THE PROGRESS: A Journal of Multidisciplinary Studies
Vol.6, No.1 (March, 2025), Pp.18-34
ISSN (Online): 2958-292X, ISSN (Print): 2958-2911
DOI: https://doi.org/10.71016/tp/k0jyhv43

Original Article **https://hnpublisher.com**

Impact of Digital Technology on Learning Outcomes of University Students: A Study of Rawalpindi and Islamabad, Pakistan

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ABSTRACT

Aim of the Study: The basic aim of this research was to explore the effects of digital technology on the learning outcomes of university students in Rawalpindi, Pakistan.

Methodology: Utilizing a quantitative research design with a cross-sectional approach, data were collected at a single point in using structured questionnaires. The target population comprised undergraduate and postgraduate students enrolled in public and private universities, including RWU, ARID, NUML, HITECH. A classified random sampling technique was employed to ensure diversity across institutions and programs, with a sample size of 177 students considered most suitable for statistical significance.

Findings: The findings suggest that universities should take a whole-system attitude to the introduction of digital integration, integrating digital tools with the key features of face-to-face learning and community building. Through careful planning and judicious use, digital technologies can play an important role to play in improving the student's learning experience and supporting in their dynamic world.

Conclusion: The study concluded that digital technologies have the potential to significantly affect the learning outcomes of university students. While they offer numerous benefits in terms of academic performance, student engagement, and collaboration, challenges remain in ensuring that these tools promote critical thinking and self-directed learning.

Keywords: Digital Technologies, Learning Outcomes, University Students, Academic Performance, Engagement and Motivation.

Article History

Received:
December 29, 2024

Revised:
March 04, 2025

Accepted:
March 13, 2025

Online:
March 30, 2025

1. INTRODUCTION

In today's fast paced society digital technologies have changed the way we learn, exchange information and interact. For university students the transition from conventional learning experience to digital technology has led to new pathways of accessing and generation information and thus innovative ideas to creation. The age of the one dimensional classroom lecture hour is over and students have at their hands

access to an ocean of information thanks to the internet e learning and interactive application. This new digital education revolution is no longer a matter of convenience but a revolution. Using emerging technologies such as the Internet, virtual classrooms, and artificial intelligence, university students now have the possibility to learn better, learn more deeply, and tailor their learning to their needs. In the evolving education landscape, digital technologies content from virtual classrooms to personalized learning applications, technology integration has become an indispensable part of the modern education system (Ab Ul Hassan et al, 2024; Gulzar et al, 2024; Selvin et al., 2012; Huma et al., 2025).

With increased access to smartphones, laptops and the internet, University students are at the forefront of this digital revolution, which is reshaping traditional learning methods and enabling innovation learning experiences .This new digital education revolution is no longer a matter of convenience but rather a revolution. By using the internet, virtual classrooms and the emerging technology such as artificial intelligence, University students now have the possibility of learning in them the best way possible, deeper, and reposition their learning styles according to their needs,. However alongside these benefits come challenges including distractions, information overload, and digital inequality. Digital Technologies are more than just additional tools. They are redefined self-learning (Zainab et al., 2023; Warsi and Rani, 2024; Scherer et al., 2019).

Highlight that digital platforms allow students to collaborate across geographic barriers, engage in self-paced learning, and access a wide array of resources in real time. Digital Technologies have evolved, from basic websites for education to advance learning management systems enabling an entire university. Such as google classroom, Zoom provide students with opportunity to learn outside the traditional classroom. Video tutorials, e-books and quiz teach students the concepts at their own speed, whereas virtual labs and simulations afford in many areas such as science and engineering practical experiences. These technologies have also facilitated the adaptation of education during unprecedented events, such as the COVID- 19 pandemic, where online platforms became the primary mode of education delivery (Dhawan, 2020).

Such shifts underscore the critical role of digital tools in enhancing educational outcomes and ensuring continuity in learning process. Social media platforms and discussion board are also important in collaborative learning. In Platforms such as Microsoft Teams and Slack, students can exchange ideas, collaborate on group work, and be provided with feedback from fellow students and teachers to name a few. The capacity to interact with each other leads to a feeling of community regardless of the sites of learning environments, making it effective for achieving high academic performance. In digital technologies, such as artificial intelligence (AI) and machine learning, are changing personalized learning. AI-based tools can parse a student's performance grade, detect which aspects of performance are deficient, and suggest specific resources to ameliorate weaknesses. This personal approach guarantees there is no duplication of efforts in the sense that two individuals do not necessarily follow the same learning route, as it meets the mixed expectations of university students. However, while digital technologies promise numerous advantages they also raise important questions about their overall impact on students' academic performance and wellbeing. For instance on excessive reliance digital devices may lead to issues on reduced face to face interaction , digital distraction , and information overload (Safdar et al., 2020; Safdar et al., 2020a ; Junco,2012).

These challenges necessitate a deeper understanding of how digital tools influence learning outcomes especially in the university context where students are required to balance academic rigor with personal and professional commitments. Digital technologies have provided new mechanisms to better learning results. Particularly, gamification (the incorporation of game-like features into education)

Introduces enjoyment and memorability to learning. Interactive applications and games are already in use to teach advanced topics such as mathematics, programming, and even operation on the human body. These tools are used to motivate students, helping them to remember things better. The rapid adoption of digital technologies in education has also paved the way for a diverse range of educational strategies.

Blended learning, for example, combines traditional classroom teaching with online modules, offering students a more flexible and interactive learning experience (Safdar and Khan, 2020; Safdar et al., 2018; Graham, 2006).

Such approaches have been shown to improve engagement and knowledge retention, but their effectiveness often depends on factors such as students' digital literacy and access to technological resources. Digital access also guarantees that students can learn any time, place. Access to online libraries, databases and academic journals is available 24/7, enabling students to conduct research and submit assignments regardless of time or place. This features are highly beneficial to university student who has multiple commitments. Additionally, digital tools promote critical thinking and problem-solving skills. Platforms such as Khan Academy, LinkedIn Learning, and EdX help students to investigate subjects themselves and engage in self-directed learning. This approach not only improves academic outcomes.

But also equips students with the skills needed to thrive in a competitive job market. The rise of technology in education is also not a challenge free, unmixed experience. Distracting is one of the most important problems. With social media, video streaming, and gaming often just a click away, students can easily lose focus during study sessions. This task demands self-control and good time organization of which many students are also deficient. Another issue is the digital divide. There are universities however, that grant access to state of the art technology but not all of the students have equal access to computers, internet and assistance. This variation can also limit the students' learning

Students from disadvantaged backgrounds often face challenges in accessing digital tools and resources and for the learning experience helped from it. Over reliance on technology may also lead to a decline in essential skills such as handwriting or interpersonal face to face interaction. Spending too much time on screens may impair students' development of interpersonal skills. Skills those are essential in team work and collaboration in out-of-class contexts. In the context of Pakistani universities, the fusion of digital technologies is gradually gaining momentum, yet it faces unique challenges, including limited resources economical issues, and variations in access to digital tools (Qureshi et al., 2020).

Understanding how these factors effect learning outcomes is vital for developing inclusive and effective educational policies. This research aims to study the multidimensional impact of digital technologies on the learning outcomes of university students. By analyzing both the opportunities and challenges presented by these tools, the study seeks to provide valuable awareness for educators, policymakers, and students. Ultimately, the findings of this research will contribute to the ongoing discourse on applying digital revolution to enhance educational quality and equity. The impact of digital technologies on the learning outcomes of university students is both innovative and complicated. On the one hand, these applications provide unique opportunities for concentration, convenience, and personalized learning. In contrast, these pose challenges that deserve to be carefully addressed and ultimately solutions that must be planned. As long as the benefits and drawbacks of digital technologies

Are understood, universities can further develop learning environments that enable the students to perform well academically and in other aspects of their lives.

1.2 Problem Statement

The use of digital technologies in higher education is changing the way of students learn and teachers teach. Tools like learning platforms, online resources and collaboration tools are now common in universities. The impact on student learning can vary widely. Differences in how these technologies are used how has to access them students digital skills and there level of participation raise questions about how effective these tools really are in improving learning. This study explored how digital technologies affect university students learning and identify what helps or get in the way of their success.

1.3 Significance

The importance of my research topic: Impact of digital technologies on learning outcomes of university students" is highly relevant in today's education. Digital technologies are changing how higher education works by digital tools like online courses, multimedia resources and Google classrooms. These tools make learning more flexible and accessible, removing barriers like time, location and physical disabilities and better supporting students with diverse needs. These technologies can make learning more interesting and engaging. This research is important because it looks at how these tools can truly improve learning for university students.

1.4 Study Gap

While previous research has explored technologies affect education overall, there is overall understanding of it specific impact on university students' learning outcomes in multiple contexts. This research aims to explore how digital tools influence university students' academic success considering the unique challenges and expectations they face compared to other education levels .It also seeks to understand the difficulties students and educators encounter in using digital resources effectively.

2. THEORETICAL FRAMEWORK

The Technology Acceptance Model (TAM) is relevant to this topic, as it explains how users come to accept and use technology. TAM posits that perceived usefulness and perceived ease of use are key factors influencing the adoption of technology. In the context of your study, TAM can help explore university students' acceptance of digital technologies and how this acceptance correlates with their learning outcomes. Alternatively, Constructivist Learning Theory can also be applied, as it emphasizes active, collaborative, and self-directed learning experiences, which digital technologies often facilitate.

2.1 The Technology Acceptance Model (TAM)

TAM is a theory that explains how people start using new technology. It highlight two main factors;

1) Perceived usefulness – how much a person thinks the technology will help them do their work better?
2) Perceived ease of use – how easy they believe it is to use the technology without much effort.

These two factors shape how a person feels about the technology, which then affects whether they plan to use it and actually do. TAM is commonly used to understand why people choose to use digital tools and systems.

2.2 Research Objectives

- To examine the effect of digital technologies on the academic performance of university students.
- To investigate the impact of digital technologies on student engagement, motivation, and collaborative skills in the learning environment.
- To evaluate how digital technologies influence critical thinking, self-directed learning, and overall satisfaction with the learning experience.

2.3 Research Questions

1) How do digital technologies affect the academic performance of university students, as measured by grades, test scores, and GPA?
2) What is the impact of digital technologies on university students' engagement, motivation, and collaborative skills in educational activities?

3) In what ways do digital technologies enhance or limit critical thinking, self-directed learning, and satisfaction with the learning experience among university students?

3. LITERATURE REVIEW

Timotheus et al. (2022) conducted a research about Impact of digital technologies on learning outcomes of university students. The aim of this study is to examine the impact of digital technology on education ,specifically examining the factors shaping schools digital capacity and transformation in the context of an increasingly digitalized educational environment .A non –systematic literature review was conducted , organizing the findings particularly. The review focused on understanding the effects of digital technology on education, with an emphasis on the factor affecting schools digital capacity and transformation .The study found that ICT assimilation in school has abroad impact beyond student performance, influencing various educational aspects and stakeholders. Digital technology impacts schools preparedness, capacity for digital transformation, and interconnected factors within the educational ecosystem. The study concludes that ICT can positively contribute to schools digital transformation, but achieving effective integration requires understanding and addressing the complex factors involved. Identifying these factors is essential for schools to enhance their digital capacity and implement successful transformation strategies.

Rafiq, et al (2024) Conducted a research about Impact of digital technologies on learning outcomes of university students. The study aimed to find the impact of digital tools and online learning platforms on learning outcomes in higher education, focusing specifically on student engagement, motivation, and academic performance. It also sought to identify the main challenges and hurdle that educators and students experienced in adopting these technologies. The study used a quantitative research design and use a multistage sampling technique to select a sample of 350 students. Data was collected using a survey questionnaire based on a Likert scale and analysis aimed to determine the impact of digital tools on various learning outcomes. The result showed that digital tools significantly improved student's engagement, motivation, and academic performance. However challenges such as technical difficulties, limited access to resources, and insufficient training, which disrupted the effective use of these tools .The study concluded that digital tools and online platforms positively affected higher education learning outcomes but to fully realize these benefits, there is a need for enhanced technical support, professional development, and institutional development, and institutional backing. The findings provided valuable insights into digital integration in higher education offered suggestions for improving learning outcomes through digital tools.

Abid, et al (2024) Conducted a study about impact of digital technologies on learning outcomes in Pakistani university students. The aim of this study was to examine the impact of digital transformation on students' learning outcomes in Pakistani educational settings, with a focus on studying the supporting role of teacher strength. The researchers conducted a quantitative study, collecting data from 336 educators using structured surveys conducted through Google Forms. The data were analyzed using Smart-PLS 4, a structural equation modeling tool to study the relationships among digital transformation, teacher strength, and student learning outcomes. The study found that digital transformation significantly improved student learning outcomes and teacher strength played a key assisting role. Teachers who used digital tools were able to enhance student engagement and academic performance. The study concluded that teacher digital skills and resilience is essential for maximizing the educational benefits of digital transformation. These findings suggest that educational institutions should support teachers in improving their digital skills and resilience to improve student learning outcomes.

Muneer, et al (2019) Conducted the research about Impact of digital technologies on learning outcomes university students. The research aimed to examine the impact of advanced technology on teaching and learning processes in college-level training environments. Specifically it desired to understand the positive and negative impacts of technology use on educational practices, as well as its effects on both students and teachers in terms of experience and adjustment. A quantitative research approach was

adopted, using a survey to collect data from 25 educators and 25 students. The statically test was applied to analyze the results. The survey explored the effects of advanced technology on learning and teaching experiences, exploring how both teachers and students acknowledge to technology in education. The study discovered that advanced technology had both positive and negative impacts on education. While it improved data entry and improved social data processing, it also contributed to increased workload and a sense of impartiality from traditional learning. Of the 50 respondents, 33% preferred using Google search engines for gathering information while the remainder preferred library resources for valid information. Additionally 41% of students were less motivated to learn, showing signs of inertia due to technology. However, the advanced system did positively impact student's academic performance by making information and resources more accessible. The study resolved that while advanced technology offers greater ease in accessing information and supports academic achievement it also poses challenges including a contraction in motivation for learning and a shift away from traditional educational values. The result highlighted the need to balance technology integration with traditional teaching strategies at the college level.

Yadav, (2024) Conducted a research about impact of digital technologies on learning outcomes of university students. The aim of this study was to explore the evolution of digital learning, examining its historical development, current trends, and future prospects while analyzing the challenges and opportunities it offered. It explored to examine the efficiency of digital teaching techniques and their impact on student performance. The study consumed an analysis of empirical studies and case examples to assess the usefulness of digital learning techniques. It studied various case studies to analyze how these digital teaching methods impacted student performance and learning outcomes. The outcomes of the study highlighted both the benefits and challenges of digital learning highlighting its potential to provide more specific and flexible learning experiences. However issues such as accessibility, equity, and quality were spotted as significant challenges that needed to be addressed for the full potential of digital learning to be realized. The study concluded that digital learning had the ability to significantly alter the educational landscape. It called for continued research and lawmaking efforts to overcome its challenges such as accessibility and equity and to fully unlock its transformative potential.

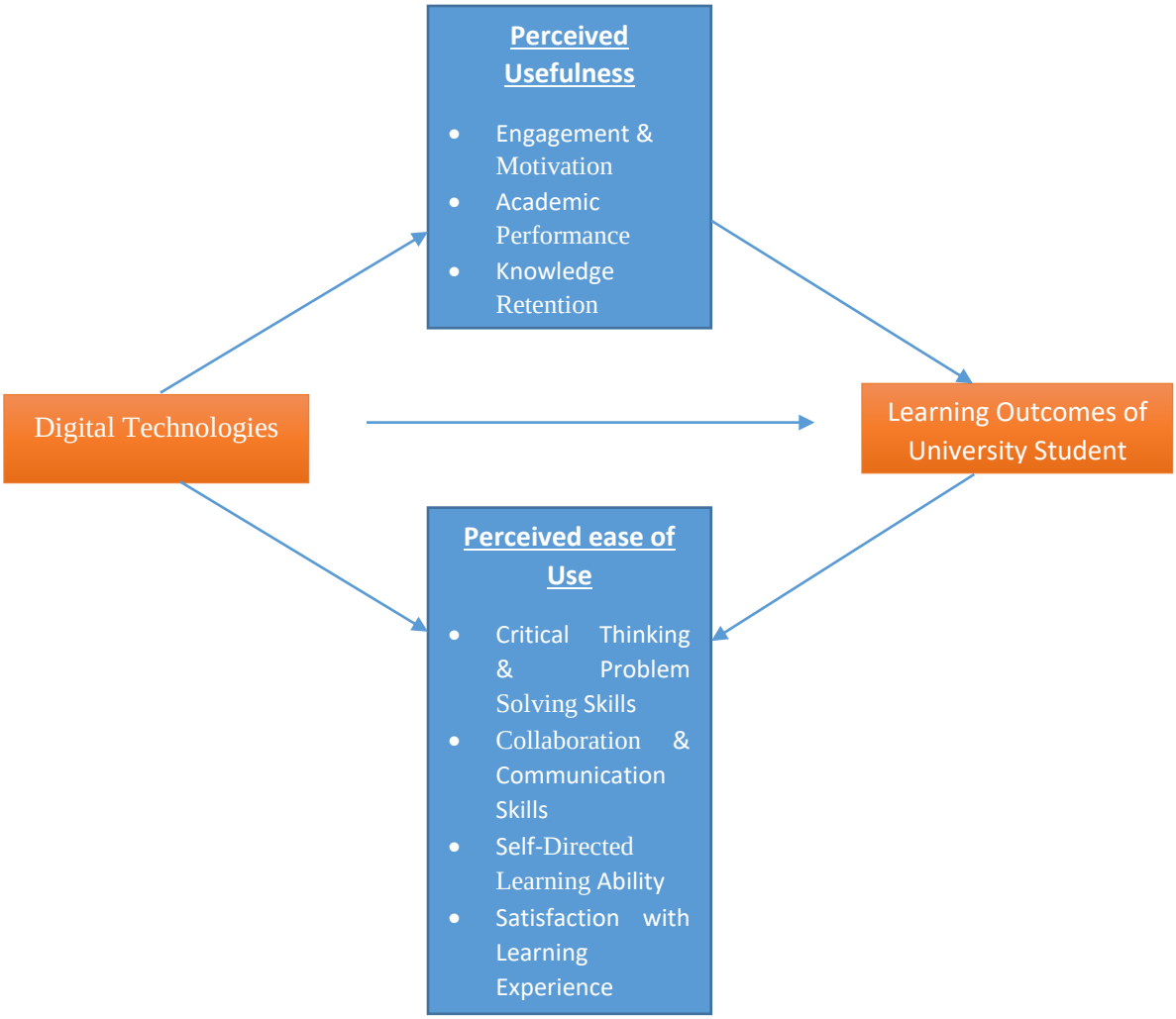
Carstens, et al (2021) conducted a research about impact of digital technologies on learning outcomes of university students. The aim of this study was to study the effects of technology on student learning particularly how technology affected classroom dynamics and student engagement. The methodology involved surveying K-12 educators to gather feedback on how technology modified their classrooms and student learning. This feedback was used to evaluate the impact of technology on educational processes. The result revealed that additional training for both teachers and students was necessary to improve the effective application of technology in the classroom. The research also showed that while technology increased student engagement and satisfaction it could lead to management challenges. The study finalized that while technology had a positive impact on student engagement and ease it required careful implementation to avoid over reliance which could potentially affect student's fine motor development and problem solving skills. It anxious the importance of providing more training to both teachers and students for effective use of technology in the classroom.

Okoye, et al (2024) Conducted a research about impact of digital technologies on learning outcomes of university students. The study aimed to uncover the depth to which digital technologies were utilized to enhance teaching and learning in HEIs across LATAM. It craved to identify key challenges stopping effective execution and to assess how digital technology impacted education processes in the region. The study applied a mixed method approach with both quantitative and qualitative analyses. Data was collected from a survey of HEI faculty members across nine LATAM countries. For qualitative analysis a Text Mining technique including belief and affective value analysis was used to analyze participants' textual responses. Quantitatively the study employed a Kruskal–Wallis H-test to assess differences in response patterns across countries regarding technology use, barriers, and implementation factors. The findings revealed that faculty members identified primary challenges to digital technology coordination,

including a lack of training, infrastructure and resources, internet access, and digital platform accessibility. These issues were steady across the surveyed LATAM countries. The study concluded that addressing the highlighted barriers such as insufficient training resources and infrastructure would be crucial for HEIs in LATAM. It clarified that effective policy making, financial investment, and strategic decisions were essential for merging digital technologies which are increasingly vital in education.

Javed, et al (2022) Conducted a research about impact of digital technologies on learning outcomes of university students. The aim of this study was to explore the necessity of digital technologies in education and to study the main applications and challenges faced within the educational field. The study involved reviewing current literature and existing data to analyze how digital technologies affected education. It concentrated on detecting ways digital tools supported learning during the epidemic reviewing both benefits and potential challenges that emerged. The result highlighted that digital technologies played a critical role in education by facilitating the shift to online learning and making the education system more adjustable and attainable. Technologies helped in knowledge co- creation, sponsorship, and evaluation. Students benefited from using digital tools like software and e-books, which refined engagement and interest in learning. In conclusion the fusion of digital technologies in education made a transformative impact on the learning experience. It shifted the role of education from a simple knowledge source to a multidimensional platform that actively engaged students, increased accessibility, and adapted to current needs. However while these advancements offered notable benefits, the paper also recognized ongoing challenges to address for optimizing digital technology use in education.

Study Model



4. METHODOLOGY

Methodology of the study was quantitative in nature and data was collected from the target public using self-designed questionnaire. Population of the study was university students and sample was taken from the four (4) universities including two from Rawalpindi (Rawalpindi Women University (RWU), Arid Agriculture University) and two from Islamabad (NUML and HITECH). Eligible to fill the questionnaire were currently enrolled university students who using digital tools (e.g. learner Platforms, electronic books, web TV etc.). Questionnaire was distributed among 210 students of selected universities and in returned (n=177) completely filled questionnaire were received. Sampling technique of the study was non-probability (available and convenient). The designed questionnaire was consisted on four (4) segments including Demographics (age, gender, program, yea of the study), Utilization of digital tools (usage frequency, tool applicability), Perception of digital tools (ease of use, satisfaction, effectiveness) and Learning outcomes (grades, skill acquisition, motivation, etc.) The researchers used a 5-point Likert scale for perception-based questions. Informed consent was obtained from all participants before filling out the survey. Participants were assured of the anonymity and confidentiality of their responses. The survey was voluntary, and participants had the right to withdraw at any stage. The collected data was process using Statistical Packages for Social Sciences (SPSS) software to draw the results.

5. RESULTS

Table 1: *Demographics of the respondents.*

S No.	Questions	Responses	*f*	%
1	Gender	Male	76	42.9
		Female	101	57.1
2	Age	18-32	102	57.6
		24-29	61	34.5
		30 & above	14	7.9
3	Qualification	BS	129	72.9
		MS/M.Phil.	36	20.3
		PhD	12	6.8
4	University Name	RWU	73	41.2
		ARID	11	6.2
		NUML	67	37.9
		HITECH	26	14.7
5	Household Monthly Income	<=50000	46	26.0
		50000-100000	43	24.3
		100000-150000	29	16.4
		150000-200000	31	17.5
		>200000	28	15.8

Above table shows the demographics of respondents. Demographics of respondents include university to whom they belong as data was collected from four universities of Rawalpindi, Islamabad. Respondent's gender male or female, class from BS to PhD, age group, and family monthly income.

Table 2: *Digital Technologies use (Independent Variable)*

Sr	Questions	Reponses	*f*	%	M	SD
1	I regularly employ digital technologies (e.g., computers, smartphones e learning services) in academic work.	Strongly Disagree	8	4.5	4.04	1.008
		Disagree	4	2.3		
		Neutral	26	14.7		
		Agree	74	41.8		
		Strongly Agree	65	36.7		
2	Digital technologies make	Strongly Disagree	4	2.3	4.23	.869

	learning more accessible and convenient for me.	Disagree	2	1.1		
		Neutral	21	11.9		
		Agree	73	41.2		
		Strongly Agree	77	43.5		
3	I am comfortable using digital learning tools and resources.	Strongly Disagree	2	1.1	4.29	.799
		Disagree	4	2.3		
		Neutral	14	7.9		
		Agree	78	44.1		
		Strongly Agree	79	44.6		
4	Digital technologies are aiding me in becoming more organized and deliver my academic work in a timely manner.	Strongly Disagree	5	2.8	4.16	.903
		Disagree	14	2.3		
		Neutral	18	10.2		
		Agree	81	45.8		
		Strongly Agree	69	39.0		
5	Self-directed learning is a powerful process when digital tools are in abundance.	Strongly Disagree	3	1.7	4.07	4.12
		Disagree	3	1.7		
		Neutral	31	17.5		
		Agree	81	45.8		
		Strongly Agree	59	33.3		
6	The introduction of digital technologies also improves the effectiveness of learning activities.	Strongly Disagree	5	2.8	4.12	.921
		Disagree	5	2.8		
		Neutral	20	11.3		
		Agree	80	45.2		
		Strongly Agree	67	37.9		
7	Online learning platforms improve access to educational resources.	Strongly Disagree	3	1.7	4.16	.899
		Disagree	9	5.1		
		Neutral	14	7.9		
		Agree	81	45.8		
		Strongly Agree	70	39.5		
8	Communication with teachers and peers improves through digital platforms.	Strongly Disagree	6	3.4	4.10	.942
		Disagree	4	2.3		
		Neutral	22	12.4		
		Agree	79	44.6		
		Strongly Agree	66	37.3		
9	Adding digital tools to the learning experience leads to more positive learning outcomes.	Strongly Disagree	4	2.3	4.07	.866
		Disagree	4	2.3		
		Neutral	24	13.6		
		Agree	28	49.7		
		Strongly Agree	57	32.2		
10	Such as e-books and video lessons, digital resources promote academic progress.	Strongly Disagree	2	1.1	41.6	.886
		Disagree	6	3.4		
		Neutral	27	15.3		
		Agree	68	38.4		
		Strongly Agree	74	41.9		

The data from the survey reflected the perceptions and engagement of the participants concerning digital technologies in the academic context. The significant majority use the stated digital tools regularly, such as computers, smartphones, and e-learning platforms, with a combined 78.5% either agreeing or strongly agreeing with the statement, yielding a high mean score (M = 4.04, SD = 1.008). Supportive of digital technologies seemed accessibility and convenience in learning (M = 4.23, SD = 0.869), and participants expressed comfort in utilizing digital learning resources (M = 4.29, SD = 0.799). Furthermore, the data

generated indicates that digital tools were perceived as aiding organization and timely submission of academic tasks (M = 4.16, SD = 0.903). Respondents reported that these tools were also instrumental for self-directed learning (M = 4.12) and enhancing the effectiveness of learning activities (M = 4.12, SD = 0.921) and access to educational resources (M = 4.16, SD = 0.899). These platforms also enhanced communication with instructors and peers (M = 4.10, SD = 0.942), were viewed as contributing to positive learning outcomes (M = 4.07, SD = 0.866) and supported academic progress through e-resources like e-books and video lessons (M = 4.16, SD = 0.886).

Table 3: *Learning Outcomes (Dependent Variable) Perceived Usefulness*

Sr	Questions	Responses	*f*	%	M	SD
		Engagement & Motivation				
11	Digital technologies make learning more engaging for me.	Strongly Disagree	6	3.4	3.98	.988
		Disagree	9	5.1		
		Neutral	25	14.1		
		Agree	80	45.2		
		Strongly Agree	57	32.2		
12	Digital technologies help sustain my focus during learning sessions.	Strongly Disagree	5	2.8	3.91	1.057
		Disagree	15	8.5		
		Neutral	32	18.1		
		Agree	64	36.2		
		Strongly Agree	61	34.5		
13	Online learning tools motivate me keep on schedule.	Strongly Disagree	5	2.8	3.97	1.011
		Disagree	12	6.8		
		Neutral	27	15.3		
		Agree	73	41.2		
		Strongly Agree	60	33.9		
14	I am motivated to engage in academic tasks when using digital technology.	Strongly Disagree	6	3.4	4.03	.985
		Disagree	7	4.0		
		Neutral	26	14.7		
		Agree	75	42.4		
		Strongly Agree	63	35.6		
		Academic Performance				
15	Digital technologies enhance my ability to complete assignments successfully.	Strongly Disagree	5	2.8	4.24	.892
		Disagree	1	.6		
		Neutral	21	11.9		
		Agree	70	39.5		
		Strongly Agree	80	45.2		
16	My studies are grounded in digital technology to answer difficult academic questions.	Strongly Disagree	3	1.7	4.21	.902
		Disagree	6	3.4		
		Neutral	21	11.9		
		Agree	68	38.4		
		Strongly Agree	79	44.6		
17	I believe that I will be able to improve my academic performance with the assistance of digital tools.	Strongly Disagree	2	1.1	4.25	.824
		Disagree	2	1.1		
		Neutral	25	14.1		
		Agree	68	38.4		
		Strongly Agree	80	45.2		
18	Digital technologies help improve my grades or academic achievements.	Strongly Disagree	2	1.1	4.20	.862
		Disagree	6	3.4		
		Neutral	21	11.9		
		Agree	73	41.2		

		Strongly Agree	75	42.4		
		Knowledge Retention				
19	I can remember better what I have learned from digital technologies.	Strongly Disagree	4	2.3	4.06	.942
		Disagree	8	4.5		
		Neutral	25	14.1		
		Agree	76	42.9		
		Strongly Agree	64	36.2		
20	Digital tools help me retain key concept for exams.	Strongly Disagree	2	1.1	4.18	.858
		Disagree	7	4.0		
		Neutral	19	10.7		
		Agree	79	44.6		
		Strongly Agree	70	39.5		
21	Multimedia (e.g. videos and infographics) help improve my recall of information over the long run.	Strongly Disagree	4	2.3	4.12	.931
		Disagree	7	4.0		
		Neutral	22	10.7		
		Agree	75	44.6		
		Strongly Agree	69	39.5		
22	I revisit online resources to reinforce my knowledge.	Strongly Disagree	4	2.3	4.13	.948
		Disagree	8	4.5		
		Neutral	21	11.9		
		Agree	72	40.7		
		Strongly Agree	72	40.7		

In this area of the survey, as articulated the multi-dimensional importance of digital technologies in student engagement, their academic progress, and retention of knowledge. In terms of engagement and motivation, a significant percentage of respondents declare that digital technologies make learning more interesting (M = 3.98, SD = 0.988), they sustain focus (M = 3.91, SD = 1.057), and it motivates them to remain up-to-date with academic responsibilities (M = 3.97, SD = 1.011). Besides, 78% agreed or strongly agreed that digital tools would promote their motivation for academic tasks (M = 4.03, SD = 0.985).

With regards to academic performance, most confirmed that digital technologies bring about successful achievement in assignment completion (M = 4.24, SD = 0.892) and aid the solving of problems in complicated academic situations (M = 4.21, SD = 0.902). Respondents showed very strong belief that digital tools would improve academic performance (M = 4.25, SD = 0.824) and overall academic achievement(M = 4.20, SD = 0.862).

In terms of the retention of knowledge, the subjects responded to recall and understanding, via the use of audio-visual tools (M = 4.06, SD = 0.942), while they found multimedia capacity to retain such knowledge for a more extended period to be verified by (M = 4.12, SD = 0.931). Most of the respondents affirm that they return to the latter online resources to reinforce their learning similar to M = 4.13, SD = 0.948. Therefore, it shows that modern digital technologies poseca supportive role in carrying on this academic endeavor.

Table 4: *Perceived ease of Use*

Sr	**Questions**	**Responses**	***f***	**%**	**M**	**SD**
		Critical Thinking & Problem Solving Skills				
23	Online tools foster my ability to evaluate and apply solutions.	Strongly Disagree	4	2.3	4.01	.935
		Disagree	7	4.0		
		Neutral	31	17.5		
		Agree	76	42.9		
		Strongly Agree	59	33.3		

24	Digital tools increase my capacity to think about and solve academic issues.	Strongly Disagree	1	.6	4.12	.854
		Disagree	7	4.0		
		Neutral	28	15.8		
		Agree	75	42.4		
		Strongly Agree	66	37.3		
25	Digital technologies have improved my overall problem solving skills.	Strongly Disagree	2	1.1	4.12	.906
		Disagree	5	2.8		
		Neutral	36	20.3		
		Agree	61	34.5		
		Strongly Agree	73	41.2		
26	Digital resources also facilitate access to tackle critical academic problems in complex ways.	Strongly Disagree			4.18	.784
		Disagree	4	2.3		
		Neutral	29	16.4		
		Agree	75	42.2		
		Strongly Agree	69	39.0		
Collaboration & Communication Skills						
27	Digital platforms are useful for organize group colloquium or teamwork.	Strongly Disagree	3	1.7	4.11	.891
		Disagree	3	1.7		
		Neutral	34	19.2		
		Agree	68	38.4		
		Strongly Agree	69	39.0		
28	I use digital tools to collaborate on academic tasks.	Strongly Disagree	2	1.1	4.15	.880
		Disagree	7	4.0		
		Neutral	24	13.6		
		Agree	74	41.8		
		Strongly Agree	70	39.5		
29	Online collaboration tools enhance my teamwork abilities.	Strongly Disagree	3	1.7	4.11	.929
		Disagree	6	2.8		
		Neutral	34	19.2		
		Agree	62	35.0		
		Strongly Agree	73	41.2		
30	Digital tools enhance my interaction with fellow students and teachers.	Strongly Disagree	5	2.8	4.10	.896
		Disagree	3	1.7		
		Neutral	24	13.6		
		Agree	83	46.9		
		Strongly Agree	62	35.0		
Self-Directed Learning Ability						
31	I use online resources to explore topics independently.	Strongly Disagree	7	4.0	4.14	.964
		Disagree	4	2.3		
		Neutral	17	9.6		
		Agree	78	44.1		
		Strongly Agree	71	40.1		
32	Digital tools help me create my own learning goals.	Strongly Disagree	5	2.8	4.12	.943
		Disagree	5	2.8		
		Neutral	24	13.6		
		Agree	73	41.8		
		Strongly Agree	70	40.1		
33	Digital technologies are useful in tracking my learning progress.	Strongly Disagree	2	1.1	4.21	.846
		Disagree	5	2.8		
		Neutral	21	11.9		

		Agree	74	41.8		
		Strongly Agree	75	42.4		
34	Digital technologies encourage me to take responsibility for my own learning.	Strongly Disagree	1	.6	4.17	.849
		Disagree	7	4.0		
		Neutral	24	13.6		
		Agree	74	41.8		
		Strongly Agree	71	40.1		
Satisfaction With Learning Experience						
35	Digital tools meet my expectations in enhancing learning.	Strongly Disagree	7	4.0	4.09	.937
		Disagree	2	1.1		
		Neutral	22	12.4		
		Agree	83	46.9		
		Strongly Agree	63	35.6		
36	Digital technologies make learning make enjoyable for me.	Strongly Disagree	4	2.3	4.08	.922
		Disagree	8	4.5		
		Neutral	20	11.3		
		Agree	82	46.3		
		Strongly Agree	63	35.6		
37	I would suggest digital technology for learning to my peers.	Strongly Disagree	1	.6	4.15	.847
		Disagree	6	3.4		
		Neutral	28	15.8		
		Agree	73	41.2		
		Strongly Agree	69	39.0		
38	I am happy with the learning experience digital tools have to offer.	Strongly Disagree	1	.6	4.19	.774
		Disagree	3	1.7		
		Neutral	24	13.6		
		Agree	82	46.3		
		Strongly Agree	67	37.9		

The conclusions indicate how far-reaching digital technologies are across the very critical dimensions of the learning process. Regarding critical thinking and problem-solving, respondents generally believed that online tools facilitate their evaluations and application of solutions (M = 4.01, SD = 0.935) and further help them in addressing academically challenging issues (M = 4.12, SD = 0.854). In addition, these digital tools were said to allow for enhanced problem-solving skills (M = 4.12, SD = 0.906) with the ability to offer some more relevant and useful resources when working on complex academic issues (M = 4.18, SD = 0.784).

Digital platforms were believed to be effective in organizing teamwork in the collaboration and communication skills area (M = 4.11, SD = 0.891), in the facilitation of academic collaboration (M = 4.15, SD = 0.880), and in promoting interaction between students and teachers (M = 4.10, SD = 0.896).

In the area of self-directed learning, participant anonymity was high for exploring topics (M = 4.14, SD = 0.964), goal setting (M = 4.12, SD = 0.943), and progress monitoring (M = 4.21, SD = 0.846). Digital tools fostered a sense of responsibility for learning (M = 4.17, SD = 0.849).

Finally, within the learning experience context, most students agreed that digital technologies are up to their expectations (M = 4.09, SD = 0.937), learning was interesting (M = 4.08, SD = 0.922), and that they would recommend these tools for their peers (M = 4.15, SD = 0.847). Participants recorded an overall high level of satisfaction with digital learning experiences (M = 4.19, SD = 0.774), indicating that students had a positive feeling towards them.

6. DISCUSSION

The aim of this research was to study the effects of digital technologies, such as academic success, motivation, engagement, collaboration, critical thinking and self- directed learning on university students. Result shows complex associations between digital tools and student's performance, with advantages and disadvantages depending upon the use of these technologies.

Impact on Academic Performance: Results show that digital technology may produce a positive as well as a negative effect on academic results. It is known from studies that if students are properly set up with the tools of the digital age (online courses and educational software) their academic performance analyzed by means of test papers/grade point averages (GPAs), will be that much better (Brown Green, 2020). This corresponds with the research by Johnson et al. (2021) who reported that students using personalized learning tools performed better. However the use of no educational digital applications like social networking platforms or games could result in escape a decrease in focus on academic work and a negative effect on student performance (Kuh, 2019). These results urge the need for strong attention to the application of digital tools in order that they do not suit the need for learning and do not become a diversion.

Engagement, Motivation, and Collaboration: The results of the second research question show that there can be positive effects of digital technology in terms of students' engagement, collaboration and motivation. Technologies such as online multimedia have been expressed to be effective for encouraging student engagement (Tucker et al., 2022). As an example, student learning can be stimulated by simulations and gamified learning, are contexts that, in addition to being engaging have also been revealed as effective in enhancing student learning (e.g., Deci et al., 2020). Moreover, digital instruments also improve motivation by providing personalized feedback allowing students to learn at their own pace, a learning sequence that can be easily adjusted to various learning styles (Schunk et al., 2022). But learning difficulties with digital collaboration can occur for some students, especially in virtual contexts one that is likely to see problems related to insufficient communication, and disproportionate contributions to group task, for example (Williams et al., 2023). As would be expected by earlier which confirmed that digital platforms when they promote collaboration can at the same time create new conditions for cooperation (Sotardi, 2020).

Critical Thinking, Self-Directed Learning, and Satisfaction: The result of the third research question is the effect of digital technologies on critical thinking, self-directed learning, and satisfaction, the results show both positive and negative effects. Digital technologies that make learning resources, online courses, and other instructional materials available to student's right from the start help develop student autonomy in their learning (Caverly et al., 2021). This is the proved by the study of Hargis et al. (2018) who reported that students used online learning tools tended to be more autonomous about their learning ownership and learning tools ended to be more autonomous about their learning ownership and their own exploration of the subject. Accessing information online is very easy, but it can sometimes make students less likely to think deeply. Instead they might depend on quick answers without fully understanding the material (Duffy & Cunningham, 2021). This aligns with the findings of Finkelstein et al. (2020) found that while digital tools offer many learning opportunities, they also make it harder for students to engage critically with what they are learning. This is a further replication of the previous work of Checkering and Gammon (1987), which highlights the feeling part of a community and having good communication with instructors are key to students being happy with online learning.

Implications for Higher Education: Using digital technology in education needs to be done carefully and thoughtfully. Although digital applications can very powerfully enhance academic study, engagement and working together their success depends on how they are used in the curriculum. Teachers are required to combine digital technologies with old fashioned approaches, in order to provide the students with a complete education that promotes critical thinking and problem solving (Bates Poole, 2019). Additionally, both teachers and students in higher education are urged to focus on digital literacy and to

be trained in how to move about the digital world (Greenhow et al., 2020). As digital technologies continue to evolve, school and universities must create environments that support both strong digital skills and traditional academic learning.

7. CONCLUSION

The study concluded that digital technologies have the potential to significantly affect the learning outcomes of university students. While they offer numerous benefits in terms of academic performance, student engagement, and collaboration, challenges remain in ensuring that these tools promote critical thinking and self-directed learning. The findings suggest that universities should take a whole-system attitude to the introduction of digital integration, integrating digital tools with the key features of face-to-face learning and community building. Through careful planning and judicious use, digital technologies can play an important role to play in improving the student's learning experience and supporting in their dynamic world.

Acknowledgments

None.

Disclosure Statement

No potential conflict of interest was reported by the authors.

Funding Source

The authors received NO funding to conduct this study.

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