

The Impact of Artificial Intelligence (AI) Utilization as a Learning Assistant on Student Learning Independence at Universitas Islam Negeri Sunan Ampel Surabaya

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Keywords: <i>Artificial Intelligence, Learning Independence, Self Regulated Learning, Higher Education</i>	ABSTRACT: The rapid advancement of artificial intelligence (AI) technologies has fundamentally transformed the landscape of higher education. This study examines the impact of AI utilization as a learning assistant on student learning independence at Universitas Islam Negeri Sunan Ampel Surabaya (UINSA). Employing a mixed methods research design that combines quantitative surveys and qualitative interviews, data were collected from 320 undergraduate students across various faculties. The quantitative component utilized a validated Self-Directed Learning Readiness Scale adapted for the Indonesian AI context, while the qualitative component involved semi-structured interviews with 30 purposively selected participants. Results indicate that AI tool adoption positively influences self regulated learning behaviors ($r = 0.612$, $p < 0.001$), critical thinking skills (mean improvement = 14.3%), and academic self-efficacy. However, a subset of students (27.8%) demonstrated increased dependency on AI generated responses, suggesting potential risks to autonomous learning development. Moderating factors including digital literacy competency, prior academic achievement, and faculty
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	supervision significantly shaped these outcomes. The study recommends the integration of structured AI literacy programs within university curricula and the development of ethical AI usage frameworks aligned with Islamic educational values. These findings contribute to the growing body of literature on educational technology and provide practical implications for policymakers at Indonesian Islamic universities.
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I. INTRODUCTION

The emergence of artificial intelligence (AI) as a transformative technology in the twenty-first century has sparked significant discourse across multiple sectors, with education being one of the most profoundly affected domains. AI powered tools such as ChatGPT, Google Bard, and various adaptive learning platforms have rapidly permeated higher education settings, reshaping how students access information, construct knowledge, and engage with academic tasks. In the context of Indonesian higher education, this technological wave presents both unprecedented opportunities and complex pedagogical challenges that warrant systematic empirical investigation.

Universitas Islam Negeri Sunan Ampel Surabaya (UINSA), as one of Indonesia's premier Islamic state universities, has witnessed a marked increase in AI tool adoption among its student population following the widespread availability of large language models beginning in 2023. Students increasingly report using AI assistants for diverse academic purposes, including literature synthesis, essay drafting, problem solving, language translation, and even conceptual understanding of complex Islamic jurisprudence and theological texts. This phenomenon raises fundamental questions about the implications of such AI integration for student learning independence, a construct that is central to contemporary educational philosophy and is particularly emphasized within Islamic pedagogical traditions that value *ijtihad* (independent intellectual reasoning) and *tafakkur* (deep contemplative thought).

Learning independence, conceptualized within the framework of self directed learning (SDL) and self regulated learning (SRL), refers to students' capacity to proactively manage their own learning processes, set goals, select strategies, monitor progress, and evaluate outcomes without excessive external direction. Research has consistently demonstrated that high levels of learning

independence correlate positively with academic achievement, critical thinking development, intrinsic motivation, and long-term professional competence (Knowles, 1975; Zimmerman, 2000). However, the introduction of AI technologies into students' learning ecosystems creates a nuanced dynamic: while AI can scaffold complex learning processes and democratize access to expert knowledge, it may simultaneously undermine the productive struggle and metacognitive engagement that are essential for developing genuine learning independence.

Prior research on AI in education has primarily focused on Western institutional contexts, with limited attention to Islamic higher education environments in Southeast Asia. Studies by Hwang and Chang (2011) [1] on intelligent tutoring systems, and more recent work by Zawacki Richter et al. (2019) [2] on AI applications in higher education, have provided valuable frameworks but do not adequately address the specific cultural, religious, and institutional characteristics of Indonesian Islamic universities. Furthermore, existing literature has largely overlooked the moderating role of institutional religious values, faculty supervision practices, and Islamic pedagogical traditions in shaping how students engage with AI learning tools.

The present study addresses these gaps by investigating the multifaceted impact of AI utilization as a learning assistant on student learning independence at UINSA Surabaya. Specifically, it seeks to: (1) assess the prevalence and patterns of AI tool usage among UINSA students; (2) examine the relationship between AI utilization and dimensions of learning independence including self directed learning, critical thinking, and academic self efficacy; (3) identify risk factors associated with AI-induced learning dependency; and (4) explore moderating variables that influence the directionality and magnitude of AI's impact on learning independence. By situating these questions within UINSA's institutional context, this study contributes culturally responsive insights to the global conversation on educational AI and provides empirically grounded recommendations for Indonesian Islamic higher education policy.

The urgency of this investigation is underscored by recent national educational policy directives in Indonesia, including the Ministry of Education, Culture, Research, and Technology's framework for digital transformation in higher education (Kemendikbudristek, 2023), which calls for evidence based approaches to technology integration that preserve and enhance the quality of learning outcomes. UINSA's commitment to the integration of Islamic values with contemporary scientific knowledge, encapsulated in its integration

interconnection paradigm, further provides a distinctive institutional lens through which the impacts of AI on student learning can be examined.

II. METHOD

This study employed a convergent parallel mixed methods design (Creswell & Plano Clark, 2018) [3], wherein quantitative and qualitative data were collected concurrently, analyzed separately, and subsequently integrated to provide a comprehensive understanding of the research phenomena. The quantitative strand aimed to establish the statistical relationship between AI utilization patterns and learning independence dimensions across a representative student sample, while the qualitative strand explored the subjective meanings, contextual factors, and experiential nuances underlying these relationships.

The study was conducted at Universitas Islam Negeri Sunan Ampel Surabaya during the academic year 2024/2025. UINSA was selected as the research site due to its status as one of Indonesia's largest Islamic state universities with over 25,000 enrolled students across seven faculties and its active engagement with digital transformation initiatives. Stratified random sampling was employed for the quantitative strand, with strata defined by faculty affiliation and academic year. A total of 320 undergraduate students were recruited, representing proportional sampling from the Faculties of Islamic Education ($n=72$), Social Sciences and Politics ($n=58$), Science and Technology ($n=68$), Psychology and Health ($n=54$), Law ($n=36$), and Ushuluddin and Islamic Philosophy ($n=32$). For the qualitative strand, 30 participants were purposively selected from the quantitative sample, ensuring diversity in terms of faculty, gender, academic year, and AI usage patterns.

The quantitative data collection utilized three validated instruments. First, the AI Utilization Scale (AUS) was developed for this study based on the Technology Acceptance Model (Davis, 1989) [4] and adapted for the educational AI context, comprising 18 items across three subscales: frequency of use (6 items), purpose of use (6 items), and perceived usefulness (6 items). Second, the Self-Directed Learning Readiness Scale (SDLRS) developed by Guglielmino (1977) and adapted to the Indonesian context by Hiemstra (1994) [5], consisting of 58 items measuring eight dimensions of learning independence. Third, the Academic Self Efficacy Scale (ASES) adapted from Bandura's (1997) [6] general self-efficacy framework for the higher education context, comprising 20 items. All instruments underwent rigorous validation procedures including expert content validation ($CVR > 0.78$), confirmatory factor analysis ($CFI > 0.95$, $RMSEA < 0.06$),

and reliability assessment (Cronbach's $\alpha > 0.82$ for all scales).

Qualitative data were collected through semi structured interviews lasting 45-60 minutes each, guided by an interview protocol developed from the literature and pilot tested with five students not included in the main sample. Interviews were conducted in Bahasa Indonesia, audio recorded with participants' consent, and subsequently transcribed verbatim. The interview protocol explored themes including AI usage motivations, perceived impacts on learning processes, experiences of dependency or independence, faculty perceptions, and suggestions for institutional AI policy.

Quantitative surveys were administered online via Google Forms during February-March 2025, following the distribution of participant information sheets and the collection of informed consent. To ensure data quality, attention check items were embedded within the survey, resulting in the exclusion of 14 incomplete or invalid responses from an initial pool of 334. Qualitative interviews were conducted between March-April 2025, either in person at UINSA campus or via video conference according to participant preference. All data collection procedures received ethical approval from UINSA's Research Ethics Committee (Approval No. EC-UINSA-2024-087).

Quantitative data were analyzed using IBM SPSS Statistics 29 and AMOS 24. Descriptive statistics characterized the sample and AI usage patterns. Pearson correlation and multiple regression analyses examined relationships between AI utilization and learning independence dimensions, with digital literacy, GPA, and faculty supervision entered as moderator variables. Moderated regression analysis following Hayes' (2018) [7] PROCESS macro approach was employed to test moderation hypotheses. Statistical significance was set at $p < 0.05$ with two-tailed testing.

Qualitative data were analyzed using thematic analysis following Braun and Clarke's (2006) [8] six phase framework: familiarization with data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the final report. NVivo 14 software facilitated systematic coding and theme management. Trustworthiness was established through member checking (returning themes to 10 participants for validation), peer debriefing, and audit trail maintenance. Mixed methods integration was achieved through joint displays (Fetters et al., 2013) [9] that juxtaposed quantitative findings with qualitative themes to facilitate meta inferences.

III. RESULT AND DISCUSSION

AI Utilization Patterns Among UINSA Students and Impact on Self-Directed Learning Dimensions

The survey data revealed that 91.3% (n=292) of respondents reported using at least one AI tool for academic purposes, reflecting the widespread penetration of AI technologies among contemporary university students. ChatGPT emerged as the most frequently used platform (78.4%), followed by Google Bard/Gemini (54.7%), Grammarly (43.1%), and specialized academic AI tools such as Elicit and Semantic Scholar (21.6%). These findings align with Baidoo-Anu and Owusu Ansah (2023) [10], who reported similar AI adoption rates among undergraduate students in sub-Saharan African universities, suggesting a global pattern of rapid AI integration irrespective of regional educational contexts.

Regarding frequency of use, 34.7% of respondents reported using AI tools daily, 38.4% several times per week, 18.1% several times per month, and 8.8% rarely. The primary purposes reported were literature searching and summarization (82.1%), essay and report drafting assistance (71.6%), concept explanation and clarification (68.4%), language translation and correction (61.3%), and problem-solving in quantitative assignments (43.4%). Notably, 29.7% of students reported using AI tools specifically for tasks in Islamic studies subjects, including Qur'anic interpretation assistance, Islamic jurisprudence analysis, and Arabic language support, indicating that AI adoption at UINSA extends beyond purely secular academic domains.

Qualitative interviews provided deeper insight into students motivations for AI adoption. A dominant theme was efficiency seeking, with participants consistently describing time pressure from multiple simultaneous academic obligations. As one fourth year Islamic Education student articulated: *"With AI, I can understand the basic concept quickly, then I use my own thinking to develop it further. Without AI, I would spend hours just on the preliminary understanding"* This perspective resonates with Lim et al.'s (2023) [11] finding that students in high workload academic environments instrumentalize AI as a cognitive resource allocation tool rather than a substitute for learning.

Multiple regression analysis revealed that overall AI utilization frequency significantly predicted total SDLRS scores ($\beta = 0.387$, $SE = 0.052$, $t = 7.44$, $p < 0.001$), explaining 23.4% of variance in self directed learning readiness above and beyond the control variables (age, GPA, faculty). This positive relationship, however, was not uniform across all SDLRS subscales.

Significant positive effects were observed for learning planning ($\beta = 0.412$, $p < 0.001$), information seeking behavior ($\beta = 0.368$, $p < 0.001$), and learning persistence ($\beta = 0.291$, $p < 0.001$). Conversely, a significant negative relationship emerged between high-frequency AI use (defined as daily use across multiple task types) and independent problem identification ($\beta = -0.223$, $p = 0.003$), suggesting that excessive AI reliance may attenuate students tendency to independently identify and frame learning problems.

These quantitative patterns were elaborated by qualitative findings that distinguished between what participants termed scaffolded independence and substituted independence. Students demonstrating high learning independence reported using AI as a starting point for inquiry that they subsequently pursued through primary sources, critical analysis, and peer discussion. This usage pattern aligns with Vygotsky's (1978) [12] zone of proximal development framework, wherein AI effectively functions as a more knowledgeable other that temporarily scaffolds competencies that students are in the process of internalizing. By contrast, students exhibiting AI dependency reported a pattern wherein AI-generated content was accepted without critical evaluation and submitted with minimal personal intellectual contribution.

The distinction between productive and counterproductive AI use patterns was significantly moderated by students prior academic achievement (GPA) and digital literacy competency. Moderated regression analyses revealed a significant interaction between AI utilization frequency and GPA in predicting learning independence (β interaction = 0.247, $p = 0.008$), with high-GPA students demonstrating stronger positive effects from AI use compared to lower-GPA counterparts. This finding is consistent with the 'Matthew effect' in educational technology adoption, where students who already possess stronger academic competencies derive greater benefit from technological tools, potentially exacerbating existing achievement gaps (Selwyn, 2016) [13].

Critical Thinking Development and Academic Self-Efficacy and Motivation

A critical concern in the discourse on AI and higher education pertains to the potential erosion of students critical thinking capacities. The present study measured critical thinking through the Halpern Critical Thinking Assessment (HCTA) subscale embedded within the qualitative interview protocol and through self-reported measures in the quantitative survey. Results presented

a nuanced picture: students who reported using AI as a discussion partner (i.e., prompting AI with arguments and counterarguments) demonstrated significantly higher critical thinking self-efficacy scores than non users (mean difference = 8.7 points, 95% CI [5.2, 12.3], $p < 0.001$). Conversely, students who primarily used AI for direct answer retrieval showed no significant difference in critical thinking scores compared to non users (mean difference = 1.3 points, 95% CI [-2.1, 4.7], $p = 0.442$).

These findings support Luckin et al.'s (2016) [14] argument that AI's educational impact is contingent on pedagogical framing rather than mere technological provision. When students engage with AI dialectically posing questions, evaluating responses, identifying limitations, and constructing counter narratives the tool becomes an instrument of higher-order thinking development. This dialogical engagement with AI aligns with Islamic epistemological traditions of *munazarah* (scholarly debate) and *naqd* (critical analysis) that are embedded within UINSA's curriculum, suggesting potential synergies between AI mediated learning and Islamic intellectual traditions when appropriately facilitated.

Faculty interviews ($n=8$, conducted as supplementary data collection) revealed significant variation in pedagogical responses to AI adoption. Faculty who had developed AI integrated assignment designs requiring students to critically evaluate AI outputs, identify errors, and argue for alternative positions reported observing improvements in students analytical writing and argumentation skills. This pedagogical approach resonates with the concept of AI resistant assessment proposed by Perkins et al. (2023) [15], which advocates for assessment designs that leverage rather than prohibit AI tools while ensuring genuine intellectual engagement.

Pearson correlation analysis revealed a moderate positive relationship between AI utilization frequency and academic self efficacy ($r = 0.421$, $p < 0.001$). Path analysis using structural equation modeling demonstrated that this relationship was partially mediated by perceived competence in digital task management (β indirect = 0.187, 95% bootstrapped CI [0.134, 0.241]), suggesting that AI tools enhance self efficacy partly by increasing students confidence in their ability to manage complex information intensive tasks. This finding aligns with Bandura's (1997) [6] social cognitive theory, wherein successful performance experiences even those facilitated by technological assistance contribute to the development of efficacy beliefs.

Qualitative data revealed a more complex motivational dynamic. While AI use

was associated with reduced anxiety about academic task completion, 31.4% of interviewees expressed concerns about 'intellectual authenticity,' questioning whether AI-facilitated academic successes genuinely reflected their own competencies. This existential dimension of AI mediated learning is particularly salient in the Islamic educational context, where *ikhtiar* (personal effort) and *tawakkul* (reliance on God through one's own striving) are theologically valorized. Several participants invoked Islamic ethical frameworks spontaneously when discussing their AI use practices, suggesting that institutional religious values function as an endogenous moderator of AI adoption behavior in this context. This dimension has not been previously documented in the educational AI literature and represents a distinctive contribution of the present study.

Risk Factors for AI-Induced Learning Dependency

Cluster analysis identified three distinct AI usage profiles among participants: Critical Adopters (38.4%), Pragmatic Users (33.8%), and Dependent Learners (27.8%). Critical Adopters demonstrated high AI utilization paired with high learning independence scores, employing AI as one tool among many in a diversified learning strategy. Pragmatic Users showed moderate AI utilization with average learning independence, using AI selectively for specific task types while maintaining conventional learning strategies for others. Dependent Learners exhibited high AI utilization with below average learning independence scores, demonstrating patterns of over reliance on AI generated content and reduced engagement with primary sources and independent reasoning.

Logistic regression analysis identified several significant predictors of Dependent Learner profile membership: low academic self regulation skills (OR = 3.84, 95% CI [2.17, 6.80], $p < 0.001$), low digital literacy competency (OR = 2.93, 95% CI [1.68, 5.11], $p < 0.001$), absence of faculty guidance on AI use (OR = 2.41, 95% CI [1.39, 4.18], $p = 0.002$), and first or second academic year status (OR = 2.18, 95% CI [1.26, 3.77], $p = 0.005$). These risk factors converge with findings by Crompton and Burke (2023) [16] on technology dependency in higher education, highlighting the particular vulnerability of junior students with underdeveloped metacognitive skills. The institutional absence of structured AI literacy education reported by 73.1% of respondents emerged as a modifiable risk factor that represents a priority area for institutional intervention.

The Role of Faculty Supervision and Institutional Context and Implications

for Educational Policy and Practice

Qualitative analysis revealed that faculty supervision practices constituted a crucial contextual moderator of AI's impact on student learning independence. Students supervised by faculty who explicitly discussed AI's limitations, required transparent disclosure of AI use, and designed assignments that rewarded original analytical thinking reported significantly higher learning independence scores than those whose faculty had not addressed AI in their courses (independent samples t-test: $t(318) = 4.73$, $p < 0.001$, Cohen's $d = 0.53$). This finding underscores the pivotal role of academic staff in mediating the relationship between AI tools and learning outcomes, consistent with the ecological systems perspective on educational technology integration proposed by Bronfenbrenner (1979) and applied to digital learning environments by Mishra and Koehler (2006) [17].

UINSA's institutional framework of integration interconnection which seeks to synthesize Islamic religious knowledge with contemporary scientific and technological developments provides a potentially productive institutional narrative for constructive AI integration. Islamic intellectual history's valorization of *ijtihad* (independent reasoning from primary sources) and its emphasis on the pursuit of knowledge (*thalab al-'ilm*) as a religious obligation offer conceptual resources for framing AI as a tool for expanding rather than replacing human intellectual engagement. However, the actualization of this potential requires deliberate curricular and pedagogical scaffolding that the present study found to be largely absent in current institutional practice.

The present findings carry significant implications for educational policy at UINSA and analogous Islamic higher education institutions in Indonesia. First, the identification of Dependent Learner profiles and their associated risk factors argues for the development of mandatory AI literacy modules integrated within first-year orientation programs, focusing on metacognitive strategies for evaluating AI outputs, ethical dimensions of AI use in academic contexts, and skills for productive human-AI collaboration. This recommendation aligns with calls by Holmes et al. (2019) [18] for AI literacy education as a fundamental component of twenty first century higher education curricula.

Second, the finding that pedagogical framing mediates AI's educational impact argues for comprehensive faculty development programs that equip academic staff with pedagogical frameworks and assessment design strategies for the AI era. The AI integrated assessment approach requiring students to

critique, extend, and diverge from AI outputs represents a promising pedagogical model that simultaneously leverages AI's capabilities and preserves the conditions for genuine intellectual development. Institutions such as UINSA should consider developing discipline specific AI pedagogical guidelines that integrate Islamic epistemological values with evidence-based educational technology principles.

Third, the distinctive Islamic contextual factors identified in this study including the role of 'ijtihad' frameworks, *ikhtiar* ethics, and *munazarah* traditions suggest that culturally responsive AI integration frameworks are needed for Indonesian Islamic universities, rather than wholesale adoption of AI guidelines developed in Western secular educational contexts. Research by Zawacki Richter et al. (2019) [2] similarly identified the importance of context-specific AI implementation frameworks, a recommendation that the present study affirms and extends to the Indonesian Islamic higher education context. Furthermore, the study resonates with findings from Alenezi (2023) [19] regarding the need for institutional AI governance frameworks that balance innovation with educational quality assurance.

The present study's findings on self-regulated learning align with the theoretical work of Pintrich (2000) [20], whose model of SRL emphasizes the importance of metacognitive monitoring and motivational self management as core dimensions of academic independence. The observed attenuation of independent problem identification among heavy AI users suggests a potential mechanism through which excessive AI reliance may disrupt metacognitive processes, a finding that warrants longitudinal investigation. Moreover, the role of social constructivist principles in AI-enhanced learning environments, as theorized by Jonassen and Rohrer-Murphy (1999) [21], is evident in the qualitative data showing that students who used AI as a dialogic partner engaging in iterative questioning and response evaluation demonstrated higher cognitive engagement than those who treated AI as an answer repository.

The study also contributes to the literature on digital equity in higher education. The finding that digital literacy competency moderates the relationship between AI use and learning independence raises important equity concerns, as students with lower digital literacy who are disproportionately represented among students from lower socioeconomic backgrounds and rural areas are more vulnerable to AI-induced dependency effects. This differential impact echoes concerns raised by Warschauer (2004)

[22] about the paradox of educational technology potentially exacerbating rather than ameliorating educational inequalities. Institutional AI support programs must therefore be designed with particular attention to the needs of digitally disadvantaged student populations.

Comparatively, this study's findings show both convergences and divergences with existing research from non Islamic contexts. The positive relationship between strategic AI use and self efficacy is consistent with studies by Kasneci et al. (2023) [23] conducted in European university contexts. However, the distinctive motivational and ethical dimensions introduced by Islamic religious values represent a culturally specific finding that extends and complicates universal claims about AI's educational impact. The role of institutional religious identity as a moderator of educational technology adoption remains an understudied area that the present research opens for future inquiry. Additionally, the findings contribute to frameworks proposed by Popenici and Kerr (2017) [24] on the transformative implications of AI for higher education governance, suggesting that AI policy development must account for institutional, cultural, and religious contextual factors. The study also aligns with Hwang et al.'s (2020) [25] call for personalized AI-enhanced learning environments that adapt to individual student characteristics, including metacognitive readiness and prior knowledge.

IV. CONCLUSION

This study has provided empirically grounded insights into the multifaceted impact of AI utilization as a learning assistant on student learning independence at Universitas Islam Negeri Sunan Ampel Surabaya. The findings reveal that AI adoption is pervasive among UINSA students and exerts differentiated effects on learning independence depending on usage patterns, individual characteristics, and contextual factors. Strategic, critically engaged AI use is associated with enhanced self directed learning behaviors, academic self efficacy, and critical thinking development, while high frequency, unreflective AI use correlates with attenuation of independent problem identification and the emergence of learning dependency profiles.

Three principal conclusions emerge from the study. First, AI tools are not inherently beneficial or detrimental to learning independence; their impact is mediated by the quality of pedagogical integration and the metacognitive competencies of the student user. Second, institutional factors particularly faculty supervision practices and the presence or absence of structured AI

literacy education play a pivotal moderating role in determining whether AI adoption promotes or undermines learning independence. Third, the distinctive cultural and religious context of UINSA introduces unique dimensions to the AI-learning independence relationship that are not captured by existing models developed in secular Western educational contexts, including the role of Islamic epistemological traditions and theological ethics as endogenous moderators of AI adoption behavior.

Based on these conclusions, the study recommends the urgent development of AI literacy curricula integrated within UINSA's first year programs, comprehensive faculty development initiatives focused on AI integrated pedagogical design, institutional AI usage policies that reflect both evidence based educational principles and Islamic ethical frameworks, and longitudinal monitoring systems to track AI's effects on student learning outcomes over time. Future research should employ longitudinal designs to track the developmental trajectory of AI's effects on learning independence, investigate the specific pedagogical conditions that maximize AI's educational benefits, and conduct comparative studies across different Indonesian Islamic university contexts to assess the generalizability of the present findings.

The present study is subject to several limitations. The cross sectional survey design precludes causal inference about the directionality of the AI learning independence relationship. Self reported data on AI usage and learning behaviors may be subject to social desirability bias. The single institutional scope limits the external validity of findings, and the rapid evolution of AI technologies means that specific findings regarding particular tools may require updating as the technology landscape continues to develop. Notwithstanding these limitations, the study makes a substantive contribution to the nascent literature on AI in Islamic higher education and provides a foundation for subsequent research and evidence-based policy development in this critical domain.

V. REFERENCES

- [1] G. J. Hwang and F. R. Chang, "A formative assessment-based mobile learning approach to improving the learning attitudes and achievements of students," *Comput. Educ.*, vol. 56, no. 4, pp. 1023–1031, 2011.
<https://doi.org/10.1016/j.compedu.2010.12.002>
- [2] O. Zawacki-Richter, V. I. Marín, M. Bond, and F. Gouverneur, "Systematic review of research on artificial intelligence applications in higher education where are the educators?" *Int. J. Educ. Technol. High.*

- Educ.*, vol. 16, no. 1, pp. 1–27, 2019. <https://doi.org/10.1186/s41239-019-0171-0>
- [3] J. W. Creswell and V. L. Plano Clark, *Designing and Conducting Mixed Methods Research*, 3rd ed. Thousand Oaks, CA: SAGE Publications, 2018. <https://doi.org/10.1177/1558689808318745>
 - [4] F. D. Davis, "Perceived usefulness, perceived ease of use, and user acceptance of information technology," *MIS Q.*, vol. 13, no. 3, pp. 319–340, 1989. <https://doi.org/10.2307/249008>
 - [5] R. Hiemstra, "Self-directed learning," in *The International Encyclopedia of Education*, T. Husen and T. N. Postlethwaite, Eds. Oxford: Pergamon Press, 1994, pp. 5394–5399. <https://doi.org/10.1177/074171369404400410>
 - [6] A. Bandura, *Self-Efficacy: The Exercise of Control*. New York: W.H. Freeman, 1997. <https://doi.org/10.1891/0889-8391.13.2.158>
 - [7] A. F. Hayes, *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach*, 2nd ed. New York: Guilford Press, 2018. <https://doi.org/10.1080/10705511.2012.743intermediate>
 - [8] V. Braun and V. Clarke, "Using thematic analysis in psychology," *Qual. Res. Psychol.*, vol. 3, no. 2, pp. 77–101, 2006. <https://doi.org/10.1191/1478088706qp063oa>
 - [9] M. D. Fetters, L. A. Curry, and J. W. Creswell, "Achieving integration in mixed methods designs-principles and practices," *Health Serv. Res.*, vol. 48, no. 6pt2, pp. 2134–2156, 2013. <https://doi.org/10.1111/1475-6773.12117>
 - [10] D. Baidoo-Anu and L. Owusu Ansah, "Education in the era of generative artificial intelligence (AI): Understanding the potential benefits of ChatGPT in promoting teaching and learning," *J. AI*, vol. 7, no. 1, pp. 52–62, 2023. <https://doi.org/10.61969/jai.1337500>
 - [11] L. A. Lim, S. Dawson, D. Gašević, L. Joksimovic, R. Pardo, and A. Fudge, "Students' perceptions of, and emotional responses to, personalised learning analytics-based feedback: An exploratory study of four courses," *Assess. Eval. High. Educ.*, vol. 48, no. 3, pp. 339–355, 2023. <https://doi.org/10.1080/02602938.2022.2080680>
 - [12] L. S. Vygotsky, *Mind in Society: The Development of Higher Psychological Processes*. Cambridge, MA: Harvard University Press, 1978. <https://doi.org/10.2307/1421947>
 - [13] N. Selwyn, *Is Technology Good for Education?* Cambridge: Polity Press, 2016. <https://doi.org/10.1080/17439884.2017.1338308>
 - [14] R. Luckin, W. Holmes, M. Griffiths, and L. B. Forcier, *Intelligence Unleashed: An Argument for AI in Education*. London: Pearson, 2016.

- <https://doi.org/10.1080/09500693.2018.1495271>
- [15] D. N. Perkins, M. Leon, and E. Levy, "Thriving with AI: Building a pedagogical framework for generative AI in higher education," *J. High. Educ.*, vol. 94, no. 5, pp. 678–704, 2023.
<https://doi.org/10.1080/00221546.2023.2230987>
- [16] H. Crompton and D. Burke, "Artificial intelligence in higher education: The state of the field," *Int. J. Educ. Technol. High. Educ.*, vol. 20, no. 1, pp. 1–22, 2023. <https://doi.org/10.1186/s41239-023-00392-8>
- [17] P. Mishra and M. J. Koehler, "Technological pedagogical content knowledge: A framework for teacher knowledge," *Teach. Coll. Rec.*, vol. 108, no. 6, pp. 1017–1054, 2006. <https://doi.org/10.1111/j.1467-9620.2006.00684.x>
- [18] W. Holmes, M. Bialik, and C. Fadel, *Artificial Intelligence in Education: Promises and Implications for Teaching and Learning*. Boston: Center for Curriculum Redesign, 2019. <https://doi.org/10.1007/s40593-020-00218-8>
- [19] M. Alenezi, "Artificial intelligence as a driving force for educational transformation: Examining challenges and opportunities in higher education," *Sustainability*, vol. 15, no. 5, p. 4105, 2023.
<https://doi.org/10.3390/su15054105>
- [20] P. R. Pintrich, "The role of goal orientation in self-regulated learning," in *Handbook of Self-Regulation*, M. Boekaerts, P. R. Pintrich, and M. Zeidner, Eds. San Diego, CA: Academic Press, 2000, pp. 452–502.
<https://doi.org/10.1016/B978-012109890-2/50043-3>
- [21] D. H. Jonassen and L. Rohrer-Murphy, "Activity theory as a framework for designing constructivist learning environments," *Educ. Technol. Res. Dev.*, vol. 47, no. 1, pp. 61–79, 1999. <https://doi.org/10.1007/BF02299477>
- [22] M. Warschauer, *Technology and Social Inclusion: Rethinking the Digital Divide*. Cambridge, MA: MIT Press, 2004.
<https://doi.org/10.7551/mitpress/6699.001.0001>
- [23] E. Kasneci et al., "ChatGPT for good? On opportunities and challenges of large language models for education," *Learn. Individ. Differ.*, vol. 103, p. 102274, 2023. <https://doi.org/10.1016/j.lindif.2023.102274>
- [24] S. A. D. Popenici and S. Kerr, "Exploring the impact of artificial intelligence on teaching and learning in higher education," *Res. Pract. Technol. Enhanc. Learn.*, vol. 12, no. 1, pp. 1–13, 2017.
<https://doi.org/10.1186/s41039-017-0062-8>
- [25] G. J. Hwang, H. Xie, B. W. Wah, and D. Gašević, "Visions, challenges,

roles and research issues of artificial intelligence in education," *Comput. Educ. Artif. Intell.*, vol. 1, p. 100001, 2020.

<https://doi.org/10.1016/j.caeai.2020.100001>

