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Technology Integration in National Education Policy of India and Its Impact on Enhanced Engagement and Student Learning Outcomes

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ABSTRACT

The prime objective of education is the advancement and dissemination of truth through scientific methods of inquiry. It helps develop the right understanding as well as cognitive, social, ethical, and emotional competence for personal and societal well-being. Recognizing the importance of these objectives, the National Education Policy of India (NEP-2020) places a strong emphasis on technology integration in the teaching-learning process. This article investigates the role of digital technologies in transforming pedagogical practices for enhanced student engagement and learning outcomes. With the help of the activity theory framework, this case study attempts to assess the impact of technology integration on student learning outcomes, such as skills and competencies, enhanced engagement, critical thinking, right understanding, problem-solving skills, effective communication, networking and collaboration, capacity building, and participation in the larger order. Data collected and analyzed through interactive sessions, survey forms, and awareness workshops were found helpful in gaining a deeper comprehension of technology integration in education and the specific needs of participants. To fulfil the objectives of this study, a total of 450 responses from students with diverse academic backgrounds were collected and analyzed. Findings of the study suggest that thoughtful integration of EdTech tools with traditional pedagogical processes helped students in the attainment of learning outcomes. More than 70% of students accepted that digital tools supported them in better comprehension of academic content and prepared them for the fulfilment of comprehensive human

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goals. This study will help researchers and academicians in proffering valuable insights and inferences for associated challenges and potential solutions.

Keywords: Digital Learning Resources; Digital Pedagogy; EdTech; Socially Responsible Learning Ecosystem; Student-Centric Learning; Value Education

1. Introduction

It is rightly said that ‘learning’ may ultimately be its own reward. This statement suggests that the joy and fulfilment derived from acquiring knowledge and skills can be a strong motivation and a sufficient reward in itself^[1]. It helps in achieving the higher standards of living and fulfilment of comprehensive human goals^[2]. Teachers and mentors have been the primary force behind the teaching-learning process for thousands of years in our civilized society, where knowledge has been transferred from one generation to the next through teacher-student interaction^[3, 4]. Although this method is still required, we’ve seen recent improvements in digital learning resources and online courses. With enhanced user control and interaction, these contents and courses are energising the entire teaching-learning process as a whole^[5]. Numerous studies have highlighted that the technology integration into the academic processes is found helpful for enhancing student engagement, promoting deeper understanding, controlling personalized learning, reducing educational disparities, and preparing students for future challenges^[5–8].

During the COVID-19 pandemic, educational activities were severely affected throughout the world. The United Nations International Children’s Fund (UNICEF) reported that during this historic disruption, schools have been entirely closed for almost a full year^[9]. In another report, the United Nations Educational, Scientific, and Cultural Organization (UNESCO) estimates that the pandemic affected more than 1.6 billion students globally, with the most vulnerable learners being hit hardest^[10]. The average duration of closures is believed to have been 41 weeks^[11]. This closure had a significant negative impact on student learning. In response to the closure of schools, UNESCO recommended online distance learning programmes and platforms^[9].

Such interventions helped schools and teachers to reach learners remotely and limit the disruption of education. During this period, several efforts were made to ensure continued learning for all children^[10]. In addition to this, online dis-

tance learning programmes and digital connectivity between students and schools helped significantly in minimizing the academic loss. The pandemic opened avenues for technology integration and adoption in the teaching-learning process. It acted as a catalyst for the digital transformations of the entire education system^[11, 12]. Digital learning from home also created some positive trends. It enabled students to continue their studies even in unprecedented global conditions. It provided an engaging learning experience and allowed them to remain interested in the topics covered^[13]. It can be accepted as a valid argument that the integration of Educational Technologies (EdTech) into the formal education systems empowered students with the necessary skills to thrive in the digital era.

While keeping all these things into consideration, the National Education Policy (NEP-2020) of India also envisions leveraging technology for online and digital education, optimizing existing digital platforms, and developing new initiatives to meet current and future needs^[14]. The policy aims to make education more affordable and accessible, promoting lifelong learning and empowering students with digital literacy^[15–19]. In addition to academic achievements, technology integration in education is enabling students to develop essential life skills, prepare them for their participation in the larger order, and foster resilience towards unprecedented global challenges^[20]. Digital technologies equip them with the ability to critically assess and navigate the vast amount of online information and utilize it for their own learning goals^[21].

The progress of NEP-2020 is designed to be tracked through five major themes, namely: Student-Centric Education, Digital Learning, Industry-Institute Collaboration, Academic Research and Internationalization, and Indian Knowledge System. These themes reflect the focus of the policy on personalized learning, leveraging technology, and integrating traditional knowledge into teaching-learning practices^[15, 16]. For digital monitoring of the progress made in this direction, NEP-2020 proposes the establishment of an

autonomous body, the National Educational Technology Forum (NETF). This forum acts as the regulating body to guide technology use, data management, and digital infrastructure standards. The key initiatives regulated under the umbrella of NETF, like National Academic Depository (NAD), Academic Bank of Credits (ABC), DIKSHA (Digital Infrastructure for Knowledge Sharing), and self-paced and flexible learning through the SWAYAM Massive Open Online Course (MOOC) platform, are transforming the entire education system in India^[22]. While focusing on creating high-quality digital content for teachers and learners, NETF is promoting the adoption of such new-age interventions^[15–19]. The prime objective of technology integration in NEP-2020 is to enhance academic engagement of students, improve learning outcomes, and develop essential life skills to achieve comprehensive human goals through autonomous learning^[20–23].

This study employs the activity theory framework to evaluate the effects of technology integration in education and its function in improving engagement and conceptual understanding^[24–26]. It identifies the outcomes and structural contradictions of digital pedagogical approaches. For this purpose, nine different learning outcomes like skills and competencies: enhanced engagement, critical thinking, right understanding, problem solving skills, effective communication, networking and collaboration, capacity building, and participation in the larger order are selected^[27–30]. In total, 450 responses from different groups of students belonging to diversified academic levels were collected. The activity theory primarily focuses on subjects, objects, tools, rules, community, and shared responsibilities to systematically analyse human behaviour^[24–26]. Generally, activities are directed toward an objective and driven by some psychosocial motives^[26]. Additionally, it is synthesizing evidence on sustainable outcomes of technology integration in education to prepare students for future challenges.

2. Methods

The teaching-learning process is essentially a tripolar process involving the teacher, the student, and the curriculum, aiming for the holistic development of the learner to act as a knowledgeable and responsible citizen^[11]. With the help of the activity theory framework^[23, 24], this case study attempts to assess the impact of technology integration on

student learning outcomes like: skills and competencies, enhanced engagement, critical thinking, right understanding, problem-solving skills, effective communication, networking and collaboration, capacity building, and participation in the larger order^[7, 8]. Data collected and analysed through interactive sessions, survey forms, and awareness workshops helped investigators gain a deeper comprehension of technology integration in education and address the specific needs of participants^[11]. The research question for the study is described as follows:

RQ: How does the integration of technology as mandated by the National Education Policy of India influence student engagement with learning resources and academic learning outcomes?

The effect of technology integration on student engagement with learning resources and academic learning outcomes was investigated using a mixed qualitative approach that incorporates behavioural and psychological elements. This approach emphasizes qualitative inquiry (interviews, focus groups, and observations) as the primary source for data comprehension. Interactive sessions with the students successfully accomplished this objective by examining institutional challenges, enabling access to educational resources, and observing changes in pedagogical strategies. These sessions also helped in the analysis of the objective data recorded in the form of test scores, screen time, and better comprehension of the covered topics. The integration of objective data and the qualitative assessment into the activity theory framework allowed for a robust, multi-dimensional narrative that directly addresses the core research question and presents a unique aspect of the methodology followed^[23]. Activity Theory serves as a powerful analytical lens to map out how a person's objectives, the tools used, and their social environment interact with each other to achieve specific outcomes^[25].

Engeström's activity theory^[24] provides a robust analytical framework for this research question. Activity theory treats technology integration as a systemic process that analyses how digital tools interact with students, teachers, and cultural rules to shape learning outcomes^[24]. It helps in the comprehension of human practices by integrating individual actions within their larger social, cultural, and historical con-

texts^[25]. **Figure 1** illustrates the framework for technology integration in education. It treats the entire activity system—which includes subjects, objects, tools, rules, communities, and responsibilities—as a primary analytical unit rather than

focusing only on individual behaviour. It helps explain that learning is not only a process of transferring information but also involves the adoption of cultural values and engaging students in skill-centric activities^[26].

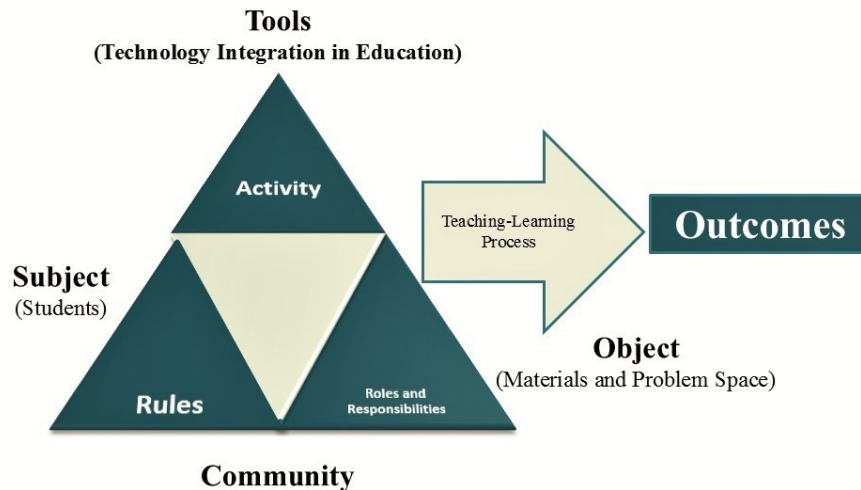


Figure 1. Activity theory framework for technology integration in education for enhanced learning outcomes.

This work primarily focuses on the subject (students/teachers), tools (EdTech tools and digital content), and community (schools/colleges/universities) to foster interactive learning and personalised pathways for enhanced classroom engagement and improved student learning outcomes, while addressing organisational/structural challenges. The Activity Theory framework treats learning as a collective, tool-mediated activity rather than just individual cognitive processing^[29]. It helps enhance learning outcomes by addressing the complex relationship between students (subjects), tools (digital technology), and goals (objects) within a structured social context (community, rules, and shared responsibilities). It also helps in the identification of bottlenecks and contradictions between these components, enabling focused intervention to improve outcomes^[30].

The framework ensures that technology is integrated into the sociocultural context, supporting active, collaborative learning as compared to isolated usage. To fulfil these objectives, a questionnaire was shared among students belonging to diversified academic backgrounds. The questionnaire mainly focused on how digital tools are changing student participation, motivation, and collaboration in the classroom and how these tools affect their academic learning outcomes. The sample size of this survey was 450 students. Out of

these, 42 responses were received from primary students, 161 responses from secondary students and the remaining 247 responses were collected from undergraduate and postgraduate students. In the digital era, teachers are not just serving the role of knowledge providers but also co-creators of information, evaluators and mentors^[3]. The study has some limitations, such as the sample size being limited, but the random sampling compensates for any selection bias. In general, activity theory-based studies are carried out with smaller sample sizes because they focus on in-depth, qualitative analysis rather than broad statistical generalisation^[24].

3. Literature Review and Theoretical Background

Several studies have shown that the integration of technology in education has resulted in the transformation of the entire learning ecosystem. The teaching-learning process is increasingly viewed as an essential tool for promoting the expansion and dissemination of truth^[2]. It encourages a profound understanding of any entity and its role in nature/existence. This approach shifts education from merely sharing informative facts to fostering a comprehensive understanding of the world and our place within it. In general,

education helps people transition from ignorance to wisdom, from darkness to light, and from death to eternity^[27]. True education goes beyond skill training or just subject knowledge; it aims to harmonise life with the larger order or entire existence. It assists in developing critical thinking, self-awareness, and the capacity to examine one's own thoughts, desires, expectations, and actions. Additionally, it transforms the learner's mind from a passive recipient of information into an instrument that actively analyses the content^[28]. Beyond academic learning, education is viewed as a means of cultivating ethics, values, harmony, empathy, and social responsibility. It also helps people understand their role in the community and the environment, facilitating the right understanding of themselves and their surroundings^[29].

The paradigm shift in the Indian education system is also highlighted in the c. It designates technology as a fundamental element and not just as an auxiliary tool^[15]. In order to promote holistic development of the learners, the policy places a strong emphasis on broad technology integration, creative digital pedagogy, and updating educational infrastructure^[15]. The significance of technological integration, digital pedagogy, and digital education in the context of NEP-2020 is emphasized in the following subsections.

3.1. Technology Integration in Education

Information and Communication Technologies (ICT) have become essential to ensure education as a fundamental right, particularly in a world experiencing more frequent con-

flicts and crises^[10]. During the COVID-19 pandemic^[9], it was observed that nations without sufficient ICT infrastructure and digital learning platforms suffered greater education disruptions and academic losses for their children. This disruption highlighted the necessity of integrating digital technologies to transform schooling systems and create inclusive, open, and resilient learning ecosystems. While observing the pressing need, NEP-2020 also encouraged the use of digital innovations to increase access to education and advance inclusion; enhance the value and significance of learning; build technology-driven lifelong learning pathways; strengthen education and learning management systems; and monitor learning-assessment processes^[15, 16]. To achieve these goals, several efforts are made to develop digital literacy and digital competencies among students and teachers^[17].

As a result of these ambitious initiatives, ICT is now enabling access to a vast array of information and learning resources, bridging geographical boundaries and liberalising knowledge systems^[31, 32]. The integration of educational technologies (EdTech) into the formal education systems is empowering students with the necessary competencies to thrive in the digital era. Key features of the technology integration in education are illustrated in **Figure 2**. Furthermore, these initiatives empower educators to personalise instruction and prepare their lesson plans to address the unique learning needs and preferences of each individual student^[6]. EdTech solutions also foster teamwork and efficient information sharing by improving communication and collaboration between teachers and learners^[14].



Figure 2. Technology integration in education.

Unlike traditional education systems, tech-enabled modern education emphasizes interactive and personalized learning, utilizing digital tools and learning resources to enhance active participation and accessibility^[14]. Modern education often incorporates a student-centric approach, focusing on experiential learning and equipping students with skills relevant to the contemporary world^[2]. In addition to this, effective online distance learning solutions have also allowed educators to continue with their lesson plans using the available digital learning resources. These initiatives are found helpful in enhancing access to quality education for all, and especially the marginalised groups, for the achievement of Sustainable Development Goal 4 (SDG 4). The United Nations 2030 Agenda aims to ensure equitable, quality education for all^[13, 19]. Some of the important aspects of technology integration in education are summarized as follows.

(1) Student-Centric Learning

EdTech tools promote a student-centric learning ecosystem by enabling personalized learning experiences, facilitating collaborations, and empowering students with choice and control over their entire learning process. It enables flexible, customized instruction, access to a wider range of learning resources, and the development of critical thinking^[20].

(2) Teaching, Learning, and Evaluation

Technology integration significantly enhances teaching, learning, and evaluation in academic institutions by offering personalised learning solutions, facilitating collaborations, and offering automated assessment and feedback. These interventions help educators deliver more engaging lectures and gain valuable insights into the academic progress of the learners^[6].

(3) Interactive Learning Material

Interactive learning materials use digital tools to actively engage students and improve the entire learning process. Ubiquitous access to these interactive tools, like electronic whiteboards, simulation platforms, and online learning resources, transforms passive learning into active participation, making the learning process more effective for the students^[7].

(4) Professional Development and Skill Training

Remote and blended learning platforms are transforming skill training and professional development by

offering individualized, adaptable, and easily accessible learning opportunities, frequently utilizing digital resources such as virtual reality, online courses, and simulations^[33]. These technologies allow teachers to improve their abilities and methods of instruction while also assisting workers in retraining, upgrading skills, and adapting to the ever-changing demands of the industry^[16].

(5) Educational Management and Administration

In order to improve administrative tasks, communication, and enhance student learning outcomes, digital technologies play a significant role in educational management and administration^[13]. These solutions help educators with scheduling lectures, marking attendance, maintaining academic/examination records, and communicating with students and their parents^[15]. They also offer real-time analytics for streamlined admissions and academic performance, and better communication channels with all stakeholders.

(6) Socially Responsible Learning Ecosystem

Technology integration in education plays a significant role in building socially responsible learning ecosystems by leveraging innovative solutions to address disparities and promote equitable access to quality education. Using technology to personalize learning, provide access to remote students, and align with social responsibility goals helps empower individuals and communities. Additionally, EdTech solutions can help students with social and emotional learning (SEL) by giving them the means to practise empathy, teamwork, and make responsible decisions^[34]. It empowers the students to achieve comprehensive human goals—such as right understanding, right feelings, trusting relationships, fearlessness, and mutual fulfilment—fostering continuous happiness within individuals and harmony throughout society.

3.2. Digital Pedagogy

The advancement and dissemination of truth, as well as the right understanding of our existence, are core aims of the teaching-learning process^[29]. The ability to discern truth from falsehood, critical thinking, and the understanding of factual knowledge are widely considered crucial aspects of different pedagogical practices. Critical examination of in-

formation, assessment of its reliability, and establishment of one's well-informed conclusions ultimately lead to a society that is more informed and truthful^[29, 34].

Digital pedagogy is about addressing the needs of teaching and learning experiences through thoughtful integration of technology to empower students to become adaptable, creative, and successful. In addition to it, digital technologies have made a paradigm shift in the entire education system^[12]. They are not just serving the role of knowledge providers but also as co-creators of information, evaluators, and mentors. With ubiquitous access to information, students are empowered to critically examine the educational content and develop competencies with enhanced academic engagement. Digital pedagogical processes have also proved their worth in developing the right understanding and ensuring effective participation of learners in the larger order.

In our civilized society, where knowledge is passed down from one generation to the next through interactions between teachers and students, pedagogy has been considered the main driver for thousands of years^[2]. It is widely recognized that integrating digital tools and online learning activities into traditional teaching has significantly improved learning outcomes and prepared students for future challenges^[35]. Technology-enabled modern education places a strong emphasis on individualized and interactive learning experiences, making use of EdTech tools and digital learning resources to increase accessibility and active involvement of the students in the learning process^[36].

Thoughtful and intentional implementation of digital technologies in online or blended education for enhanced teaching and learning experiences is referred to as 'digital pedagogy'. Instead of only emphasizing the digital tools themselves, it highlights how technology may be blended to enhance learning outcomes and ensure active participation of students^[37]. It facilitates interactive learning environments to support dialogues where both students and educators actively participate as agents in the learning process. Online learning platforms, multimedia tutorials^[37], and social media platforms for collaboration, coupled with mobile devices enhancing access to educational information and course content, are key elements of digital pedagogy^[2].

In a rapidly changing world, the role of teachers is continually being transformed to address contemporary educational challenges. Despite several efforts to integrate

technology into education, many teachers remained unprepared for digital or blended learning. The negative impact of the COVID-19 pandemic on education compelled the entire teaching community to adopt various digital tools to address the academic needs of the students. This disruption contributed to the widespread adoption of digital pedagogy^[38]. As a force for transformation, it is continually evolving and offering new opportunities for the stakeholders, necessitating thoughtful integration to harness its full potential in enhancing student learning outcomes and influencing humanistic education^[29, 39].

The use of digital platforms in education does not automate desired educational outcomes. In certain instances, technology is used merely as an alternative mode of instruction without undergoing any pedagogical transformation or for enhancing the efficiency of learning processes or administrative functions. Critics also contend that students may not be able to develop higher-level reasoning and critical thinking if they excessively rely on digital tools. Therefore, thoughtful integration of EdTech solutions in blended learning may lead to more personalized and interactive learning^[40]. By integrating conventional classroom teaching with digital learning resources and tools, blended learning can create an opportunity for the students to learn at their own pace, access a wider range of learning materials, and develop essential life skills to achieve comprehensive human goals^[40].

3.3. Digital Education in the Light of NEP-2020

The relationship between technology and education is of a bi-directional nature^[36]. The emerging digital technologies are transforming India into a digitally empowered society and a knowledge economy. These technological advancements are also playing a significant role in nation-building by enhancing the teaching and learning processes and improving educational outcomes. Addressing these underlying challenges in education, the National Education Policy emphasizes the integration of technology to provide quality education to students irrespective of their language, geographical location, and socio-economic background^[15]. The progress of NEP-2020 is designed to be tracked through five major themes, namely: Student-Centric Education, Digital Learning, Institute-Industry Collaboration, Academic

Research and Internationalization, and Indian Knowledge System^[39]. These themes reflect the policy's focus on personalized experiential learning, leveraging technology, and integrating traditional knowledge^[15].

The NEP-2020 aims to leverage digital platforms for online classes, e-learning resources, and interactive learning tools to cater to diverse learning needs. It proposes the formation of an autonomous body, the National Educational Technology Forum^[21]. The NETF provides independent advice to government agencies on technology-based interventions and establishes guidelines for online and digital teaching-learning content, technology, and pedagogy^[22]. It facilitates decision-making and promotes the use of technology in education to provide guidance and also supports the EdTech ecosystem with a specific focus on digital literacy, accessibility, and equitable access to quality education^[16].

Popular initiatives under the NETF framework include the National Academic Depository, Academic Bank of Credits (ABC), DIKSHA (Digital Infrastructure for Knowledge

Sharing), and SWAYAM^[22]. These Learning Management Systems (LMS) focus on creating high-quality digital content for teachers and learners^[1]. The lifecycle of adoption of new-age technologies for education and skilling, as illustrated in **Figure 3**, shall begin with identifying key futuristic areas and emerging technologies that have the potential to provide benefits to the EdTech ecosystem. The second step of this process is the evaluation of identified technologies, followed by the evaluation of the technologies that shall deliver the intended benefits with a considerable degree of confidence. During the core solution definition, the ideation of use cases and student-centric design approaches is finalized. The fifth stage of the design cycle is alignment and teamwork, which involves the actual thoughtful planning and project milestone estimation in order to accomplish the intended outcomes, followed by the implementation. The next step focuses on driving adoption and familiarization. Finally, the Sandbox ecosystem integrates the developed EdTech solution with formal education^[16].

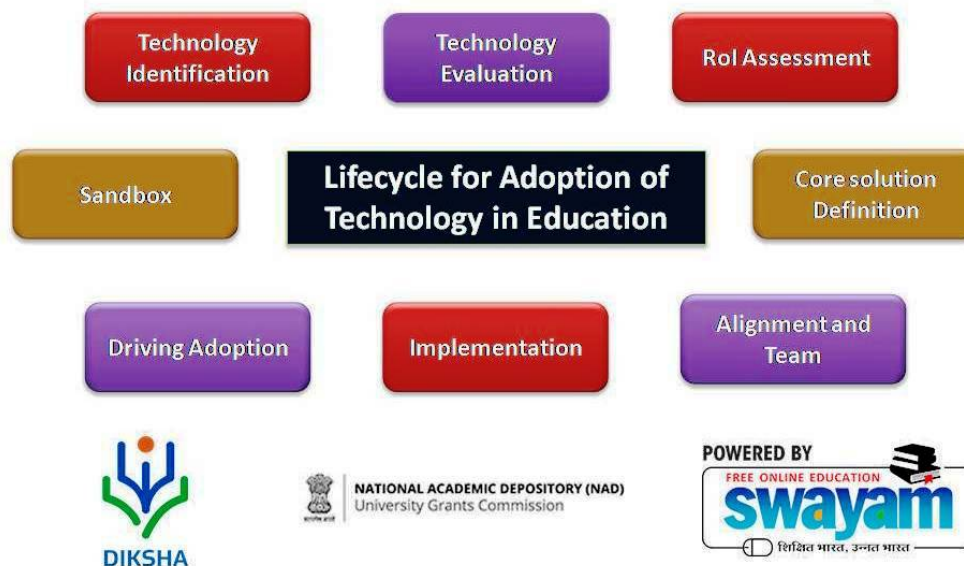


Figure 3. Popular initiatives and lifecycle for the adoption of technology in education.

All these efforts have contributed to the creation of digital education infrastructure, ultimately making quality education more accessible and engaging^[41]. Initiatives like the National Digital Library, SWAYAM, and DIKSHA play a significant role in comprehensive digital education^[15]. Furthermore, technology integration in education has facilitated access to education through multiple modes, ensuring that learning opportunities are not limited by location or any type

of traditional barrier^[42–46].

4. Results and Discussion

Education is the basic foundation of all spheres of our lives. Students learn in several ways, including listening, reading, watching, playing, interacting, and doing^[47]. The observed and assessed change in the behaviour of the stu-

dents during this process is often referred to as a ‘learning outcome’^[48]. Learning outcomes are also referred to as the competencies that learners continue to develop and improve. These outcomes are the result of competencies as a state of being skilled^[28]. In this continuous process of learning and skill development, digital tools play a significant role. These interventions are not just considered a luxury but a necessity in the present context. Digital pedagogical processes create a dynamic and enriching learning ecosystem to prepare students for the evolving needs of the changing world^[21]. The educational ecosystem—which includes teaching, learning, and administration—has increasingly transformed^[48–50].

The qualitative research approach followed in the activity theory framework relies on descriptive and naturalistic data collection methods^[23]. It is highly valued and commonly applied in studies to analyse how students, teachers, and learning materials (tools) interact within a classroom environment (community). Investigators and local volunteers observed the activities of the learners: their interaction with tools and the interchange of shared responsibilities. Frequent interactions with the learners allowed investigators to uncover their motivations, objectives and subjective realities. The primary goal of this study was to uncover the “why” and “how” behind the motivations and objectives of the partici-

pating students. The qualitative assessment in the form of classroom observations and interactions with the students and teachers helped investigators in analysing the recorded statements to understand their experience with EdTech interventions. It also supported identifying drivers and barriers to technology integration.

The role of digital pedagogical processes in student learning outcomes is illustrated in **Figure 4**. It outlines the holistic framework for modern education, demonstrating how student learning outcomes intersect with the advantages provided by digital technologies^[51]. It links fundamental aspects of holistic development—knowledge, skills, competency, attitude, and values—to specific student learning outcomes and presents a comprehensive model related to value education^[29]. The integrated approach aims for the cognitive reframing of students beyond academic knowledge and focuses on developing well-rounded, adaptable, and ethically competent individuals. The outcomes listed on the right side in the given figure (e.g., Critical Thinking, Effective Communication, Capacity Building, Participation in the Larger Order, etc.) are the practical manifestations of developing these core values and skills^[2]. The activity theory provided a framework for better understanding how collective and goal-oriented actions supported students in identifying and ensuring societal participation.

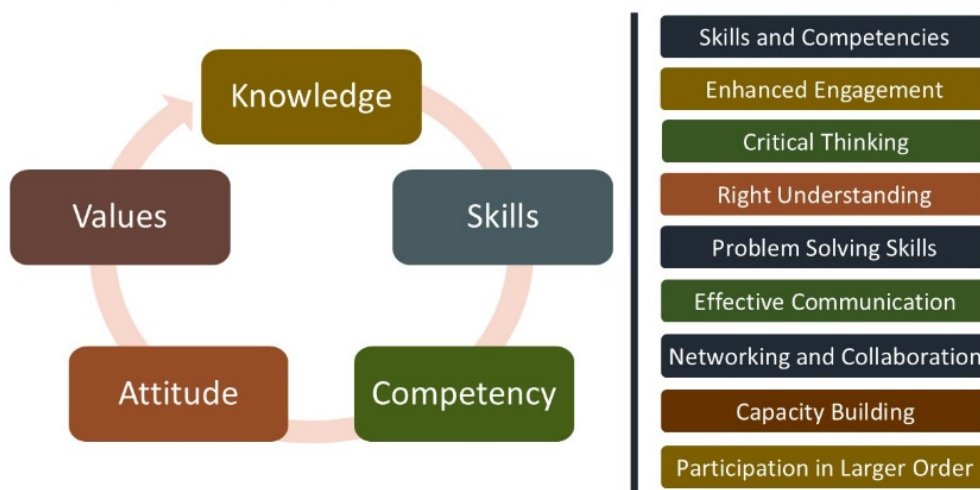


Figure 4. Role of digital technologies in enhanced student learning outcomes.

While focusing on these learning outcomes, this study investigates the impact of the digital interventions on student learning outcomes through evidence collected from

academic institutions. For this purpose, a questionnaire was shared among students belonging to primary education, secondary education, and higher education. The sample

size of this survey was 450 students. Out of these, 42 responses were received from primary students, 161 responses from secondary students, and the remaining 247 responses

were collected from undergraduate and postgraduate students. The results of the conducted survey for this study are shown in **Table 1**.

Table 1. Key highlights of the case study on student learning outcomes.

Sr. No.	Digital Drivers	Description	Response	Primary Education	Secondary Education	Higher Education
1	Skills and Competencies	Fuels knowledge by providing learning resources.	Agree	12	80	210
			Neutral	18	35	27
			Disagree	12	46	10
2	Enhanced Engagement	Boosts attitude by making learning interactive.	Agree	20	95	180
			Neutral	8	31	15
			Disagree	14	35	52
3	Critical Thinking	Verification of content and concept building.	Agree	10	84	188
			Neutral	19	56	22
			Disagree	13	21	37
4	Right Understanding	Building clear perception of the content.	Agree	15	40	220
			Neutral	20	75	20
			Disagree	7	56	7
5	Problem Solving Skills	The capacity to identify, analyse, and overcome challenges.	Agree	18	85	225
			Neutral	8	45	8
			Disagree	16	31	14
6	Effective Communication	The clear, purposeful exchange of messages and documentation.	Agree	25	120	185
			Neutral	12	35	28
			Disagree	5	6	34
7	Networking and Collaboration	Building professional relationships to share knowledge, resources, and opportunities.	Agree	22	87	190
			Neutral	10	35	20
			Disagree	10	39	37
8	Capacity Building	Developing and strengthening the skills, instincts, and abilities.	Agree	20	80	192
			Neutral	12	25	27
			Disagree	10	56	28
9	Participation in the Larger Order	Active contribution to the welfare of society and nature.	Agree	5	65	175
			Neutral	28	34	45
			Disagree	9	62	27

Digital EdTech tools helped learners by shifting their role from passive receivers of the information to active knowledge creators. The Activity Theory framework used in this study presents learning as a collective tool-mediated activity. Digital tools act as cognitive extensions to help learners better comprehend data, concepts, and natural phenomena. Interactive digital content also helped students construct comprehensive, collaborative, and practical knowledge. Students strongly agreed that digital interventions helped them develop the right understanding of the academic content and

played a significant role in improving their problem-solving skills. Digital techniques also played a major role in improving the communication skills of students at the primary and secondary levels. The entire activity system performed more efficiently, resulting in higher academic attainments, improved information retention, and increased motivation among students.

Interactive sessions carried out with the students also indicated that understanding of the academic contents and principles depends on the stage of their cognitive develop-

ment. However, digital platforms helped learners keep up with the pace of learning and solve their doubts. Digital techniques proved their worth in fostering learning outcomes like Enhanced Student Engagement, Critical Thinking, and Problem-Solving Skills. At later stages of cognitive development, other outcomes like Effective Communication, Networking and Collaboration, and Capacity Building helped learners to encourage their Participation in the Larger Order. The collected data helped in interpreting technology integration, allowing academics to understand how digital tools and learning resources are being used, their impact on learning, and where gaps exist. With data and feedback on student progress, digital learning platforms are supporting teachers in customising their lesson plans. At the same time, it was also recorded that these platforms offered a flexible, interactive, and personalised learning experience to the students.

The results of this qualitative study show that students' cognitive development stage affects their comprehension of academic content and theoretical concepts. It also inferred that technology integration helped students overcome their doubts and adjust to the speed of learning. Student learning outcomes like improved engagement, critical thinking, and problem-solving skills are significantly promoted by digital pedagogy. Other outcomes, such as effective communication, networking/collaboration, and capacity building, supported the entire ecosystem to ensure learners' participation in the larger order in later stages of cognitive development. Technology integration acts as a transformative tool in modern education, fostering an engaging and personalized learning environment that helps students manage the pace of learning and clarify their doubts, particularly through ubiquitous access to learning resources and tools.

5. Conclusions

Over the past few years, the adoption of smart digital technologies in the teaching-learning process has grown exponentially. This has created new problems, opportunities, and challenges in contemporary society. These technologies have been most prevalent in advanced schools in cities and towns, but recently, they have reached the schools located in remote areas around the globe. Many of these schools and educators relied on smart digital technologies to guide

students in their learning and capacity building during the historic disruption of the COVID-19 pandemic. EdTech features like virtual classrooms, video conferencing, discussion boards, and online feedback facilitate effective communication between educators and students.

The primary goal of education is to foster, develop, and nurture a robust system for the realization of truthfulness, empowerment, accountability, and critical thinking. It helps significantly in the process of transformation, innovation, and collaboration. Digital technologies, including social media platforms, have profoundly altered how people communicate, share information, and interact with one another. These interventions have enabled global connectivity, facilitated the creation of interactive learning content, and empowered people with a wider audience and a stronger voice. They also foster bonding and collaboration based on shared interests, hobbies, and values. However, excessive screen time for the students was found to be a counterproductive step in technology-enhanced learning. Therefore, a blended approach that combines digital and traditional learning methods is recommended as a better option for the holistic development of students.

Under the framework of the National Education Policy of India, NETF also provides guidance and supports the entire education ecosystem with a specific focus on digital literacy, accessibility, and equitable access to quality education. As a transformative force, EdTech tools promoted under the NETF framework are evolving and offering new opportunities to the stakeholders, requiring thoughtful integration to harness their full potential in enhancing learning outcomes and shaping the future of humanistic education for the attainment of Sustainable Development Goal 4. Findings of the study suggest that thoughtful integration of such interventions with traditional pedagogical practices ensures the holistic development of students aligned with the stages of their cognitive development.

Ubiquitous access to information empowers students to critically examine educational content and develop competencies. Digital technologies have made a paradigm shift in the entire education system. Additionally, digital technology is connecting teachers with students and parents, fostering a stronger sense of community and creating a socially responsible learning ecosystem. As a future research agenda, this study suggests comprehensive end-to-end programmes

and creative ways to conceptualise and execute EdTech facilities that create a socially responsible learning ecosystem with equitable opportunities to encourage learners' active participation towards the fulfilment of comprehensive human goals.

Author Contributions

D.S.G. originated this work, designed the theoretical framework, and prepared the draft; S.T. analysed the survey results and helped with editing; S.G. proofread and improved the quality of this work. All authors have read and agreed to the published version of the manuscript.

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In this research, the investigators followed the ethical standards of the institutional and/or national research committee and were in compliance with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Ethical approval for this study was obtained from the institutional research committees of our respective institutions. This study is based on purely observational research with minimal or no risk to subjects, and does not involve animals.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

Data related to this study are recorded and can be provided if required.

Conflicts of Interest

The authors declare no conflict of interest.

AI Use Statement

During the preparation of this manuscript, the authors used Google AI Mode and Quillbot solely for language refinement. No AI tools were used for data analysis, interpretation, or generation of scientific content. All outputs were critically reviewed and edited by the authors. The authors take full responsibility for the integrity and accuracy of the work.

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