
- **Social Cohesion and Empowerment:** Community engagement initiatives foster social cohesion and empowerment by promoting collaboration, trust, and mutual respect among diverse stakeholders. By involving community members in decision-making processes and project implementation, higher education institutions empower marginalized groups, amplify local voices, and promote social equity. These initiatives build social capital, strengthen community resilience, and contribute to the overall well-being and quality of life in local communities.

- **Global Learning and Solidarity:** Community engagement initiatives provide opportunities for students and faculty to gain firsthand experience with global sustainability challenges and solutions. Through service-learning projects, internships, and study abroad programs, students engage with communities around the world to address issues such as climate change, biodiversity conservation, poverty alleviation, and sustainable development. These cross-cultural experiences promote global awareness, intercultural understanding, and solidarity, inspiring students to become responsible global citizens and advocates for sustainable change.
- **Policy Influence and Advocacy:** Community engagement initiatives can influence local and global policy agendas by generating evidence, raising awareness, and mobilizing grassroots support for sustainability initiatives. Higher education institutions may partner with community organizations and advocacy groups to conduct research, develop policy recommendations, and advocate for legislative reforms that promote environmental protection, social justice, and economic equity. By amplifying the voices of communities affected by sustainability issues, these initiatives contribute to more inclusive and participatory decision-making processes at all levels of governance.
- **Scaling Up Impact:** Community engagement initiatives facilitated by higher education institutions have the potential to scale up impact by serving as models for replication and innovation. Successful projects and partnerships can inspire other communities, universities, and stakeholders to adopt similar approaches and adapt them to their own contexts. Through networks, conferences, and knowledge-sharing platforms, higher education institutions can disseminate best practices, lessons learned, and success stories, catalyzing broader transformational change towards sustainability at local, regional, and global scales.

Therefore, community engagement initiatives facilitated by higher education institutions play a crucial role in advancing local and global sustainability efforts by building capacity, fostering knowledge exchange, promoting social cohesion, empowering communities, facilitating global learning, influencing policy, and scaling up impact. By bridging the gap between academia and society, these initiatives

contribute to creating a more just, equitable and sustainable world for current and future generations.

5. Sustainable practices and governance structures within higher education institutions and their influence on broader societal sustainability transitions

Higher education institutions are increasingly adopting sustainable practices and integrating sustainability principles into their operations and governance structures. From campus sustainability initiatives to sustainability reporting and strategic planning, universities demonstrate leadership in environmental stewardship, social responsibility, and ethical governance. By modeling sustainable behaviors and values, institutions inspire students, faculty, staff, and stakeholders to embrace sustainability as a core institutional value.

Case Study: Lund University in Sweden has implemented a comprehensive sustainability strategy that encompasses research, education, operations, and outreach, positioning the university as a leader in sustainable higher education.

The adoption of sustainable practices and governance structures within higher education institutions has a profound influence on broader societal sustainability transitions. Here's an assessment of their impact:

- **Role Modeling and Leadership:** Higher education institutions that embrace sustainability serve as role models and leaders in their communities and beyond. By implementing sustainable practices such as energy efficiency, waste reduction, sustainable procurement, and green building design, universities demonstrate their commitment to environmental stewardship and social responsibility. This leadership inspires other organizations, businesses, and government agencies to follow suit, driving broader adoption of sustainable practices across society.
- **Educational Impact:** Higher education institutions have a unique opportunity to educate and empower future leaders, professionals, and citizens to address sustainability challenges. By integrating sustainability principles into their curricula, research, and campus operations, universities equip students with the knowledge, skills, and values needed to promote sustainability in their careers and communities. Graduates of

sustainability-focused programs become catalysts for change, driving innovation and influencing societal norms and behaviors towards more sustainable practices.

- **Research and Innovation:** Higher education institutions are hubs of research and innovation, generating knowledge and technologies that contribute to sustainability transitions. Universities conduct research on diverse sustainability topics, from renewable energy and climate adaptation to sustainable agriculture and urban planning. This research informs evidence-based policymaking, drives technological advancements, and fosters interdisciplinary collaboration, accelerating societal transitions towards sustainability.
- **Community Engagement:** Higher education institutions engage with local communities and stakeholders to address sustainability challenges collaboratively. Universities partner with community organizations, government agencies, businesses, and residents to implement sustainability initiatives, such as community-based research, service-learning projects, and outreach programs. These partnerships build trust, foster social capital, and empower communities to take ownership of sustainability transitions at the local level, creating ripple effects that extend to broader societal change.
- **Policy Influence:** Higher education institutions play a crucial role in shaping public policy and governance structures to support sustainability transitions. Universities conduct research, provide expertise, and advocate for evidence-based policies and regulations that promote environmental protection, social equity, and economic prosperity. Through policy analysis, advisory roles, and advocacy efforts, higher education institutions influence decision-making processes at local, national, and global levels, catalyzing systemic changes towards sustainability.
- **Institutional Collaboration:** Higher education institutions collaborate with each other and with external partners to scale up their impact on sustainability transitions. Networks, consortia, and partnerships facilitate knowledge exchange, resource sharing, and collective action on sustainability challenges. Universities leverage their collective expertise, resources, and influence to address complex, interrelated issues such as climate change, biodiversity loss, social inequality, and global health, driving transformative change across sectors and borders.

Thus, the adoption of sustainable practices and governance structures within higher education institutions serves as a catalyst for broader societal sustainability transitions. Through leadership, education, research, community engagement, policy influence, and collaboration, universities contribute to creating a more sustainable and resilient future for all. By harnessing their unique capacities and collective efforts, higher education institutions play a vital role in shaping a more just, equitable, and sustainable society for current and future generations.

Conclusion

Higher education plays a central role in advancing sustainable development by fostering research, curriculum development, community engagement, and institutional practices aligned with sustainability principles. Through interdisciplinary collaboration, innovation, and leadership, universities contribute to the creation of a more sustainable and resilient society. As we confront global challenges such as climate change, biodiversity loss, and social inequality, the transformative potential of higher education in shaping a sustainable future cannot be overstated. By harnessing the collective efforts of students, faculty, staff, and stakeholders, higher education institutions can catalyze positive change and drive progress towards a more just, equitable, and sustainable world.

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CHAPTER : 36

ACHIEVEMENT OF STUDENT-TEACHER'S COMPETENCIES IN PEDAGOGY OF MATHEMATICS AT SECONDARY LEVEL

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Abstract

This study investigates the achievement of student teacher competencies in the pedagogy of mathematics at the secondary level. With a focus on understanding the factors influencing the development of pedagogical skills, this research offers insights into the strategies and challenges encountered during the preparation phase for teaching mathematics. The study adopts a survey method and the sample of the size was all the student teachers of four year and six-year integrated and Two-year B.Ed. course who are studying pedagogy of mathematics. Assessment tool employed to gather data from a sample of student teachers undergoing training in mathematics pedagogy. Through thematic analysis, the study findings revealed that multifaceted aspects contributing to the achievement of competency in pedagogy. Key themes emerging from the analysis include the various aspects of the competencies such as identifying and writing objectives, identifying content categories and suitable definitions, suitable approaches for the content and various assessment techniques that signified the theoretical knowledge, practical knowledge, conceptual knowledge in shaping pedagogical practices. Moreover, the study findings revealed that, in all the four areas, student teachers of both the programmes of integrated course (four year and six years) and two-year B.Ed. programmes achievement at mastery level was less than the 10% and some of the competencies none of them are mastered from both the teacher education programme. Additionally, there is no significant difference between the integrated teacher education programme and two-year B.Ed. programme in achievement of pedagogical competencies. Therefore, there is a need to emphasize on ongoing teacher education programme for redeveloping curriculum

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and practices which enhance their pedagogical skills and fosters a commitment to lifelong learning and development. However, the study also highlights various challenges encountered by student teachers, including classroom management issues, curriculum constraints, and the need for ongoing professional development. Addressing these challenges requires comprehensive support systems and collaborative efforts among educational institutions, mentor teachers, and policymakers.

***Keywords**: Pedagogy of Mathematics, Student Teachers, Pedagogy competencies, Assessment, Secondary level*

Introduction

In the past one-decade research has been growing significantly on the professional development of mathematics teachers' competencies due to the inefficiency of teacher education programs in developing adequate teachers' cognitive and professional skills in terms of different facets of teacher competencies (Gabriele Kaisel et.al., 2016). Mathematics considered as the essential subject in the curriculum of school education and one of the major subjects at the school level, that everyone should learn to sustain in the future with basic calculations in day-to-day life. As a subject, it consists of different areas such as geometry, calculus, algebra, and probability. In order to make them understand each concept in maths subject importantly, teachers need to master at pedagogy competencies and as well as content. While teaching mathematics subject at the school level during the teaching-learning process the student teachers will be facing many problems in terms of content, pedagogical knowledge and those challenges faced by the in-service teachers and pre service teachers can be measured through assessing their cognitive capabilities or processes such as conceptual, procedural, and declarative knowledge and pedagogy skills of the teacher. In the realm of education, the pedagogy of mathematics holds a very special place in education right from elementary to higher levels. Mathematics is often viewed as the universal or global language of logic and patterns, it teaches not only just arithmetic and geometrical forms but also helps to develop analytical thinking, problem-solving skills, and abstract reasoning. The pedagogical approach to the teaching of mathematics is about molding young minds to tackle issues with logical precision and creativity. Mathematics is not just emphasizing formulas and theorems it’s more about understanding the conceptual and procedural knowledge involved in the subject. As educators, we realize that the way of

teaching mathematics has a tremendous impact on how students perceive, engage with the subject, and finally master this complex discipline. The pedagogy of mathematics is important in the teaching of mathematics it influences students' teachers to understand the nature of mathematics which consists of different teaching learning strategies and evaluation or assessment methods.

To foster students with cognitive competencies educators must use a variety of methods, to comprehend whether student teachers have acquired the necessary pedagogical knowledge. Assessment is one of the fundamental aspects of education that plays a pivotal role in evaluating individual knowledge, skills, abilities, and potential. Assessment serves as a multi-faceted tool for evaluation that enables educators, teachers, and students in order to gauge the performance of the individual. Often assessment can be seen in different forms such as formative and summative assessments, diagnostic tools, tests, and quizzes. Hence conducting assessments through various forms will help to identify the pedagogical content knowledge of student teachers in mathematics.

Teaching mathematics plays a major role in developing cognitive and procedural competencies that help pupils foster physical and logical concepts or principles required for comprehending, analysing, and problem-solving creative thinking, critical thinking, etc.

To ensure the fostering of cognitive and procedural competencies in the teaching of mathematics, teachers must provide opportunities for the students to get ideas by employing various teaching strategies, like the teacher collaborating with students and making them employ numerous methods for solving mathematics problems by identifying, analysing, and synthesizing them. This will help students to develop their cognitive skills, collaborative skills, and mathematical thinking skills, including discussing their own ideas and thoughts with their peers. In the teaching-learning process, the teacher can support pupils by organizing mathematical content, and developing problem-solving skills, which will help pupils to develop their cognitive and procedural competencies. Students will benefit from practicing word problems which helps to analyse the situation and solve the problems using their theoretical understanding and improve their cognitive skills.

Student Teacher Competencies

Pedagogical competencies are the competencies which refers to the knowledge, skills and abilities that educators acquire the during pre-service and in-service teacher education programme and to plan, deliver, teach effectively during teaching learning process and also for the professional development. Knowledge such as Conceptual knowledge, Procedural knowledge, Declarative knowledge, Factual knowledge. These competencies comprehend various aspects of teaching including instructional design, classroom management skills, including assessment methods. (Cooper, 1986) defined pedagogical competencies as "in teaching learning process the pedagogical competencies are the comprehend knowledge, skills and performance. Therefore, it includes a teacher capability to manage in teaching learning process from engage phase to evaluation phase. According to Indonesian government policy and regulation defined teachers‟ pedagogical competence as the understanding of basic education, students, curriculum development, lesson plans, dialogical teaching and learning process, learning evaluation, and students‟ potential developments. (Chandan Kumar Sahana, 2018).

Rationale for the study

Mathematics is believed to be an abstract subject because of its certain ways of acquiring knowledge, conclusive procedures, rules, symbols and, making sense of them and their relationships is frequently difficult for both students and teachers throughout the school grades, resulting in very mechanical teaching and learning of mathematics. Teachers have to create a stimulating learning atmosphere for their students, which will improve their comprehension of the subject matter. The improvement of pupils & mathematical achievement depends heavily on the mathematical understanding, pedagogical proficiency, and reasoning of teachers. Despite the substantial literature on the training and development of student teachers in various pedagogical aspects (Zeichner,2012; Grossman et al., 2009) there exist a notable research gap regarding the achievement of student teachers' competencies specifically in the pedagogy of mathematics at the secondary level. While several studies have investigated general teacher competencies or focused on the specific subject area such as language arts or science Wei et al., 2018; Darling Hammond et al., 2017) there is a scarcity of research dedicated to examining the unique challenges in pedagogical training especially in mathematics at the secondary level.

Statement of the Problem

Achievement of Student Teacher Competencies in Pedagogy of Mathematics at Secondary level.

Objectives

1. To determine the level of achievement of student teacher in pedagogy of mathematics with respect to different areas of competencies.
2. To compare the levels of the achievement of student teacher in pedagogy of mathematics among different teacher education programme with respect to four- and six-year integrated teacher education programme and two-year B.Ed. Programme.

Hypotheses: H01: There is no significant difference between in the attainment of pedagogy competencies of mathematics among student teachers of 4-year and 6-year Teacher education programs and two-year B.Ed. programme.

Methodology

The study is conducted to identify the level of achievement of student teacher competencies who are studying final year of four year and six-year integrated programs and two-year B.Ed. programme in RIE Mysore. In order to achieve the objective of the study the investigator adopted the descriptive survey method.

Sample

The sample of the study is all the student teachers studying pedagogy of mathematics in four-year and six-year teacher education programmes and two-year B.Ed. programme are considered.

Delimitation of the study

The present study was delimited to the fourth-year integrated course of four-year and six-year student teachers of the Regional Institute of Education -Mysore Karnataka India.

Tools and techniques

An achievement test in skills and strategies of teaching, mathematics tool was developed by Prof. K. Doraswamy (1986) and Y. Nirmala

(1992) with the systematic analysis of curriculum and validation of the tool for the teaching of mathematics at secondary level. The investigator adopted that tool to identify the attainment of student-teacher competencies in pedagogy of mathematics. The tool consists of 20 teacher competencies each competency consists of 10 items. The tools consist of majorly four areas namely, the first area is identifying and writing objectives according to cognitive level (Bloom taxonomy), second area is content categories and identifying suitable definition for the content, third area is identifying suitable approaches based on classroom transaction situations and fourth area is various assessment techniques. The Scores of each competency area indicate the percentage of the attainment of the respective competency area level. In the present study, overall achievement of the competencies are considered for analysis of the data and testing of the hypothesis to know the difference between four-year and six-year student teachers of teacher education programme. The data is transferred into SPSS and analyzed according to the objectives and research hypothesis of the study. The statistics like descriptive statistics, percentage, and independent sample t-tests were used in the study.

Data collection

After looking into the nature of the study, the researcher felt that the tool was suitable for fourth-year and sixth-year student teachers of BSc. Ed and MSc. Ed and B.Ed. who got training in the pedagogy of mathematics parallelly with the major subjects and pedagogy subjects during a pre-service course over a long period of time. The investigator established rapport with student teachers and administrated tests.

Data Analysis and Interpretation

Objective 1: To determine the level of achievement of student teachers in pedagogy of mathematics with respect to different areas of competencies.

In order to achieve the first objective of the study namely "To determine the level of achievement of student teachers in pedagogy of mathematics with respect to different areas of competencies." A test was administered to the 4^{th} year BSc. Ed and MSc. Ed student teachers of RIE-Mysuru and scores were recorded. The results are indicated in the following table 01 according to areas.

Table N0:01

Area one: Identifying and writing objectives according to cognitive level (Bloom taxonomy)

Competencies	**Mastery level**	
	Integrated programme (4&6 Years)	**Two-year B. Ed programme**
Classification of Objectives	**20(30%)**	08 (53%)
Identification of the levels under Cognitive domain	**03(04%)**	01(07%)
Listing the Objectives for teaching "Functions	**19(28%)**	07(07%)
Cognitive domain and Test items	**03(05%)**	00 (0%)

Fromthe table 01 shows that, there are 30% of the student teachers achieved mastery level in integrated teacher education programme while 53% of the two-year B.Ed. student teachers were achieved mastery level in classification of objectives in terms of general objective and specific objective. In identification of the cognitive levels according to bloom taxonomy only 4% of the student teachers achieved mastery level in Integrated programme where as only 7% of the student teachers were mastered in Two-year B.Ed. programme. Writing instructional objectives for the concept of function integrated teacher education programme student teachers were mastered better than the Two-year B.Ed. programme such as 28% and 7% respectively. None of the two-year B.Ed. student teachers were mastered in identifying the level of specific taxonomy within the cognitive domain whereas only 5% of the student teachers were mastered in integrated teacher education programme.

From the table, overall can be generalised that, both the programmes of student teachers are very few in achieving mastery level in particular competencies such as the competency of identification of the learning objectives and identifying the level of test items within the cognitive domain. Therefore, there is a need to re look in developing these competencies of student teachers in pedagogy of mathematics. Since these competencies are very much need in order to write learning objectives and also to assess these learning objectives at the end of the class. If these competencies are not clear to the student teachers cannot be an effective teacher in the future. Over all integrated teacher

education programme student teachers were achieved better than the Two-Year B. Ed programme.

Table N0:02

Area two: Content categories and identifying suitable definition for the content.

Competencies	**Mastery level**	
	Integrated Programme (4&6 Year)	**Two-year B. Ed programme**
Identification of the content categories in Mathematics	**02(03%)**	02(14%)
Identification of the limitations of the good definition	**17(25%)**	07(47%)
Defining the concept using the superordinate concept	**19(28%)**	09(60%)
Replacing the term to define the concept	**11(16%)**	06(40%)
Providing Counter Examples	**1(1%)**	01(07%)
Conditions of the Concept	**10(14%)**	00(0%)

From the above table it can be infer that, identification of the content categories, providing counter examples and identifying the conditions of the concept, integrated teacher education programme student teachers were mastered only 3%,1%,14% respectively. Whereas only 7% of the B.Ed. student teachers were mastered in providing counter example and none of them are mastered in identifying the conditions of the concept.

From the above data it can be concluded that, less than 15% of the student teachers are at mastery level in identification of the content categories, providing counter examples and conditions of the concept where as in other competencies most of the student teachers were able to perform approximately equally in both the programmes. Therefore, in order to be an effective teacher, there is a need to emphasise on developing these competencies in pre service teacher education programme.

Table N0:03

Area three: Identifying suitable approaches based on classroom transaction situations

Competencies	**Mastery level**	
	Integrated Programme (4&6 Year)	Two-Year B. Ed Programme
Types of Introducing Lesson	**05(08%)**	04(27%)
Types of Explanation	**5(08%)**	00(0%)
Moves of teaching Concept	**05(8%)**	00(0%)
Activities under Types of Explanation	**1(1%)**	00(0%)
Guidelines for questions	**04(06%)**	00(0%)
Probing Questions	**03(04%)**	01(7%)
Reinforcement	**00(00%)**	01(07%)
Stimulus Variation	**01(1%)**	**00 (0%)**

From the above table it shows that, in the area of identifying suitable approaches based on classroom transaction situations that consist of 08 different competencies such as (types of explanation and activities , types of introducing lessons, moves of teaching concept, guidelines for questions, probing questions, reinforcement, stimulus variation) in both the programmes two year and integrated programme student teachers were mastered less than the 10% of the sample whereas identifying suitable types of introducing lesson 27% of the B.Ed. student teachers mastered.

From the above data over all it can be concluded that, the skills or competencies which are required in the teaching learning process especially in classroom content transaction in pedagogy of mathematics student teachers from the sample were performed very poor level such as for introducing lesson, in types of explanation provided and identifying suitable moves of teaching concept, identifying suitable activities under types of explanation, providing proper guidelines for framing questions and probing different questions and providing reinforcement and stimulus variation. Hence these skills are need to be ensure that all student teachers need to learn effectively to become an effective teacher in both the teacher education programme.

Table N0:04

Area four: Various assessment techniques

Competencies	**Mastery level**	
	Integrated Programme (4&6 Year)	Two-Year B. Ed Programme
Objective and Test items	**10(15%)**	04(27%)
Learning difficulties	**06(09%)**	01(07%)

From the above table it shows that, only 15% of the student teachers were mastered in judging whether test item measure's objective prefixed at mastery level in integrated teacher education programme where as 27% of the B.Ed. student teachers were mastered higher than the integrated programme respectively. 09% of the student teachers were mastered in identifying kind of learning difficulties confronted with learning mathematical concepts and only 7% of the people were mastered in two-year B.Ed. programme. Thus, in identifying learning difficulties both the programmes were mastered less than the 10% of the sample. Hence there is a need to emphasize in pre service training programme to ensure in identifying kind of learning difficulties faced by students in learning mathematical concepts and responding to the teacher questions.

Objective 2: To compare the levels of the achievement of student teacher competencies in pedagogy of mathematics among different teacher education programme with respect to four- and six-year integrated teacher education programme and two-year B.Ed. Programme.

To find whether there is a significant difference in the levels of achievement of student teacher competencies in pedagogy of mathematics among different teacher education programme with respect to four year and six-year integrated teacher education programme and two-year B.Ed. programme. The following hypothesis formulated for testing.

Hypothesis 1: There is no significant difference between in the attainment of pedagogy competencies of mathematics among student teachers of 4-year and 6-year Teacher education programs and two-year B.Ed. programme.

The above hypothesis is tested by using t-test. The summary of the test result is given in Table 5.

Table No:05

Descriptive statistics- significant level of achievement of student teachers' competencies in the pedagogy of mathematics. (Course wise)

Course programme	N	Mean	Std.Deviation	t-Test
Integrated Programme (Four and Six year)	67	81.28	25.777	$.084^{ns}$
B. Ed Two Year Programme	15	93.93	22.945	

ns = not significant

It is inferred from the above table that the t value (.084) is less than the table value at 5% level of significance though there is a difference in mean of the two programmes. So, the null hypothesis is accepted. Hence, there is no significant difference between the four-year and six-year student teachers of integrated teacher education programs and Two-year B. Ed Programme in the achievement of teacher competencies in the pedagogy of mathematics.

Major findings:

- In Identifying and writing objectives according to cognitive level according to bloom taxonomy Both the programmes (Four year & Six year Integrated and Two-year B.Ed.) of student teachers are very few in achieving mastery level especially, in particular competencies such as the competency of identification of the learning objectives and identifying the level of test items within the cognitive domain. Therefore, there is a need to re look in developing these competencies of student teachers in pedagogy of mathematics.
- In the area of content categories and identifying suitable definition for the content in both the programmes less than 15% of the student teachers are at mastery level in some of the competencies such as identification of the content categories, providing counter examples and conditions of the concept where

as in other competencies most of the student teachers were able to perform approximately equally in both the programmes. Therefore, in order to be an effective teacher, there is a need to emphasise on developing these competencies in pre service teacher education programme.

- In the area of Identifying suitable approaches based on classroom transaction situations that consist of 08 different competencies such as (types of explanation and activities, types of introducing lessons, moves of teaching concept, guidelines for questions, probing questions, reinforcement, stimulus variation) in both the programmes two year and integrated programme student teachers were mastered less than the 10% of the sample whereas identifying suitable types of introducing lesson 27% of the B.Ed. student teachers mastered.
- In the area of various assessment and techniques in identifying learning difficulties in both the programmes were mastered less than the 10% of the sample. Hence there is a need to emphasize in pre service training programme to ensure in identifying kind of learning difficulties faced by students in learning mathematical concepts and responding to the teacher questions.
- There is no significant difference between the four-year and six-year student teachers of integrated teacher education programs and Two-year B. Ed Programme in the achievement of teacher competencies in the pedagogy of mathematics.

Discussion & Conclusion

The findings of the study contribute a deeper understanding of the achievement of student teacher competencies in the pedagogy of mathematics at secondary level with respect to four year and six-year integrated programme and two-year B.Ed. programme.

The study explores the level of achievement of student-teacher competencies and compare the significance level in achievement of student-teacher competencies in the pedagogy of mathematics of four-year and six-year teacher education programme and Two-year B.Ed. education programme. Hattie and Yates (2014), highlight the importance of quality mathematics instruction and the role of the teacher during teaching learning process. They suggested that developing student-teacher competencies in the pedagogy of mathematics will help student teachers to become more effective in imparting mathematical concepts and their role in improving learning

outcomes aligning with curriculum reforms. Secondly, the pedagogical competencies (PCK) have become a crucial factor in impacting student teacher competencies in teaching of mathematics. Student teachers who grasp strong mathematical concepts and teaching strategies or pedagogical strategies are pre requisite for students' teachers who want to engage and meaningful learning (Ball et al., 2008; Hill et al., 2008). The findings of the present study supported the recommendation of the Tapan Kumar Basantia & Krushna Chandra Patra (2021) that the efforts made in implementing four-year integrated programs are not satisfactory till now and also, recommended that these programs of the curriculum should be revised or modified based on the regular basis to become a proficient teacher. Since the present study results also revealed that, most of the student teachers are not at mastery level in developing pedagogical teacher competences especially in pedagogy of mathematics. The findings of the present study also support the National Education Policy 2020 (NEP, 2020) emphasizes the need for continuous professional development of teachers and calls for the transformation of teacher education programs to ensure comprehensive training on pedagogical methods for mathematics which include the changes of B.Ed. curriculum aligning with the changing demands of the education sector. It's also recommended that teacher competencies should be assessed regularly where they need support for in the pedagogy of mathematics. The study conducted by Lee, S.H., & Wang, L (2020) revealed and support this study that achievement of student teachers' competencies within the pedagogy of mathematics will help to identify the actual challenges of teaching mathematics such as micro-teaching sessions which include various teaching skills and various teaching methods and assessing different strategies will help to become a more effective teacher. As in the present 21st century scenario National Education Policy NEP (2020) also emphasizes that teachers are given the highest quality training in content, pedagogy and practice. There are some studies also identified that evaluating the effectiveness of existing teacher education programs in developing pedagogical competencies and identifying some the areas for improvement, (NCTE, 2019) and Justice Verma committee (2012). Therefore, in the four-year and six-year integrated teacher education program and two-year B.Ed. programme of student teachers should be exposed to more a variety of teaching strategies and classroom management techniques, different assessment techniques, assessment, and feedback skills through hands-on experience, where they study pedagogy papers quiet longer period of time along with major subjects. By focusing on these competencies and investing in the development of

student-teacher competencies will help to become a quality mathematics teacher in pedagogy of mathematics and also will become a professional teacher in the particular pedagogy. As further research long term impact of pedagogical training on student achievement or investing the effectiveness of different teaching method can be studied in order to find the impact of the teacher education programmes by incorporating specific pedagogy strategies or providing more practical or hands on experience in the classroom.

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