DIGITAL TRANSFORMATION OF ONLINE LEARNING TOOLS ADOPTED BY HIGHER EDUCATION INSTITUTIONS IN HARYANA DURING THE PANDEMIC

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ABSTRACT

The COVID-19 pandemic has precipitated unprecedented changes across various sectors, with education being one of the most significantly impacted. As higher education institutions swiftly transitioned from traditional in-person teaching methods to online platforms, the need to assess and understand this digital transformation has become critical. This research paper explores the adoption of online learning tools by higher education institutions in Haryana during the pandemic, employing a qualitative research methodology to gain deeper insights into the experiences, challenges, and outcomes associated with this shift.

Utilizing a self-administered questionnaire, the study captures the perspectives of 200 teachers from higher education institutions across Haryana. The questionnaire is designed to probe various facets of the digital transition, including the selection of tools, the effectiveness of online teaching methodologies, the challenges faced by educators in engaging students, and the overall impact on the educational process. Responses will be analyzed to identify patterns and themes that shed light on the effectiveness of the digital tools and strategies implemented during the pandemic.

The study aims to contribute to the broader discourse on digital education by providing empirical evidence on the successes and obstacles encountered by educators during this forced digital shift. By highlighting specific tools and practices that have either facilitated or hindered effective teaching or learning, the research seeks to offer valuable insights for policymakers, educational leaders, and technology providers. This, in turn, could guide future decisions on the integration of technology in education, ensuring that digital

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platforms not only supplement but enhance the learning experience.

Moreover, the research will explore the sustainability of these digital practices post-pandemic, examining whether the emergency measures can evolve into long-term educational strategies. The findings are expected to provide a comprehensive overview of digital education's trajectory during a critical period, contributing to a strategic framework for leveraging technology in enhancing the resilience and quality of higher education in the face of future challenges.

Keywords: Digital Transformation Learning Tools in Higher Education Institutions (HEIs) in Haryana.

INTRODUCTION

The COVID-19 pandemic has dramatically accelerated the adoption of digital technologies in higher education, forcing institutions around the globe to transition rapidly from traditional classroom settings to online learning environments. In Haryana, this shift has been particularly significant, with higher education institutions confronting both the opportunities and challenges presented by this sudden transformation. The adoption of various online learning tools has become a focal point for educational research, as it encapsulates the challenges of digital integration in an emergency context and its impacts on pedagogical outcomes. This study focuses on the digital transformation in higher education institutions in Haryana during the pandemic, examining the effectiveness of the online tools and methodologies adopted. By employing a qualitative approach through a self-administered questionnaire distributed among 200 teachers, the research aims to capture a comprehensive view of the educators' experiences, the pedagogical challenges encountered, and the overall efficacy of digital learning. This introduction sets the stage for a detailed exploration into how these digital tools have reshaped the educational landscape, highlighting the need for policies and practices that support effective online teaching and learning. The study's insights are intended to inform future decisions by educational leaders and policymakers, ensuring that the integration of technology not only addresses immediate challenges but also enhances the long-term resilience and quality of education in the face of potential future disruptions.

Relevance to Higher Education in Haryana

The relevance of studying the digital transformation of higher education in Haryana during the COVID-19 pandemic lies in the region's unique demographic and technological landscape. Haryana, a significant contributor to India's educational and technological sectors, faced a distinct set of challenges and opportunities when transitioning to online learning. Prior to the pandemic, while urban areas of Haryana boasted relatively high levels of technological adoption and internet connectivity, the rural areas were not as well-equipped, leading to a pronounced digital divide. The sudden necessity to shift to online platforms tested the resilience and adaptability of higher education institutions across this diverse state. Educational leaders were compelled to rapidly implement digital solutions, often improvising

to accommodate a varied student body in terms of technological accessibility and digital literacy. This transition is particularly relevant in Haryana, where the mix of rapidly growing tech hubs and traditional educational practices created a unique laboratory for studying the impact of digital tools on education. The pandemic magnified existing inequalities and forced institutions to innovate and rethink pedagogical strategies. Thus, examining how these institutions navigated the crisis, managed continuity in education, and planned for an uncertain future can provide valuable insights not only for local policymakers and educational administrators but also for global education systems facing similar challenges. The experience of Haryana's higher education sector during the pandemic highlights crucial lessons in leveraging technology to bridge educational gaps, enhancing digital literacy, and preparing for future disruptions, making it a vital area of study.

Importance of Digital Transformation

The importance of digital transformation in the context of higher education has been dramatically underscored by the COVID-19 pandemic, which acted as a catalyst for an unprecedented shift towards online learning platforms across the globe. In higher education, digital transformation is not merely about substituting physical classrooms with virtual ones; it involves a comprehensive rethinking of teaching methodologies, learning processes, and administrative operations to enhance educational accessibility, efficiency, and quality. This transformation is crucial for several reasons. Firstly, it broadens the reach of educational offerings, allowing institutions to extend their resources beyond traditional geographic limitations and make education more accessible to a diverse student body, including those from remote or underserved regions. Secondly, digital tools and technologies, such as learning management systems, artificial intelligence, and data analytics, provide educators with innovative ways to deliver content, assess performance, and personalize learning experiences at scale, which can lead to improved educational outcomes. Furthermore, digital literacy itself is a critical skill in the modern workforce, and integrating technology into everyday learning prepares students for the digital-centric jobs of the future.

Additionally, the resilience of educational institutions during disruptions, be they pandemics, natural disasters, or social unrest, is significantly enhanced by having robust digital infrastructures in place that can adapt and continue to function under a variety of conditions. Lastly, digital transformation encourages a culture of continuous innovation within institutions, promoting regular updates to curricula and teaching practices and fostering an environment that is responsive to the evolving demands of society and industry. Thus, the digital transformation of higher education is not just a response to a temporary crisis but a strategic evolution that aligns with broader educational and economic trends.

Technological Preparedness

Technological preparedness in higher education institutions, particularly in a diverse state like Haryana, is a critical factor in their ability to respond effectively to the abrupt demand for

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online learning platforms brought about by the COVID-19 pandemic. Prior to the pandemic, the level of readiness varied significantly across institutions, with those in urban areas generally better equipped with the necessary infrastructure, such as high-speed internet access and digital learning management systems. Conversely, institutions in rural areas often struggled due to limited connectivity and a lack of robust technological tools, which posed significant challenges when the need to transition to online learning became urgent.

The disparity in technological preparedness not only influenced the immediate response capabilities of these institutions but also impacted the overall effectiveness of the digital transition. Those with advanced IT departments and prior experience with online courses were able to pivot more smoothly, maintaining continuity of teaching and learning with less disruption. On the other hand, institutions that lacked this preparedness faced steep learning curves and delays in implementation, which could affect the educational outcomes of their students. The situation highlighted the importance of strategic investments in technology and training in educational settings, not just as a crisis response but as a fundamental component of educational planning and infrastructure. The pandemic underscored the need for all institutions, regardless of their previous level of technological adoption, to assess and upgrade their digital readiness as a critical step towards ensuring educational resilience and quality in the face of future challenges. This preparedness is not only about having the right tools but also about cultivating the digital literacy of both educators and students to leverage these tools effectively, fostering an environment where technology enhances learning and operational efficiency.

Student Accessibility and Engagement

Student accessibility and engagement in digital learning environments, particularly during the COVID-19 pandemic, emerged as pivotal factors in the effectiveness of the educational process in higher education institutions in Haryana. With the sudden shift to online platforms, disparities in access to reliable internet and appropriate digital devices significantly influenced students' ability to participate in online classes. In Haryana, where economic and geographic disparities are pronounced, the challenge was not only providing the hardware but also ensuring that all students had sufficient internet bandwidth and digital literacy to engage with the new modes of learning. Institutions faced the dual task of deploying digital tools that were user-friendly and could run on minimal technical specifications while also implementing support systems to assist students facing accessibility issues. Engagement, another critical aspect, was challenged by the impersonal nature of online interactions and the difficulty of replicating hands-on, interactive learning experiences in virtual classrooms. Teachers had to innovate with pedagogical strategies that could hold student attention and foster interactive participation. Techniques such as synchronous (real-time) and asynchronous (task-based, at one's own pace) learning, interactive discussion forums, and virtual group projects were employed to enhance

engagement. The psychological impact of isolation was also significant, with institutions needing to provide more than just academic support to maintain student engagement; emotional and motivational support became just as crucial. This scenario highlighted the essential need for educational institutions to develop comprehensive strategies that address not only the technological aspects of online learning but also the human factors that influence student engagement and accessibility, ensuring that learning remains inclusive and effective regardless of external circumstances.

Evaluation of Learning Tools

The evaluation of learning tools during the rapid shift to online education in Haryana amid the COVID-19 pandemic required a multi-faceted approach to ensure that these tools met educational needs effectively. Higher education institutions embarked on assessing a wide array of digital platforms and tools based on several critical criteria, including user-friendliness, technical reliability, and the ability to facilitate interactive and engaging learning experiences. This process involved not only technical assessments but also pedagogical evaluations to determine how well these tools aligned with the curriculum needs and learning objectives of various courses. Feedback from both students and educators played a crucial role in this evaluation process, providing insights into the practical usability and effectiveness of these tools in a real-world educational context. Institutions prioritized tools that supported a range of functions, such as video conferencing for live classes, robust discussion forums for asynchronous communication, and secure platforms for assessments and exams. Additionally, compatibility with multiple devices and operating systems was essential to accommodate the diverse technology access among students. The evaluation also considered the scalability of tools to handle varying class sizes and the inclusion of accessibility features to support students with disabilities. Ultimately, the effectiveness of learning tools was measured not just by their technical performance but by their impact on learning outcomes and student satisfaction. This comprehensive evaluation helped institutions not only adapt to immediate challenges but also plan for a future where blended and fully online modalities might become more prevalent, aiming to create a more resilient and flexible educational environment. This process highlighted the necessity for ongoing review and adaptation of technology in education, ensuring that learning tools evolve in tandem with pedagogical goals and technological advancements.

Objectives

1. Evaluate the Effectiveness of Online Learning Tools and Methodologies
2. To study the effect of digital tools on teaching and learning practices
3. To study the effectiveness of various online tools on digital learning

LITERATURE REVIEW

Kumar et al. (2020) studied "Outcome of Online Teaching-Learning over Traditional Education during the Covid-19 Pandemic" and stated that the purpose of this research is

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to determine how the COVID-19 epidemic affected online education in India's higher education institutions. Problems, including inadequate training and resources, were uncovered via an online survey. The overarching goal of this study is to provide policymakers and academic institutions with the data they need to design better online education programs that foster the growth of young scholars and increase their employability.

Harman Preet Singh (2021) studied "Personalized and Adaptive Learning on Student Learning Performance: A TOE (Technology Organization Environment) Framework for Saudi Arabia" and stated that this research shows that a DT-PAL (Digital technology-enabled personalized and adaptive learning) student learning framework at the institutional level can be built using the TOE model. It also shows that this framework has the ability to improve students' performance. The concept posits that curriculum simplification, gender equality, increased professionalism, improved teaching approaches, and student creativity may all result from digital technology-enabled adaptive and individualized learning. With this information, Saudi Arabia and other nations may advance their education systems and achieve their digital transformation objectives set forth by their National Transformation Programs.

Mahajan and Gulati (2017) underscore the transformative potential of cloud computing in enhancing accessibility, scalability, and cost-efficiency within academic resource management, particularly in libraries. While their focus centers on library administration, the principles extend to other institutional domains, notably online learning resources. The pandemic-induced pivot to remote education has prompted global postsecondary institutions to implement learning management systems, video conferencing tools, and other digital assets. In Haryana, leveraging digital technology has surmounted pandemic challenges, revolutionized traditional pedagogical landscapes, and fostered innovative educational methodologies.

(Bhardwaj & Rathee, 2021) in the paper titled "Virtual Flipped Classroom: An Approach Transforming Online Learning in Indian Higher Education" and said that virtual flipped classrooms are one of the digital techniques that have emerged in response to the COVID-19 epidemic. Research involving fifty Master of Education (M.Ed.) students at Maharshi Dayanand University in Rohtak indicated that the virtual flipped classroom significantly improved their learning results. By highlighting the benefits of both online and in-person instruction, the results hope to inspire educators to embrace technology and open up new avenues for student learning.

(Bharej & Billus, n.d.), in the paper titled "Quality Enhancement in Teaching-Learning and Evaluation of HEIs during Covid Scenario - with Reference to Sanatan Dharma College, Ambala Cantt" and said that focusing on its ongoing attempts to preserve higher education quality, this research article examines the online teaching and learning system used by Sanatan Dharma College, Ambala Cantt during the COVID-19 epidemic. To emphasize the most employable educational materials, it employs quantitative and qualitative methods.

The study on mobile applications in education by Sunitha and Elina (2020) provides insight into the expanding significance of digital learning tools in contemporary pedagogy. The investigation of mobile applications highlights how they might improve student and teacher accessibility, engagement, and individualized learning experiences. The implementation of digital technologies has been crucial in Haryana's higher education institutions during the epidemic, as it has enabled remote teaching and learning and altered conventional educational paradigms.Prakash et al., 2021, in the research paper "Pandemic of Covid-19, Lockdown and its Impact on Indian Education System," said that education has a key role in human evolution, adapting to new technology, and social demands. Education is still going strong in the face of the COVID-19 epidemic, which has killed millions of people and left many more without jobs, thanks to new tools and approaches in the classroom. The effects of COVID-19 on the Indian education system are examined in this study, with special emphasis on the pros and cons of online education.

The investigation of mobile application development for Android platforms by Chawla, Aggarwal, and Aggarwal (2016) provides insights into the nexus between technology and education. Pupils may access instructional materials anywhere, at any time, using mobile digital education, which opens up new possibilities for ubiquitous learning. Mobile applications have become essential tools for providing online learning content throughout the epidemic, helping Haryana's higher education institutions to successfully engage students and adjust to distant teaching.

Aslam et al. (2021) study examined how the COVID-19 lockdown affected higher education, with a particular focus on Library and Information Science (LIS) students in India. Based on a survey methodology conducted at 19 Central Universities, the results showed that online courses, mostly offered by Zoom, were widely adopted. Prominent obstacles, like insufficient internet connectivity, were noted, highlighting the critical function of webinars in transforming teaching methods in the LIS field.

The study of ICT in higher education by Dixit and Raheja (2020) demonstrates the complex array of problems, difficulties, and solutions in India. Haryana's higher education institutions had to quickly adopt digital transformation because of the major challenges they encountered during the epidemic. In light of these extraordinary conditions, the incorporation of online learning resources became essential for maintaining educational continuity and meeting the changing demands of both teachers and students.

Chatterjee et al., 2023, studied "Information and Communication Technologies in Education: A Framework for Transforming the Indian Education System through Smart Learning" and said that the all-around development of a developed country depends on its educational system's use of digital tools. Modernizing its education system, India has promoted "Smart learning," an approach based on information and communication technologies. In this research, we look at how information and communication technologies may help build a digital world and how they

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might improve education for the future. Analyzing reports, research works, and expert views, the study employs descriptive research, qualitative methodologies, and thematic and content analysis. Educational policymakers and scholars in the future of India might use the findings as a reference.The study by Malik and Rana (2018) highlights the critical role that cloud computing plays in e-learning ecosystems by looking at it as the foundation of educational platforms. Cloud-based solutions offer scalable infrastructure that makes it easier to deliver interactive tests, multimedia information, and collaboration tools necessary for online learning. During the epidemic, this technology architecture facilitates easy access to instructional resources, improving the flexibility and effectiveness of e-learning settings in Haryana's higher education institutions.

The study conducted during the COVID-19 epidemic by Bansal et al. (2021) examined the transformative influence of digital technology in e-learning. It concentrated on implementing online learning tools, including WhatsApp, AnyDesk, Zoom, and Microsoft Teams, in the face of widespread lockdowns and school closures. Studies have highlighted issues with data security and transmission performance, especially in cloud computing settings intended to improve the safe and effective delivery of educational content. Incorporating encrypted and compressed data communication protocols was intended to decrease packet loss and minimize delays, improving the overall resilience of e-learning systems throughout the epidemic.

(Singh & Rana, 2023) studied "Revitalizing E-Governance in Haryana: Embracing Digital Transformation Post-Pandemic" and said that Governments at all levels in Haryana have embraced technology in response to the COVID-19 pandemic's effects on the state's e-governance infrastructure. The significance of e-governance efforts is underscored by the transition to a cashless society. To maintain excellent governance, encourage contactless interactions, and progress the Digital India program, the Haryana government must devise a plan to speed up digital transformation and public involvement, making appropriate use of technology.

Arora and Yadav (2020) outline the complex terrain of ICT activities in higher education, concentrating on the educational environment of Haryana. Their academic discussion captures the complex development of virtual learning resources throughout the epidemic and illuminates the revolutionary path taken by universities. By carefully combining theoretical ideas with empirical data, the writers navigate the complexity of this paradigm shift to explain the many facets of digital transformation.The scholarly discourse of Aggarwal (2014) delves deeply into the transformative potential of digital education by navigating the complex domain of e-learning in the context of mobile ad hoc networks. Examining how mobile technology and pedagogical paradigms work together harmoniously, the author sheds light on how online learning tools have changed education. By means of a thorough analysis of mobile ad hoc networks, Aggarwal outlines the changing features of digital education,

emphasizing its critical function in supporting dynamic educational environments.

In Rana and Malik's (2022) research, the literature analysis clarifies the many ways in which the COVID-19 pandemic has affected the educational environment, with an emphasis on how online learning tools have changed in Haryana's Higher Education Institutions (HEIs). Using a thorough synthesis of previous research, the study emphasizes how important it is for HEIs to quickly transition to digital modalities in the midst of the epidemic, pointing out both the benefits and problems that come with this revolutionary change. Regression analysis and correlation coefficients were two of the statistical techniques used in the article to identify the complex link between COVID-19 and the development of the educational system.

In Maiti, Sharma, and Pandey's comparative analysis from 2022, the stark differences in higher education quality between Chhattisgarh's public and private universities were highlighted. These differences were made worse by the use of technological instruments in pedagogy. The study found that whereas private colleges were skilled at running their online programs, government universities had many challenges, such as restricted access to necessary equipment and poor internet connectivity, which were made worse in tribal regions. In the end, the study emphasized the need for deliberate initiatives to close the educational gap by noting the many problems associated with online learning, including poor infrastructure, limited funding, and inconsistent teacher quality.

Using information from government initiatives and the National Education Policy (NEP) of 2020, the literature review based on Papnoie and Ravi's (2023) study offers a thorough examination of the digital transformation of online learning tools within Higher Education Institutions (HEIs) in Haryana during the pandemic. This study delves deeply into the crucial role that government interventions play in encouraging the use of online education platforms. It also clarifies the policies, regulations, and financing mechanisms that are intended to improve the digital infrastructure and pedagogical practices in higher education institutions. The study utilized both descriptive statistics and thematic analysis as statistical methods to explicate the complex dynamics of the digital revolution in the context of education.

Uppal and Rana's (2023) study elucidate the increased prevalence of digital learning in Indian schools, emphasizing Haryana's HEIs during the pandemic. It meticulously examines online learning technology adoption, obstacles, and impacts on pedagogy and student engagement, employing trend and qualitative content analysis. Government initiatives, including digital infrastructure development, e-learning policies, and programs like SWAYAM and the National Digital Library, aim to democratize access to quality education across socioeconomic strata.

The literature study that is taken from the research of Sarkar and Syamsunder (2022) offers a comprehensive analysis of how the COVID-19 pandemic has affected efforts related to training and development. It provides

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insightful information about how online learning resources have evolved digitally within Haryana's Higher Education Institutions (HEIs). By utilizing statistical techniques such as regression analysis and ANOVA, the research thoroughly clarifies the complex dynamics influencing how the pandemic affects training paradigms. Aspects including the use of remote learning, improvements to the technology infrastructure, and pedagogical modifications are examined in light of the pandemic's unparalleled disruptions.The rapid transition from traditional to online education in India, brought about by the COVID-19 epidemic, was critically studied by Nawale (2021), who also highlighted the substantial obstacles that both instructors and students experienced in sustaining the quality of e-learning. The study highlighted the differences between the pandemic-induced ad hoc emergency remote teaching that lacked necessary infrastructure and voluntary participation, and the established online education frameworks like those offered by IGNOU. Despite significant challenges, such as psychological strain and inadequate technology, the study highlighted fresh avenues for educational innovation and the need for a quick transition to the new digital paradigm.

The study conducted by Chauhan et al. (2021) examined the desire of full-time business school students and teachers in India and Italy to continue using digital classroom approaches instead of traditional ones during the COVID-19 epidemic. Using Smart PLS 3 software, the study analyzed survey data from 396 students and 130 faculty members, integrating the Expectation Confirmation Model (ECM) and Task-Technology Fit (TTF). The results showed that task-technology fit, perceived utility, and satisfaction all had a substantial impact on students' intentions to continue using technology. Italian students were more likely to prioritize task-technology fit than Indian students, who were more concerned with technological mastery. Teachers in both nations showed that the correlation between task-technology fit and inclination to continue was relatively less.

Singh, Gopal, and Kiran (2022) meticulously analyzed the transformative impact of digitalization on the teaching-learning process at Sanatan Dharma College, Ambala Cantt, highlighting the profound reliance on ICT advancements during the pandemic. Their study underscored the increased relevance and utilization of digital platforms such as SWAYAM, National Digital Library of India, and CEC, which facilitated continued educational engagement despite lockdowns. By integrating ICT tools with conventional methods, the college effectively addressed the diverse needs of learners, thereby enhancing the quality of education and adapting to the 'new normal' in higher education.

Sahu and Samantaray (2022) conducted a thorough assessment of the digital revolution of education in India, focusing on rural areas. They highlighted the critical role that technology plays in improving educational outcomes. The study emphasized the government's efforts to provide instructors and pupils with cutting-edge technology tools and online resources, highlighting the possibilities and difficulties that rural India may face in adjusting to these technological improvements. Despite these challenges, the study outlined a promising path for digitizing rural education with the goal of

preparing rural students for the demands of future technology.

The literature study derived from Wadhwa's (2013) research emphasizes how important it is for Higher Educational Management Institutes (HEMIs) to have full 360-degree training and development systems. It clarifies how important these kinds of solutions are in helping Higher Education Institutions (HEIs) in Haryana during the epidemic to digitize their online learning resources. In her study, Wadhwa promotes the incorporation of a variety of training techniques and pedagogical strategies, highlighting the importance of these approaches in helping teachers and students develop their ability to adapt and become technologically proficient.

The deployment of ICT-based learning tools in Indian higher education during the COVID-19 epidemic was carefully examined by Singh et al. (2022). They also conducted a comparative examination of the widely supported 'SWAYAM' platform against other international e-learning platforms. The study's findings indicated notable differences in characteristics including distribution channels, target markets, and user population, suggesting that 'SWAYAM' needs to be significantly improved in order to compete globally. The thorough SWOC analysis included insightful information about the advantages, disadvantages, opportunities, and difficulties related to these e-learning portals. It also offered tactical suggestions for the creation of policies that would satisfy stakeholders and spur innovation in education.

Bello and Hamam's (2020) literature analysis delves into the complexities of information and communication technology (ICT) adoption in Nigerian tertiary education regulations. It provides insightful information on the larger context of digital transformation. It examines the complex dynamics affecting the adoption of ICT techniques and technologies, outlining the opportunities and obstacles that come with the process. The study by Bello and Hamam emphasizes the role that institutional policies and regulatory frameworks play in determining how ICT adoption develops, emphasizing the necessity of all-encompassing approaches to enable seamless integration into the higher education environment.The literature review derived from Krishna and Sekharaiah's (2015) study explores the complex domain of security aspects related to online social network users, providing important insights into the protective mechanisms of the digital world. It examines the wide range of instruments and procedures used to guarantee the availability, confidentiality, and integrity of user information on online social networking sites. In their study, Krishna and Sekharaiah highlight the need for strong security frameworks and explain how they may reduce vulnerabilities and maintain user confidence in the face of changing cyber threats.

Yadav and Soni's (2022) study's literature analysis delves into a fascinating investigation of the ways in which technology interacts with social dynamics, with a special emphasis on the ways in which technology contributes to societal peace and harmony. It deftly examines the plethora of digital tools that are employed to strengthen social ties, foster communication, and diffuse conflicts, providing a new outlook on the transformational power of technology in

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promoting communal well-being. This study raises important questions about how digital platforms might help communities develop empathy, understanding, and resilience. It also signals the beginning of a new age in which technology plays a key role in promoting social harmony and cohesiveness.

Shukla and Singh (2022) scrutinized the utilization and perception of electronic resources by faculty in private universities within Delhi NCR during the COVID-19 pandemic. Their study highlighted the significant reliance on e-resources and online learning tools facilitated by university libraries, which were essential in maintaining the continuity of education amid widespread institutional closures. The research underscored the need for robust library support and tailored e-resource development to enhance faculty teaching and research experiences in the digital transformation era.

A comprehensive literature analysis was carried out by Duggal, et, al, (2021) to investigate the state of schooling in India during the COVID-19 epidemic. They emphasized the move to digital teaching techniques and disclosed government initiatives to set up free online learning environments. But there were also major obstacles, like differences in internet accessibility and poor infrastructure. The study's findings were intended to contribute to the growing conversation about online education during international emergencies by educating educators and higher education institutions on how to restructure pedagogical practices to better prepare for future crises. Sharma and Choudhary (2022) carried out a thorough analysis of the revolutionary effects of ICT on education, which were especially expedited by the COVID-19 epidemic and required an immediate transition to digital learning modalities. The study highlighted the ways in which educational institutions have adapted to online and blended learning settings, underscoring the important role that electronic resources play in improving the quality of education and the development of skills. The report also stressed how well the paper aligns with India's New Education Policy (NEP) 2020, which promotes significant ICT integration changes for comprehensive and excellence-driven educational experiences.

During the COVID-19 epidemic, Kumar et al. (2023) investigated instructors' attitudes on the adoption of e-learning in Indian higher education institutions, concentrating on factors including perceived utility, institutional support, and teacher-student interaction. The results, which were obtained through the use of PLS-SEM and online questionnaires, emphasized the critical role that teachers' attitudes and levels of satisfaction with online instruction are shaped by perceived usefulness and institutional support. By providing thorough insights into the factors impacting instructors' intention to continue using online teaching approaches in the face of educational disruptions, the study adds to the body of literature.

The literature review that resulted from the research conducted by Gupta and Gupta (2011) explores the practical implications of Information Technology (IT) in the context of management education, providing insight into the relevance and practical applicability of IT. It examines a range of IT resources and approaches used in management education,

explaining how they improve the delivery of instruction, enable experiential learning, and develop managerial skills. The study by Gupta and Gupta is a groundbreaking investigation of the complex relationship between IT and management education, emphasizing the transformational power of this relationship in preparing future leaders with the knowledge and abilities needed to successfully navigate a world that is becoming more and more digital.

The literature study that was taken from the research of Raman and Kaushik (2016) performs a thorough investigation of contemporary cybersecurity technologies and approaches, providing a thorough evaluation of their applicability and effectiveness. It explores a wide range of innovative methods and tools used to protect networks and digital assets, explaining how they help to reduce cyber threats and guarantee data integrity. The work of Raman and Kaushik is regarded as a foundational work in the industry, offering insightful information on how cybersecurity methods are changing and opening the door to greater resilience in a world that is becoming more linked.A thorough evaluation of online versus traditional teaching-learning was carried out by Kumar et al. (2020) in multiple Indian higher education institutions during the COVID-19 pandemic. Their quantitative survey demonstrated the critical role that online education plays, even in the face of obstacles like limited resources and inadequate preparation for ICT-based learning. In order to improve online learning outcomes and students' employability in a post-pandemic environment, the study underlined the necessity of customized training programs for instructors and students.

The study conducted by Maheshwari et al. (2021) carefully explained the substantial shift in higher education brought about by the introduction of e-learning, which was greatly accelerated by the COVID-19 epidemic. This study highlighted the emerging trend of moving away from traditional pedagogical frameworks and towards virtual, learner-centric paradigms. It also revealed that e-learning has received generally positive feedback from both educators and students because of its many benefits, including increased mobility, content richness, and feasibility. However, the investigation also revealed significant obstacles, such as poor infrastructure, the digital divide in rural areas, and cybersecurity issues, which call for proactive steps to remove these barriers and maintain productive teacher-student relationships.

The Malik and Rana (2020) study's literature review provides a comprehensive analysis of the benefits and drawbacks of e-learning deployment in higher education. It explores the several platforms and technologies used in e-learning settings in detail, explaining how they might improve the accessibility, adaptability, and interactivity of instruction. Informed by a comprehensive knowledge of the complex consequences of adopting e-learning, Malik and Rana's study makes a significant addition to the conversation and helps higher education institutions make strategic decisions throughout the epidemic.

Gupta and Pal's (2021) study on COVID-19's impact on Indian higher education,

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focusing on the University of Delhi, reveals significant challenges in transitioning to online instruction across seventeen departments. Urban and rural student disparities, unpreparedness for work placements, and administrative hurdles due to reliance on paper-based systems emerged. Nonetheless, the university community's resilience underscores potential future advancements in digital educational technologies.

In their research chapter, Gusai, et al, (2023) offered a thorough examination, examining the dramatic transition during the COVID-19 epidemic from traditional schooling to e-learning and distance learning. Their study covered the potential and problems faced by teachers and students around the globe, emphasising how quickly digital platforms like Tencent Classroom and Byju's are being adopted. Disparities in digital access, especially in rural regions, remained a serious concern despite the explosion of online resources. The chapter recognised the continuing value of in-person connection in education while highlighting the transformative potential of online learning.

The literature study, which is based on Bhat's 2009 ground-breaking work, explores how Information and Communication Technology (ICT) has the power to drastically alter India's educational system. It carefully looks at the range of instruments and approaches used to use ICT to improve outreach, quality, and accessibility in education, and it clarifies the various ways that it affects Haryana's higher education institutions in the middle of the epidemic. Bhat's work is a ground-breaking analysis of the tactical use of ICT tools, explaining how they may drive digital change in the classroom and create inclusive learning environments that are responsive to the needs of the modern world.

Shukla's (2023) research perceptively explores digital technology's transformative potential in education, analyzing tools, methodologies, and models reshaping teaching, organization, and student engagement in Haryana's HEIs during the pandemic. This foundational work provides a comprehensive examination of digital adoption impacts, informing strategic plans that foster resilient and progressive educational environments, significantly contributing to academic discourse.

The study of literature that resulted from Kumar et al.'s (2021) thorough inquiry explores the complex world of blended learning techniques and tools, providing a thorough examination of their suitability and effectiveness in Haryana's Higher Education Institutions (HEIs) during the epidemic. It carefully examines a wide range of instructional strategies, technology tools, and pedagogical techniques used in blended learning settings, explaining how they contribute to individualized, dynamic, and interesting learning experiences. The study by Kumar et al. stands out as a foundational addition to the academic conversation because it offers priceless insights into the complex dynamics of blended learning adoption, guiding strategic actions meant to improve student outcomes and resilience in the face of unprecedented upheavals.

The literature evaluation that resulted from the empirical inquiry conducted by Anthony et al. (2019) explores the complex ways in which blended learning might improve teaching and learning effectiveness in higher education institutions. It carefully examines a wide range of instruments, approaches, and teaching strategies used in blended learning settings, explaining their complex effects on student participation, learning outcomes, and knowledge acquisition. The paper by Anthony et al. stands out as a foundational contribution to the academic conversation because it offers insightful information about the complex dynamics of blended learning adoption. This information can then be used to inform strategic initiatives that aim to maximize educational opportunities in the context of higher education's constant change.

RESEARCH METHODS

This quantitative study investigates the digital transformation of online learning tools in Higher Education Institutions (HEIs) across Haryana during the pandemic. Employing a cross-sectional design, data are collected from 200 participants representing diverse HEIs in the region. A purposive sampling approach is utilized to ensure a comprehensive understanding of digital transformation efforts. The study relies on a structured questionnaire developed from existing literature and expert input to gather insights into the extent and nature of digital transformation initiatives in HEIs amidst the pandemic.

Reliability Analysis

The case processing summary reveals that all 200 cases in the study were valid, with none excluded. Utilizing listwise deletion, cases with missing data across all variables were excluded from analysis, ensuring the completeness of the dataset. Regarding reliability, Cronbach's Alpha, a measure of internal consistency, was calculated at 0.949, suggesting high reliability. This analysis involved 14 items, indicating the likely use of a questionnaire or scale with multiple components. Overall, these findings indicate a well-processed dataset with strong reliability, providing a robust foundation for drawing conclusions from the study's results.

Table 1:

Case Processing Summary			
		N	%
Cases	Valid	200	100.0
	Excluded	0	.0
	Total	200	100.0
a. Listwise deletion based on all variables in the procedure.			

Reliability Statistics	
Cronbach's Alpha	N of Items
.949	14

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DATA ANALYSIS AND RESULTS

Demographic Analysis:

The data presents the distribution of gender and age among participants in the study. Regarding gender, 58% of the participants identified as male, while 42% identified as female. This indicates a slight male majority within the sample. In terms of age, the majority of participants fall within the 18-30 age bracket, comprising 44% of the sample. Participants aged 30-40 represent 35% of the sample, while those aged 41-60 account for 21%. Overall, the data reflects a diverse representation in terms of both gender and age groups among the participants.

The data outlines the distribution of participants across academic departments and their years of teaching experience. In terms of academic departments, the highest frequency is observed in Humanities, accounting for 37% of the participants. Sciences, Engineering and Technology, and Social Sciences each represent 21% of the participants, indicating a relatively balanced distribution across these fields.

Regarding years of teaching experience, participants with 1-5 years of experience constitute the largest group, making up 37% of the sample. Those with 6-10 years, 11-15 years, and more than 15 years of teaching experience each represent 21% of the participants. This distribution suggests a diverse range of teaching experience

Table 2:

Gender				
	Frequency	Percent	Valid Percent	Cumulative Percent
Male	116	58.0	58.0	58.0
Female	84	42.0	42.0	100.0
Age				
	Frequency	Percent	Valid Percent	Cumulative Percent
18-30	88	44.0	44.0	44.0
30-40	70	35.0	35.0	79.0
41-60	42	21.0	21.0	100.0

Table 3:

Academic Department				
	Frequency	Percent	Valid Percent	Cumulative Percent
Humanities	74	37.0	37.0	37.0
Sciences	42	21.0	21.0	58.0
Engineering and Technology	42	21.0	21.0	79.0
Social Sciences	42	21.0	21.0	100.0
Years of Teaching Experience				
	Frequency	Percent	Valid Percent	Cumulative Percent
1-5 years	74	37.0	37.0	37.0
6-10 years	42	21.0	21.0	58.0
11-15 years	42	21.0	21.0	79.0
More than 15 years	42	21.0	21.0	100.0

levels among the participants, contributing to a comprehensive representation across different academic disciplines and experience levels.

The data illustrates perceptions regarding the impact and usability of digital learning tools utilized during the pandemic. Regarding the overall quality enhancement of teaching and learning, 35% of respondents agreed that the tools positively affected quality, while 14% strongly agreed. Conversely, 22.5% strongly disagreed and 14.5% disagreed with this notion, indicating some dissenting opinions.

Regarding ease of navigation and use, 36% of respondents agreed that the tools were easy to navigate and use, while another 14% strongly agreed. However, 15% strongly disagreed and 21% disagreed with this statement, suggesting a higher proportion of respondents expressing challenges with tool usability. Overall, the data reflects a range of perceptions regarding the impact and usability of digital learning tools during the pandemic, with a notable proportion of respondents expressing positive sentiments but also indicating areas for improvement.

For student engagement, 35% of respondents agreed that the digital tools effectively facilitated engagement, with an additional 14% strongly agreeing. Conversely, 22.5% strongly disagreed and 14.5% disagreed with this statement, indicating mixed opinions on the effectiveness of the tools in promoting engagement.

Regarding the enhancement of teaching and learning quality, 28% of respondents agreed that the tools had a positive impact, while 14.5% strongly agreed. However, 22.5% strongly disagreed and 21% disagreed with this notion, suggesting a higher proportion of dissenting opinions regarding the tools' efficacy in improving overall teaching and learning

Table 4:

The digital tools I used improved the overall quality of teaching and learning.				
	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Disagree	45	22.5	22.5	22.5
Disagree	29	14.5	14.5	37.0
Neutral	28	14.0	14.0	51.0
Agree	70	35.0	35.0	86.0
Strongly Agree	28	14.0	14.0	100.0
The digital learning tools I used during the pandemic were easy to navigate and use.				
	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Disagree	30	15.0	15.0	15.0
Disagree	42	21.0	21.0	36.0
Neutral	28	14.0	14.0	50.0
Agree	72	36.0	36.0	86.0
Strongly Agree	28	14.0	14.0	100.0

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quality. Overall, the data reflects a diverse range of perspectives on the effectiveness and impact of digital tools in the educational setting during the pandemic.

Table 5:

The digital tools I used effectively facilitated student engagement during online classes.				
	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Disagree	45	22.5	22.5	22.5
Disagree	29	14.5	14.5	37.0
Neutral	28	14.0	14.0	51.0
Agree	70	35.0	35.0	86.0
Strongly Agree	28	14.0	14.0	100.0
The digital tools I used improved the overall quality of teaching and learning.				
	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Disagree	45	22.5	22.5	22.5
Disagree	42	21.0	21.0	43.5
Neutral	28	14.0	14.0	57.5
Agree	56	28.0	28.0	85.5
Strongly Agree	29	14.5	14.5	100.0

Table 6:

Using digital tools for online teaching presented significant technical challenges.				
	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Disagree	60	30.0	30.0	30.0
Disagree	42	21.0	21.0	51.0
Neutral	28	14.0	14.0	65.0
Agree	56	28.0	28.0	93.0
Strongly Agree	14	7.0	7.0	100.0
The adoption of digital tools provided new opportunities for innovative teaching methods.				
	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Disagree	45	22.5	22.5	22.5
Disagree	43	21.5	21.5	44.0
Neutral	14	7.0	7.0	51.0
Agree	70	35.0	35.0	86.0
Strongly Agree	28	14.0	14.0	100.0

Regarding technical challenges, 30% of respondents strongly disagreed that significant technical challenges were present, while 28% agreed, and 21% disagreed. Meanwhile, 14% held a neutral stance, and 7% strongly agreed with the statement, suggesting a mixed range of experiences regarding technical hurdles.

In terms of opportunities for innovative teaching methods, 35% of respondents agreed that the adoption of digital tools provided new opportunities, with an additional 14% strongly agreeing. Conversely, 22.5% strongly disagreed and 21.5% disagreed with this statement, indicating differing perspectives on the extent to which digital tools facilitate innovative teaching approaches.

In terms of usability, 28% of respondents found the tools easy to navigate and use, with an additional 28% agreeing with this statement. Conversely, 22% disagreed and 15% strongly disagreed, indicating a notable proportion of participants expressing challenges with tool usability. Additionally, 7% strongly agreed with the statement, suggesting a smaller yet positive sentiment regarding tool usability.

Regarding student engagement, 36% of respondents agreed that the digital tools effectively facilitated engagement, while 14% strongly agreed. Conversely, 21% disagreed and 15% strongly disagreed, indicating a mix of opinions on the effectiveness of the tools in promoting student engagement. Additionally, 14% held a neutral stance on this matter.

Concerning confidence in integration, 36% of respondents agreed that they felt confident in their ability to integrate digital tools into teaching practices, while 14% strongly agreed. Conversely, 21% disagreed and 15% strongly disagreed, indicating varying levels of

Table 7: The digital learning tools I used during the pandemic were easy to navigate and use.

The digital learning tools I used during the pandemic were easy to navigate and use.				
	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Disagree	30	15.0	15.0	15.0
Disagree	44	22.0	22.0	37.0
Neutral	56	28.0	28.0	65.0
Agree	56	28.0	28.0	93.0
Strongly Agree	14	7.0	7.0	100.0
The digital tools I used effectively facilitated student engagement during online classes.				
	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Disagree	30	15.0	15.0	15.0
Disagree	42	21.0	21.0	36.0
Neutral	28	14.0	14.0	50.0
Agree	72	36.0	36.0	86.0
Strongly Agree	28	14.0	14.0	100.0

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Table 8:

I felt confident in my ability to integrate digital tools into my teaching practices.				
	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Disagree	30	15.0	15.0	15.0
Disagree	42	21.0	21.0	36.0
Neutral	28	14.0	14.0	50.0
Agree	72	36.0	36.0	86.0
Strongly Agree	28	14.0	14.0	100.0
The digital tools provided sufficient flexibility to adapt to different teaching styles and course formats				
	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Disagree	45	22.5	22.5	22.5
Disagree	42	21.0	21.0	43.5
Neutral	28	14.0	14.0	57.5
Agree	56	28.0	28.0	85.5
Strongly Agree	29	14.5	14.5	100.0

confidence among participants. Additionally, 14% held a neutral stance on this matter.

Regarding flexibility, 28% of respondents agreed that the digital tools provided sufficient flexibility to adapt to different teaching styles and course formats, with an additional 14.5% strongly agreeing. However, 22.5% strongly disagreed and 21% disagreed with this statement, suggesting a notable proportion of participants expressing challenges with tool flexibility. Additionally, 14% held a neutral stance on this matter.

DISCUSSION

The data provides valuable insights into educators' perceptions regarding the integration and effectiveness of digital tools in online teaching practices during the pandemic. It is notable that while a significant proportion of respondents expressed confidence in their ability to integrate digital tools into their teaching practices, there were also dissenting opinions, with a considerable number indicating either a lack of confidence or neutrality on the matter. This suggests a need for further support and training to enhance educators' digital literacy and confidence in utilizing these tools effectively.

Similarly, the data highlights mixed perceptions regarding the usability and effectiveness of digital tools in facilitating student engagement and adapting to different teaching styles and course formats. While a substantial portion of respondents acknowledged the positive impact of these tools, there were also concerns raised about usability challenges and limitations in flexibility.

These findings underscore the importance of ongoing professional development and support to address technical challenges, enhance usability, and maximize the potential of digital tools in enhancing teaching and learning experiences. Additionally, it emphasizes the need for a nuanced approach to technology integration that considers educators' varying levels of confidence and expertise, as well as the diverse needs of students and the demands of different teaching contexts.

Overall, the data underscores the complex nature of digital tool integration in education and the importance of continuous improvement and adaptation to meet the evolving needs of educators and students in an increasingly digital learning environment.

CONCLUSION

In conclusion, this study sheds light on the multifaceted experiences and perceptions of educators regarding the integration of digital tools into online teaching practices during the pandemic. The findings reveal a spectrum of viewpoints, with some educators expressing confidence in their ability to utilize digital tools effectively, while others face challenges and uncertainties. Despite these varied experiences, it is evident that digital tools have played a significant role in shaping the landscape of online education, providing opportunities for innovation and enhancing teaching and learning experiences. While some educators have found these tools to be user-friendly and effective in promoting student engagement, others have encountered technical challenges and limitations in flexibility.

Moving forward, it is imperative to address the needs and concerns raised by educators through targeted professional development initiatives and support mechanisms. By equipping educators with the necessary skills, knowledge, and resources, we can foster a culture of digital literacy and empowerment, enabling them to harness the full potential of digital tools in education.

Furthermore, ongoing research and collaboration are essential to identify best practices and innovative approaches for integrating digital tools into teaching practices. By continuously refining our strategies and adapting to the evolving needs of educators and students, we can ensure that digital technology remains a valuable asset in enhancing teaching and learning outcomes.

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