Major Research Project

Factors influencing adoption of Digital Education by school teachers: A study on Delhi Government Schools

Submitted By

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CERTIFICATE

This is to certify that Rama Shankar (2K22/DMBA/98) has fulfilled a portion of the requirements for the Master of Business Administration (MBA) degree from Delhi School of Management, Delhi Technological University, New Delhi, by submitting the summer research report titled "FACTORS INFLUENCING ADOPTION OF DIGITAL EDUCATION BY SCHOOL TEACHERS: A STUDY ON DELHI GOVERNMENT SCHOOLS" during the academic year 2023–2024.

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DECLARATION

I hereby declare that the work done on this report is solely carried out by me and is being submitted to Delhi School of Management, Delhi Technological University for the partial fulfillment for the degree of Masters of Business Administration, academic period 2022-2024.

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EXECUTIVE SUMMARY

Abstract of the study

This summer research report, titled "**Factors influencing adoption of Digital Education by school teachers: A study on Delhi Government Schools**", encapsulates comprehensive research on the adoption of digital education products by the teachers in Delhi government schools. The primary objective of the research was to acquire practical experience in conducting research, formulating hypotheses, and constructing a research model. This executive summary offers a concise overview of the main methodologies, findings, and implications derived from the research.

The research commenced with an extensive review of prior research in the domain of digital education and its adoption among teachers and students.

The report emphasizes the following key points:

Methodology: I employed a systematic approach to assess the adoption of various digital educational tools currently utilized in Delhi government schools. My primary aim was to evaluate the efficacy of digital educational tools in Delhi government schools for instructional purposes. It was imperative to investigate how digital technologies influence student performance as educational institutions increasingly integrate them to enhance course effectiveness. I employed suitable tools and methods to accomplish our research objectives. Employing a descriptive research design, we utilized a quantitative research strategy. Teacher data was collected through surveys, and data analysis was performed using IBM SPSS software.

Challenges and Learning: The research journey was not without its challenges. Reviewing existing literature to comprehend the state of knowledge in our field was a time-consuming endeavor. It could be overwhelming, and it was crucial to ensure that our research was innovative and added to the existing body of knowledge. Gathering data presented logistical challenges, which included issues related to access, ethical considerations, and the requirement for specialized equipment or software. Nonetheless, the experience fostered critical thinking skills, encouraging us to question assumptions, evaluate evidence, and think analytically.

Outcomes and Recommendations: Our research revealed that the use of digital education can have an impact on students' academic performance. Based on our findings, we propose recommendations for the development of a clear policy that

outlines the utilization of digital educational products in the classroom. This policy should be aligned with a strategic objective supported by a set of key performance indicators.

In conclusion, the "Investigating the Factors Affecting the Uptake of Digital Education Among School Teachers: A Research Study in Delhi Government Schools" research provided valuable insights into the realm of research. This research analysis is distinct in two significant ways: firstly, it examines the predominant factors influencing technology adoption among teachers and students in India, and secondly, it introduces a conceptual model based on prior Indian research utilizing the Technology Acceptance Model (TAM).

The knowledge and perspectives gained from this research are expected to contribute to a deeper understanding of research and its implications. This report stands as a testament to the dedication, expertise, and adaptability required in the field of research, particularly in the context of digital education.

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CHAPTER 1: INTRODUCTION

1.1. Introduction

Digital education, which employs various digital tools such as computers, laptops, smartboards, and projectors for instructional purposes, has gained increasing acceptance within the Indian educational landscape in recent years. Public institutions are progressively adopting this approach, offering an interactive learning environment that yields benefits for teachers, educational institutions, students, and parents (Torrato, Prudente & Aguja, 2020). With this context in mind, the following chapter provides a concise overview of the concept of digital education in Delhi government schools, specifically focusing on the use of specific digital tools and exploring the potential for integrating digital technology into the educational system.

1.2. Research Background

The most pivotal human pursuits encompass learning and education, which serve as primary avenues for shaping accomplished individuals and enduring civilizations. As we traverse the threshold of a new millennium, we confront formidable challenges in adapting to the evolving needs of society. Consequently, the role of education has undergone a profound transformation in the contemporary world compared to earlier times. The principal objective of education in the twenty-first century is to facilitate students in becoming self-directed learners and engaged citizens who can actively and confidently contribute to the advancement of global society. This is achieved by nurturing competencies in various domains, including self-awareness, social awareness, self-management, relationship management, effective communication, critical and creative thinking, digital literacy, and collaborative skills.

To realize this objective, the adoption of cutting-edge, evidence-based educational practices is crucial. These practices should address historical issues that have persisted while equipping students with the skills demanded by the modern, information-based global economy.

The term 'digital education' pertains to the utilization of digital technology and resources in educational contexts. Students of all ages and educational backgrounds can benefit from the incorporation of digital tools into their learning experiences, spanning disciplines such

as art, science, philosophy, and commerce. Digital education rests upon three essential pillars: content, technological platforms, and delivery infrastructure.

One of the principal advantages of digital classrooms lies in their capacity to enable educators to create and share interactive content with their students. This content encompasses videos, animations, simulations, and other multimedia resources that facilitate students' comprehension of intricate concepts and ideas. Additionally, digital classrooms empower teachers to monitor their students' progress and offer personalized feedback and support.

Another notable benefit of digital classrooms is their accessibility to students from diverse backgrounds. As digital devices and internet connectivity become increasingly prevalent, students can access digital classrooms from anywhere and at any time. This fosters inclusivity and equity in education, ensuring that no student is left behind due to geographic, economic, or social barriers. The Delhi government has taken proactive measures to promote the use of digital classrooms in schools throughout the city. Through initiatives such as the Delhi Education Revolution program, the government has invested in digital infrastructure and teacher training programs to enable effective integration of digital technology into classrooms. Moreover, the government has launched various initiatives aimed at providing digital devices and internet connectivity to students from economically disadvantaged backgrounds. The integration of technology into education has revolutionized traditional teaching and learning methods.

1.3 Purpose of the study

The main aim of the study is to determine the effectiveness of digital learning in increasing student achievement in Delhi Govt. Schools. Progress will depend on teachers starting to use digital tools in their teaching plans and explaining their meaning to students.

In digital education, mental problems may be more difficult and may require special support. Therefore, it is very important to have a support program that can assist users when needed. In this research article, we aim to evaluate the learning of smart classrooms in India (Delhi).

I conducted a survey in Delhi Govt. Schools to collect data on the academic performance of students in traditional and digital classrooms. I then analyzed this data to evaluate the effectiveness of smart classrooms in supporting students' learning outcomes.

This article provides evidence to support the hypothesis that learning in digital classrooms can be a way to improve student engagement, motivation, and learning. However, it must be recognized that the effectiveness of digital education will depend on many factors, such as the quality of digital equipment, the level of teacher support, and the individual needs and preferences of students. The list of goals is as follows:

- To determine the effectiveness of smart classrooms in improving the learning of secondary school students at Delhi Govt. Schools.
- Compare the improvement in the learning of students taught in the smart classroom with those taught with traditional teaching methods.
- Evaluation of the impact of smarter classrooms on middle school students' academic skills.
- Calculated percentages of change in learning based on the performance of students educated in smart classrooms and traditional teaching methods.
- Evaluation of the Effectiveness of Using Smart Classes in Delhi Govt. Schools.
- Delhi Govt. Schools provide evidence-based recommendations on the use of smart classrooms as an effective alternative to traditional classrooms, particularly for students with restrictions on educational use.
- This study will be the first to use TAM in digital learning tools in Delhi Govt. schools and will evaluate the effectiveness of TAM from a teacher's point of view. Introduce the two main beliefs that make up the TAM model, namely perceived value and other innovations that affect perceived ease of use. Strategic focus is a new concept introduced by the Delhi government. while less research is being done in the school setting, information technology and digital education research. Therefore, consider this as one of the external variables that adds a new perspective to the research model. Other factors in the literature considered in the theoretical model of this study include social impact, need for benefits, positive content, support, and personal effectiveness.

1.4 Technology Acceptance Model

Digital classrooms enable more collaborative learning. It gives students the opportunity to interact with their friends and teachers in real time, wherever they are. Technology also allows teachers to monitor student progress and provide immediate feedback, leading to more personalized learning. Integrating the projector and computer technology into the classroom provides a new and exciting way to learn. The discussions found in this research

book demonstrate that technology use is accepted by teachers and students, resulting in good education.

Further research could explore the long-term effects of using digital learning in the classroom and how it compares to traditional teaching.

A challenging and essential part of technology integration is comprehending why people choose to use or reject new technologies in the classroom. The qualities of the technology itself as well as user behavior and attitudes are among the many variables that affect how new technologies are adopted. Many models and theories have been created to address this. The Technology Acceptance Model (TAM), first presented by Davis in 1986, is one of the most prominent and widely acknowledged models relating to technology acceptance and application.

TAM has been shown to be a useful theoretical model in explaining and predicting information technology user behavior, Collerette, P. et al. (2003). According to Fishbein, M. and Ajzen, I. (1975), TAM is considered an important extension of Action Theory (TRA). TAM, Davis, Bagozzi, and Warshaw in 1989, Warshaw, P. R. et al. (1989) & Pierre, C. et al. (2003). The model is based on two criteria, perceived usefulness (PU) and perceived ease of use (PEOU), which lead to technology use behavior.

TAM has proven to be a theoretical model in helping to explain and predict user behavior of information technology, Collerette, P. et al (2003). TAM is considered an influential extension of the theory of reasoned action (TRA), according to Fishbein, M., & Ajzen, I. (1975). TAM is generally referred to as the most influential and commonly used theory of Information System developed by Davis, Bagozzi and Warshaw in 1989, Warshaw, P. R. et al. (1989) & Pierre, C. et al. (2003). This model is based on the two theoretical determinants which are the perceived usefulness (PU), perceived ease of use (PEOU) which results in Behavioural intention to use technology.

1. Research Aims and Objectives

a) Research Objective

To examine the effectiveness of digital education for the govt students by the teachers using unique digital tools. There is a feeling that there is a culture in government when it comes to digital education products. Schools influencing teachers' behavior. To be clear, it is the government. The teachers were asked the following question: “What do you think about the use of digital learning materials in the classroom?

The usual answer to the question “Digital learning materials are the latest technological developments in the educational process that are used successfully in many schools today. Although in government school, but I don't use it” It is said that this behavior will cause problems in achieving the goals of educational administration and therefore it is worth investigating. explained in more detail below.

The theoretical framework of this study is based on the psychological model. argued that teachers' intentions towards digital learning materials are influenced by two beliefs: PU of digital materials and PEOU of digital materials; A theoretical model based on TAM (Davis, 1989). In addition, it is thought that both beliefs are affected by external factors - Personal factors, technology and related institutions in the research environment defined as a teacher. This study aims to assess the impact of such beliefs and understand what is going on in the government. school. The result is said to be a reinforcement of school teachers' beliefs about technology.

To study the effectiveness of digital education on students and teachers in Delhi government schools with specific digital tools. For digital education product it is argued that a culture exists within the government schools that influence the teachers to behave in a certain way. For the purpose of clarity, if a teacher is asked, “how do you feel about using digital education products in the classroom?”, a typical answer might be “digital education product is a new technological development in an educational process that is being effectively used in many modern schools. Although it is available at govt. schools, I do not use it, however”. It is argued that such an attitude may create a problem for the Education department administration in meeting its strategic objectives, and hence this attitude is worthy of investigation. In order to support this argument, the researcher’s view of the study approach is further explained below.

The theoretical framework of this study is built on a social psychological based model. It is argued that teachers' intention toward digital education product is influenced by two beliefs: PU of digital product and PEOU of digital product; based on the theoretical model of TAM (Davis, 1989). Furthermore, the two beliefs are argued to be affected by external factors that exist within the research environment and these are identified as teachers' personal factors, technology related factors, and organizational related factors. The study intends to measure the influence of those factors on such beliefs and to understand what has founded the social phenomena to exist within govt schools. It is claimed that such a phenomenon is collectively formed by the teachers' pre-determined beliefs regarding technology at the school.

b) Research Question:

This study investigates the effects of factors (Performance Expectancy, Content Quality, Self-Efficacy and Enabling Factors) on teachers' intention to use digital tools, which are seen as useful and easy-to-use digital learning tools.

CHAPTER 2: LITERATURE REVIEW

2.1. INTRODUCTION

An educated workforce is the cornerstone of a nation's prosperity. The Delhi Government firmly believes that education stands as the paramount factor capable of breaking the vicious cycle of poverty, reshaping the way a generation asserts its rights, and fostering genuine progress. Guided by this conviction, the Delhi Government has tirelessly worked to revolutionize the educational landscape in Delhi, ensuring that quality education is not a privilege reserved solely for the affluent, but an inherent right of every child. The government has strived to elevate government schools to a level at least equal to, if not surpassing, private institutions, through continuous efforts to upgrade school infrastructure to a world-class standard. This transformation encompasses the integration of Smart Classes, swimming pools, well-stocked classroom libraries, modern desks, and improved laboratories.

In contemporary education, digital classrooms have gained prominence with the increasing accessibility and affordability of technology. In India, the government has taken proactive measures to introduce digital education in schools, aiming to enhance the quality of learning for students. The Delhi government, in particular, has introduced Smart Classrooms in government schools to enrich the learning experience. Smart classrooms represent an advanced manifestation of digital learning environments, harnessing technology to make learning more immersive and interactive. These classrooms feature interactive multimedia content designed to engage students in a more dynamic educational process.

2.2. Digital Education in India: Bridging the Gap and Expanding Horizons

This chapter delves into the existing literature and research surrounding the effectiveness of digital education in Delhi government schools. The review encompasses a wide range of sources to provide a comprehensive understanding of the current trends and analyses in this domain. The focus is primarily on two key aspects:

1. The impact of digital education on student outcomes in Delhi government schools.

2. The effectiveness of digital tools and their adoption by teachers

The Delhi government has been actively pursuing its goal of revolutionizing education by transforming the Delhi education system. Since 2015, the Delhi Education Department has undertaken numerous initiatives to achieve its vision of education transformation and make education more relevant to the growth needs of students. These initiatives encompass a wide spectrum, including improving student outcomes, building the capacity of teachers and principals, involving parents in school functioning, enhancing infrastructure, and creating pathways for school-to-work transition for youth.

In June 2016, the Education Department launched the 'Chunauti 2018' initiative aimed at bridging the learning gaps of students in classes 6, 7, and 8. This initiative involved grouping students into three sections based on their foundational learning skills (ability to read and do basic math) and employing different pedagogies and content for each group. Within the first year, there was an average improvement of 20 percentage points across the three domains: ability to read Hindi, ability to read English, and ability to do basic math.

In April 2018, the Delhi government introduced 'Mission Buniyaad,' a three-month focused initiative with specific goals and activities. The mission was launched in response to the National Achievement Survey (NAS), which revealed that a majority of students in classes 3, 5, and 8 were not performing at grade level. As the name suggests, Mission Buniyaad aims to strengthen the foundation of students' learning and aligns with the previous 'Chunauti' scheme.

Alongside these initiatives, the Delhi government has launched and implemented various interventions aimed at developing students, teachers, and principals, building a strong school community, and improving school infrastructure.

2.3. Transforming Education with Digital Tools: Enhancing Teaching and Learning

Digital learning tools encompass a wide array of applications, websites, and educational portals that engage students, teachers, and sometimes even parents to enhance the learning

experience. These tools offer a range of teaching, learning, and communication functionalities that benefit both educators and students (Brenner, 2020).

Today's generation of students is technologically savvy, readily embracing innovations and utilizing cutting-edge technology, information, and communication tools, both in their academic and professional pursuits. They favour multimedia tools and believe that sharing knowledge through instructional videos makes instruction more effective.

Digital tools are increasingly being incorporated into classroom teaching; however, questions remain about which tools are most appropriate for engaging and motivating students in educational settings. New methodologies, such as project-based learning, e-learning, bring-your-own-device initiatives, and massive open online courses for higher education, are gaining traction. These innovative methods not only enhance student motivation but also help them develop the skills necessary for professional success (Szabo et al., 2021).

To understand how digital technologies can enhance student learning in Mathematics and Science, Hillmayr et al. (2020) conducted a meta-analysis of research published since 2000. Their findings suggest that the utilization of digital tools has a positive impact on student learning. Simulations, such as dynamic math tools or intelligent tutoring systems, proved to be significantly more beneficial than multimedia systems. On a descriptive level, using digital tools as a complement to existing teaching strategies, rather than as a replacement, had a more substantial impact. The study also highlighted the importance of teacher training in the effective use of digital tools for education. As technology continues to evolve, the application of digital technologies in education is only expected to increase.

2.4. Teacher Perspectives on Digital Education: Insights from Research

The virtual classroom presents a distinctly different learning environment compared to traditional face-to-face classroom sessions. The design and delivery of online courses play a crucial role in student satisfaction, learning outcomes, and retention (Irani, 2005). To ensure effective and productive learning, it is essential to consider the preferences and perceptions of learners when designing online courses.

Studies indicate that a majority of students enrolled in online courses express satisfaction with the mode of instruction. However, research also highlights that various factors influence learners' perceptions (Shreshtha et al., 2019; Salloum et al., 2019; Pérez-Pérez et al., 2019).

Prior research has established that one's attitude is a strong predictor of one's intention (Ajzen and Fishbein, 2000; Glasman and Albarracin, 2006). The attitude of students enrolling in an online program is influenced by their perceptions of digital learning (Zebregs et al., 2015). Students are more inclined to adopt digital learning if they perceive it as easy to use and believe it enhances their academic performance and progress (Yeap et al., 2016). The perceived usefulness of digital learning is another factor that may contribute to students' academic success in an online environment (Proffitt, 2008).

Age, gender, prior computer literacy skills, and individual learning styles are also significant determinants of student technology acceptance (Kurdi et al., 2020). Country-specific research conducted in the United Kingdom (Green and Hannon, 2007), the United States of America (Kvavik, 2005), and Australia (Kennedy et al., 2006; Kennedy et al., 2008) revealed that a vast majority of students have access to internet-enabled devices such as computers and smartphones. They engage with these digital devices through formal and informal networking channels like emails, blogging, and social media.

Additional factors related to individuals' attributes that may influence their intention to accept technology and learn online include the social influence of students' referent groups and students' attitudes towards online learning (Bertea, 2009; Shen et al., 2006). Course design, psychological characteristics, and institutional support can also contribute to successful academic integration (Lee and Choi, 2011).

Blackwell, Lauricella, and Wartella (2014) surveyed over 1000 early childhood educators to investigate the relationship between extrinsic and intrinsic factors influencing their technology use. They found that teachers' perceptions of the importance of technology in supporting children's learning had the most significant impact on technology use.

2.5. Digital Tools for Modern Learning: Enhancing Education with Technology

Digital Classrooms revolutionize teaching by providing an intuitive and user-friendly platform that seamlessly integrates technology into blended learning environments. Utilizing a combination of computers, smart boards, projectors, carefully curated content, and assessment tools, Digital Classrooms transform traditional learning spaces into dynamic and interactive hubs of knowledge.

With the implementation of Smart Board infrastructure, any ordinary board can be transformed into an interactive canvas for engaging and diverse instructional activities. Digital Classrooms come equipped with a rich library of multimedia content aligned with

curriculum standards, empowering educators to create, organize, and deliver lessons that cater to the needs of all learners.

KYAN, a prime example of such a device, boasts a powerful built-in speaker system, ensuring crisp and easily audible audio even in larger classrooms or auditoriums with interactive boards. KYAN stands as an invaluable resource for educators seeking to provide engaging, interactive, and effective instruction across a variety of settings (KYAN, 2023).

2.6. Integrating Technology into Education: Digital Tools for Modern Learning

The pervasiveness of technology and digital education applications has significantly impacted educational institutions, particularly schools (Mohanta, Debasish & Nanda, 2017). Advancements in connectivity, cloud-based storage, and network speed have fueled the adoption of digital educational products, such as smart boards, LCD screens, videos, and projectors, in classrooms.

Primary and secondary schools in India exemplify this trend, embracing digital educational products to enhance teaching and learning methodologies (Hassan, Mirza & Hussain, 2019). Smart boards and LCD screens are employed to present engaging explanations of subject concepts in subjects like Maths, English, and Science. Image and video-based content deepens student understanding and facilitates the achievement of desired learning outcomes.

Digital recordings of lectures, projectors, videos, and LCD screens enable teachers to effectively deliver both simple and complex concepts, acting as facilitators in the learning process (Wijaya et al., 2020). However, school leaders emphasize that while digital educational products have revolutionized traditional teaching methods, they cannot entirely replace the role of teachers. Consequently, schools implementing Smart Classes from grades 6 to 12 have trained teachers to utilize the software and provide instruction in subjects like Geography, Maths, Science, English, and History.

Wijaya et al. (2020) examined the effectiveness of software in teaching trigonometry, highlighting that textbooks can sometimes lack engagement and that technology integration is crucial for enhancing learning activities. Their study analyzed the impact of Hawgent Dynamic Mathematics Software on students' mathematical proficiency in

trigonometry. The findings revealed that the software improved students' trigonometry skills and increased their classroom engagement and enthusiasm.

Ghavifekr & Rosdy (2015) emphasized the importance of curriculum planning to maximize the effectiveness of digital educational products. Teachers should review digital content and develop their own PowerPoint presentations to enhance the existing material. For instance, when explaining concepts in Biology or Maths, teachers can utilize Smart Boards, projectors, and audio-visual videos, incorporating real images and explaining terminologies from the PowerPoint presentations.

In conclusion, digital educational products have transformed the landscape of teaching and learning, offering engaging and interactive tools to enhance student understanding and achievement. While technology plays a crucial role, it is essential to recognize that teachers remain central to the educational process, guiding and facilitating student learning through effective integration of digital tools.

2.7 Hypothesis Developed for Acceptance of Digital Education by Teachers

This section attempts to build the relationship of identifying five dominant external factors over technology acceptance model by reviewing the literature and tested models used by Indian authors. The following causal relationship can be constructed from our research analysis. The explanation of each external factor and hypothesis are described below:

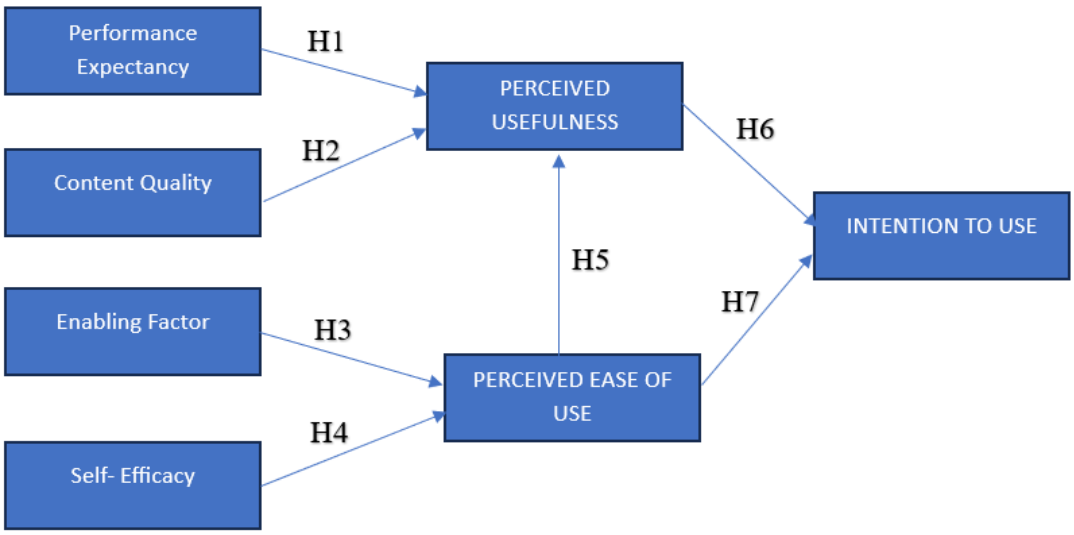


Figure 2.1: *Conceptual Model*

1. Performance Expectancy: This factor will come into play when a user is satisfied with his/her preparedness to use a system and it will also depend on the desirable success level of the user with the system. Teachers are likely to accept and adopt digital education or educational technology if they can see tangible evidence of its effectiveness in achieving desired educational outcomes or improving student performance.

H1: Performance expectancy has a positive influence on the perceived usefulness of technology in Indian education.

2. Content Quality: This construct was introduced by Wang,Y.S ,2003 . This construct explains that the content of an information system is important for its success in education. High-quality content (audio, video, and Visual elements) is often seen as an important factor influencing technology adoption in education.

H2: Content Quality has a positive influence on the perceived usefulness of technology in Indian education.

3. Enabling Factor: It is described as "the degree to which an individual considers that an organization and technical infrastructure exists to support the use of the system" (Venkatesh et al., 2003, p. 453).

H3: Enabling factor has a positive influence on the perceived ease of use of technology in Indian education.

The following three hypotheses can be interpreted from the TAM theoretical model. They are well explained in Indian reference studies Bhatt, S., & Shiva, A. (2020), Chahal, J (2022), Saloni Mehra, 2015, Rai,S(2022).

4.Self-Efficacy (SE): The degree to which an individual believes that he or she has the ability to perform a specific task/job using a computer. The results of (Chahal, J., Rani, N) had confirmed that Self-efficacy has a positive influence on the perceived ease of use of digital education.

H4: Self Efficacy has a positive influence on the perceived ease of use of technology in education.

5. Perceived Ease of Use:

In 1989, Davis (Perceived Usefulness, Perceived Ease of Use, and User Acceptability of Information Technology) defined PEOU as "the degree to which a person believes that using a particular system would be free from effort".

H5: Perceived ease of use has a positive influence on Perceived usefulness use of technology in Indian education.

6. Perceived Usefulness:

According to Fred Davis (Davis, Perceived Utility, Perceived Ease of Use, and User Acceptability of Information Technology, 1989), this is "the degree to which a person believes that using a particular system would enhance his or her job performance."

H6: Perceived Usefulness has a strong influence on Intention to use technology in Indian education.

7. Intention to Use:

It is known as a person's "subjective probability that he or she will engage in a given behavior," according to the Institute of Medicine (US), 2002.

H7: Perceived ease of use has a strong influence on Intention to use technology in Indian education.

CHAPTER 3: RESEARCH METHODOLOGY

3.1. Introduction

Research methodology serves as a structured framework for addressing research questions. It outlines the systematic steps undertaken to investigate a research problem. This methodology provides researchers with a structured approach to describe, explain, and predict phenomena while maintaining the validity, insight, and integrity of the research (Rajasekar et al., 2013; Matthews & Ross, 2010).

To conduct a scientifically robust study, researchers must be cognizant of the underlying assumptions of the study (Patel & Patel, 2019). The significance of research methodology lies in its ability to legitimize the study within the scientific community. It serves as a strong indicator of the quality and credibility of research findings.

This study primarily aims to determine the effectiveness of digital education in Delhi government schools using selected digital tools. As educational institutions increasingly adopt digital technologies to enhance classroom efficiency, it is crucial to examine its impact on student performance. To achieve the research objectives, appropriate tools and methods are employed.

The study adopts a descriptive research design followed by a quantitative research approach. Primary data is collected from teachers using a questionnaire. A stratified random sampling method is employed, and data analysis is conducted using IBM SPSS software.

This chapter elaborates on the methods and techniques employed in this study, including the research approach, research design, sampling design, data collection, and data analysis methods. The chapter is divided into two sections: one for teachers and one for students.

The present research significantly contributes to theoretical and practical development by providing reliable insights into the effectiveness of digital education in schools with respect to selected digital education products in the context of the Delhi region. While previous studies have focused on digital penetration in schools in India, there is a lack of research specifically highlighting the condition of digital education in government schools in India, particularly in Delhi. This gap in the literature underscores the need for further research in this area.

The study observes that the Indian education sector has undergone significant reforms in recent times regarding teaching and learning methodologies employed by educators in school environments. There has been a gradual shift from traditional blackboard teaching practices to emerging digital education technologies that provide teachers and students with access to a wide range of study materials and content from multiple sources.

This chapter details the research methodology chosen to test the hypotheses and validate the research model used to investigate the effects of active learning strategies with digital technological support on the learning process and product and the effectiveness of digital education in government schools of Delhi.

The chapter begins with an overview of research paradigms in the social sciences to determine the appropriate research methodology for the study. It then discusses the chosen methodology and the rationale behind it. The chapter proceeds to identify the research objective and research questions, followed by a discussion of sample identification and size. The chapter then presents the research tools and explains various analytic techniques employed in the study's mixed method of quantitative and qualitative approaches. Finally, the chapter concludes with an overview of the ethical considerations addressed by the researcher and provides a summary of the chapter.

3.2. Research Paradigm

Paradigms, often serving as the foundation for research, can be conceptualized as distinct worldviews. They encompass a set of assumptions about the nature of reality, knowledge creation, and the purpose of inquiry. Researchers must maintain transparency regarding their own biases and perspectives within this framework (Davies & Fisher, 2018).

Ugwu et al. (2021) advocate for providing aspiring researchers with comprehensive guidance on selecting research paradigms, such as pragmatism, constructivism, and interpretivism, and applying these concepts to other aspects of research methodology. A thorough understanding of the key elements of a research paradigm is essential for its effective application in a study.

Positivist Paradigm: Research adhering to the positivist paradigm typically employs quantitative methods to establish explanatory relationships or causal connections, favoring empirically validated findings derived from large sample sizes. Applicable

conclusions, reproducibility of results, and controlled experimentation serve as cornerstones of positivist science (Park et al., 2020).

3.3. Study for Teachers

The research on teachers employed a quantitative research approach, emphasizing the collection and analysis of numerical data. To gain deeper insights into technology adoption by teachers in Delhi government schools, the study utilized a Likert scale-based questionnaire to quantify teacher responses and conducted statistical analysis to test hypotheses and relationships. The quantitative approach was favored over qualitative methods due to its ability to provide objective and generalizable findings.

The study's theoretical framework is grounded in a social-psychological model, drawing upon the Technology Acceptance Model (TAM) proposed by Davis (1989). It posits that teachers' intention to use digital education products is influenced by two beliefs: perceived usefulness (PU) and perceived ease of use (PEOU). Furthermore, these beliefs are proposed to be affected by external factors within the research environment, categorized as teachers' personal factors, technology-related factors, and organizational factors. The study aims to measure the influence of these factors on the aforementioned beliefs and understand the underlying social phenomena within government schools. It is argued that this phenomenon is shaped by teachers' pre-existing beliefs about technology in the school context.

Therefore, this study adopts a pragmatic mixed-methods approach to investigate the social phenomena related to teachers' perspectives on digital education tools in government schools. The rationale for selecting a pragmatic approach is as follows:

A. The research objective is divided into smaller components, including variables, research hypotheses, and research questions, aligning with the postpositivist view underpinning quantitative research. These variables are derived from the context of government schools' work environments.

B. An initial theoretical model, based on TAM, is employed to predict causal relationships between variables. Quantitative statistical models are used to validate these relationships, aiming to generalize findings to the population of teachers in government schools.

C. A pragmatic approach is adopted for data collection to gain a deeper understanding of the research problem concerning teachers' perspectives on digital education tools in government schools.

The study serves as a means to provide insights for decision-making administrators in government schools, aiding in the improved implementation of digital education tools. Additionally, the study contributes to research in social science and education by uncovering factors that influence the strategies of educational institutions towards digital education.

3.4. Research Design

Research design serves as a blueprint for organizing and conducting research endeavors. It provides a structured framework that guides the research process, encompassing the selection of appropriate methods and approaches. Research design outlines the methodology, approach, and other pertinent details of a research project (Jaiswal, 2023). Various types of research designs exist, each tailored to specific research objectives:

Exploratory Research Design: Exploratory research aims to delve into unanswered questions or areas of limited understanding. It involves in-depth investigations of a problem or the formulation of hypotheses for further exploration (Sreejesh et al., 2014).

Explanatory Research Design: Explanatory research focuses on examining concepts and hypotheses to uncover new theories or explanations. The primary goal is to answer "what," "how," and "why" questions related to the research topic (Jaiswal, 2023).

Descriptive Research Design: Descriptive research aims to provide a detailed account of the distribution of variables without making causal inferences. It encompasses a range of study types, including case studies and cross-sectional analyses (Aggarwal & Ranganathan, 2019).

Experimental Research Design: Experimental research involves developing a set of procedures to systematically test a hypothesis. It requires a thorough understanding of the theoretical framework being investigated (Bevans, 2019).

3.5 Sampling and Population

In research, the term "population" refers to the entire group of individuals who meet the criteria for participation in a study. Since it is often impractical or impossible to gather

data from every member of the population, researchers select a smaller subset, known as a sample, to represent the larger group. When selecting a sample, it is crucial to ensure that it accurately reflects the characteristics of the overall population to ensure the validity and generalizability of the findings.

3.5.1 Population for Teachers

The study's target population, referred to as the "population," was meticulously selected. For the research involving teachers, the total population comprised all teachers employed in Delhi government schools at the time of data collection. All teachers were eligible to participate in the study as long as they met the inclusion criteria of being actively employed as teachers in Delhi government schools during the data collection period.

3.5.2 Sampling Technique for Teachers

To investigate the study of secondary school teachers, the entire population of teachers from SOSE and RPVV Delhi government schools was considered for sample selection. Questionnaires were distributed to the teachers, and their responses were collected on a purely voluntary basis to ensure informed consent and participation.

3.6. Data Collection

Data collection serves as a crucial step in the research process, enabling researchers to gather and analyze information to produce meaningful results. It involves systematically collecting data from various sources (Sharma, 2023). To ensure the validity of the findings, data collection methods should be objective and reliable, allowing for statistical analysis.

In this study, primary data was collected using a questionnaire administered to teachers currently employed in Delhi Govt. Schools. The questionnaire was designed to measure seven constructs, including both dependent and independent variables. Additionally, pre-test and post-test scores were collected for both experimental and control groups in the student study. This approach allowed for the assessment of digital tools' impact on student performance and teachers' perceptions of these tools.

For teachers, a five-point Likert scale questionnaire was employed, while a multiple-choice test was used for students. Likert scales are widely recognized as a valuable psychometric tool in research, providing a structured way to measure responses (Anjaria,

2022). They are particularly useful for gathering responses to specific questions or statements in behavioral surveys (Crix Cunine et al., 2019).

Typically, participants indicate their level of agreement on a five-point scale ranging from "strongly disagree" to "strongly agree." The questionnaire used in this study was carefully tailored to address the specific research questions. It was divided into sections corresponding to the variables under investigation.

To assess the effectiveness of digital education on students, achievement tests in physics and biology were administered. The respective marks were recorded and analyzed for both the experimental and control groups.

To explore teachers' perceptions of digital learning materials, the study included all teachers in Delhi government schools. Questionnaires were distributed to teachers for personal completion. Additionally, an online version of the questionnaire was made available to teachers via email. A link to the survey form was provided in the email.

The distribution of questionnaires was proportional to the number of teachers in each school. However, teacher participation was voluntary and dependent on their availability. Completing the questionnaire took approximately 15 minutes.

To ensure informed consent and increase the response rate, a privacy statement accompanied the survey. This statement clearly outlined the research purpose, the researcher's responsibility for data collection, and participants' right to withdraw their data at any time. An English version of the questionnaire was provided to eliminate any language barriers.

Participants were asked to complete a survey based on perceptions of digital education administered by the Delhi Education Department. To facilitate the research process and avoid delays, a letter was sent to the school administration, as permission from school authorities was required for project implementation.

3.7. Instruments Design

Surveys serve as valuable tools for social scientists, enabling them to gather insights into people's knowledge, opinions, and attitudes by surveying representative samples (Abbott & McKinney, 2013).

The survey instrument used in this study was meticulously designed to gather comprehensive information from participants, maximizing the richness of data collected. The questionnaire's development involved a thorough examination of previous research related to the topic, ensuring alignment with established research practices and the specific objectives of the study.

3.8. The Questionnaire Design

Questionnaires serve as valuable tools for collecting data on individuals' thoughts, beliefs, knowledge, feelings, and attitudes (Key, 1997). They are structured instruments designed to gather specific information relevant to the research objectives. Effective questionnaires possess certain characteristics (Hunt, 2001). Firstly, the questions should be clear, concise, objective, and engaging to ensure respondents' comprehension and willingness to provide accurate responses. Secondly, the questionnaire's structure should facilitate ease of completion, minimizing respondent burden and maximizing response rates. Thirdly, the questionnaire should be designed for efficient tabulation and analysis of responses (Hunt, 2001). Additionally, questionnaires should be crafted to elicit high-quality responses from the target sample (Hussey & Hussey, 1997).

To ensure the development of an appropriate questionnaire for this study, a rigorous process was followed:

Identification of relevant information and evaluation of potential participant responses based on previous research to formulate questions that effectively address the survey objectives.

Incorporation of feedback, thoughts, and insights from teachers to revise and refine the questions, ensuring that the content aligns with the research requirements.

Review of the questionnaire by experts in the field of education to evaluate the instrument's structure, content, and clarity, eliminating any ambiguities. Conduction of a pilot test to assess the questionnaire's validity and reliability, ensuring that each item accurately measures the intended construct. The questionnaire items were adapted from previous studies and validated for their relevance to the research topic. Modifications were made to address the specific focus of the study. The questionnaire was divided into two sections:

Section 1: General Information

This section gathered demographic data and general information about the participants, providing a profile of the sample population and essential context for evaluating the research hypotheses.

Section 2: Research Constructs

This section comprised twenty-nine questions designed to assess the latent variables in the research's theoretical model. It included various indicators related to the model, enabling the collection of appropriate data for hypothesis testing.

A detailed explanation of the questionnaire is provided in the subsequent section, and a copy of the questionnaire in English is included in Appendix A1.

3.8.1. General Demographic Information for Digital Education Product

This section of the questionnaire gathers information about the participants' background, including:

General Information:

Age group: 25 & less, 26 to 35, 36 to 45, 46 to 55, 56 & above

Gender: Male, Female

Teaching experience: 1 year or less, 2 to 5 years, 6 to 10 years, 11 to 20 years, 20 years or more

Subject/Area: Social Science, Mathematics, Computer Education, Science, Others

Experience with Digital Education Tools:

Experience using Smart Classroom tools (in years): 1 year or less, 1 to 2 years, 2 to 3 years, 3 to 4 years, 4 years or more.

Frequency of using digital tools for teaching in the classroom: Never, Occasionally, Moderately, Frequently, Always

Perception of digital learning tools compared to traditional classroom teaching: Yes (digital tools are better), No

Digital products currently used for teaching and learning in the classroom: Digital Smart Board, Kyan, ICT Lab in School, Smart Classroom with Chromebook devices, Teacher Devices (e.g., Tablet)

Constructs used in this study:

The questionnaire assesses seven factors related to teachers' perceptions of the effectiveness of digital education tools in Delhi government schools. Three factors are considered internal variables (dependent variables) based on the TAM model: Perceived Usefulness, Perceived Ease of Use, and Intention to Use. Four factors are considered external variables: Performance Expectancy, Content Quality, Self-Efficacy and Facilitating Conditions. The following section provides a detailed explanation of each construct.

A) Performance Expectancy (PE) items

PE items are designed to measure how the surroundings affect teachers' beliefs relating to digital education and their perspectives, with respect to the use of it. PE is measured using four items developed by the researcher, (see Table 3.1), and using a five-point Likert scale, with one for strongly disagree, two for disagree, three for neutral, four for agree, and five for strongly agree.

Table 3.1 – Questionnaire Performance Expectancy (PE) items

Q No.	Question
1	Incorporating digital tools into classroom instruction enhances student academic performance.
2	Digital tools in the classroom can enhance student engagement and focus.
3	Digital tools foster the development of students' ideas, knowledge, and expression, making them my preferred teaching aids.
4	Incorporating digital tools into classroom instruction stimulates students' curiosity and encourages them to ask more questions.

B) Content Quality (CQ) items

CQ items are designed to measure how the surroundings affect teachers' beliefs relating to digital education systems and their perspectives, with respect to the use of it. CQ is measured using four items developed by the researcher, (see Table 3.2), and using a five-point Likert scale, with one for strongly disagree, two for disagree, three for neutral, four for agree, and five for strongly agree.

Table 3.2 – Questionnaire Content Quality (CQ) items

Q No.	Question	From
8	I think digital content (Text, Image, Audio, Video) is rich in quality	
9	The available digital content is updated as per syllabus	
10	I can engage students effectively using Digital Multimedia Content in classroom	
11	Explanation and practice questions on each topic are effective and useful for teaching and learning in classroom	

C) Perceived Usefulness (PU) items

The Perceived Usefulness (PU) construct assesses teachers' beliefs about whether using digital tools enhances their teaching performance. Davis (1989) emphasizes the significance of PU in influencing individuals' attitudes towards adopting new technologies. To measure PU, the research instrument incorporates three items using a five-point Likert scale adapted from Davis (1989) and other researchers (see Table 3.3). The scale ranges from 5 (Strongly Agree) to 1 (Strongly Disagree), with 3 representing a

neutral stance. This scale allows for a comprehensive evaluation of teachers' perceptions regarding the usefulness of digital tools in improving their teaching effectiveness.

Table 3.3 – Questionnaire Perceived Usefulness (PU) items

Q No.	Question	From
5	The use of Digital tools saves my time and energy	Davis (1989)
6	Digital content helps me in making my lesson plan effective for teaching	
7	Using digital tools in classroom improves my teaching performance	

D) Enabling Factors (EF) items

The Environmental Factors (EF) construct aims to assess how the surrounding environment influences teachers' beliefs and perspectives regarding digital education systems and their willingness to utilize them. EF is measured using four items developed by the researcher (see Table 3.4) and a five-point Likert scale. The scale ranges from 1 (Strongly Disagree) to 5 (Strongly Agree), with 3 representing a neutral position. This scale allows for a comprehensive evaluation of how external factors shape teachers' perceptions and attitudes towards adopting digital education systems.

Table 3.4 – Questionnaire Facilitating Condition (FC) items

Q No.	Question
8	Classrooms are purposefully designed to facilitate the effective integration of digital tools into instruction.
9	Our school administration is a strong advocate for the integration of digital tools into our teaching practices.

10	The digital tools are fully functional and ready for use.
11	Technical assistance is readily accessible whenever I encounter difficulties with digital tools.

E) Self-Efficacy (SE) items

The SE items are designed to measure the ability of the instructors to apply computer skills to achieve their tasks (Compeau, et al., 1999). Several empirical studies found significant effects of computer self-efficacy on the perceived usefulness and perceived ease of use on an e-learning system (Gong, el al., 2004; Ferdousi, 2009; Waheed & Farooq Hussain, 2010). CSE is an important construct that affects instructors' attitudes and their intention to use e- learning systems.

In this study, SE is measured using three items developed by scholars such as Compeau, el al. (1999) (see Table 3.5), and using a five-point Likert scale, with five for strongly agree, four for agree, three for neutral, two for disagree, and one for strongly disagree.

Table 3.5 – Questionnaire Self-Efficacy (SE) items

Q No.	Question	From
19	I am confident of integrating digital tools in to my teaching activities.	Compeau, el al., (1999)
20	I have received sufficient training to use digital tools easily in classroom	
21	I am comfortable using digital tools without any assistance	

F) Perceived Ease of Use (PEOU) items

The PEOU project assesses teachers' perceptions of the ease of use of digital tools. Davis (1989) thinks that PEOU plays an important role in determining the behavior of using new technology. Among research tools, PEOU is measured using four items developed by Davis (1989) and other researchers (see Table 3.6) and using a five-point Likert scale with five for strongly agree, four for agree, three for neutral, two for disagree, and one for strongly disagree.

Table 3.6 – Questionnaire Perceived Ease of Use (PEOU) items

Q No.	Question	From
12	The digital tools have required features that makes my teaching task easy in classroom	Davis (1989)
13	I can easily integrate Digital tools for my lesson plans	
14	I can use Digital tools to communicate with students easily in class	
15	It is easy for me to complete teaching activities more efficiently by using digital tools	

G) Intention To Use (ITU) items

The ITU aims to measure the strength of teachers' willingness to use digital education products. Intention to use was measured using four items developed by Paul et al. (2003) and Coskuncay & Özkan (2013) (see Table 3.7) and it is good to use a five-point Likert scale with five for strongly agree, four for agree, three for neutral, two for disagree, and one for strongly disagree.

Table 3.7 – Questionnaire Intention to Use (ITU) items

Q No.	Question	From
16	I intend to utilize the available digital tools and content for teaching and learning in the classroom	Paul et al.

17	I intend to increase my use of Digital Tools in the future	(2003); Coskuncay
18	I think use of Digital tools improves the quality of teaching	
19	I would like to recommend others to use digital tools in classroom	

3.8.1.1. Questionnaire Pilot Study

This study only focuses on teachers' views on using digital learning materials to measure the reliability of the questions. For this purpose, we selected 47 teachers from the target audience. The sample size of the study was chosen as 10% of the total sample size of the research study (approximately 400 teachers) according to the research model. In the research study, Cronbach's alpha internal reliability test was performed using SPSS (version 27), which provides the results of the measurement items.

A reliability coefficient of 0.70 or higher is considered acceptable in most social science research situations (Nunnally, 1978). The Cronbach alpha for the following 8 measurement scales is presented in Table 3.8.

Table 3.8 – Questionnaire Based Survey Measurement Scale Cronbach's alpha

Construct	Cronbach's alpha
Perceived Usefulness	0.91
Perceived Ease of Use	0.94
Intention to Use	0.95
Performance Expectancy	0.88
Content Quality	0.89
Enabling Factors	0.88
Self-Efficacy	0.86

3.9. Method of Data Analysis

The data gathered through the questionnaire underwent analysis using IBM's SPSS software. SPSS stands out as one of the most widely utilized statistical tools for quantitative data assessment, with researchers across the globe frequently relying on it. The advantage of employing this software is its ability to yield results swiftly and accurately. With SPSS, multiple tests can be executed concurrently. In this study, the software was employed to assess demographic characteristics and perform various statistical tests to validate the research hypothesis.

In this research, the SPSS software was employed to conduct a descriptive statistical analysis. This facilitated the calculation and summarization of the questionnaire-collected data. Furthermore, appropriate statistical tests were executed to evaluate the research hypothesis.

3.9.1 Factor Analysis

The analysis conducted in this study employs a multivariate statistical approach aimed at condensing numerous interconnected variables into a limited number of underlying dimensions. The primary objective of this analysis is to attain simplicity by utilizing the fewest possible explanatory variables to elucidate the highest variation within the correlation matrix. Moreover, factor analysis serves the purpose of assessing the credibility and effectiveness of measurement instruments (Carmines & Zeller, 1979). In summary, the analysis was employed in this study to achieve the following objectives:

1. Streamline the remaining data to a manageable scope.
2. Eliminate superfluous redundancy or duplication originating from various processes.
3. Unveil discernible patterns within the data.

Confirmatory analysis is an important form of analysis

Confirmatory factor analysis is typically conducted in the advanced stages of research investigations to assess latent variables within the framework of a hypothesis (Tabachnick & Fidell, 2001; Kinnear & Gray, 2009). In this process, items are carefully assigned to specific factors to validate the alignment of the data (Stevens, 2002) and to ascertain its alignment with the research hypotheses.

The outcomes of this validation serve as the ultimate research model, derived from the theoretical model initially constructed for questionnaire development. This final model represents the most robust configuration, offering the optimal explanation of the relationships between latent variables. Ensuring the reliability and validity of the analytical results is a vital aspect of any research endeavor.

3.9.2 Correlation Structure between Different Constructs

Correlation assesses both the magnitude and direction of the association between two variables, essentially quantifying the extent of cooperation or interdependence between them. The correlation coefficient (denoted as 'r') can assume a range of values from negative to positive, with a value of zero signifying the absence of any relationship between the two variables. Negative results imply a positive correlation, where an increase in one variable corresponds to a decrease in the other. Conversely, similar values suggest that the variables move in unison, such that a change in one variable leads to a concurrent change in the other. A higher or lower correlation coefficient indicates that the strength of the relationship or interdependence between the two variables is more pronounced at higher 'r' values than at lower ones.

A 'r' value of zero denotes a weak relationship, indicating that the two variables are essentially independent of one another.

3.9.3. Composite Reliability and the Extracted Variance

Reliability is a measure of the consistency of the test model (see model below). Practice is to achieve a confidence level of 70% or higher (Hair et al. (2010).

$$\text{Composite Reliability} = \frac{(\sum \text{Standardized loading})^2}{(\sum \text{Standardized loading})^2 + \sum |\text{error}|}$$

Another measure of internal reliability is variable; this metric evaluates all explanatory variables described by this tool.

Variance extracted of 50% or more is considered adequate (Sharma, 1996; Hair, et al., 2010). The variance extracted is computed by the following formula

$$\text{Variance Extracted} = \frac{(\sum \text{Standardized loading})^2}{\text{Number of loadings (n)}}$$

The coefficient of determination, represented as R-squared or (R2), is another measure of the difference between independent variables explained by the variable. The R2 value is 0 to 1, or percent. The higher the R2 value, the better the variance as a predictor of the arguments.

CHAPTER 4: DATA ANALYSIS

4.1. Introduction

The study's theoretical foundation, the Technology Acceptance Model (TAM) by Davis (1989), is introduced in Chapter Two. Chapter Three elaborates on how this model guided the development of research instruments, particularly the questionnaire. It also details the process of ensuring questionnaire reliability through pilot testing before final distribution. Data gathered from Delhi government school teachers were subjected to rigorous analysis using SPSS software, aiming for maximum reliability in data collection.

This meticulous approach led to the creation of a definitive and reliable research model. Research questions and hypotheses aligned with this model were formulated accordingly.

The findings are presented in two parts: Part A details the development of the final research model and the analysis of research hypotheses, while Part B presents the results of data analysis.

Section A delves into the model fitting procedure, a collection of dimensional reduction techniques. Cronbach's alpha analysis, performed using SPSS, ensured the questionnaire's internal reliability and consistency.

The analysis yielded Cronbach's alpha values, indicating the contribution of each variable and the reduction in the number of variables (questions) defining the model. Additionally, SPSS facilitated pattern recognition within the collected data. The model fitting process culminated in a final design encompassing seven constructs: PE, CQ, PU, EF, SE, PEOU, and ITU (see Figure 2.1).

It is important to reiterate that the population of interest for this study comprises all teachers at Delhi government schools.

The data were collected from 747 teachers, which is above the required respondent for the research.

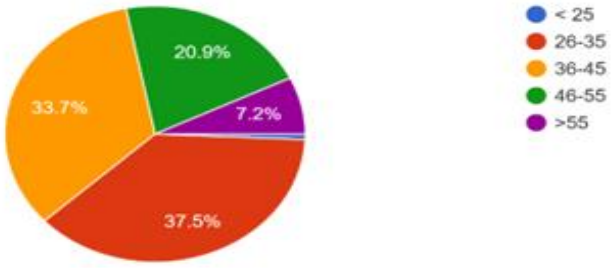
4.2. Demographic Characteristics of the Sample

The background of the participants is examined in this section of the questionnaire from the following perspective:

General Information: Gender (Male and Female), age group (25 & less, 26 to 35, 36 to 45, 46 to 55 and 56 & teaching experience (1 & less, 2 to 5, 6 to 10, 11 to 20, and 20 & above), Subject/Area (Social Science, Mathematics, Computer Education, Science, Others) Experience of using Smart Classroom tools (in years) (1 & less, 1 to 2, 2 to 3, 3 to 4, and 4 & above), How frequently do they use digital tools for teaching in classroom?(Never, Occasionally, Moderately, Frequently, Always), Do, they think use of digital learning tools are better than traditional classroom teaching (Yes or No), which digital product they are currently using for teaching and learning in classroom (Digital Smart Board, Kyan, ICT Lab in School, Smart Classroom with Chromebook devices, Teacher Devices ie., Tablet).

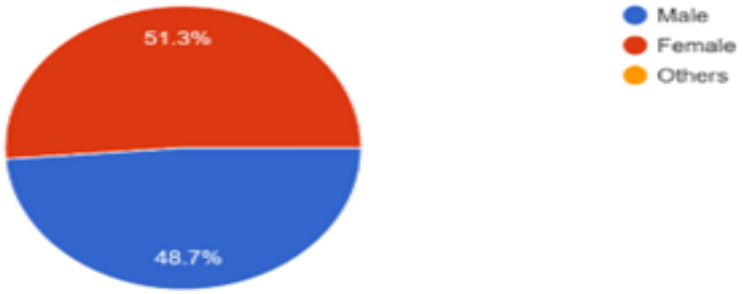
Total of 747 responses were received out of which 51 outlier responses were removed taking the response count to 696 valid responses.

1. **Age**



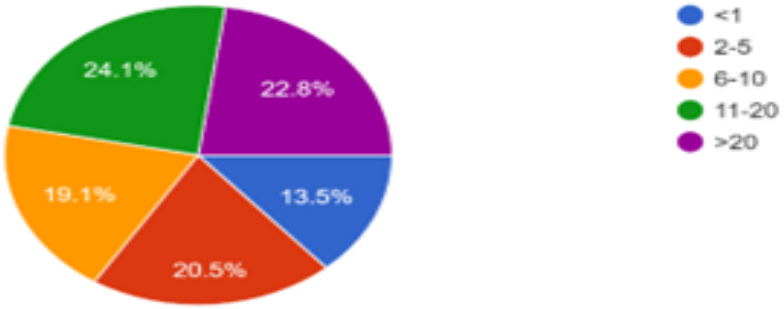
Total 696 valid responses were collected out of which 37.5% respondent were in the age group of 26 to 35 years of age, 33.7% respondent were in the age group of 36 to 45 years of age, 20.9% respondent were in the age group of 46 to 55 years of age, 7.2% respondent were above 55 years of age, and 0.7% respondent were less than 25 years of age.

2. **Gender**



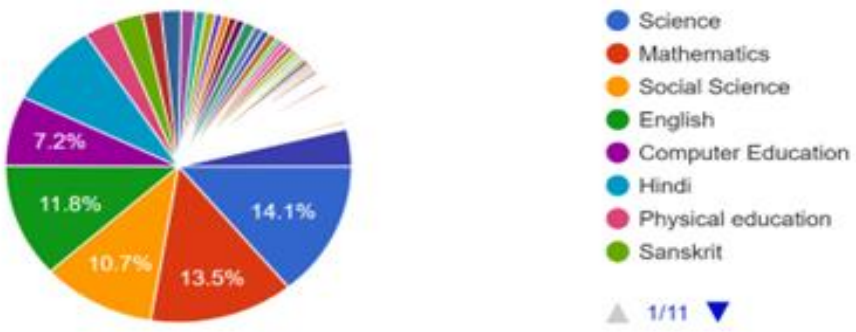
Out of 696 valid responses 51.3% respondents were females and 48.7% respondent were male.

3. **Teaching Experience (in years)**



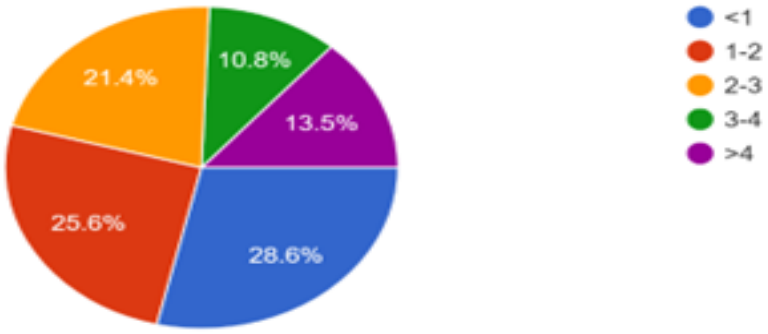
Total 696 valid responses were recorded, out of which 24.1% respondent were having teaching experience between 11 to 20 years, 22.8% respondent has teaching experience of more than 20 years, 20.5% respondent has teaching experience between 2 to 5 years, 19.1% respondent has teaching experience between 6 to 10 years and 13.5% respondent has less than 1 year of teaching experience.

4. **Subject/ Area of specialization**



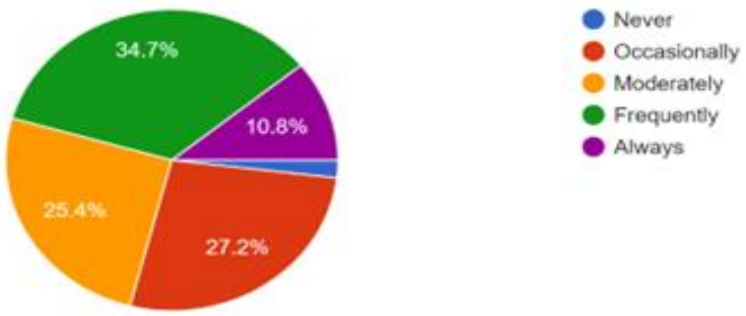
Total 696 valid responses were recorded, out of which 14.1% respondent has Science as their subject/ area of specialization, 13.5% respondent has Mathematics as their subject/ area of specialization, 11.8% respondent has English as their subject/ area of specialization, 10.7% respondent has social science as their subject/ area of specialization, 7.2% respondent has Computer Education as their subject/ area of specialization and 42.7% respondent has other subject/ area of specialization.

5. **Experience of using Smart Classroom tools (in years)?**



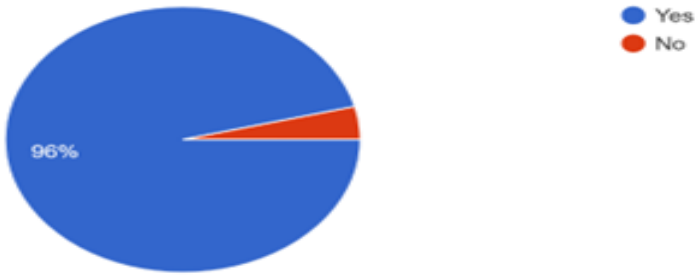
Total 696 valid responses were recorded, out of which 28.6% respondent have less than 1 year of experience of using smart classroom tools, 25.6% respondent have between 1 to 2 years of experience of using smart classroom tools, 21.4% respondent have between 2 to 3 years of experience of using smart classroom tools, 10.8% respondent have between 3 to 4 years of experience of using smart classroom tools and 13.5% respondent have more than 4 years of experience of using smart classroom tools.

6. **How frequently do they use digital tools for teaching in classroom?**



Total 696 valid responses were recorded, out of which 34.7% of the respondent frequently uses digital tools for teaching in classroom, 27.2% of the respondent occasionally uses digital tools for teaching in classroom, 25.4% of the respondent moderately uses digital tools for teaching in classroom, 10.8% of the respondent always uses digital tools for teaching in classroom and 1.9% of the respondent never uses digital tools for teaching in classroom.

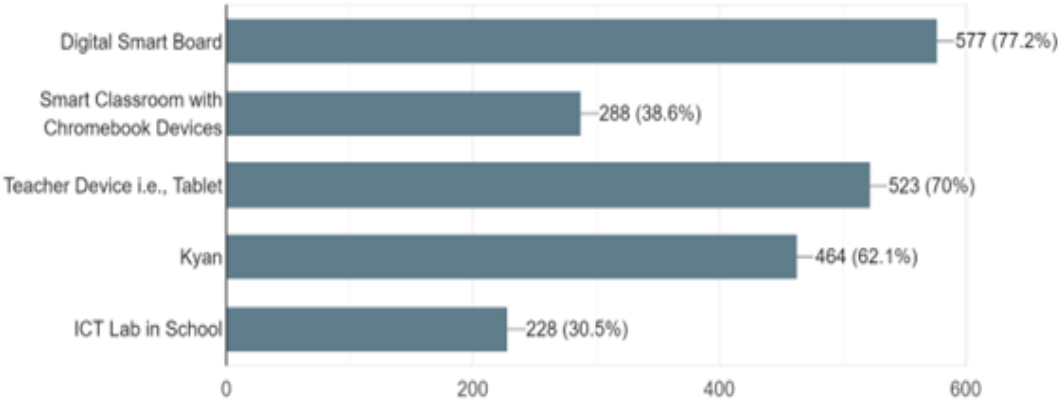
7. **Do you think teaching and learning is better using digital tools as compared to traditional methods?**



Total 696 valid responses were recorded out of which 96% responded think teaching and learning is better using digital tools as compared to traditional method, while only 4 % of the respondent thinks teaching and learning is not better using digital tools as compared to traditional method.

8. **Pick the digital product that you are using for teaching and learning in the classroom?**

Figure 4.1



Total 696 valid responses were recorded, out of which 77.2% respondent uses Digital Smart Board for teaching and learning in classroom, 70% respondent uses Teaching Devices i.e Tablet, 62.1% respondent uses Kyan, 38.6% respondent uses Smart Classroom with Chromebook Devices for teaching and learning in classroom, and 30.5% respondent uses ICT Lab in Schools for teaching and learning in classroom.

Research Final Model Development and Research Hypotheses

4.2.1. The Study Final Model

As explained in Chapter 3 and repeated here, the theoretical model of the study serves as the basis for the design of the study's research instrument, and sample data are collected accordingly.

Initially, the analysis process begins with the theoretical model, which includes 8 models (see above) divided into two groups item:

1. First, the endogenous variable (the dependent latent variable) represents the TAM model, as defined, it is affected by other variables; these are PU, PEOU and ITU.
2. The second group are exogenous variables (independent latent variables), ie. Variables outside the TAM model is not affected by other variables PE, CQ, EF and SE.

The subsequent sections unveil the outcomes of the analytical methods employed to refine the final research model and assess its reliability and validity. These methods encompass Cronbach's alpha, exploratory factor analysis, composite reliability, variance extracted, correlation measures between model constructs, and discriminant validity. The collective application of these techniques corroborates the precision and robustness of the study's final model.

4.2.2. Model Fitting Process: Cronbach's Alpha and Exploratory Factor Analysis

The model fitting process is a multi-stage endeavor that begins with evaluating the theoretical model and culminates in fitting the final model to the collected data. The initial step involves assessing the reliability of the research instruments, primarily the surveys. Cronbach's alpha analysis, a widely used reliability measure, assesses the consistency of the measurement items. It provides a correlation coefficient, indicating the relationship between each item and the sum of all other items (Creswell, 2003).

Furthermore, the fitting process incorporates exploratory factor analysis, a dimensionality reduction technique that aims to identify the factors (constructs) most strongly supported by the data. Both Cronbach's alpha and exploratory factor analysis were performed using SPSS version 27. The analysis outcomes for the selected constructs are presented below.

Performance Expectancy (PE)

Table 4.1 displays both the reliability and the exploratory factor checking analysis for PE. The table shows the explained variance at 83.28% factor loading for first item at 0.766, second item at 0.784, third item at 0.800, fourth item at .760 and the Cronbach's reliability coefficient α at 93.3%, for the construct in the study instrument; as displayed, reliability is greater than 75%. From a statistical standpoint, the reliability and variances are within accepted levels.

Table 4.1 Explained Variance, Reliability coefficient α for Performance Expectancy

Questionnaire Items	Explained variance	Factor Loading	Cronbach's Reliability
Performance Expectancy (PE)	83.28%		93.3%
Incorporating digital tools into classroom instruction enhances student academic performance.		.766	
Digital tools in the classroom can enhance student engagement and focus.		.784	
Digital tools foster the development of students' ideas, knowledge, and expression, making them my preferred teaching aids.		.800	
Incorporating digital tools into classroom instruction stimulates students' curiosity and encourages them to ask more questions.		.760	

Content Quality (CQ)

Table 4.2 displays both the reliability and the exploratory factor checking analysis for CSE. The table shows the explained variance at 75.98%, factor loading for first item at 0.752, second item at 0.640, third item at 0.755, fourth item at 0.771 and the Cronbach's reliability coefficient α at 89.4%, for the construct in the study instrument; as displayed, reliability is greater than 75%. From a statistical standpoint, the reliability and variances are within accepted levels.

Table 4.2 Explained Variance, Reliability coefficient α for Content Quality

Questionnaire Items	Explained variance	Factor Loading	Cronbach's Reliability
Content Quality (CQ)	75.98%		89.4%
I think digital content (Text, Image, Audio, Video) is rich in quality		.752	
The available digital content is updated as per syllabus		.640	
I can engage students effectively using Digital Multimedia Content in classroom		.755	
Explanation and practice questions on each topic are effective and useful for teaching and learning in classroom		.771	

Perceived Usefulness (PU)

The following, Table 4.3, is limited to the data that passed both the reliability and the exploratory factor checking analysis for PU. The table shows the factor loading for the first statement is 0.739, the second statement is 0.772, the third statement is 0.801, and the Cronbach's reliability coefficient α is 91.8%, for the construct in the study instrument. As displayed, the reliability is greater than 70%. From a statistical standpoint, the reliability is within the accepted level.

Table 4.3 Explained Variance, Reliability coefficient α for Perceived Usefulness

Questionnaire Items	Explained variance	Factor Loading	Cronbach's Reliability
Perceived Usefulness (PU)	86.27%		91.8%
The use of Digital tools saves my time and energy		.739	
Digital content helps me in making my lesson plan effective for teaching		.772	
Using digital tools in classroom improves my teaching performance		.801	

Enabling Factors (EF)

Table 4.4 displays both the reliability and the exploratory factor checking analysis for FC. The table shows the explained variance at 74.26%, factor loading for first item at 0.613, second item at 0.643, third item at 0.639, fourth item at 0.713 and the Cronbach's reliability coefficient α at 88%, for the construct in the study instrument; as displayed, reliability is greater than 75%. From a statistical standpoint, the reliability and variances are within accepted levels.

Table 4.4 Explained Variance, Reliability coefficient α for Enabling Factors

Questionnaire Items	Explained variance	Factor Loading	Cronbach's Reliability
Enabling Factors (EF)	74.26%		88%
Classrooms are purposefully designed to facilitate the effective integration of digital tools into instruction.		.613	
Our school administration is a strong advocate for the integration of digital tools into our teaching practices.		.643	
The digital tools are fully functional and ready for use.		.639	

Technical assistance is readily accessible whenever I encounter difficulties with digital tools.		.713	

Self-Efficacy (SE)

Table 4.5 shows the explained variance at 78.87%, factor loading for the first statement at 0.774, the second statement at 0.758, the third statement at 0.781, and the Cronbach's reliability coefficient α at 86.5%, for the construct in the study instrument; as displayed, reliability is greater than 75%. The reliability and variances are within accepted range.

Table 4.5 Explained Variance, Reliability coefficient α for Self-Efficacy

Questionnaire Items	Explained variance	Factor Loading	Cronbach's Reliability
Self Efficacy (SE)	78.87%		86.5%
I am confident of integrating digital tools in to my teaching activities		.774	
I have received sufficient training to use digital tools easily in classroom		.758	
I am comfortable using digital tools without any assistance		.781	

Perceived Ease of Use (PEOU)

Table 4.5 displays both the reliability and the exploratory factor checking analysis for PEOU. The table shows the explained variance of 84.75%, the factor loading for first

item is 0.697, second item is 0.785, the third item is 0.726, the fourth item is 0.668 and the Cronbach's reliability coefficient α is 94%, for the construct in the study instrument. From a statistical standpoint, the reliability and variances are within accepted levels.

Table 4.5 – Explained Variance, Reliability coefficient α for Perceived Ease of Use

Questionnaire Items	Explained variance	Factor Loading	Cronbach's Reliability
Perceived Ease of Use	84.75%		94%
The digital tools have required features that makes my teaching task easy in classroom		.697	
I can easily integrate Digital tools for my lesson plans		.785	
I can use Digital tools to communicate with students easily in class		.726	
It is easy for me to complete teaching activities more efficiently by using digital tools		.668	

Intention to Use (ITU)

Table 4.6 shows the explained variance at 87.90%, factor loading for the first statement at 0.795, the second statement at 0.863, the third statement at 0.838, fourth statement at .837 and the Cronbach's reliability coefficient α at 95.4%, for the construct in the study instrument. As displayed, reliability is greater than 75%. As from the table below, the reliability and variances are within accepted levels.

Table 4.6 – Explained Variance, Reliability coefficient α for Intention to Use

Questionnaire Items	Explained variance	Factor Loading	Cronbach's Reliability
Intention to Use (ITU)	87.90%		95.4%
I intend to utilize the available digital tools and content for teaching and learning in the classroom.		.795	
I intend to increase my use of Digital Tools in the future		.863	
I think use of Digital tools improves the quality of teaching		.838	
I would like to recommend others to use digital tools in classroom		.837	

To summarize, this subsection has presented the final fitted model for the research. The selected constructs (factors) have been reliably defined based on the most contributing questionnaire items, and the constructs representing the strongest relationships, as supported by the data, have been identified. Consequently, the identified models are deemed ready for further analysis to verify other aspects of model reliability and validity, as elaborated in the following subsection.

CHAPTER 5: CONCLUSION

1. Many schools are moving toward the usage of digital education products in the classroom in light of rising technology and the creation of digital educational products. In addition to balancing the amount of system adoption by the government schools, more digital educational items are required to be used in the classroom.
2. The study also aimed to investigate the effectiveness of digital education products used by the Delhi government school's teachers in their teaching in the classrooms. All the exogenous variables have a significant impact ($p < .05$) on the endogenous variables. The result of the study suggests that digital education products enhance the teachers' performance in teaching.
3. These findings support previous research suggesting that digital learning methods can create more engaging and effective learning environments, thereby providing students with the opportunity to excel in their academic pursuits (Lai & Bower, 2019; Bernard et al., 2009). This has important implications for the future of education, particularly with respect to the integration of technology in the classroom.
4. Future research is needed to investigate the effectiveness of digital learning methods in different educational contexts and with larger and more diverse student populations. Additionally, research should explore the factors that contribute to the effectiveness of digital learning methods, such as the design of digital learning environments and the use of student-centered teaching approaches. The present study adds to the growing body of evidence supporting the effectiveness of digital learning methods in enhancing the academic performance of students. As such, it provides valuable insights for educators seeking to create more engaging and effective learning environments in the digital age.
5. The findings of the present study suggest that digital classrooms are more effective than traditional classrooms. The advantages of digital classrooms make them an ideal alternative to the traditional classroom. However, it is important to note that digital classrooms require proper infrastructure and resources, and educators need to be trained to effectively use technology in the classroom. In conclusion, the integration of technology in primary education is a promising step towards

improving the quality of education in Delhi. With the support of government initiatives and the use of innovative digital resources, students in government schools can receive a quality education and be better prepared for the future.

6. To assess characteristics that influence teachers' intention to adopt digital education products in the classroom, questionnaires were sent to all the teachers in Delhi government schools and responses were on a voluntary basis and a total 747 responses were recorded.
7. This study is unique from others in that it focused on the teachers at Delhi government schools, where online education was not widely used prior to the COVID-19 outbreak. Because of this, more study is required to understand the factors that affect teachers' acceptance of digital education products in the classroom. We looked at this issue using the TAM model (Davis et al., 1989), which took into account external factors and system-specific characteristics of digital education products. The TAM and external factors (individual and system characteristics) hypothesis. This study highlights four crucial discussion areas.
8. **First**, the perceived usefulness (PU) of digital educational products is greatly influenced by performance expectancy (PE), which derives from human characteristics, and content quality (CQ), which derives from system features.
9. **Second**, self-efficacy (SE) from individual characteristics and enabling factor (EF) from system characteristics showed a significant positive effect on PEOU which is also supported by many studies.
10. **Third**, this study shows that teachers' perceptions of perceived usefulness and Perceived Ease of Use significantly influenced their desire to use. This finding confirms our prediction that the PU and PEOU of digital educational products had a significant impact on teachers' intention toward adopting them.
11. **Fourth**, this study found that individual characteristics (PE) and system characteristics (EF) have a significant impact on PU & PEOU of using digital education products when looking at the overall effect of the exogenous variable on PU and ITU of acceptance of the product. This result supports our hypothesis that teachers' intention of the use of digital education products in the classroom were significantly influenced by the PE, CQ, SE, EF, PU, and PEOU of those products.

5.1 Limitations

1. The majority of the teachers at Delhi government schools are not native Delhiites, and they bring with them a variety of cultural and societal perspectives on work, organization, discipline, and ethics. Instead of considering potential societal divides, the study focused on how an organization would impose its own cultural norms on everyone.
2. Some of the school teachers might have acquired a mindset towards the use of digital tools for education as a result of their prior involvement with other organizations.
3. The study considered the fact that teachers' replies were based on their knowledge of or exposure to systems employed at government schools. The participants were informed of this, and it was expressly stated in the questionnaire forms.
4. All the selected school classrooms were not fully equipped with the tools and technical support which was required to measure the study effectiveness, such as Wifi and Infrastructure.

5.2 Recommendations Based on the Study Results

This study recommends the following:

1. If government schools are to continue serving the community of learners by offering organized education, the digital education product needs to be a component of the strategic plan for teaching at those institutions.
2. A clear policy that outlines the usage of digital educational goods in the classroom and connects it to a strategic goal using a set of key performance indicators should be in place.
3. The policy should properly inform all parties involved and be made known through awareness campaigns, with visual, textual, and vocal messages delivered to everyone, on the usage of digital education products in the classroom.
4. Each department's responsibilities for supporting the system and making sure it is successful in meeting its goals should be described in detail in the policy.

These departments should incorporate their dedication to the policy into internal procedures that specify what must be done, when it must be done, and how it must be done. The highest level of the organization should approve all procedures, and this approval should be properly conveyed to everyone who needs to know.

5. The demand for training should be specified in terms of frequency and who should receive it in the policy and related procedure. All training should also be evaluated for efficacy and quality.
6. The organization's primary stream of systems, which handle daily tasks completed by teachers, administrators, IT staff, and students, should incorporate the digital education product. The system function should be served by the integration. Additionally, regular product feature reviews should be incorporated into the handling procedures and carried out successfully by a qualified workforce. It is important to keep an eye out for infrastructure issues that affect system performance. To find out what stakeholders, namely teachers, desire and need from the digital education product, those stakeholders should be contacted.
7. Employing competent personnel to create the material for digital educational products and assist teachers in their job is a good idea. It is advisable to promote teacher collaboration when discussing their experiences with digital learning tools.
8. It is important to employ knowledgeable personnel to support the system and address any issues.
9. To reward top performers who use the system, an incentive program should be implemented.

5.3 Future Research Opportunities

The study of students at secondary school has investigated the combined effect of the select strategies in influencing the dependent variables. There are some suggestions for further research:

1. Further studies can be undertaken to explore the relative effectiveness of the individual strategies on these variables.

2. Similar studies can be undertaken to study the effectiveness of other Active Learning Strategies.
3. Surveys can be conducted to study the extent of implementation of Active Learning Strategies in the present classrooms and to identify the factors contributing to or impeding the use of these practices. Similar studies can be conducted to study the influence of these strategies on other categories of digital technological support.
4. The study can be extended to explore the effectiveness of Active Learning Strategies on other higher-order thinking skills.
5. It is possible to extend the study to other academic disciplines.
6. The study can be replicated in other populations including students at elementary or higher education using more sophisticated experimental designs.
7. The components of the research model for how people perceive digital educational products include PE, EF, PU, PEOU, and ITU. Mixed elements covering intention to use could be included in the questionnaire used to gauge people's perspectives on using digital educational resources.
8. TAM was successfully used in this study to get opinions from teachers. TAM could be used to get student opinions for another investigation.
9. The research community could benefit from another study on how such modifications, as described above, can make a difference if Delhi government school heeds the advice and makes the suggested improvements.

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