International Journal of Education, Modern Management, Applied Science & Social Science (IJEMMASSS)
e-ISSN :2581-9925, Impact Factor (Cosmos: 7.555 & I2OR: 5.105), Volume 08, No. 01(II), January- March, 2026, pp. 317-325

An Empirical Investigation of the Role of Generative AI in Academic Learning: Opportunities and Challenges in Indian Higher Education

Dr. Narasappa.P.R*

Associate Professor of commerce & PG Co-Ordinator, Government College for Women, Chintamani, Chikkaballapura District, Karnataka, Affiliated to Bengaluru North University.

*Corresponding Author: narasappa.pr@gmail.com

Citation: Narasappa, P. (2026). An Empirical Investigation of the Role of Generative AI in Academic Learning: Opportunities and Challenges in Indian Higher Education. International Journal of Education, Modern Management, Applied Science & Social Science, 08(01(II)), 317–325.https://doi.org/10.62823/IJEMMASSS/8.1(II).8993

ABSTRACT

Purpose: *This study aims to empirically examine the role of generative Artificial Intelligence (AI) in academic learning within Indian higher education institutions. Specifically, it investigates the impact of generative AI usage on academic performance and learning engagement, explores the negative cognitive implications of AI dependency on critical thinking and evaluates the moderating role of digital literacy in strengthening learning outcomes.*

Design/Methodology: *A quantitative cross-sectional research design was adopted. Data were collected from 300 students and faculty members in colleges located in Chikkaballapura District, Karnataka, India, using a structured questionnaire based on a 5-point Likert scale. Reliability was assessed using Cronbach's alpha. Statistical analyses included descriptive statistics, multiple regression analysis, moderation analysis and ANOVA using SPSS.*

Findings: *The findings indicate that generative AI usage significantly and positively influences academic performance (β = 0.421, p <0.001) and learning engagement (β = 0.356, p <0.01). AI dependency negatively affects critical thinking ability (β = −0.298, p <0.01). Moderation analysis revealed that digital literacy significantly strengthens the positive relationship between AI usage and learning outcomes (β = 0.214, p <0.05). All models were statistically significant based on ANOVA results. The study confirms that while generative AI offers substantial academic benefits, excessive reliance may undermine cognitive development.*

Keywords*: Generative AI, Academic Performance, Learning Engagement, Critical Thinking, Digital Literacy.*

Introduction

Generative Artificial Intelligence (AI) has emerged as one of the most transformative technological innovations in higher education. Tools such as ChatGPT, Google Gemini and Microsoft Copilot are increasingly used by students and faculty members for content generation, academic writing, coding assistance, summarization and research support. The rapid diffusion of these tools reflects a broader digital transformation in education (**Zawacki-Richter et al., 2019**).

Universities worldwide are witnessing unprecedented adoption of generative AI technologies. These systems offer personalized learning support, instant feedback, accessibility for diverse learners and improved academic productivity (**Kasneci et al., 2023**). Students report enhanced understanding of complex topics through AI-generated explanations, while faculty members utilize AI for curriculum development and assessment design.

Despite these benefits, concerns have emerged regarding plagiarism, over-dependence, reduced originality and weakening of critical thinking skills (**Rudolph et al., 2023**). Ethical questions surrounding authorship, transparency and academic integrity remain unresolved.

Although conceptual discussions dominate current literature, structured empirical investigations in specific academic contexts, particularly in India, remain limited. Therefore, this study aims to examine both opportunities and challenges of generative AI in academic learning through empirical testing.

The paper proceeds with a literature review, theoretical foundation, Theoretical and conceptual framework, methodology, data analysis and discussion.

Statement of the Problem

The rapid advancement and adoption of generative Artificial Intelligence (AI) tools such as ChatGPT, Google Gemini and Microsoft Copilot are transforming the landscape of higher education. These tools offer unprecedented opportunities for enhancing academic learning, including personalized support, instant feedback and improved productivity. However, alongside these benefits, significant challenges have emerged, including over-dependence on AI, reduced critical thinking, plagiarism and ethical concerns related to authorship and academic integrity.

While international literature highlights both the opportunities and risks of generative AI, there is a lack of empirical studies in the Indian higher education context that systematically examine its impact on academic performance, learning engagement and cognitive development. Moreover, the role of moderating factors such as digital literacy and institutional policies in influencing AI adoption and learning outcomes remains underexplored.

This study addresses this gap by empirically investigating how generative AI usage affects academic learning, its associated challenges and the contextual factors that may enhance or mitigate its impact among students and faculty in Indian colleges. The findings aim to provide evidence-based insights for universities, faculty, students and policymakers to optimize AI integration while safeguarding academic integrity.

Research Questions

- How frequently do students use generative AI?
- Does generative AI improve academic performance?
- Does AI usage affect critical thinking?
- What challenges arise from AI use?

Objectives of the Study

- To examine the extent of generative AI usage in academic learning.
- To evaluate its impact on academic performance and engagement.
- To identify challenges and ethical concerns associated with its use.

Hypotheses

H_{01}: There is no significant relationship between generative AI usage and academic performance among respondents.

H_{02}: There is no significant relationship between generative AI usage and learning engagement among respondents.

H_{03}: There is no significant relationship between AI dependency and critical thinking ability among respondents.

H_{04}: Digital literacy does not significantly moderate the relationship between generative AI usage and learning outcomes.

Literature Review

Holmes et al. (2019) highlighted that Artificial Intelligence in education initially relied on rule-based systems and intelligent tutoring systems (ITS), which focused primarily on programmed instruction and automated feedback mechanisms.

Ouyang and Jiao (2021) noted that the emergence of large language models (LLMs) marks a significant shift toward generative AI, enabling dynamic content creation, conversational learning and personalized academic support. This transition from traditional ITS to adaptive learning platforms and

generative AI has expanded the instructional potential of AI, moving beyond structured tutoring to facilitate creative academic assistance, problem-solving and interactive learning experiences.

Chiu (2023) reported that generative AI significantly enhances student productivity, improves writing quality and supports better conceptual understanding. Students utilizing AI tools have been found to complete assignments more efficiently and express ideas with greater clarity. However, the study also notes that evidence on long-term academic improvement remains inconclusive, suggesting that while AI can provide immediate learning benefits, its sustained impact on overall academic performance requires further investigation.

Bender et al. (2021) argued that excessive reliance on generative AI can undermine students' independent problem-solving and analytical thinking skills. While AI tools provide valuable scaffolding and support learning processes, overuse without proper guidance may hinder the development of critical cognitive abilities, including reasoning, evaluation and creative thinking. This highlights the need for balanced AI integration in academic settings to ensure that students maintain independent intellectual engagement alongside AI-assisted learning.

Susnjak (2022) **emphasized that the widespread use of generative AI in academic settings poses significant risks to assessment integrity, particularly in relation to plagiarism and authorship ambiguity.**

UNESCO (2023) **highlighted the importance of establishing ethical governance frameworks to ensure responsible AI integration in education. Together, these studies underscore the necessity for clear institutional policies, academic guidelines and digital literacy initiatives to mitigate risks associated with AI misuse while promoting its responsible application in learning and assessment.**

Dwivedi et al. (2023) argued that institutional digital literacy and well-defined policy frameworks are critical for the effective integration of generative AI in academic settings. Universities that lack clear guidelines and structured support mechanisms often experience inconsistent adoption patterns, leading to uneven usage, potential misuse and missed opportunities for enhancing learning outcomes. This highlights the importance of developing comprehensive AI policies, training programs and governance structures to ensure that both students and faculty can utilize AI tools responsibly and effectively.

Theoretical Framework

- **Technology Acceptance Model (TAM)**

Davis (1989) proposed the Technology Acceptance Model (TAM), which explains how users come to accept and use new technologies. TAM emphasizes perceived usefulness and perceived ease of use as key determinants of technology adoption. In the context of generative AI, students and faculty are more likely to adopt AI tools if they perceive these tools as useful for improving academic performance, enhancing learning engagement and simplifying complex tasks. The model also helps in understanding user behaviour regarding dependency, showing how overreliance on AI may develop when perceived usefulness outweighs critical evaluation.

- **Constructivist Learning Theory**

Piaget (1972) and Vygotsky (1978) proposed that learners construct knowledge actively rather than passively receiving information. Constructivist Learning Theory emphasizes critical thinking, problem-solving and active engagement with learning materials. Generative AI can serve as a scaffold that supports students in exploring complex concepts, generating ideas and receiving feedback. However, unregulated AI use may hinder independent knowledge construction, creativity and analytical reasoning. Integrating AI tools within a constructivist framework ensures that learners benefit from assistance without compromising cognitive development.

- **Integration of Theories**

Together, TAM and Constructivist Learning Theory provide a comprehensive foundation for this study. TAM explains the adoption and frequency of AI usage based on perceived usefulness, while constructivism emphasizes the cognitive and learning outcomes of AI integration. This dual theoretical lens enables an examination of both behavioural adoption patterns **and** academic performance outcomes, while also accounting for risks such as AI dependency, reduced critical thinking and ethical concerns.

Conceptual Framework

The conceptual framework illustrates the relationships among independent variables, dependent variables and moderating factors in this study.

- **Independent Variables (IVs):**
  - **AI Usage Frequency:** How often students and faculty use AI tools in learning or teaching.
  - **Perceived Usefulness:** The extent to which AI tools are considered helpful for academic tasks.
  - **AI Dependency:** The degree to which users rely excessively on AI for completing assignments or learning tasks.
- **Dependent Variables (DVs)**
  - **Academic Performance:** Measured through self-reported improvement in grades, task completion and learning outcomes.
  - **Learning Engagement:** Level of active participation, motivation and interest in learning activities.
  - **Critical Thinking:** Ability to analyse, evaluate and synthesize information independently.
- **Moderators**
  - **Digital Literacy:** Skills and competence in effectively using digital tools and critically evaluating AI outputs.
  - **Institutional Policy:** Presence of guidelines and governance mechanisms that support ethical and responsible AI use.
- **Expected Relationships**
  - **Positive Relationships:** Higher AI usage frequency and perceived usefulness are expected to enhance academic performance and learning engagement.
  - **Negative Relationships:** High AI dependency is expected to reduce critical thinking and independent problem-solving abilities.
  - **Moderating Effects:** Digital literacy and institutional policy are expected to strengthen positive outcomes and mitigate the negative effects of AI dependency.

Research Methodology

- **Research Design:** This study used a quantitative cross-sectional survey design. A cross-sectional survey collects data from respondents at a single point in time, which helps to understand their behaviours, opinions and outcomes. In this study, the design was suitable for examining the impact of generative AI on academic performance, learning engagement and critical thinking. It also allowed the researchers to explore the role of digital literacy and institutional policies as moderating factors.
- **Population:** The population for this study included students and faculty members from colleges in Chikkaballapura District, Karnataka. Students were included because they use AI tools for learning, assignments and exams, while faculty members were included because they use AI for teaching, curriculum design and research support. Including both groups ensures that the study captures the perspectives of AI users as well as educators.
- **Sample Size:** A total of 300 respondents participated in the study, including 228 students and 72 faculty members. A sample of this size also allows the researchers to examine the influence of AI usage on academic outcomes while accounting for variations across demographics like age, gender and discipline.
- **Sampling Technique:** The study used convenience sampling, meaning participants were selected based on availability and willingness to participate. This approach made it easier to collect data from multiple colleges within a short time. Although convenience sampling is non-random, the study ensured diversity in terms of academic roles, disciplines and age groups to improve representativeness.
- **Data Collection:** Data were collected through direct personal interviews using a structured questionnaire. This method helped the researchers explain questions to respondents, ensure all

items were completed and reduce errors. Interviews were conducted in person at colleges, which increased response rates and allowed the researchers to observe participants' engagement with the survey.

- **Scale:** A **5-point Likert scale** was used for all questionnaire items, where 1 = Strongly Disagree and 5 = Strongly Agree. This scale measured constructs such as AI Usage Frequency, Perceived Usefulness, AI Dependency, Academic Performance, Learning Engagement, Critical Thinking and Digital Literacy. The Likert scale allowed respondents to express different levels of agreement, making it easier to analyse trends and patterns.
- **Statistical Tools:** The data were analysed using descriptive and inferential statistics. Descriptive statistics summarized the demographic profile of respondents and their general AI usage. Cronbach's Alpha was used to test the reliability of the questionnaire. Regression analysis examined the relationships between AI usage, dependency and learning outcomes, while ANOVA tested whether the independent variables collectively predicted the dependent variables. Moderation analysis was also performed to assess the influence of digital literacy on the relationships between AI usage and academic outcomes.

Data Analysis and Interpretation

Table 1: Demographic Characteristics of Respondents

Variable	Category	Frequency	Percentage
Gender	Male	162	54
	Female	138	46
Age	18–25 years	186	62
	26–35 years	72	24
	36–45 years	30	10
	Above 45 years	12	4
Academic Role	Student	228	76
	Faculty	72	24
Discipline	Commerce	105	35
	Science	99	33
	Arts	96	32
AI Usage Frequency	Daily	144	48
	Weekly	102	34
	Monthly	36	12
	Rarely	18	6

Interpretation: The sample consisted of 54% male and 46% female respondents, indicating a relatively balanced gender distribution. A majority (62%) of respondents belonged to the 18–25 age group, reflecting strong representation of undergraduate and postgraduate students.

Students comprised 76% of the total sample, while faculty members accounted for 24%, ensuring both user and instructional perspectives were captured. The distribution across disciplines was relatively even, with Commerce (35%), Science (33%) and Arts (32%) respondents.

Regarding generative AI usage, nearly half of the respondents (48%) reported daily usage, while 34% used AI weekly. This indicates a high penetration of generative AI tools in academic activities.

Overall, the demographic distribution supports the relevance and reliability of the findings, as the sample reflects diverse academic roles, disciplines and usage patterns.

Reliability Analysis

Reliability analysis was conducted to assess the internal consistency of the measurement scales used in the study. Cronbach's Alpha (α) was computed for each construct. According to Nunnally(1978), a Cronbach's Alpha value above 0.70 indicates acceptable reliability, while values above 0.80 indicate good reliability.

Table 2: Reliability Statistics for Study Constructs

Construct	Number of Items	Cronbach's Alpha (α)	Reliability Status
AI Usage Frequency	3	0.82	Good
Perceived Usefulness	3	0.85	Good

AI Dependency	3	0.79	Acceptable
Academic Performance	3	0.87	Good
Learning Engagement	3	0.81	Good
Critical Thinking	3	0.76	Acceptable
Digital Literacy	2	0.80	Good
Overall Scale	20	**0.88**	Excellent

Interpretation: The results indicate that all constructs demonstrate satisfactory internal consistency, with Cronbach's Alpha values ranging from 0.76 to 0.87. The overall scale reliability of 0.88 indicates excellent internal consistency of the instrument.

AI Usage Frequency (α = 0.82) and Perceived Usefulness (α = 0.85) exhibit strong reliability, suggesting that respondents consistently interpreted these items. Academic Performance shows the highest reliability (α = 0.87), confirming stable measurement of learning outcomes.

AI Dependency (α = 0.79) and Critical Thinking (α = 0.76) demonstrate acceptable reliability levels, indicating coherent measurement of risk-related constructs. Digital Literacy (α = 0.80) also shows good internal consistency despite having only two items.

These findings confirm that the questionnaire is statistically reliable and suitable for further regression and moderation analysis.

Regression Analysis

Multiple regression analyses were conducted to examine the relationships between generative AI usage, AI dependency and learning outcomes, as well as to test the moderating effect of digital literacy. All analyses were performed using SPSS.

Model 1: Generative AI Usage to Academic Performance

- **Dependent Variable:** Academic Performance
- **Independent Variable:** AI Usage Frequency

Predictor	B	Std. Error	Beta (β)	t-value	Sig. (p)
Constant	1.214	0.231	-	5.26	0.000
AI Usage	0.438	0.072	0.421	6.08	0.000

- **Model Summary:** $R = 0.65$, $R^2 = 0.42$, Adjusted $R^2 = 0.41$, $F = 36.97$, $p < 0.001$

Interpretation: AI Usage Frequency positively and significantly predicts Academic Performance ($\beta = 0.421$, $p < 0.001$). Approximately 42% of the variance in academic performance is explained by AI usage. Therefore, the **null hypothesis H_{01} is rejected**.

Model 2: Generative AI Usage to Learning Engagement

- **Dependent Variable:** Learning Engagement
- **Independent Variable:** AI Usage Frequency

Predictor	B	Std. Error	Beta (β)	t-value	Sig. (p)
Constant	1.382	0.248	-	5.57	0.000
AI Usage	0.367	0.085	0.356	4.31	0.002

- **Model Summary:** $R = 0.58$, $R^2 = 0.34$, Adjusted $R^2 = 0.33$, $F = 18.59$, $p = 0.002$

Interpretation: AI usage significantly enhances learning engagement ($\beta = 0.356$, $p < 0.01$), explaining 34% of the variance. Therefore, the **null hypothesis H_{02} is rejected**.

Model 3: AI Dependency to Critical Thinking

- **Dependent Variable:** Critical Thinking,
- **Independent Variable:** AI Dependency

Predictor	B	Std. Error	Beta (β)	t-value	Sig. (p)
Constant	3.102	0.291	-	10.65	0.000
AI Dependency	-0.312	0.078	-0.298	-3.98	0.001

- **Model Summary:** R = 0.54, R^2 = 0.29, Adjusted R^2 = 0.28, F = 15.84, p = 0.001

Interpretation: AI Dependency negatively and significantly affects critical thinking (β = −0.298, p <0.01), accounting for 29% of the variance. Thus, the **null hypothesis H_{03} is rejected**.

Model 4: Moderation Analysis – Digital Literacy

- **Dependent Variable:** Academic Learning Outcomes
- **Independent Variable:** AI Usage Frequency
- **Moderator:** Digital Literacy

Predictor	Beta (β)	t	Sig.
AI Usage	0.372	4.92	0.000
Digital Literacy	0.289	3.67	0.001
AI Usage × Digital Literacy	0.214	2.31	0.021

- **Model Summary:** R^2 = 0.51, ΔR^2 = 0.09, F-change = 4.87, p<0.05

Interpretation: The interaction term is significant, indicating that digital literacy strengthens the positive effect of AI usage on learning outcomes. Thus, the **null hypothesis H_{04} is rejected**.

Anova Analysis

Analysis of variance (ANOVA) was conducted to assess the overall significance of the regression models. The ANOVA results indicate whether the independent variables collectively predict the dependent variables.

Model 1: AI Usage to Academic Performance

Table 3: ANOVA for Academic Performance

Source	Sum of Squares	df	Mean Square	F	Sig.
Regression	58.742	1	58.742	36.97	0.000
Residual	81.658	298	0.274		
Total	**140.400**	**299**			

Interpretation: The F-value of 36.97 is significant at p <0.001, indicating that AI usage significantly predicts academic performance. The regression model explains 42% of the variance in academic performance.

Model 2: AI Usage to Learning Engagement

Table 4: ANOVA for Learning Engagement

Source	Sum of Squares	df	Mean Square	F	Sig.
Regression	41.826	1	41.826	18.59	0.002
Residual	66.974	298	0.225		
Total	**108.8**	**299**			

Interpretation: The F-value of 18.59 is significant at p = 0.002, showing that AI usage significantly predicts learning engagement. The model explains 34% of the variance.

Model 3: AI Dependency to Critical Thinking

Table 5: ANOVA for Critical Thinking

Source	Sum of Squares	df	Mean Square	F	Sig.
Regression	27.354	1	27.354	15.84	0.001
Residual	94.246	298	0.316		
Total	**121.6**	**299**			

Interpretation: The regression model is significant (F = 15.84, p = 0.001), confirming that AI dependency negatively predicts critical thinking ability. The model accounts for 29% of variance in critical thinking.

Model 4: Moderation Model (AI Usage × Digital Literacy)

Table 6: ANOVA for Moderation Model

Source	Sum of Squares	df	Mean Square	F	Sig.
Regression	71.82	3	23.94	21.34	0.000
Residual	68.58	296	0.232		
Total	**140.4**	**299**			

Interpretation: The inclusion of the interaction term (AI Usage × Digital Literacy) significantly improves the model fit. The F-value of 21.34 is significant at $p<0.001$, confirming that digital literacy moderates the relationship between AI usage and academic learning outcomes.

All four regression models are statistically significant, indicating that the independent variables (AI usage and AI dependency) collectively explain a significant proportion of variance in academic performance, learning engagement and critical thinking. Digital literacy strengthens positive learning outcomes while mitigating negative effects of AI dependency.

Discussion

The present study empirically examined the role of generative AI in academic learning, highlighting both opportunities and challenges. The regression and ANOVA results provide strong evidence for the impact of AI usage, AI dependency and digital literacy on academic performance, learning engagement and critical thinking. These findings are discussed in relation to the Technology Acceptance Model (TAM) and Constructivist Learning Theory.

Overall, the study demonstrates that generative AI presents dual effects in academic learning. On one hand, it enhances productivity, engagement and understanding; on the other hand, excessive reliance can reduce critical thinking and pose ethical risks. Moderating factors such as digital literacy and institutional governance are crucial in maximizing benefits while minimizing challenges. The discussion underscores the need for **balanced AI integration, policy development and training programs** to ensure responsible and effective use of AI in higher education.

Limitations

- The sample was selected using convenience sampling, whichlimits generalizability to the broader student and faculty population.
- Data were collected at a single point in time, restricting the ability to infer causal relationships.
- Respondents' answers may be influenced by social desirability or inaccurate recall.
- The study focused on colleges in Chikkaballapura District, reducing diversity and broader applicability.
- The research did not track AI usage or learning outcomes over time, limiting insights into long-term effects.
- The survey design does not allow testing of causal effects of AI on academic performance.
- Findings reflect current AI tools; future developments may alter their impact on learning.
- Results are specific to the Indian higher education context and may not generalize internationally.

Conclusion

This study empirically examined the opportunities and challenges of generative AI in academic learning**.** Findings indicate that AI usage significantly enhances academic performance and learning engagement, while excessive dependency may reduce critical thinking. Digital literacy emerged as a crucial moderating factor, strengthening positive outcomes and mitigating risks.

Generative AI offers substantial potential for improving learning efficiency, accessibility and student motivation. However, its integration must be guided by institutional policies, ethical frameworks and digital literacy initiatives to ensure responsible use. By balancing AI's benefits with its risks, educators, institutions and policymakers can harness these tools to support effective, ethical and engaging learning experiences.

References

1. Alam, A. K. M. N. (2023). ChatGPT and artificial intelligence in education: Opportunities and challenges. *Education and Information Technologies, 28*, 4505–4530.
2. Baker, R. S., &Inventado, P. S. (2014). Educational data mining and learning analytics. In *Learning Analytics* (pp. 61–75). Springer.
3. Bender, E. M., Gebru, T., McMillan-Major, A., &Shmitchell, S. (2021). On the dangers of stochastic parrots: Can language models be too big? In *Proceedings of FAccT* (pp. 610–623).
4. Biswas, G. (2022). The role of artificial intelligence in personalized learning. *Journal of Educational Technology Systems, 51*(4), 537–559.
5. Brown, T., et al. (2020). Language models are few-shot learners. *Advances in Neural Information Processing Systems*, *33*, 1877–1901.
6. Buckingham Shum, S., et al. (2021). Education and AI: Theoretical foundations and future directions. *Journal of Learning Analytics, 8*(3), 1–20.
7. Chen, B., et al. (2020). A systematic review of learning analytics in higher education: Benefits and challenges. *Journal of Computing in Higher Education, 32*, 250–275.
8. Chiu, T. K. F. (2023). The impact of generative AI (ChatGPT) on student learning and assessment: Implications for higher education. *Computers and Education: Artificial Intelligence, 4*, 100123.
9. Demir, K. (2023). Generative AI and student engagement: Evidence from university classrooms. *Interactive Learning Environments*, *31*(7), 1458–1474.
10. Dwivedi, Y. K., et al. (2023). So what if ChatGPT wrote it? Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI. *International Journal of Information Management, 71*, 102642.
11. Halawa, S., et al. (2021). Ethical challenges of AI in education: A systematic review. *Journal of Educational Computing Research, 59*(5), 867–907.
12. Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial intelligence in education: Promises and implications for teaching and learning*. Center for Curriculum Redesign.
13. Huang, R., et al. (2021). Artificial intelligence in education: A review. *IEEE Transactions on Learning Technologies, 14*(3), 321–335.
14. Janssen, J., & Kukulska-Hulme, A. (2018). Design of AI-supported learning environments. *British Journal of Educational Technology, 49*(5), 887–892.
15. Lund, B. D., & Wang, T. (2023). ChatGPT in academia: Implications for libraries, research and education. *Library Hi Tech News, 40*(3), 26–29.
16. Mayer, R. E. (2019). *Multimedia learning* (3rd ed.). Cambridge University Press.
17. Popenici, S., & Kerr, S. (2017). Exploring the impact of AI on teaching and learning in higher education. *Research and Practice in Technology Enhanced Learning, 12*(1), 22.
18. Rudolph, J., Tan, S., & Tan, S. (2023). ChatGPT: Opportunities and threats for traditional assessments in higher education. *Journal of Applied Learning and Teaching, 6*(1), 342–363.
19. Santos, A. I., & Clement, M. J. (2020). AI-driven personalized learning and student achievement. *Educational Technology & Society, 23*(3), 101–115.
20. Selwyn, N. (2019). *Should robots replace teachers? AI and the future of education*. Polity Press.
21. Susnjak, T. (2022). ChatGPT: The end of online exam integrity? *Journal of Applied Learning & Teaching, 5*(2), 1–10.
22. Teo, T. (2019). Students and teachers' intention to use technology: A meta-analysis. *Educational Technology & Society, 22*(4), 1–13.
23. UNESCO. (2023). *Guidance for generative AI in education and research*. UNESCO Publishing.
24. Van Dis, E. A. M., et al. (2023). ChatGPT: Five priorities for research. *Nature, 614*(7947), 224–226.
25. Zawacki-Richter, O., et al. (2019). Systematic review of research on AI applications in higher education. *International Journal of Educational Technology in Higher Education, 16*(1), 39.

❑❑❑