Impact of Digitalization on Learning of Undergraduate Students of Management Sciences: A Case Study

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Abstract

In an era of rapid technological advancement, digitalization has emerged as a transformative force in the field of education including field of management sciences. It is a very useful tool for reshaping traditional classrooms into interactive and technology-enhanced learning environments. This study investigates the impact of digitalization on undergraduate students' academic learning and instructional practices during the first three years of the BS Management Sciences program at the College of Business Management (CBM), Rawalpindi. The research aims to assess how the integration of digital tools such as smart boards, Android-based applications, and multimedia content affects students' conceptual understanding, attitudes towards learning, and enhance academic performance. The study adopts a mixed-methods approach, combining quantitative data collected through structured survey questionnaires from 50 students of the programme, their academic results comparisons across last three academic years, and qualitative insights obtained via interviews with 20 renowned faculty members at undergraduate level of the college. Quantitative data was analyzed using SPSS Statistics Version-26, while qualitative data was thematically analyzed to extract emerging perceptions and experiences. The findings reveal a generally positive attitude towards the use of digital tools, with over 90% of participants affirming that digitalization enhances conceptual clarity and learning retention across subject areas. Faculty responses also indicate favorable perceptions of digital instruction in the learning process, although several challenges were noted, including insufficient IT support, lack of faculty training, and concerns about data security. Comparative analysis of academic results of last three years suggests that digitalization contributed to improved academic performance over time despite initial adaptation hurdles. The study concludes that digital classrooms, when effectively implemented, foster academic excellence, students' engagement, and

achieve desired learning outcomes. However, to ensure sustainability, institutions must address faculty readiness, infrastructure constraints, and the digital divide. The study contributes to the growing literature on educational technology in developing country contexts and offers recommendations for enhancing digital pedagogy at the undergraduate level across the country.

Keywords: Impact, Digitalization, CBM, Undergraduate students, Smart boards, ICT, Learning outcomes, Faculty perception, Mixed-methods research

Introduction

We are living in an era of rapid technological advancement, where every aspect of life including education is undergoing transformation. The digital revolution has brought about a paradigm shift in teaching and learning methodologies, replacing traditional practices with technology-enhanced approaches. In the realm of education, digitalization has emerged as a transformative force, reshaping classrooms into interactive, learner-centered environments. Smart boards, digital content and Android-based applications are increasingly being utilized to enhance the effectiveness of classroom instruction, especially at the undergraduate level. Digitalization in education is not just a trend but a necessity in the contemporary knowledge economy. The increasing integration of Information and Communication Technology (ICT) into classrooms has garnered the attention of researchers and educators worldwide. These technological tools promote active engagement, provide visual learning aids, and help both instructors and students in achieving desired learning outcomes. According to Kamble (2013), the digital classroom represents the future of education, offering an ICT-based environment that transforms traditional classrooms into dynamic, interactive learning spaces. Similarly, Jadhav (2011) emphasized that digitalization demands a shift in teacher education programs to develop competencies aligned with evolving technological expectations. At the College of Business Management Rawalpindi, the use of smart interactive boards and other digital tools was introduced to enhance the instructional process during the first two semesters of the BS Management Sciences program. These digital tools not only supplement the delivery of complex concepts but also cater to the diverse learning styles of students, improving knowledge retention and classroom engagement. As noted by Keengwe, Schnellert, and Mills (2012), the integration of laptops and other digital tools in classrooms positively influences both student participation and learning outcomes. Despite the potential benefits, the integration of digital technology in educational settings is not without its challenges. Rapid technological advancements outpace the preparedness of educational institutions, and many instructors are still adapting to the demands of digital teaching (Karadag et al., 2017). Concerns such as insufficient IT support, data security, and overreliance on electronic media remain critical issues in digital education environments. In Pakistan and other developing countries, the shift toward digital classrooms is still in a nascent stage, facing infrastructural, cultural, and pedagogical challenges. However, progressive institutions such as the College of Business Management Rawalpindi have started piloting digital integration at the

undergraduate level, particularly within business and management disciplines. This transformation not only aligns with global educational trends but also addresses the needs of modern learners who are increasingly tech-savvy and expect interactive, technology-rich learning environments. According to Mishra and Koehler's Technological Pedagogical Content Knowledge (TPACK) framework, effective digital instruction requires a harmonious integration of content knowledge, pedagogy, and technological expertise (Mishra & Koehler, 2006), making faculty development a central pillar in the success of digitalization initiatives. Moreover, the digitalization of classrooms enables a shift from passive to active learning, where students become co-creators of knowledge rather than mere recipients. Through multimedia tools, simulations, and real-time feedback mechanisms, students are better able to visualize complex business concepts, apply theoretical knowledge, and engage in collaborative problem-solving. Digital technologies also promote differentiated instruction by accommodating varied learning preferences, including visual, auditory, and kinesthetic learners (Al-Awidi & Aldhafeeri, 2017). This responsiveness to student diversity is especially crucial in undergraduate management education, where students come from varied academic and linguistic backgrounds. Despite these benefits, the introduction of digital tools into teaching practices must be strategically managed to prevent potential pitfalls. The digital divide, both in terms of access and skill, continues to be a concern especially in public sector and rural institutions where resources are limited. Furthermore, without continuous professional development and institutional support, educators may struggle to adapt to rapidly evolving technologies, risking reduced instructional effectiveness (Ertmer & Ottenbreit-Leftwich, 2010). Additionally, overreliance on digital tools can compromise interpersonal skills, reduce face-to-face interaction, and limit opportunities for mentoring, which remain integral to holistic learning. In this context, the current study aims to critically examine the impact of digitalization on undergraduate students' learning and faculty teaching practices during the first two semesters of the BS Management Sciences program at the College of Business Management Rawalpindi. By integrating both quantitative (student surveys and academic results) and qualitative (faculty interviews) data, this research provides a nuanced understanding of how digitalization is shaping educational practices, learning outcomes, and stakeholder experiences in a developing country setting. The findings are expected to contribute to the growing discourse on educational technology by offering context-specific insights and recommendations for future digital learning strategies.

Problem Statement

In the contemporary landscape of global education, the integration of digital technologies in teaching and learning has become both a necessity and a challenge. Educational institutions are under increasing pressure to adopt modern instructional tools to enhance learning outcomes, foster student engagement, and meet the demands of a rapidly evolving digital society. Despite the recognized benefits of digital tools such as improved conceptual understanding, interactive learning, and accessibility to diverse resources, their implementation often presents practical difficulties. These

include lack of technical expertise among faculty, inadequate IT infrastructure, concerns over data security, and resistance to change from traditional teaching methods. At the College of Business Management Rawalpindi, the early semesters of undergraduate education were recently introduced to digitalized classrooms equipped with smart boards and electronic learning aids. While these technologies were aimed at improving the instructional process and student performance, their effectiveness, acceptance, and potential drawbacks had not been systematically evaluated. Furthermore, there was a lack of empirical evidence comparing the academic performance of students taught in traditional versus digitalized environments within this specific institutional context. This study, therefore, seeks to investigate the effectiveness of digital classroom technologies in achieving desired learning outcomes at the initial level of undergraduate studies. It aims to assess both student and instructor perspectives on the use of digital tools, identify associated benefits and challenges, and evaluate their overall impact on student academic performance. Addressing this problem is critical not only for enhancing the learning experience at the College of Business Management Rawalpindi but also for informing broader educational strategies in similar academic institutions transitioning toward digital learning environments.

Contribution of the Paper to the Existing Literature

This study makes several significant contributions to the growing body of literature on the integration of digital technologies in higher education, particularly in the context of developing countries like Pakistan. While global research has explored the benefits and challenges of digital learning environments extensively, this paper addresses a relatively under-explored context by focusing on the localized experience of undergraduate students and instructors at the College of Business Management Rawalpindi. One of the most critical contributions of this paper is its context-specific analysis. Most existing literature, including studies by Karadag et al. (2017), Keengwe et al. (2012), and Kamble (2013), is situated in technologically advanced settings. This paper brings new insights by exploring how digitalization unfolds in a resource-constrained yet rapidly evolving academic environment in Pakistan. It offers empirical evidence from a real-world application of smart boards, Android-based applications, and other digital tools, bridging the gap between theory and practice in a non-Western educational setting.

The study utilizes a mixed-methods approach combining quantitative data (student surveys and CGPA analysis) with qualitative insights (faculty interviews) to provide a comprehensive understanding of the digital learning experience. While much of the prior research often leans heavily on either quantitative or qualitative data, this study contributes methodologically by integrating both forms, thereby yielding a holistic view of how digitalization affects students' academic performance and conceptual understanding. A unique aspect of this study is its comparative analysis of student performance over three academic years before and after digitalization. The results demonstrate measurable improvement in learning outcomes, validating prior claims in literature (e.g., Cristen, 2009; Huang, 2014) while providing fresh statistical evidence

in a local academic context. This comparison strengthens the argument that digitalization, when implemented effectively, can lead to better academic achievement.

While affirming the benefits of digitalization, the study also contributes to the literature by identifying context-specific challenges such as insufficient IT support, concerns over cybersecurity, technical training gaps among faculty, and issues related to the digital divide. These practical insights add to global discussions on digital education by offering lessons that are especially relevant to policymakers and academic administrators in similar institutional contexts.

The research goes beyond theoretical implications to offer actionable recommendations. These include the need for hands-on instructor training, the establishment of digital libraries, deployment of IT staff, centralized content monitoring, and implementation of data security measures. These recommendations contribute to policy-oriented literature by suggesting strategies to optimize digitalization efforts in higher education. By grounding the study in Constructivist Learning Theory and the Technology Acceptance Model (TAM), the research reaffirms the theoretical understanding that learner engagement, digital readiness, and perceived usefulness are critical factors in successful technology adoption. The study provides new empirical support for these theories within a practical undergraduate teaching environment.

Research Objectives

To assess students' attitudes toward the impact of digitization on the learning process.
To identify the benefits and challenges experienced by faculty about the impact of digitization on the learning process
To suggest recommendations for improving the use of digital technologies in teaching learning environment at undergraduate level.

Research Questions

What are students' attitudes towards the impact of digitization in the learning environment?
How do instructors perceive the use of digitization in terms of instructional effectiveness and classroom management?
What measures can be taken to overcome the challenges and enhance the benefits of digitalization in undergraduate education?

Theoretical Framework

The theoretical foundation of this study is grounded in Constructivist Learning Theory, which emphasizes the active role of learners in constructing knowledge through experience, interaction, and engagement. According to constructivist thinkers like Vygotsky and Piaget, learning is most effective when students are involved in meaningful, contextualized activities that require critical thinking and problem-solving. Digitalization of classrooms, through tools such as smart boards, multimedia content, and Android-based applications, aligns with this theory by fostering an
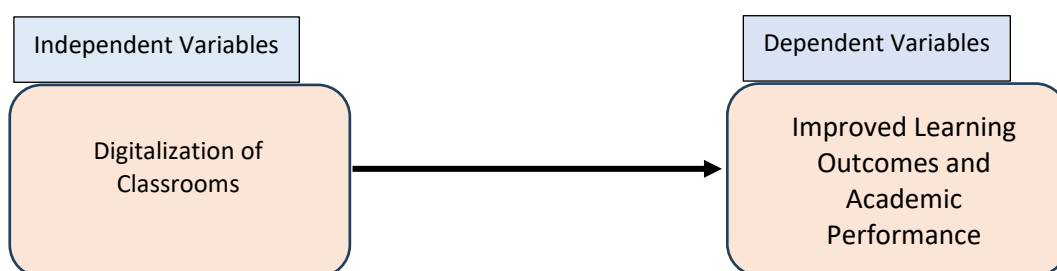
interactive and student-centered environment. These technologies allow students to engage with content visually and kinesthetically, enhancing comprehension and retention. Moreover, constructivism promotes the idea that instructors should act as facilitators rather than mere transmitters of knowledge an approach well-supported by digital learning tools. Additionally, the Technology Acceptance Model (TAM) by Davis (1989) serves as a supporting framework, explaining how perceived usefulness and ease of use influence individuals' acceptance of technology. In the context of this study, students' and instructors' attitudes toward digital tools impact their adoption and integration into the learning process. The TAM helps assess how these perceptions affect learning outcomes, participation, and motivation in a digital classroom setting.

Conceptual Framework

The conceptual framework of the study is designed to explore the relationship between digitalization of classrooms and student learning outcomes, considering both students' and instructors' perspectives. The framework includes two core components:

Independent Variable: Digitalization of Classrooms (Smart boards, Multimedia content, Android applications, Laptops and digital gadgets)

Dependent Variables: Academic Performance (Semester results, Conceptual understanding, Retention of Information), Learning Experience (Student motivation, Perceived ease of learning, Classroom participation)

Independent Variables	Dependent Variables
Digitalization of Classrooms	→ Improved Learning Outcomes and Academic Performance

Literature Review

The transformation of education through digital technology has become a defining feature of 21st-century learning. As digital tools continue to evolve, their integration into classrooms offers new pedagogical possibilities and challenges. The literature affirms that digitalization enhances the teaching and learning experience by improving engagement, accessibility, and academic performance (Cristen, 2009; Kamble, 2013). This section reviews relevant studies and theoretical perspectives related to the digitalization of classrooms, students' and instructors' perceptions of technology, and its impact on learning outcomes. The move toward digital classrooms reflects a shift from traditional teacher-centered instruction to learner-centered models grounded in constructivist principles. Constructivist learning theory emphasizes active

engagement, collaboration, and context-based learning attributes are well supported by digital tools. Vygotsky's social constructivism supports the use of interactive digital environments that allow learners to explore concepts collaboratively and build on prior knowledge. The Technology Acceptance Model (TAM) by Davis (1989) further explains how users' perceptions of usefulness and ease of use impact their willingness to adopt new technologies. In educational settings, students and instructors are more likely to engage with digital tools if they perceive them as beneficial and user-friendly. Numerous studies have established that digitalization improves students' understanding of complex concepts, especially through visual and interactive content. Keengwe, Schnellert, and Mills (2012) found that the integration of laptops in classrooms led to higher levels of student participation and academic achievement. Similarly, Karadag et al. (2017) concluded that smart board usage positively affects classroom communication, time management, and student attention. Cristen (2009) emphasized the necessity of integrating digital tools to prepare students for the demands of the digital economy, arguing that the use of ICT not only supports curriculum goals but also enhances higher-order thinking skills. According to Huang (2014), students who engaged in digital learning exhibited improved reading comprehension and retention, compared to those who relied solely on printed materials. Digital tools such as animations, simulations, and smart boards enable students to visualize abstract concepts, leading to improved conceptual understanding across diverse subjects. In the context of business management education, where students are often introduced to multifaceted theories and models, digitalization supports clarity and better knowledge retention. In the present study, 98% of students reported that visual aids helped them retain information for longer periods. Wilden (2013) also observed that digital devices empower learners to study at their own pace, especially students with lower academic confidence. Such personalization fosters autonomy and boosts students' motivation and confidence in their academic abilities. The role of instructors is critical in digital learning environments. As facilitators of knowledge, instructors must adapt to new technologies and revise their pedagogical strategies accordingly. Studies suggest that when instructors are trained and comfortable with digital tools, they can significantly improve instructional quality and student engagement (Jadhav, 2011). However, challenges persist. Some instructor's express reluctance due to limited technical training, increased workload, or unfamiliarity with software. The current study confirms these findings some faculty members noted that insufficient IT support and cybersecurity concerns hindered the effective use of digital tools. Furthermore, the rapid pace of technological change places additional demands on instructors to continually update their skills. Literature consistently highlights multiple benefits of digitalization, including: Faster delivery of content, Enhanced interactivity and engagement, Support for varied learning styles, Improved academic performance, Access to global educational resources. Nonetheless, several challenges are also noted. These include technological glitches, lack of technical support, concerns about data privacy, and the risk of reducing meaningful human interactions (Bejinaru, 2017; Bankewitz et al., 2016). The current study echoes these concerns some instructors worried that over-reliance on technology could

diminish the student-teacher relationship, essential for developing soft skills and critical thinking. In Pakistan, educational institutions are increasingly adopting digital technologies, though challenges related to infrastructure, training, and policy implementation remain. The current study contributes to this local context by providing empirical evidence from an undergraduate program at the College of Business Management Rawalpindi. The study's findings suggest that, when implemented thoughtfully and supported by training and technical infrastructure, digitalization can yield substantial educational benefits. The reviewed literature underscores a consensus: digitalization enhances the teaching-learning process when supported by proper training, infrastructure, and alignment with pedagogical goals. However, it must be strategically integrated to avoid potential drawbacks, such as over-dependence on technology or neglect of human-centered teaching approaches. The theoretical underpinnings in constructivism and TAM support the dual role of user perception and interactive engagement in successful technology adoption.

Limitations of the Research Study

While the study provides valuable insights into the impact of digitalization on undergraduate learners at the College of Business Management Rawalpindi, several limitations must be acknowledged. These limitations define the scope within which the findings should be interpreted and offer directions for future research.

The study was limited to undergraduate students enrolled in the first two semesters of the BS Management Sciences program. These students were chosen because they were the first cohort to experience classroom digitalization through tools such as smart boards and interactive applications. This selection allowed for: A focused evaluation of early-stage digital learning exposure. A uniform population for comparative analysis (e.g., against previous non-digitalized cohorts). The focus was on Management Sciences, which includes courses from economics, business, marketing, and organizational studies. Other disciplines (e.g., pure sciences, engineering, humanities) were excluded to maintain uniformity in curriculum expectations and instructional methods. The study centered on the use of digital gadgets such as: Smart boards and digital whiteboards. Android-based applications used in teaching. Laptops and multimedia resources in classrooms. The study was conducted at a single institution College of Business Management Rawalpindi focusing on students from the initial two semesters of the BS Management Sciences program. As a result, the findings may not be generalizable to other academic disciplines, institutions, or educational contexts, particularly those with different infrastructural, technological, or socioeconomic conditions. The quantitative component of the study involved a relatively small sample size (50 students and 20 faculty members). Although useful for drawing initial insights, the limited number of participants may reduce the statistical power of the study and increase the margin for sampling error. Larger, more diverse samples across multiple institutions would enhance the reliability and generalizability of the findings. The data analysis focuses primarily on short-term academic performance and perceptions following the implementation of digital technologies. Long-term impacts such as sustained

knowledge retention, skill development, or post-graduation outcomes were not within the scope of this study. As a result, the full range of educational impacts of digitalization may not have been captured. The study did not employ a controlled experimental design to isolate the effects of digitalization. While it includes comparative analysis of academic results from pre- and post-digitalization cohorts, other factors influencing academic performance (e.g., instructor variability, curriculum changes, student motivation) were not controlled for, which may affect the internal validity of the conclusions.

The study broadly evaluates the effects of "digital gadgets" and "smart screens" but does not provide a detailed breakdown of how individual tools (e.g., specific apps, software, or hardware components) contributed to learning outcomes. A more granular analysis could offer deeper insights into which technologies are most effective and why. Although the study briefly mentions that some instructors faced challenges due to lack of technical training, it does not thoroughly evaluate the training background or readiness levels of faculty members. Since instructor competence is a critical factor in the success of digital learning environments, this aspect remains underexplored. Much of the study relies on self-reported data from students and faculty via surveys and interviews. Such data can be influenced by social desirability bias or subjective interpretation, which may affect the accuracy of the reported attitudes, experiences, and opinions.

Research Methodology

This study was designed to investigate the impact of digitalization on undergraduate learners, with a specific focus on the academic performance, attitudes, and classroom experiences of students and instructors at the College of Business Management Rawalpindi. A structured methodology was employed to ensure reliability, validity, and comprehensive data collection.

Research Design: The study adopts a mixed-methods research approach, combining both quantitative and qualitative data. This approach was chosen to provide a holistic understanding of the digitalization experience by examining not only numerical trends (e.g., academic results, survey responses) but also the subjective perspectives of instructors and students. The study utilizes a case study research method, focusing on a single institution College of Business Management Rawalpindi as the unit of analysis. This method allows for an in-depth, contextualized exploration of the use of digital tools in classroom instruction and their outcomes.

Study Population: The target population for this research consisted of: Undergraduate students enrolled in the first three years of the BS Management Sciences program at the College of Business Management Rawalpindi. Faculty members teaching in the same semesters at the institution were included.

Sampling and Sampling Technique: A non-probability purposive sampling technique was used to select participants based on their relevance to the study

objectives. Students Sampled: 50 undergraduate students who were currently learning in digitalized classrooms. Faculty Sampled: 20 instructors teaching in the digitally equipped classrooms. This technique ensured that participants had direct experience with digital learning environments.

Methods of Data Collection: The study employed primary methods of data collection: Structured survey questionnaires for students. Semi-structured interviews with instructors. Academic performance records (CGPAs) of students from both pre- and post-digitalization cohorts.

Research Instruments: Questionnaire for Students: Designed to assess students' attitudes toward technology, conceptual understanding, and perceived academic benefits of digitalization. It included closed-ended Likert-scale items. Interview Protocol for Faculty Members: Focused on instructors' perceptions of teaching effectiveness, challenges, use of digital tools, and their views on learning outcomes. Academic Result Records: Used to compare students' CGPA performance before and after the introduction of digital learning tools in the college.

Data Analysis Techniques

Survey data from students were analyzed using SPSS statistics version 26 was used. Descriptive statistics (percentages, means, frequencies) and graphical representations were used to interpret the data. Comparative analysis of student's performance (CGPA) across three academic years helped assess the impact of digitalization. Interview data from faculty members were thematically analyzed to identify recurring patterns, challenges, and observations.

Validity And Reliability of Research Instruments

Validity: The survey questionnaires and interview guides were designed with reference to established theoretical models Constructivist Learning Theory and the Technology Acceptance Model (TAM). This alignment ensured that all key dimensions of digital learning (e.g., perceived usefulness, engagement, conceptual understanding) were systematically covered. The instruments were reviewed by faculty and research advisors (Directing Staff) at the College of Business Management Rawalpindi to confirm that the items appeared relevant, clear, and appropriately worded. This peer validation enhanced the face validity of the tools. To maintain internal validity: No prior briefing or coaching was provided to participants, thereby minimizing response bias. The study triangulated data from multiple sources students, faculty, and academic records to ensure that conclusions were not based solely on one form of data. Responses were gathered in a consistent academic setting with similar environmental factors for all participants, ensuring fairness. Construct validity was strengthened by ensuring that each survey item was directly linked to key constructs (e.g., learning outcomes, digital engagement, retention) outlined in the research objectives and theoretical framework.

Reliability: To ensure the reliability of the survey tool: The questionnaire items were carefully structured using standardized Likert scales, which are widely used in educational research for consistency in responses. Terminology and phrasing were kept simple and consistent to reduce ambiguity and interpretation errors. Participants were provided with: Adequate time (60 minutes) to fill out the questionnaire. Instructions to complete the survey individually without peer discussion, which reduced the chances of external influence or social conformity. Although test-retest reliability was not conducted due to time constraints, the consistency of findings across multiple data sources (e.g., similar themes in interviews and survey responses) supports stability and trustworthiness of the data collected.

Ethical Considerations
All participants were informed about the purpose of the research and the voluntary nature of their participation. They were assured that their responses would be used only for academic research. No identifying information (such as names, student numbers, or personal details) was collected. Survey and interview data were recorded and analyzed anonymously to protect the privacy of the participants. Institutional data (e.g., academic results) were aggregated, and no individual student's performance was singled out. Participants were not pressured or incentivized to take part in the study. They were allowed to withdraw at any point without any academic or professional consequences. All collected data were stored securely and were accessible only to the research team. No digital or printed copies of individual responses were shared outside the research team, ensuring compliance with data protection norms.

Findings of the Study
The findings of this research are based on the data collected through three key sources: survey questionnaires from undergraduate students, interviews with faculty members, and analysis of academic results over the past three years. These findings are presented thematically to align with the research objectives.

Survey Questionnaires from Undergraduate Students
To understand the perceptions and experiences of students regarding the use of digital technologies in classroom settings, a structured survey was administered among first-year undergraduate students enrolled in the BS Management Sciences program at the College of Business Management, Rawalpindi. The survey targeted students in their first three years, those directly exposed to the newly introduced digital learning tools such as smart boards, digital whiteboards, and Android-based educational applications. A total of 50 students from diverse academic courses and branches were selected for participation. The questionnaire included Likert-scale items (SD: Strongly Disagree, D: Disagree, N: Neutral, A: Agree, SA: Strongly Agree) designed to assess students' attitudes toward technology, conceptual understanding across disciplines, and their views on the effectiveness of digitalization in enhancing academic excellence. Ethical protocols were strictly observed: students completed the survey independently within

a 60-minute time frame without external influence or researcher guidance to ensure authenticity and reliability of responses.

Table **1: Responses of Survey Questionnaires from Undergraduate Students**

S. No	Statements	Theme	Strongly Disagree (SD)	Disagree (D)	Neutral (N)	Agree (A)	Strongly Agree (SA)
1	I enjoy using technology for learning /recreational matters.	Attitude Toward Technology	2 (4%)	4 (8%)	4 (8%)	29 (58%)	11 (22%)
2	I have a positive attitude towards technology for recreation purpose.	Attitude Toward Technology	3 (6%)	3 (6%)	4 (8%)	32 (64%)	8 (16%)
3	I enjoy using technology for learning.	Attitude Toward Technology	3 (6%)	3 (6%)	6 (12%)	30 (60%)	8 (16%)
4	I have a positive attitude towards technology for learning.	Attitude Toward Technology	2 (4%)	0 (0%)	0 (0%)	33 (66%)	15 (30%)
5	Digital based lectures / contents help me understand boring concepts with ease.	Conceptual Understanding	1 (2%)	1 (2%)	3 (6%)	4 (8%)	41 (82%)
6	Technology is only helpful in understanding science subjects.	Conceptual Understanding	10 (20%)	24 (48%)	1 (2%)	9 (18%)	6 (12%)
7	Technology is only helpful in humanities/social sciences.	Conceptual Understanding	37 (74%)	9 (18%)	1 (2%)	2 (4%)	1 (2%)
8	Technology is only helpful in subjects of Management Sciences.	Conceptual Understanding	37 (74%)	9 (18%)	1 (2%)	2 (4%)	1 (2%)
9	Technology is helpful in all subjects equally in	Conceptual Understanding	1 (2%)	2 (4%)	7 (14%)	39 (78%)	1 (2%)

	the BS program.					
10	I can retain content learned through visual tools for a longer duration.	Conceptual Understanding	0 (0%)	0 (0%)	1 (2%)	7 (14%)	42 (84%)
11	Traditional black/whiteboard methods hamper learning and take more time.	Traditional Vs Digital	1 (2%)	1 (2%)	3 (6%)	44 (88%)	1 (2%)
12	Digital classrooms help me learn more in less time.	Traditional Vs Digital	2 (4%)	1 (2%)	1 (2%)	3 (6%)	43 (86%)
13	Digitalization causes more challenges than benefits.	Perceived Challenges	24 (48%)	6 (12%)	3 (6%)	10 (20%)	7 (14%)
14	Digitalization creates hurdles in classroom learning.	Perceived Challenges	25 (50%)	6 (12%)	2 (4%)	8 (16%)	9 (18%)
15	Digitalization has a positive impact on learning of students.	Impact of Digitization	3 (6%)	2 (4%)	2 (4%)	7 (14%)	36 (72%)

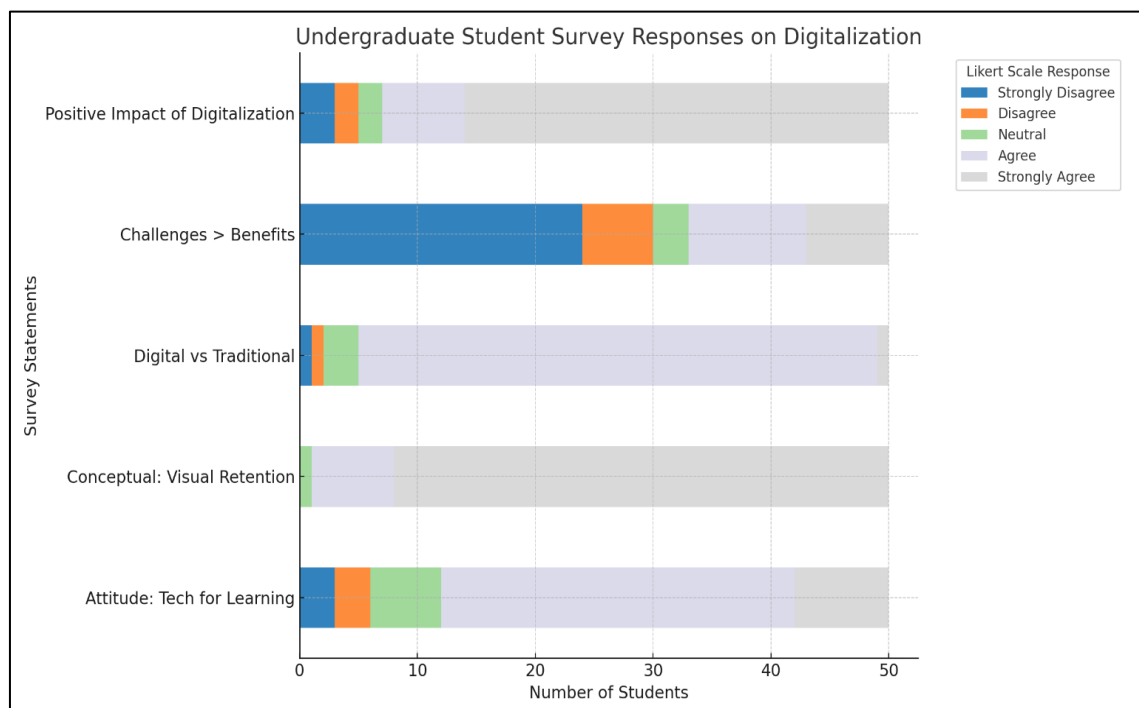Undergraduate Student Survey Responses on Digitalization

Figure 1: Responses of Survey Questionnaires from Undergraduate Students

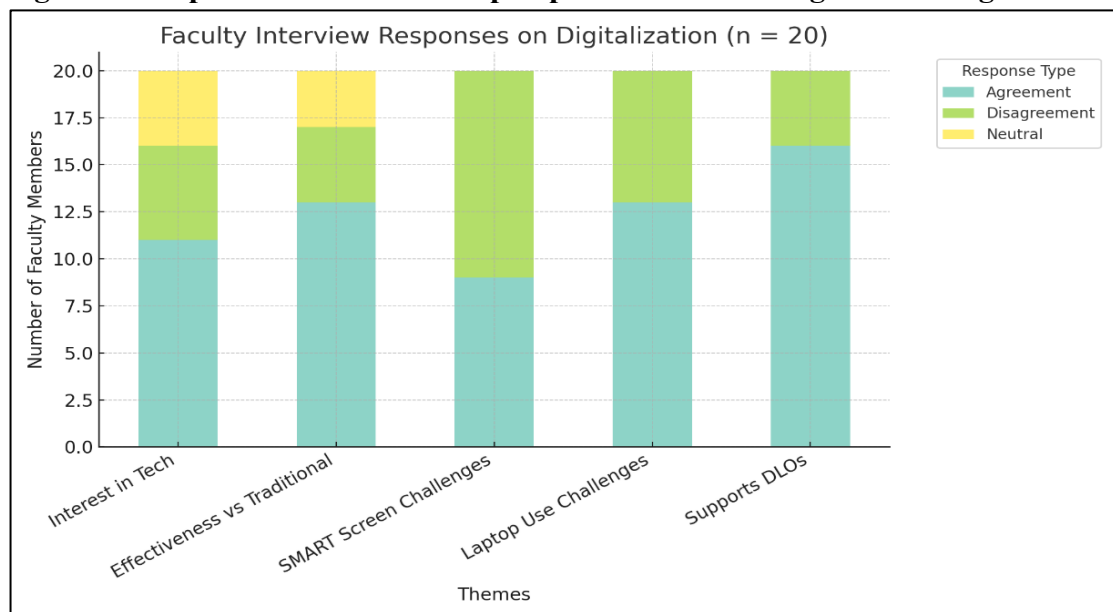**Interviews With Faculty Members**

To complement the quantitative students' data and gather expert insights into the instructional implications of digitalization, semi-structured interviews were conducted with 20 faculty members teaching in the initial semesters of the BS Management Sciences program at the same institution. The interviews aimed to explore the instructors' perspectives on the integration of digital tools in teaching, their impact on student learning, the attainment of desired learning outcomes (DLOs), and any perceived operational or pedagogical challenges. These interviews were held both online and in-person, based on logistical feasibility and convenience of the participants. Faculty members represented diverse academic specializations and had direct experience with delivering instruction using digital platforms. Their candid reflections helped to identify both the instructional advantages and practical challenges associated with digitalization, including concerns related to technical training, workload, cyber security, and the evolving role of educators.

Table 2: **Responses of Faculty' perspectives on the integration of digital tools**

S. No.	Interview Question	Theme	Agreement	Disagreement	Neutral
1	Do you enjoy using technology for teaching in the classroom?	Faculty Interest in Technology	11	5	4
2	Do digital based lessons and SMART screens help impart instructions more effectively than traditional boards?	Comparison with Traditional Methods	13	4	3
3	Are there some challenges associated with the use of SMART screens in classrooms?	Challenges with Digital Gadgets	9	11	0

4	Are there challenges associated with student use of laptops in classrooms?	Cybersecurity/Operational Concerns	13	7	0
5	Is digitalization helpful toward the attainment of Desired Learning Outcomes (DLOs) in your subject area?	Learning Outcomes	16	4	0

Figure 2: Responses of instructors' perspectives on the integration of digital tools

Comparative Analysis of Academic Results (Past 3 Years)
To objectively assess the academic impact of classroom digitalization, a comparative analysis of student performance data was undertaken using examination results from the past three academic years. The dataset, obtained from the registrar's office, included the academic outcomes of multiple undergraduate cohorts enrolled in the BS Management Sciences program. These cohorts were divided into two groups: students who underwent traditional instruction prior to digitalization (pre-2024) and those who received digitally enhanced instruction post-implementation in January 2024. The

analysis focused on course grades, average CGPAs, and year-on-year academic progress across the two phases. Although a slight decline in performance was observed during the transition period, subsequent results revealed a notable improvement in academic performance, validating the positive influence of digital technology on learning effectiveness. This result-based evidence provided a quantifiable foundation to support the qualitative and perceptual findings from students and faculty alike. The third phase of data collection focused on analyzing the examination results of various courses from the past three academic years at the College of Business Management, Rawalpindi, with the aim to evaluate the impact of digitalization on students' academic performance. The findings are categorized below:

Pre-Digitalization vs Post-Digitalization Cohorts: The digitalization initiative was implemented in January 2024. Students who received instruction before January 2024 were considered the non-digitalized cohort, while students taught after this date were considered the digitalized cohort.

Initial Impact: In the initial phase of transition (early 2024), there was a slight decline in student performance, attributed to the adjustment period during the shift from traditional to digital classrooms. This included issues such as: Learning curve for both faculty and students. Inadequate training in using digital platforms. Occasional technical challenges and IT support limitations.

Improvement in Academic Results: As digitalization became more established and users became more accustomed: Noticeable improvement in average CGPAs and course pass rates was recorded. Students began to demonstrate greater conceptual clarity, engagement, and retention of content. Digital tools like smart boards, visual aids, and interactive applications facilitated more effective learning, especially in abstract or complex topics.

Longitudinal Performance Trends: Over the course of a full academic year following digitalization, students consistently outperformed their predecessors in: Assignment quality, Midterm and final exam scores, Presentation skills and class participation

Subject-Wise Observations: Improvements were uniform across subject disciplines (economics, business, marketing, organizational studies). This suggests that the benefits of digitalization are not limited to a particular domain but enhance overall academic excellence.

Faculty Validation: Faculty also validated the results, affirming that students: Showed quicker comprehension of lecture content. Demonstrated more confidence during assessments. They were able to self-direct their learning using digital materials outside class.

Table 3:   **Trend of Average GPA Over Three Academic Years**

S No	Academic Year	Average CGPA
1	2022 (Pre-Digitalization)	2.65
2	2023 (Transition Phase)	2.75
3	2024 (Post-Digitalization)	2.95

Discussion
Discussion: Survey Questionnaires from Undergraduate Students

Table No.1 depicts that the survey responses from undergraduate students highlight a strong inclination toward the use of digital technologies in classroom learning. The majority of students reported a positive attitude toward integrating digital tools, such as smart boards and multimedia applications, into their academic environment. This is consistent with existing literature suggesting that digitalization increases student motivation, enhances engagement, and facilitates active learning (Anderson, 2010; Prensky, 2001). One of the most significant findings was that 90% of students agreed that digital tools helped them understand difficult concepts more easily, and 98% believed that concepts learned through visual aids were better retained. This supports the cognitive theory of multimedia learning (Mayer, 2009), which posits that students learn more effectively when information is presented in both visual and verbal formats. However, some mixed responses also emerged: 46% of students felt digitalization presented more challenges than benefits, though 60% disagreed, suggesting that while the majority appreciated the technological integration, a minority encountered usability or accessibility issues. These findings suggest that although digitalization is generally perceived as beneficial, its implementation must be accompanied by adequate support systems and user training.

Discussion: Interviews with Faculty Members
Table No.2 shows the interviews with faculty members provided valuable qualitative insights into the integration of digital technology in classroom instruction. A majority of instructors (65%) expressed enthusiasm for using digital tools and agreed that SMART boards and digital content facilitated more effective teaching compared to traditional methods. These perspectives align with existing pedagogical studies that recognize the potential of educational technology to improve content delivery and classroom interactivity (Selwyn, 2012; Laurillard, 2013). Faculty also acknowledged that digitalization supported the attainment of Desired Learning Outcomes (DLOs), validating the positive impact of visual instruction on comprehension and critical thinking skills. Nevertheless, significant challenges were identified. These included lack of technical training for instructors, insufficient IT support personnel, and concerns about data privacy and cybersecurity—issues echoed in broader research on

the digital divide and infrastructure disparities in education (Van Dijk, 2006). Some instructors also noted that reliance on digital platforms may risk diminishing real-life social interactions and increase the instructional burden on teachers, suggesting a need for balanced integration. Hence, while the faculty generally endorsed digital learning environments, their concerns highlight the importance of institutional readiness, professional development, and digital ethics.

Discussion: Analysis of Academic Results Over the Past Three Years
Table No.3 discloses the analysis of academic records from the past three years revealed a clear and progressive improvement in students' performance following the introduction of digital technologies in January 2024. While a slight decline was observed during the initial transition period likely due to the learning curve associated with new tools, subsequent cohorts demonstrated significantly higher average CGPAs and stronger academic outcomes across multiple subject areas. This upward trend is a compelling indicator that digitalization positively impacts student achievement when implemented effectively. These results corroborate earlier survey and interview findings, validating that digital tools not only improve students' perceptions and learning experiences but also translate into tangible academic gains. The findings align with previous research (Heinich et al., 2002; Tamim et al., 2011) that confirms the effectiveness of educational technology in improving student outcomes across disciplines. Additionally, the improvement across all subject areas business, economics, marketing, and organizational studies suggests that the benefits of digitalization are not limited to specific content types but rather enhance the broader learning environment. However, long-term studies and multi-institutional comparisons would further validate the sustainability of these improvements.

Conclusion
This study explored the impact of classroom digitalization on student learning and instructional practices at the College of Business Management, Rawalpindi. The findings from multiple data sources including survey questionnaires from undergraduate students, interviews with faculty members, and a comparative analysis of academic results over the past three years provide a comprehensive and triangulated understanding of the effectiveness and challenges associated with the integration of digital tools in undergraduate education. From the students' perspective, the use of digital gadgets such as smart boards, multimedia resources, and Android-based applications significantly enhanced their conceptual understanding, academic engagement, and overall learning experience. A large majority of students expressed positive attitudes toward digital learning and affirmed its usefulness in making complex academic content more accessible and memorable. Faculty interviews further supported these findings by indicating that digitalization has improved instructional delivery, facilitated the attainment of desired learning outcomes (DLOs), and increased student participation and comprehension. Nevertheless, faculty members also pointed out important challenges, including the need for technical training, concerns about data security, and the increased cognitive and technological demands

placed on instructors. The academic results analysis provided empirical evidence to reinforce the perceptual data. A clear upward trend in student performance measured by average CGPAs and course outcomes was observed after the implementation of digital technologies. Although a minor dip occurred during the initial adjustment period, sustained improvement in academic achievement was noted in subsequent semesters. Taken together, the findings of this research study affirm that classroom digitalization, when appropriately planned and supported, can serve as a powerful catalyst for enhancing the quality of teaching and learning in higher education. However, to maximize its effectiveness, institutions must address associated challenges by investing in faculty development, ensuring cybersecurity protocols, and maintaining adequate technical infrastructure. In conclusion, digitalization in education is not merely a trend but a transformative shift that holds immense potential for academic innovation provided it is implemented thoughtfully and inclusively. This study contributes to the growing body of evidence advocating for technology-enhanced learning environments, especially in the context of undergraduate business education in developing countries like Pakistan.

Recommendations

Considering the study's findings and the analysis of survey data, faculty interviews, and academic results, several practical and strategic recommendations are proposed to enhance the effectiveness of digital learning environments in higher education, particularly in institutions similar to the College of Business Management, Rawalpindi. To ensure optimal use of digital tools in classrooms, comprehensive training programs should be introduced for faculty members. These programs should focus on: Technical operation of digital devices (smart boards, multimedia tools). Integration of educational technology into pedagogical practices. Ongoing professional development in digital instruction and content delivery.

A robust technical support system is essential for the sustainability of digital classrooms. Institutions should: Recruit and retain qualified IT staff to address technical issues promptly. Ensure regular maintenance and updates of digital equipment. Establish dedicated help desks or support channels for faculty and students. Given the faculty's concerns regarding data security, institutions must: Develop clear policies for data usage, access, and privacy. Provide cybersecurity training for faculty and students. Invest in secure digital platforms and encrypted systems to protect sensitive academic data.

While digitalization has clear academic benefits, excessive reliance may reduce social interaction and critical thinking. Institutions should: Encourage a blended learning model that combines digital and face-to-face interactions. Design classroom activities that promote collaboration, discussion, and real-time feedback. Monitor students' screen time and promote responsible technology use.

To ensure continuous improvement, institutions should: Establish feedback mechanisms (e.g., periodic surveys, focus groups) for both students and instructors. Regularly assess the impact of digitalization on academic performance and engagement. Use assessment data to refine teaching strategies and digital tool

integration. Given the positive outcomes at the early undergraduate level, it is recommended to: Extend digitalization initiatives to senior undergraduate and postgraduate programs. Implement similar interventions in other departments beyond Management Sciences (e.g., STEM, Social Sciences). Facilitate inter-departmental sharing of best practices in digital pedagogy.

To prevent digital divides among students, institutions should: Provide access to essential digital devices (e.g., laptops, tablets) for all students. Offer technical orientation sessions to help students effectively use educational technologies. Consider subsidized internet access or on-campus Wi-Fi enhancements to support remote learning. To better understand the long-term impact of digitalization, future research should: Track student performance and engagement over multiple semesters or years. Study digitalization's influence on graduate employability and skill development. Investigate the psychological and social dimensions of digital learning.

Future Work

While the current study provides valuable insights into the initial impact of classroom digitalization on undergraduate students' learning and instructional practices, several avenues remain open for further exploration.

Future research can expand the scope by including multiple institutions both public and private, and from diverse geographic and socioeconomic contexts. A comparative study across institutions would enhance the generalizability of findings and help identify contextual factors that influence the success or failure of digitalization initiatives.

This study focused solely on Management Sciences students. Future work should include disciplines such as Engineering, Humanities, Natural Sciences, and Social Sciences to determine whether the impact of digitalization varies across different knowledge domains and instructional needs.

A critical area for future research is the long-term impact of digitalization on students' academic growth, skill development, and post-graduation performance. A longitudinal study could provide deeper insights into knowledge retention, digital competency evolution, and the sustainability of positive academic outcomes. While the current study examined digitalization in a general sense, future studies can isolate and evaluate the effectiveness of individual technologies (e.g., Google Classroom, Moodle, Zoom, SMART Boards, specific mobile learning apps). This would help identify the most impactful tools and support evidence-based technology adoption.

Given the observed gaps in technical preparedness among faculty, future studies can focus on designing, implementing, and evaluating digital pedagogy training programs. Measuring their effectiveness could provide a roadmap for enhancing instructional capacity and confidence in digital classrooms. As digital learning reshapes traditional teacher-student interactions, it is important to explore its psychological and social effects on both learners and instructors. Future work could assess student engagement, mental well-being, and sense of community in digital versus traditional settings.

Future research should also explore issues of digital equity, such as access to devices, reliable internet, and digital literacy among students from marginalized or underrepresented groups. Understanding and addressing these disparities is essential for inclusive educational policy planning.

With the rise of artificial intelligence (AI), augmented reality (AR), and virtual reality (VR) in education, future studies could examine the integration of these emerging technologies into digital classrooms and assess their potential to further enhance learning outcomes. Considering the concerns raised by instructors, future work should explore the risks, vulnerabilities, and safeguards associated with data security and privacy in educational settings. Establishing digital ethics frameworks will be crucial as institutions move toward fully digital ecosystems.

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