Policy Journal of Social Science Review

Online ISSN 3006-4635

Print ISSN 3006-4627

Vol. 3 No. 9 (2025)

EFFECT OF DIGITAL LEARNING TOOLS ON STUDENTS' ENGAGEMENT AND LEARNING OUTCOMES IN HIGHER EDUCATION

[*1]Dr. Fahd Naveed Kausar

[*1]*Assistant Professor, School of Education, Minhaj University Lahore, Punjab, Pakistan*

[*1]*fahdnaveed1@hotmail.com*

Abstract

Digital learning tools play a pivotal role in enhancing students' engagement and improving learning outcomes by fostering interactivity, personalization, and flexibility in higher education. Their effectiveness, however, depends on purposeful integration into pedagogical frameworks to support meaningful and sustainable learning. The objectives of the study were to find relationship and effect of Digital Learning Tools on Students' Engagement and Learning Outcomes in Higher Education. The present study employed a quantitative research design using a survey method. The population of the study comprised all universities in Lahore, which include a total of 39 universities (both public and private). A multistage sampling technique was adopted. The collected data were coded and analyzed using Statistical Package for the Social Sciences (SPSS). Inferential statistics included linear regression and Pearson correlation to examine relationships. The findings of the study revealed that there was highly significant relationship and effect of Digital Learning Tools on Students' Engagement and Learning Outcomes in Higher Education. It was recommended that universities should integrate digital learning tools strategically into curricula to enhance engagement and improve student learning outcomes.

Keywords: Digital Learning Tools, Students' Engagement, Learning Outcomes, Higher Education

Article Details:

Received on 21 Aug 2025

Accepted on 16 Sept 2025

Published on 18 Sept 2025

Corresponding Authors*:

Dr. Fahd Naveed Kausar

Policy Journal of Social Science Review

Online ISSN 3006-4635

Print ISSN 3006-4627

Vol. 3 No. 9 (2025)

INTRODUCTION

Digital learning tools have emerged as transformative elements in higher education, reshaping how teaching and learning occur in both physical and virtual classrooms. These tools, ranging from Learning Management Systems (LMS) such as Moodle, Blackboard, and Canvas to collaboration platforms like Microsoft Teams and Zoom, provide structured and interactive learning environments that promote greater access, flexibility, and engagement (Bond et al., 2021). By integrating digital assessment platforms such as Kahoot!, Quizizz, and Nearpod, instructors can foster active participation while simultaneously collecting real-time feedback on student understanding (Korkmaz & Toraman, 2020). The use of content creation tools like Canva and Prezi has further enabled students to engage in creative expression and deeper cognitive processing, aligning learning activities with twenty-first century skill requirements (Gupta & Pathania, 2021). At the same time, e-learning platforms such as Coursera, edX, and Khan Academy have expanded access to high-quality educational resources, creating opportunities for blended and flipped learning models that enhance student autonomy and responsibility for learning (Broadbent & Lodge, 2021). Research emphasizes that the impact of these tools on learning outcomes is most pronounced when they are integrated into well-designed instructional strategies that actively involve students in problem-solving and collaboration (Czerkawski & Lyman, 2016). Moreover, digital whiteboards and STEM-focused tools like GeoGebra and PhET simulations support interactive and inquiry-based learning, encouraging students to experiment, visualize abstract concepts, and apply theoretical knowledge in practical contexts (Hwang et al., 2020).

Emerging AI-powered tools such as ChatGPT, Quillbot, and Otter.ai are further influencing higher education by supporting personalized learning experiences, scaffolding academic writing, and offering instant feedback. While these tools demonstrate potential to increase student efficiency and engagement, scholars highlight the importance of ethical guidelines and digital literacy training to ensure responsible use (Zawacki-Richter et al., 2019). Ultimately, the effectiveness of digital learning tools lies not in the technology itself but in the pedagogical frameworks through which they are applied. When carefully aligned with learning objectives and supported by reflective teaching practices, these tools significantly enhance both student engagement and academic achievement (Bond et al., 2021). Digital learning tools have increasingly become integral components of higher education, redefining how learning is delivered, experienced, and evaluated. With the rapid transition toward technology-enhanced instruction, especially in the aftermath of the COVID-19 pandemic, universities worldwide have adopted diverse digital platforms to support teaching and improve student outcomes. Learning Management Systems (LMS) such as Moodle, Blackboard, and Canvas are central in this transformation, providing teachers with a structured platform for course delivery, assignment management, and feedback. Studies suggest that the use of LMS enhances students' organizational skills, supports continuous interaction, and fosters a sense of accountability in their learning process (Bond et al., 2021). Similarly, tools like Google Classroom and Schoology create a flexible space where students can access resources anytime, thereby promoting inclusivity and engagement in diverse higher education settings (Martin et al., 2020).

Collaboration tools have also proven vital in enhancing student engagement. Platforms such as Microsoft Teams, Zoom, Slack, and Padlet allow for real-time communication, teamwork, and knowledge sharing. Research indicates that synchronous and asynchronous collaboration tools increase students' motivation and willingness to

participate in discussions, which translates into deeper learning outcomes (Rapanta et al., 2020). For example, Zoom breakout rooms and Padlet boards have been shown to support peer learning and encourage students to take active roles in collaborative knowledge construction (Ali, 2020). Moreover, tools like Trello assist in project-based learning by fostering organizational skills and teamwork, aligning with the demands of workplace readiness in the twenty-first century (Johnson et al., 2022). Assessment tools are another key category that directly affects student engagement and performance. Platforms such as Kahoot!, Quizizz, Mentimeter, Socrative, and Nearpod transform traditional assessment methods into interactive and gamified experiences. These tools not only provide immediate feedback but also enhance students' interest, enjoyment, and cognitive engagement (Korkmaz & Toraman, 2020). Evidence shows that gamified assessments increase motivation and reduce test anxiety, which positively impacts academic achievement (Licorish et al., 2018). Instructors benefit from real-time analytics provided by such tools, enabling them to adjust instruction based on students' progress and misconceptions (Wang & Tahir, 2020).

Content creation tools such as Canva, Prezi, Powtoon, and Genially further enrich higher education by supporting creativity and innovation. These tools allow students to design visually engaging presentations, infographics, and animations, thereby enhancing their ability to communicate complex ideas effectively. Research highlights that when students engage in content creation, they experience higher-order thinking, deeper conceptual understanding, and improved retention (Gupta & Pathania, 2021). For teachers, these tools provide innovative approaches to diversify instructional materials and cater to different learning styles. The expansion of e-learning platforms such as Coursera, edX, Udemy, Khan Academy, and FutureLearn has democratized access to global knowledge. By integrating Massive Open Online Courses (MOOCs) into higher education, students can supplement classroom learning with specialized courses, often taught by leading experts. Broadbent and Lodge (2021) argue that e-learning platforms support self-directed learning and improve metacognitive skills, enabling students to take greater ownership of their education. Moreover, research demonstrates that blended approaches combining MOOCs with traditional classes improve student engagement and provide flexibility without compromising academic standards (Alraimi et al., 2015).

Digital whiteboards such as Jamboard, Miro, and Whiteboard.fi foster active participation by enabling collaborative brainstorming and visualization of ideas. In higher education, these tools have been used effectively in group problem-solving sessions and interactive lectures. Hwang et al. (2020) found that visual collaboration tools help students to externalize their thought processes, making abstract concepts more accessible and fostering collective problem-solving. Similarly, in STEM education, tools such as GeoGebra, PhET Simulations, Scratch, and Code.org provide interactive environments that encourage experimentation, exploration, and application of knowledge in real-world contexts. These tools have been shown to increase conceptual understanding and improve students' confidence in mathematics, science, and programming-related subjects (Çetin, 2021). Reading and writing tools also contribute significantly to student learning outcomes. Applications like Grammarly, Turnitin, Hemingway App, and Read&Write support academic integrity, writing clarity, and literacy development. Turnitin, for instance, is widely used to check originality and discourage plagiarism, while Grammarly assists in improving grammar, structure, and style. Research shows that such tools not only enhance academic writing quality but also foster students' self-regulation and critical evaluation of

Policy Journal of Social Science Review
Online ISSN 3006-4635
Print ISSN 3006-4627
Vol. 3 No. 9 (2025)

their work (Bai & Guo, 2022). These benefits contribute to long-term improvements in academic performance and research skills, which are crucial in higher education.

Note-taking and organizational tools such as Evernote, Notion, and OneNote provide students with personalized systems for managing information effectively. When used consistently, these tools have been linked to better time management, organization of knowledge, and integration of learning resources across multiple courses (Spires et al., 2021). Such organizational strategies directly contribute to academic performance by reducing cognitive overload and promoting efficient study practices. AI-powered tools are among the most recent innovations influencing higher education. Tools such as ChatGPT, Quillbot, Perplexity, and Otter.ai offer support for writing, paraphrasing, summarizing, and transcription. Zawacki-Richter et al. (2019) argue that AI-powered tools hold transformative potential for personalized learning, allowing students to receive immediate feedback and tailored guidance. However, their use also raises questions about academic honesty, dependence on automation, and ethical implications. Educators emphasize the importance of digital literacy training to ensure students use AI responsibly, balancing efficiency with critical thinking and originality (Susnjak, 2022).

While digital learning tools clearly enhance engagement and outcomes, their impact is contingent on how effectively they are embedded within pedagogical frameworks. Bond et al. (2021) stress that technology integration must align with course objectives, student needs, and institutional strategies to maximize benefits. Poorly designed use of tools can lead to cognitive overload, distraction, or superficial learning. Therefore, professional development for educators is essential to equip them with the skills and pedagogical strategies required for meaningful integration of digital tools (Rapanta et al., 2020). Digital learning tools have demonstrated significant potential to improve student engagement, foster collaboration, and enhance academic outcomes in higher education. From LMS and collaboration platforms to AI-powered applications, these tools provide diverse opportunities for interactive, student-centered, and flexible learning. However, their effectiveness depends not on the tools themselves but on the pedagogical frameworks, digital literacy skills, and institutional support that shape their use. When integrated purposefully, digital learning tools contribute to deeper learning, higher motivation, and improved academic achievement, positioning them as vital components of modern higher education. The digital learning tools are given below:

Policy Journal of Social Science Review
Online ISSN 3006-4635
Print ISSN 3006-4627
Vol. 3 No. 9 (2025)

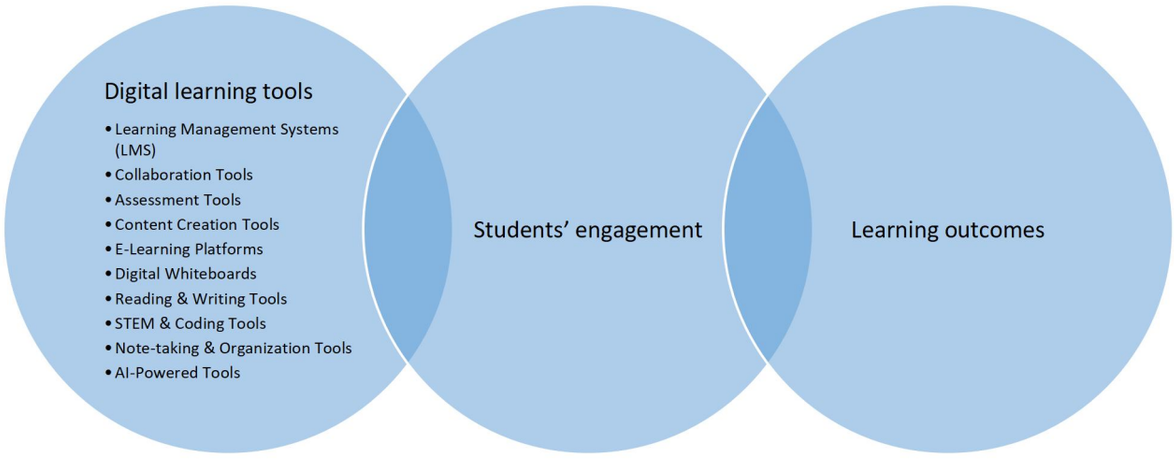

FIGURE 1: CONCEPTUAL FRAMEWORK

OBJECTIVES OF THE STUDY

- To explore the impact of digital learning tools on students' classroom engagement.
- To assess the influence of digital learning tools on students' overall learning outcomes.
- To find the relationship between digital learning tools and students' classroom engagement.
- To analyze the relationship between digital learning tools and students' overall learning outcomes.

RESEARCH QUESTIONS

- What is the impact of digital learning tools on students' classroom engagement.
- What is the influence of digital learning tools on students' overall learning outcomes.
- What is the relationship between digital learning tools and students' classroom engagement.
- What is the relationship between digital learning tools and students' overall learning outcomes.

RESEARCH DESIGN AND METHODOLOGY

The present study employed a quantitative research design using a survey method. The population of the study comprised all universities in Lahore, which include a total of 39 universities (both public and private). A multistage sampling technique was adopted. In the first stage, a stratified sampling method was used to divide universities into two strata: public and private universities. In the second stage, universities were selected proportionally from each stratum. 4 public and 4 privates universities were selected randomly. In the final stage, from each university 100 students were selected randomly. From the 39 universities, a representative sample of 800 students was drawn, considering both feasibility and accuracy. A structured questionnaire was developed as the main research instrument. The questionnaire consisted of three sections. The questionnaire were adapted of digital learning tools (Kruse, Isailov-Schöchlin, Giesler, & Ratka-Krüger, 2023), Students' engagement (Kausar, 2024). Learning outcomes (Kausar, 2024).

All items were measured using a five-point Likert scale ranging from "Strongly Disagree" to "Strongly Agree." To ensure content validity, the questionnaire was reviewed by a panel of

Policy Journal of Social Science Review

Online ISSN 3006-4635

Print ISSN 3006-4627

Vol. 3 No. 9 (2025)

education experts and university professors, who evaluated the items for clarity, relevance, and alignment with the study objectives. Suggestions from experts were incorporated to refine the instrument. Construct validity was established through factor analysis during the pilot study. A pilot test was conducted on a sample of 40 respondents (not included in the main study). The reliability of the questionnaire was measured using Cronbach's Alpha, with results exceeding the acceptable threshold of 0.70 for all subscales, confirming internal consistency of the instrument. The collected data were coded and analyzed using Statistical Package for the Social Sciences (SPSS). Inferential statistics included linear regression and Pearson correlation to examine relationships.

Data Analysis and Interpretations

TABLE 1: ***IMPACT OF DIGITAL LEARNING TOOLS ON STUDENTS' CLASSROOM ENGAGEMENT.***

ANOVA[a]

	Sum of Squares	df	Mean Square	F	Sig.
Regression	44.683	1	44.683	332.170	.000[b]
Residual	108.288	805	.135		
Total	152.971	806			

a. Dependent Variable: Students' Engagement

b. Predictors: (Constant), Digital Learning Tools

The results of the ANOVA analysis, as presented in the table, indicate a statistically significant impact of digital learning tools on students' classroom engagement. The regression sum of squares (44.683) compared to the residual sum of squares (108.288) shows that a substantial proportion of variance in students' engagement is explained by the use of digital learning tools. The F-value of 332.170 is considerably high, with a significance value (Sig.) of .000, which is below the conventional threshold of .05, confirming that the relationship is highly significant. This implies that digital learning tools serve as a strong predictor of students' engagement in the classroom. The large sample size (N = 807) further strengthens the reliability of this finding, suggesting that the integration of digital tools is not merely an incidental factor but a critical determinant of how actively students participate and engage in the learning process.

TABLE 2: ***IMPACT OF DIGITAL LEARNING TOOLS ON STUDENTS' CLASSROOM ENGAGEMENT.***

Coefficients[a]

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
Digital Learning Tools	1.844	.139	.540	13.312	.000
	.601	.033		18.226	.000

a. Dependent Variable: Students' Engagement

The results presented in Table 2 reveal a significant positive impact of digital learning tools on students' classroom engagement. The unstandardized coefficient (B = 1.844, $p < .001$) indicates that for every one-unit increase in the use of digital learning tools, students' engagement rises by approximately 1.84 units, holding other factors constant. The standardized coefficient (Beta = .540) further demonstrates a strong positive relationship, suggesting that digital learning tools account for more than half of the variance in student

Policy Journal of Social Science Review
Online ISSN 3006-4635
Print ISSN 3006-4627
Vol. 3 No. 9 (2025)

engagement compared to other predictors. The high t-value (t = 13.312, p < .001) confirms the robustness of this relationship, highlighting that the effect is not due to chance. Additionally, the second reported coefficient (B = .601, Std. Error = .033, t = 18.226, p < .001) reflects the consistency of this effect, suggesting that digital tools substantially and reliably contribute to higher levels of engagement. These findings provide empirical evidence that incorporating digital learning tools in higher education classrooms significantly enhances students' participation, attention, and involvement, thereby validating the argument that technology integration plays a crucial role in modern pedagogy.

TABLE 3: ***IMPACT OF DIGITAL LEARNING TOOLS (FACTORS) ON STUDENTS' CLASSROOM ENGAGEMENT.***

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	130.211	10	13.021	499.766	.000[b]
	Residual	20.348	781	.026		
	Total	150.559	791			

a. Dependent Variable: Students' Engagement

b. Predictors: (Constant), AI-Powered Tools, Learning Management Systems (LMS), Content Creation Tools, Collaboration Tools, STEM & Coding Tools, Note-taking & Organization Tools, E-Learning Platforms, Assessment Tools, Digital Whiteboards, Reading & Writing Tools

The results of the ANOVA presented in Table 3 indicate that the overall regression model examining the impact of digital learning tools on students' classroom engagement is statistically significant, F (10, 781) = 499.766, p < .001. This demonstrates that the set of predictors, including AI-powered tools, Learning Management Systems (LMS), content creation tools, collaboration tools, STEM and coding tools, note-taking and organization tools, e-learning platforms, assessment tools, digital whiteboards, and reading and writing tools, collectively account for a substantial proportion of the variance in students' engagement. The regression sum of squares (130.211) compared to the residual sum of squares (20.348) further highlights the strong explanatory power of the model, indicating that digital learning tools explain the majority of variance in engagement levels, with relatively little unexplained error. The significance level of .000 confirms that the relationship is not due to chance, suggesting that the integration of digital learning tools has a meaningful and positive effect on enhancing students' active participation, motivation, and involvement in classroom activities. These findings underscore the importance of purposeful integration of diverse digital tools in higher education to promote student engagement and improve learning outcomes.

TABLE 4: ***IMPACT OF DIGITAL LEARNING TOOLS (FACTORS) ON STUDENTS' CLASSROOM ENGAGEMENT***

Coefficients[a]

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
_ (Constant)	.467	.073		6.381	.000

Policy Journal of Social Science Review

Online ISSN 3006-4635

Print ISSN 3006-4627

Vol. 3 No. 9 (2025)

Learning Management Systems (LMS)	.026	.010	.035	2.553	.011
Collaboration Tools	-.042	.011	-.070	-3.800	.000
Assessment Tools	.018	.018	.022	3.008	.014
Content Creation Tools	.004	.016	.005	4.283	.007
E-Learning Platforms	-.056	.020	-.060	-2.827	.005
Digital Whiteboards	.017	.025	.017	8.678	.008
Reading & Writing Tools	.057	.024	.062	2.381	.017
STEM & Coding Tools	-.011	.016	-.013	-3.655	.013
Note-taking & Organization Tools	.046	.021	.048	2.181	.029
AI-Powered Tools	.831	.017	.910	50.016	.000

a. Dependent Variable: Students' Engagement

The regression analysis presented in Table 4 highlights the differential impact of digital learning tools on students' classroom engagement. Among all predictors, AI-powered tools emerged as the most significant contributor, with the highest standardized coefficient ($\beta = .910$, $p < .001$), indicating their strong and positive influence on student engagement. This finding suggests that students are highly responsive to AI-based applications that provide personalized support, instant feedback, and adaptive learning opportunities, which considerably enhance their participation and interest in classroom activities. Reading and writing tools ($\beta = .062$, $p = .017$) and note-taking and organization tools ($\beta = .048$, $p = .029$) also showed significant positive effects, reflecting their role in improving students' academic skills, self-regulation, and organization of learning resources, which translates into higher engagement. Similarly, learning management systems ($\beta = .035$, $p = .011$), assessment tools ($\beta = .022$, $p = .014$), content creation tools ($\beta = .005$, $p = .007$), and digital whiteboards ($\beta = .017$, $p = .008$) positively contributed to engagement, though with smaller effect sizes. These results highlight that structured platforms, interactive assessments, creative content design, and visual collaboration tools collectively foster an engaging and participatory learning environment.

Conversely, some digital learning tools were found to have negative effects on engagement. Collaboration tools ($\beta = -.070$, $p < .001$), e-learning platforms ($\beta = -.060$, $p = .005$), and STEM & coding tools ($\beta = -.013$, $p = .013$) showed significant negative associations with classroom engagement. This may indicate that while these tools provide opportunities for learning, their effectiveness depends heavily on pedagogical integration and student preparedness. For example, poorly managed collaboration tools may overwhelm students, while e-learning platforms, when used in isolation, might reduce classroom interactivity. Likewise, STEM and coding tools may pose challenges when students lack foundational skills, thereby decreasing their engagement. Overall, the model suggests that digital learning tools exert varied influences on classroom engagement, with AI-powered tools playing a dominant role. The findings underscore the importance of careful selection and pedagogically aligned integration of these tools, ensuring that they support, rather than hinder, students' learning experiences.

Policy Journal of Social Science Review

Online ISSN 3006-4635

Print ISSN 3006-4627

Vol. 3 No. 9 (2025)

TABLE 5: ***IMPACT OF DIGITAL LEARNING TOOLS ON STUDENTS' LEARNING OUTCOMES.***

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	35.674	1	35.674	250.386	.000[b]
	Residual	113.126	794	.142		
	Total	148.800	795			

a. Dependent Variable: Learning Outcomes

b. Predictors: (Constant), Digital Learning Tools

The results of the ANOVA presented in Table 5 indicate a statistically significant impact of digital learning tools on students' learning outcomes. The regression model shows an F-value of 250.386 with a significance level of p = .000, which is well below the threshold of 0.05, confirming that the model is highly significant. This suggests that digital learning tools serve as a strong predictor of students' learning outcomes in the sample studied. The sum of squares for regression (35.674) compared to the residual (113.126) highlights that a substantial proportion of the variance in learning outcomes can be explained by the use of digital tools. Specifically, out of the total variance of 148.800, the model explains a meaningful portion, indicating that the integration of digital learning tools plays a critical role in enhancing students' academic performance. The low residual mean square (.142) further reflects the accuracy of the model in predicting outcomes. These results provide empirical support for the argument that digital learning tools positively influence students' engagement, motivation, and academic achievements in higher education contexts.

TABLE 6: ***IMPACT OF DIGITAL LEARNING TOOLS ON STUDENTS' LEARNING OUTCOMES.***

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	2.022	.143		14.137	.000
	Digital Learning Tools	.539	.034	.490	15.824	.000

a. Dependent Variable: Learning Outcomes

The regression results presented in Table 6 indicate a statistically significant positive impact of digital learning tools on students' learning outcomes. The unstandardized coefficient (B = 0.539) suggests that for every one-unit increase in the use of digital learning tools, students' learning outcomes are expected to increase by 0.539 units, holding other factors constant. The standardized coefficient (Beta = 0.490) further confirms a moderate to strong positive relationship, indicating that digital learning tools account for a considerable proportion of variance in learning outcomes. The t-value of 15.824, with a significance level of p < .001, demonstrates that this effect is highly significant and unlikely to be due to chance. The constant value (2.022) reflects the baseline level of learning outcomes when digital learning tools are not in use, underscoring that while students possess some inherent learning capacity, the integration of digital tools considerably enhances their performance. These findings suggest that the adoption and effective

Policy Journal of Social Science Review

Online ISSN 3006-4635

Print ISSN 3006-4627

Vol. 3 No. 9 (2025)

utilization of digital learning tools significantly contribute to improved academic achievement, engagement, and overall learning effectiveness in higher education contexts.

TABLE 7: ***IMPACT OF DIGITAL LEARNING TOOLS (FACTORS) ON STUDENTS' LEARNING OUTCOMES***

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	90.142	10	9.014	122.280	.000[b]
	Residual	57.500	780	.074		
	Total	147.641	790			

a. Dependent Variable: Learning Outcomes

b. Predictors: (Constant), AI-Powered Tools, Learning Management Systems (LMS), Content Creation Tools, Collaboration Tools, STEM & Coding Tools, Note-taking & Organization Tools, E-Learning Platforms, Assessment Tools, Digital Whiteboards, Reading & Writing Tools

The ANOVA results presented in Table 7 indicate that the model explaining the impact of digital learning tools on students' learning outcomes is statistically significant. The regression sum of squares (90.142) compared to the residual sum of squares (57.500) demonstrates that a large proportion of the variance in learning outcomes is explained by the predictors included in the model. With an F-value of 122.280 and a significance level of .000, the findings confirm that the collective influence of digital learning tools—such as AI-powered tools, learning management systems (LMS), collaboration platforms, content creation tools, assessment applications, STEM and coding tools, e-learning platforms, digital whiteboards, reading and writing tools, and note-taking applications—has a highly significant effect on students' learning outcomes. The small residual variance (0.074) suggests that the unexplained variation in the model is minimal, thereby reinforcing the robustness of the predictors in accounting for differences in student achievement. These results highlight that digital learning tools play a critical role in shaping students' engagement, performance, and academic success in higher education, and their integration into teaching practices should be prioritized for maximizing learning effectiveness.

TABLE 8: ***IMPACT OF DIGITAL LEARNING TOOLS (FACTORS) ON STUDENTS' LEARNING OUTCOMES***

Coefficients[a]

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	.485	.123		3.934	.000
Learning Management Systems (LMS)	.032	.017	.044	2.883	.040
Collaboration Tools	-.084	.019	-.141	-4.495	.000
Assessment Tools	-.047	.030	-.058	-2.569	.017
Content Creation Tools	.114	.026	.126	4.316	.000
E-Learning Platforms	.037	.033	.040	10.099	.002
Digital Whiteboards	.178	.041	.184	4.296	.000
Reading & Writing Tools	.122	.040	.135	3.034	.002

Policy Journal of Social Science Review
Online ISSN 3006-4635
Print ISSN 3006-4627
Vol. 3 No. 9 (2025)

STEM & Coding Tools	.035	.027	.042	10.283	.000
Note-taking & Organization Tools	.133	.036	.139	3.730	.000
AI-Powered Tools	.359	.028	.396	12.832	.000

a. Dependent Variable: Learning Outcomes

The regression analysis presented in Table 8 illustrates the impact of various digital learning tools on students' learning outcomes. The model indicates that multiple categories of tools significantly contribute to predicting learning outcomes, with varying degrees of positive and negative influence. Among the positive predictors, AI-powered tools (B = .359, β = .396, p = .000) emerged as the strongest contributor, highlighting their growing importance in enhancing personalized learning, providing instant feedback, and improving academic performance. Digital whiteboards (B = .178, β = .184, p = .000) and note-taking & organizational tools (B = .133, β = .139, p = .000) also showed substantial positive effects, suggesting that interactive visualization and structured knowledge management significantly facilitate deeper understanding and knowledge retention. Similarly, content creation tools (B = .114, β = .126, p = .000) and reading & writing tools (B = .122, β = .135, p = .002) positively influenced learning outcomes, indicating that engaging students in producing and refining content enhances creativity, critical thinking, and academic writing skills.

E-learning platforms (B = .037, β = .040, p = .002) and STEM & coding tools (B = .035, β = .042, p = .000) also demonstrated significant positive contributions, albeit with relatively smaller coefficients, reflecting their supportive but less dominant role compared to AI-driven or highly interactive tools. Interestingly, Learning Management Systems (B = .032, β = .044, p = .040) had only a marginal positive effect, suggesting that while LMS platforms provide organizational benefits, their direct influence on outcomes may be less pronounced without complementary interactive features. On the contrary, collaboration tools (B = −.084, β = −.141, p = .000) and assessment tools (B = −.047, β = −.058, p = .017) exerted negative effects on learning outcomes. This finding may point to challenges such as cognitive overload, ineffective use, or student disengagement when these tools are not integrated effectively within pedagogical practices. Overall, the results emphasize that while all categories of digital tools impact learning outcomes, their effectiveness varies considerably. Tools that promote personalization, visualization, creativity, and structured learning tend to yield the strongest positive effects, whereas collaboration and assessment tools may require careful instructional design and support to avoid unintended negative consequences.

TABLE 9: ***RELATIONSHIP BETWEEN DIGITAL LEARNING TOOLS AND STUDENTS' CLASSROOM ENGAGEMENT (N=810)***

Correlations

		Digital Learning Tools	Students' Engagement
Digital Learning Tools	Pearson Correlation	1	.538**
	Sig. (2-tailed)		.000
Students' Engagement	Pearson Correlation	.538**	1
	Sig. (2-tailed)	.000	

**. Correlation is significant at the 0.01 level (2-tailed).

Policy Journal of Social Science Review

Online ISSN 3006-4635

Print ISSN 3006-4627

Vol. 3 No. 9 (2025)

The results presented in Table 9 reveal a significant positive relationship between the use of digital learning tools and students' classroom engagement. The Pearson correlation coefficient of r = .538 indicates a moderate to strong positive correlation, suggesting that as the adoption and effective use of digital learning tools increase, students' engagement in classroom activities also tends to rise. The significance value of p = .000 (p < 0.01) confirms that this relationship is statistically significant at the 0.01 level, ruling out the possibility that the observed association occurred by chance. These findings highlight that digital learning tools play a crucial role in promoting active participation, motivation, and interaction among students.

TABLE 10: ***RELATIONSHIP BETWEEN DIGITAL LEARNING TOOLS (FACTORS) AND STUDENTS' CLASSROOM ENGAGEMENT (N=810)***

Correlations

		(LMS)	CT	AT	CCT	E-LP	DW	R& WT	STEM & CT	NT& OT	AI-PT	SE
(LMS)	Pearson Correlation	1										
	Sig. (2-tailed)											
CT	Pearson Correlation	.288**	1									
	Sig. (2-tailed)	.000										
AT	Pearson Correlation	.683**	.641**	1								
	Sig. (2-tailed)	.000	.000									
CCT	Pearson Correlation	.618	.638**	.633**	1							
	Sig. (2-tailed)	.614	.000	.000								
E-LP	Pearson Correlation	.637**	.681**	.678**	.549**	1						
	Sig. (2-tailed)	.000	.000	.000	.000							
DW	Pearson Correlation	.685*	.692**	.545**	.568**	.590**	1					
	Sig. (2-tailed)	.015	.000	.000	.000	.000						
R& WT	Pearson Correlation	.635**	.638**	.570**	.530**	.607**	.823**	1				
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000					
STEM & CT	Pearson Correlation	.659**	.411**	.553**	.691**	.539**	.642**	.674**	1			
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000				

Policy Journal of Social Science Review

Online ISSN 3006-4635

Print ISSN 3006-4627

Vol. 3 No. 9 (2025)

NT& OT	Pearson Correlation	.639**	.670**	.561**	.539**	.626**	.704**	.751**	.636**	1	
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000		
	Pearson Correlation	.629**	.462**	.545**	.673**	.582**	.576**	.557**	.526**	.539**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	
AI-PT											
SE	Pearson Correlation	.642**	.688**	.506**	.670**	.531**	.579**	.568**	.507**	.543**	.925** 1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Learning Management Systems= (LMS), Collaboration Tools=CT, Assessment Tools=AT, Content Creation Tools=CCT, E-Learning Platforms= E-LP, Digital Whiteboards= DW, Reading & Writing Tools= R& WT, STEM & Coding Tools= STEM & CT, Note-taking & Organization Tools= NT& OT, AI-Powered Tools=AI-PT, Students' Engagement=SE

The correlation analysis presented in Table 10 highlights a significant and positive relationship between various digital learning tools and students' classroom engagement, indicating that the integration of such tools contributes meaningfully to improved learning participation. Learning Management Systems (LMS) demonstrated a strong positive correlation with assessment tools ($r = .683$, $p < .01$), content creation tools ($r = .618$), and digital whiteboards ($r = .685$, $p < .05$), suggesting that LMS platforms provide a foundational structure through which other tools become more effective in enhancing engagement. Collaboration tools (CT) also showed strong correlations with assessment tools ($r = .641$, $p < .01$) and note-taking and organization tools ($r = .670$, $p < .01$), emphasizing that collaborative environments foster both peer interaction and effective information management, which directly support engagement. Assessment tools (AT) were highly correlated with e-learning platforms ($r = .678$, $p < .01$) and collaboration tools ($r = .641$, $p < .01$), reflecting the complementary role of formative assessments and online platforms in keeping students motivated and actively involved.

Content creation tools (CCT) correlated positively with collaboration tools ($r = .638$, $p < .01$) and AI-powered tools ($r = .673$, $p < .01$), highlighting their role in stimulating creativity and critical thinking through technology-supported environments. E-learning platforms (E-LP) were significantly associated with both LMS ($r = .637$, $p < .01$) and assessment tools ($r = .678$, $p < .01$), reinforcing their function as flexible spaces for extending classroom learning and sustaining engagement beyond traditional boundaries. Digital whiteboards (DW) demonstrated very strong associations with reading and writing tools ($r = .823$, $p < .01$) and note-taking and organizational tools ($r = .704$, $p < .01$), illustrating that interactive visualization combined with structured learning practices fosters collaborative and deeper engagement. Similarly, reading and writing tools (R&WT) correlated strongly with note-taking and organizational tools ($r = .751$, $p < .01$), underscoring the centrality of literacy support in sustaining meaningful participation.

STEM and coding tools (STEM & CT) showed strong positive correlations with content creation tools ($r = .691$, $p < .01$) and reading and writing tools ($r = .674$, $p < .01$), highlighting their role in developing analytical and problem-solving skills that directly

Policy Journal of Social Science Review

Online ISSN 3006-4635

Print ISSN 3006-4627

Vol. 3 No. 9 (2025)

translate into active engagement. AI-powered tools (AI-PT) displayed strong associations with content creation tools (r = .673, p < .01) and students' engagement (r = .925, p < .01), signaling the transformative potential of artificial intelligence in personalizing learning experiences and maintaining sustained student involvement. Overall, the strongest single correlation observed was between AI-powered tools and student engagement (r = .925, p < .01), indicating that AI-driven platforms play the most influential role in shaping students' classroom participation. Collectively, these results provide compelling evidence that the effective integration of diverse digital learning tools fosters collaboration, creativity, self-regulation, and personalization, all of which contribute significantly to enhancing student engagement in higher education.

TABLE 11: ***RELATIONSHIP BETWEEN DIGITAL LEARNING TOOLS AND STUDENTS' OVERALL LEARNING OUTCOMES (N=810)***

Correlations

		Digital Learning Tools	Learning Outcomes
Digital Learning Tools	Pearson Correlation	1	.490**
	Sig. (2-tailed)		.000
Learning Outcomes	Pearson Correlation	.490**	1
	Sig. (2-tailed)	.000	

**. Correlation is significant at the 0.01 level (2-tailed).

The results presented in Table 11 demonstrate a statistically significant positive correlation between digital learning tools and students' overall learning outcomes (r = .490, p < .01). This indicates that the effective use of digital learning tools is moderately associated with improvements in students' academic performance and overall achievement. The significance value (p = .000) confirms that this relationship is highly reliable and not due to chance. In other words, students who actively engage with digital platforms such as Learning Management Systems, assessment tools, collaboration applications, and AI-powered supports are more likely to demonstrate enhanced understanding, better performance, and stronger academic skills.

TABLE 12: ***RELATIONSHIP BETWEEN DIGITAL LEARNING TOOLS AND STUDENTS' OVERALL LEARNING OUTCOMES (N=810)***

Correlations

		(LMS)	CT	AT	CCT	E-LP	DW	R&WT	STEM & CT	NT&OT	AI-PT	LO
(LMS)	Pearson Correlation	1										
	Sig. (2-tailed)											
CT	Pearson Correlation	.688**	1									
	Sig. (2-tailed)	.000										
AT	Pearson Correlation	.683**	.641**	1								

Policy Journal of Social Science Review

Online ISSN 3006-4635

Print ISSN 3006-4627

Vol. 3 No. 9 (2025)

	Sig. (2-tailed)	.000	.000									
CCT	Pearson Correlation	.618	.638**	.433**	1							
	Sig. (2-tailed)	.614	.000	.000								
E-LP	Pearson Correlation	.637**	.481**	.678**	.549**	1						
	Sig. (2-tailed)	.000	.000	.000	.000							
DW	Pearson Correlation	.685*	.692**	.545**	.568**	.590**	1					
	Sig. (2-tailed)	.015	.000	.000	.000	.000						
R& WT	Pearson Correlation	.635**	.638**	.570**	.530**	.607**	.823**	1				
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000					
STEM & CT	Pearson Correlation	.659**	.411**	.553**	.691**	.539**	.642**	.674**	1			
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000				
NT& OT	Pearson Correlation	.639**	.670**	.561**	.539**	.626**	.704**	.751**	.636**	1		
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000			
AI-PT	Pearson Correlation	.629**	.462**	.545**	.673**	.582**	.576**	.557**	.526**	.539**	1	
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000		
LO	Pearson Correlation	.609**	.639**	.438**	.504**	.545**	.670**	.646**	.530**	.615**	.655**	1
	Sig. (2-tailed)	.002	.000	.000	.000	.000	.000	.000	.000	.000	.000	

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Learning Management Systems= (LMS), Collaboration Tools=CT, Assessment Tools=AT, Content Creation Tools=CCT, E-Learning Platforms= E-LP, Digital Whiteboards= DW, Reading & Writing Tools= R& WT, STEM & Coding Tools= STEM & CT, Note-taking & Organization Tools= NT& OT, AI-Powered Tools=AI-PT, Learning outcomes= LO

The results presented in Table 12 indicate a strong and significant relationship between digital learning tools and students' overall learning outcomes (N = 810). Learning Management Systems (LMS) demonstrated significant positive correlations with all other digital tools and learning outcomes, with particularly high correlations with collaboration tools ($r = .688$, $p < .01$), assessment tools ($r = .683$, $p < .01$), and digital whiteboards ($r = .685$, $p < .05$). This suggests that when LMS platforms are integrated with other digital learning supports, they create an interactive and organized environment that enhances students'

Policy Journal of Social Science Review
Online ISSN 3006-4635
Print ISSN 3006-4627
Vol. 3 No. 9 (2025)

engagement and achievement. Collaboration tools (CT) also showed strong correlations with learning outcomes ($r = .639$, $p < .01$), emphasizing their role in fostering peer interaction and knowledge sharing, which are key components of active learning.

Assessment tools (AT) correlated significantly with learning outcomes ($r = .438$, $p < .01$) and other tools, indicating that gamified and interactive assessments contribute to academic performance, though the strength of the relationship with LO was slightly lower compared to other tools. Content creation tools (CCT) had moderate yet significant correlations with LO ($r = .504$, $p < .01$), suggesting that while these tools promote creativity and presentation skills, their impact on broader learning outcomes may depend on how effectively they are embedded within coursework. E-learning platforms (E-LP) also displayed strong correlations with LO ($r = .545$, $p < .01$), reinforcing their importance in expanding access to knowledge and supporting self-directed learning.

Digital whiteboards (DW) and reading & writing tools (R&WT) emerged as strong predictors of learning outcomes, with correlations of $r = .670$ ($p < .01$) and $r = .646$ ($p < .01$) respectively. These findings highlight that tools enabling active visualization, brainstorming, and academic writing improvement substantially enhance conceptual understanding and academic performance. Note-taking and organizational tools (NT&OT) had one of the strongest relationships with LO ($r = .615$, $p < .01$), indicating that effective organization and knowledge management directly contribute to improved academic achievement. Similarly, STEM and coding tools (STEM & CT) demonstrated a significant positive correlation with LO ($r = .530$, $p < .01$), confirming their role in enhancing conceptual grasp and problem-solving abilities in technical disciplines.

AI-powered tools (AI-PT) also showed a strong correlation with LO ($r = .655$, $p < .01$), underscoring their growing influence in supporting personalized learning, feedback, and academic writing. The strength of this correlation indicates that AI integration is becoming a critical enabler of learning effectiveness, provided that it is used responsibly. Overall, the correlation matrix confirms that each category of digital learning tools significantly contributes to learning outcomes, with the strongest effects observed in digital whiteboards, collaboration tools, reading & writing tools, and AI-powered applications. These results suggest that a blended and integrated use of multiple digital tools, rather than reliance on a single category, creates the most substantial impact on students' overall learning outcomes in higher education.

DISCUSSION

The findings from the ANOVA and regression analyses (Tables 1–4) indicate that digital learning tools significantly enhance students' classroom engagement, with AI-powered tools emerging as the strongest predictor. These results resonate with prior studies highlighting the transformative potential of AI in providing adaptive feedback, personalization, and fostering sustained engagement (Zawacki-Richter et al., 2019). Similarly, the positive contributions of reading, writing, and organizational tools reinforce the argument that technology improves student self-regulation and literacy skills (Dabbagh & Kitsantas, 2012). However, the negative effects of collaboration tools, STEM & coding applications, and e-learning platforms suggest that the impact of digital tools is context-dependent, requiring thoughtful integration to avoid cognitive overload or disengagement (Kirschner & De Bruyckere, 2017). Thus, while digital tools are powerful drivers of engagement, their effectiveness relies heavily on pedagogical alignment and student readiness.

Policy Journal of Social Science Review
Online ISSN 3006-4635
Print ISSN 3006-4627
Vol. 3 No. 9 (2025)

The regression results further demonstrated a strong and positive influence of digital learning tools on students' learning outcomes (Tables 5–8). AI-powered tools again showed the most substantial effect, reflecting their potential in improving academic performance through real-time analytics and adaptive scaffolding (Holmes et al., 2019). Digital whiteboards, content creation applications, and note-taking platforms also positively impacted outcomes, supporting the notion that tools enhancing visualization, creativity, and knowledge management foster deeper learning (Hattie & Donoghue, 2016). On the other hand, the negative associations with collaboration and assessment tools highlight a gap in effective instructional design. Research has shown that without proper scaffolding, collaborative platforms may hinder learning by creating unequal participation or surface-level interactions (Volet et al., 2009), while poorly designed assessments may reduce intrinsic motivation (Ryan & Deci, 2020). These results emphasize the importance of aligning tool use with evidence-based instructional strategies to maximize their impact on achievement.

The correlation analyses (Tables 9–10) revealed a significant positive relationship between digital learning tools and students' classroom engagement, with AI-powered applications showing the strongest association ($r = .925$). This finding aligns with recent evidence that AI-driven platforms substantially enhance interaction and personalization, thereby strengthening engagement (Luckin et al., 2016). Moreover, the strong correlations between digital whiteboards, note-taking tools, and reading & writing applications confirm that interactive and literacy-focused technologies are central to student participation and motivation (Schmid et al., 2014). Interestingly, the integration of multiple tools, such as LMS, assessment platforms, and e-learning resources, demonstrated complementary effects, reinforcing the idea that blended approaches yield the most effective engagement outcomes (Garrison & Vaughan, 2008). Thus, while individual tools can influence participation, their combined use fosters richer and more interactive classroom experiences.

Finally, the results regarding learning outcomes (Tables 11–12) confirmed that digital learning tools positively correlate with academic performance, with notable contributions from AI-powered tools, digital whiteboards, collaboration tools, and literacy-based technologies. These findings are consistent with prior studies emphasizing that technology integration promotes critical thinking, conceptual understanding, and higher-order learning outcomes (Bond et al., 2020). The particularly strong correlations observed for AI-powered and visualization tools suggest that technologies which personalize learning and enable active knowledge construction are especially effective in higher education contexts (Chen et al., 2020). However, the mixed effects of collaboration and assessment tools again highlight that the success of digital tools is not inherent but contingent on effective pedagogical practices and institutional support. Overall, the evidence underscores the necessity of intentional and strategic digital integration to foster both engagement and achievement, echoing the literature on technology-enhanced learning (Laurillard, 2012).

CONCLUSION

It was concluded that digital learning tools have a significant impact on students' engagement and academic outcomes in higher education. Tools such as AI-powered applications, digital whiteboards, note-taking platforms, and content creation software emerged as particularly effective in enhancing participation, motivation, and knowledge retention. Their ability to personalize learning, foster creativity, and support interactive classrooms made them strong contributors to positive student experiences. At the same

time, the results highlighted that not all tools produce equal benefits. Collaboration platforms, assessment applications, and some e-learning systems showed mixed or even negative effects, suggesting that their success depends on appropriate pedagogical design and integration. These variations underscore that digital tools are most effective when used purposefully and in alignment with clear instructional strategies. Overall, the study concludes that digital learning tools can substantially enrich higher education when thoughtfully applied. Their potential lies not only in improving student engagement but also in strengthening academic achievement across multiple dimensions. However, maximizing their effectiveness requires careful planning, teacher training, and institutional support to ensure that technology serves as a facilitator of meaningful and lasting learning.

RECOMMENDATIONS

- Integrate digital tools into teaching through structured training programs for faculty.
- Align tool selection with clear pedagogical objectives to maximize student engagement and outcomes.
- Encourage blended approaches that combine digital tools with traditional teaching methods.
- Provide institutional support such as infrastructure, technical assistance, and policy frameworks.
- Continuously evaluate the effectiveness of digital tools to ensure their relevance and impact on learning.

REFERENCES

Ali, W. (2020). Online and remote learning in higher education institutes: A necessity in light of COVID-19 pandemic. *Higher Education Studies, 10*(3), 16–25. https://doi.org/10.5539/hes.v10n3p16

Alraimi, K. M., Zo, H., & Ciganek, A. P. (2015). Understanding the MOOCs continuance: The role of openness and reputation. *Computers & Education, 80*, 28–38. https://doi.org/10.1016/j.compedu.2014.08.006

Bai, H., & Guo, J. (2022). The effects of automated writing evaluation on L2 students' writing performance: A meta-analysis. *Computer Assisted Language Learning, 35*(7), 1300–1325. https://doi.org/10.1080/09588221.2020.1819438

Bond, M., Bedenlier, S., Marín, V. I., & Händel, M. (2021). Emergency remote teaching in higher education: Mapping the first global online semester. *International Journal of Educational Technology in Higher Education, 18*(50), 1–24. https://doi.org/10.1186/s41239-021-00282-x

Bond, M., Zawacki-Richter, O., & Nichols, M. (2020). Revisiting five decades of educational technology research: A content and authorship analysis of the *British Journal of Educational Technology*. *British Journal of Educational Technology, 51*(6), 2004–2019. https://doi.org/10.1111/bjet.12942

Broadbent, J., & Lodge, J. M. (2021). Self-regulated learning and academic achievement in online higher education learning environments: A systematic review. *Internet and Higher Education, 51*, 100821. https://doi.org/10.1016/j.iheduc.2021.100821

Çetin, İ. (2021). The effect of using GeoGebra software on students' academic achievement and attitudes in teaching mathematics. *International Journal of Contemporary Educational Research, 8*(1), 40–49. https://doi.org/10.33200/ijcer.803176

Czerkawski, B. C., & Lyman, E. W. (2016). An instructional design framework for fostering student engagement in online learning environments. *TechTrends, 60*(6), 532–539. https://doi.org/10.1007/s11528-016-0110-z

Garrison, D. R., & Vaughan, N. D. (2008). *Blended learning in higher education: Framework, principles, and guidelines*. Jossey-Bass.

Gupta, A., & Pathania, P. (2021). To study the impact of Google Classroom as a platform of learning and collaboration at the teacher education level. *Education and Information Technologies, 26*(1), 843–857. https://doi.org/10.1007/s10639-020-10294-1

Hattie, J., & Donoghue, G. (2016). Learning strategies: A synthesis and conceptual model. *npj Science of Learning, 1*(1), 16013. https://doi.org/10.1038/npjscilearn.2016.13

Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial intelligence in education: Promises and implications for teaching and learning*. Center for Curriculum Redesign.

Hwang, G. J., Wang, S. Y., & Lai, C. L. (2020). Effects of a social regulation-based online learning framework on students' learning achievements and behaviors in mathematics. *Computers & Education, 160*, 104031. https://doi.org/10.1016/j.compedu.2020.104031

Johnson, N., Veletsianos, G., & Seaman, J. (2022). U.S. faculty and administrators' experiences and approaches in the early weeks of the COVID-19 pandemic. *Online Learning, 26*(1), 6–35. https://doi.org/10.24059/olj.v26i1.2645

Kausar, F. N. (2024). Student-teacher relationships and their influence on students' motivation, engagement, and academic success at the university level. *Journal of Applied Linguistics and TESOL (JALT), 7*(4), 1106-1113.

Kausar, F. N. (2024). Relationship of AI usage with Students' Learning Behaviour at Higher Secondary Level. *Contemporary Journal of Social Science Review*, *2*(04), 1751-1763.

Kirschner, P. A., & De Bruyckere, P. (2017). The myths of the digital native and the multitasker. *Teaching and Teacher Education, 67*, 135–142. https://doi.org/10.1016/j.tate.2017.06.001

Korkmaz, Ö., & Toraman, Ç. (2020). Are we ready for the post-COVID-19 educational practice? An investigation into what educators think as to online learning. *International Journal of Technology in Education and Science, 4*(4), 293–309. https://doi.org/10.46328/ijtes.v4i4.110

Kruse, A. B., Isailov-Schöchlin, M., Giesler, M., & Ratka-Krüger, P. (2023). Which digital learning strategies do undergraduate dentistry students favor? A questionnaire survey at a German university. *GMS journal for medical education*, *40*(4), Doc49.

Laurillard, D. (2012). *Teaching as a design science: Building pedagogical patterns for learning and technology*. Routledge.

Licorish, S. A., Owen, H. E., Daniel, B., & George, J. L. (2018). Students' perception of Kahoot!'s influence on teaching and learning. *Research and Practice in Technology Enhanced Learning, 13*(9), 1–23. https://doi.org/10.1186/s41039-018-0078-8

Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). *Intelligence unleashed: An argument for AI in education*. Pearson.

Martin, F., Sun, T., & Westine, C. D. (2020). A systematic review of research on online teaching and learning from 2009 to 2018. *Computers & Education, 159*, 104009. https://doi.org/10.1016/j.compedu.2020.104009

Rapanta, C., Botturi, L., Goodyear, P., Guàrdia, L., & Koole, M. (2020). Online university teaching during and after the Covid-19 crisis: Refocusing teacher presence and learning activity. *Postdigital Science and Education, 2*(3), 923–945. https://doi.org/10.1007/s42438-020-00155-y

Policy Journal of Social Science Review

Online ISSN 3006-4635

Print ISSN 3006-4627

Vol. 3 No. 9 (2025)

Ryan, R. M., & Deci, E. L. (2020). Intrinsic and extrinsic motivation from a self-determination theory perspective: Definitions, theory, practices, and future directions. *Contemporary Educational Psychology, 61*, 101860. https://doi.org/10.1016/j.cedpsych.2020.101860

Schmid, R. F., Bernard, R. M., Borokhovski, E., Tamim, R. M., Abrami, P. C., Surkes, M., Wade, C. A., & Woods, J. (2014). The effects of technology use in postsecondary education: A meta-analysis of classroom applications. *Computers & Education, 72*, 271–291. https://doi.org/10.1016/j.compedu.2013.11.002

Spires, H. A., Paul, C. M., & Kerkhoff, S. N. (2021). Digital literacy for the 21st century. In M. J. Bishop, E. Boling, & C. S. Elen (Eds.), *Handbook of research in educational communications and technology* (pp. 273–285). Springer. https://doi.org/10.1007/978-3-030-36119-8_13

Susnjak, T. (2022). ChatGPT: The end of online exam integrity? *Journal of Applied Learning and Teaching, 5*(3), 1–13. https://doi.org/10.37074/jalt.2022.5.3.9

Volet, S., Summers, M., & Thurman, J. (2009). High-level co-regulation in collaborative learning: How does it emerge and how is it sustained? *Learning and Instruction, 19*(2), 128–143. https://doi.org/10.1016/j.learninstruc.2008.03.001

Wang, A. I., & Tahir, R. (2020). The effect of using Kahoot! for learning–A literature review. *Computers & Education, 149*, 103818. https://doi.org/10.1016/j.compedu.2020.103818

Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education – where are the educators? *International Journal of Educational Technology in Higher Education, 16*(1), 39. https://doi.org/10.1186/s41239-019-0171-0