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Integrating Generative AI within Deep Learning Frameworks to Transform Student Learning Dimensions: A Systematic Literature Review

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ABSTRACT

The rapid advancement of Artificial Intelligence (AI) in education has increased the necessity of understanding its role in supporting learning processes. Most current studies focus on teacher performance or instructional efficiency, while the relationship between AI and the student learning model remains under-explored. This study aims to analyze how the utilization of AI supports student learning models and identifies specific AI technologies, applications, or platforms that optimize these models. Through a Systematic Literature Review (SLR) protocol tracking 392 initial records down to 25 final articles from Scopus and SINTA (2020-2025) databases, this study provides an explicit methodological framework mapping AI's interaction with student agency. Theoretically, it shifts the educational discourse from teacher performance to student-centered autonomy, while practically offering design strategies for implementing collaborative AI tools within deep learning environments. Through a SLR method, two primary findings emerged. First, AI technologies such as Intelligent Tutoring Systems (ITS) and Large Language Models (LLM) significantly influence indicators of aspirations, learning to learn capabilities, and interpersonal relationships. Second, AI-based learning environments facilitate a more adaptive, personalized, and student-centered learning model by simultaneously integrating cognitive, social, and motivational dimensions. These findings confirm that AI is not merely an automation tool but a collaborative partner that strengthens student learning autonomy.

INTRODUCTION

The development of Artificial Intelligence (AI) technology is increasingly rapid and has a significant impact on various fields, including education. In addition to improving efficiency and automation, the development of AI also opens opportunities for innovation in various sectors while simultaneously presenting new challenges that must be managed wisely. In the education sector, the use of AI supports the

transformation of learning through personalization, automation, and increased interactivity, which are closely related to the concept of deep learning. Within the learning design component of the deep learning framework, the utilization of AI is positioned under the concept of digital utilization. In addition to digital utilization, learning design also includes other elements such as learning partnerships, learning environments, and pedagogical practices. These elements interact to create engaging, meaningful, and impactful learning experiences (Fullan, M., Q, Quinn, J., & McEachen, J., 2017).

The utilization of AI highlights how the integration of AI tools and resources can support learning in powerful ways. However, technology that is used without appropriate teaching strategies and deep learning tasks will have limited impact on learning outcomes. Large investments made by governments and educational institutions in providing technology will not produce optimal results without changes in the underlying pedagogical models through which teachers teach and students learn (Q Quinn, J., McEachen, J., Fullan, M., Gardner, M., & Drummy, M., 2019). In efforts to improve learning effectiveness, studies and educational practices have generally focused on how teachers teach, including how they utilize AI technology in the learning process. Meanwhile, the conditions and processes of how students learn, whether influenced by teaching strategies or other factors, have received less attention. To better understand how students learn, the student learning model framework proposed by González-Pérez et al (2022) can be used as a reference. This framework emphasizes student voice and choice so that students can actively participate in the learning process. The framework consists of three main components, namely learning to learn, relationships, and aspirations (Joo, K. H., & Park, N. H., 2024).

AI refers to the capability of machines to perform tasks that normally require human cognitive abilities such as learning, reasoning, problem solving, and decision making (Talan, 2022; Sadiku et al., 2021). In the field of education, AI technologies are utilized to support and improve teaching and learning processes. Applications such as intelligent tutoring systems, adaptive learning platforms, and automated feedback systems aim to personalize learning experiences and improve student engagement, motivation, and learning outcomes (Utina et al., 2024). The utilization of AI in this context highlights how the integration of AI tools and resources can support learning in optimizing the student learning model. The student learning model used in this study refers to the framework introduced by Adiguzel et al (2023), which emphasizes the active role of students in the learning process. The framework prioritizes student voice and choice so that learners can actively participate in shaping their learning experiences. The student learning model framework used in this study is presented in Figure 1 below:

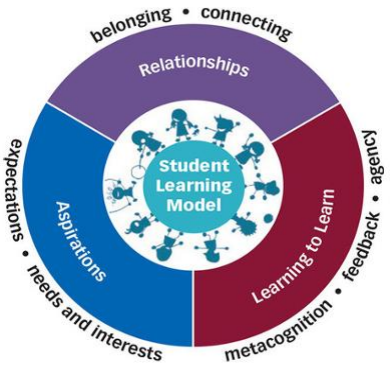

Figure 1. Framework of Student Learning Models

Based on this framework, it can be understood that the student learning model prioritizes student voice and choice so that learners can actively participate in the learning process. Despite the surging volume of research on educational artificial intelligence, a critical systematic gap remains in how these technologies intersect with structural pedagogical frameworks. Prior review articles have predominantly examined AI from an institutional or instructional efficiency lens, focusing heavily on how automation optimizes teacher performance, grading workloads, or curriculum delivery (Chen et al., 2020; Hwang et al., 2020). Conversely, the operationalization of AI to cultivate and reshape the internal capacities of the learners themselves has been largely sidelined. This study distinctly departs from traditional instructional-centric reviews by re-centering the analytical focus onto the student's holistic ecosystem through the lens of Fullan's Deep Learning framework (Fullan, et all., 2017) Specifically, this review offers a novel contribution by systematically mapping how generative AI and advanced educational technologies interact with, support, and actively restructure the three core pillars of the Student Learning Model: student agency (learning to learn), motivational aspirations, and socio-emotional relationships. By exploring these converging digital dynamics, this paper bridges the theoretical gap between raw AI capabilities and human-centric, deep learning outcomes.

Therefore, this study aims to analyze how the utilization of AI supports the student learning model and to identify AI technologies, applications, or platforms that can be used to optimize the student learning model. The findings are expected to provide a reference for designing appropriate strategies to transform the role of students, not only by providing autonomy but also by integrating the development of internal capacities such as self-understanding, motivation, and metacognitive abilities (Sagheer, H., Saleem, A., & Urooj, T., 2025). The framework of the student learning model, which emphasizes aspirations, relationships, and learning capabilities, requires an in-depth analysis of how AI technology interacts with these elements. To bridge the gap between pedagogical theory and the practical implementation of AI technology, this study employs a systematic literature review approach. This step is taken to map current research trends and provide empirical evidence regarding the effectiveness of AI in transforming the role of students in the digital era (George, A. S., 2023).

METHODS

This study examines a comprehensive range of scholarly articles specifically focused on the integration of Artificial Intelligence (AI) in student learning models, its role in strengthening technological mastery among educators and students, and its contribution to deep learning competencies. The primary references are drawn from reputable international journals indexed in Scopus and national journals accredited SINTA 2 – 4. The review's analytical focus is structured around several critical factors, including research clusters, topic density, and emerging trends within the intersection of AI and pedagogical evolution.

Research aim to synthesize previously reviewed studies to identify a common thread that bridges the gap between AI implementation and practical learning outcomes. The systematic search was conducted using title, abstract, and keywords (TITLE-ABS-KEY), complemented by forward and backward snowballing techniques across electronic databases, primarily the Scopus and national journals accredited SINTA 2 – 4. The search strings were refined from Google Scholars using specific

Boolean operators as table 1 follows (Carrera-Rivera, A., Ochoa, W., Larrinaga, F., & Lasa, G., 2022):

Table 1. Search Strings Topic and Initial Results

No	Topic	Search Terms	Initial Results
1	AI Integration Supports Student Learning Models	TITLE-ABS-KEY (“artificial intelligence” AND “student learning models” AND “integration”) AND (LIMIT-TO (SUBJAREA , “SOCI”) OR LIMIT-TO (SUBJAREA , “EDU”)) AND (LIMIT-TO (DOCTYPE , “art”)) AND (LIMIT-TO (LANGUAGE , “English”)) AND (LIMIT-TO (EXACTKEYWORD , “Artificial Intelligence”) OR LIMIT-TO (EXACTKEYWORD , “Student Learning”))	184
2	AI Strengthens Technological Mastery of Educators and Students	TITLE-ABS-KEY ("artificial intelligence" AND "technological mastery" AND ("educators" OR "students")) AND (LIMIT-TO (SUBJAREA , "SOCI") OR LIMIT-TO (SUBJAREA , "EDU")) AND (LIMIT-TO (DOCTYPE , "art")) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (EXACTKEYWORD , "Technology Integration") OR LIMIT-TO (EXACTKEYWORD , "Digital Literacy"))	92
3	AI-Supported Learning Contributes to Deep Learning Competencies	TITLE-ABS-KEY ("AI-supported learning" AND "deep learning competencies") AND (LIMIT-TO (SUBJAREA , "SOCI") OR LIMIT-TO (SUBJAREA , "EDU")) AND (LIMIT-TO (DOCTYPE , "art")) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (EXACTKEYWORD , "Deep Learning") OR LIMIT-TO (EXACTKEYWORD , "Competency Based Education"))	16
	Total		**392**

To ensure reproducibility and rigorous transparency, the study followed a multi-stage screening protocol adapted from the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. The systematic selection process was executed through four sequential phases: Identification, Screening, Eligibility, and Inclusion/Exclusion Criteria. In the Identification phase, the initial automated database search across Scopus and SINTA 2-4 yielded a gross total of 392 articles based on the tailored Boolean search strings. These metadata records were exported as .ris files and uploaded into Rayyan and Mendeley reference management software for cross-database deduplication, which resulted in the removal of 43 duplicate entries, leaving 349 unique articles for active screening.

During the Screening phase, a strict title and abstract review was conducted independently against the predetermined inclusion criteria (focusing strictly on educational technology, peer-reviewed journals, and publication years 2020–2025). This phase eliminated 214 articles that were fundamentally irrelevant to the core intersection of AI and student-centered pedagogy, because the studies focused purely on technical computer science algorithms, non-educational corporate training, or traditional teacher-centric evaluation frameworks.

The remaining 135 articles advanced to the Eligibility phase, where full-text assessments were performed. At this juncture, 110 articles were systematically excluded based on explicit criteria: 42 articles lacked direct mapping onto the specific

dimensions of the Student Learning Model (aspirations, relationships, learning to learn), 37 were from book chapters or conference proceedings that did not meet the rigorous journal standard, 19 were published in journals subsequently discovered to be discontinued, and 12 had inaccessible full texts. This meticulous filtering culminated in a final synthesis sample of 25 high-quality, fully accessible empirical articles (N=25) that formed the analytical core of this systematic review.

Inclusion Criteria

Due to the continuous updates in academic databases, these numbers search strings are representative snapshots of real-time search results for each topic. Inclusion criteria were strictly applied to articles published between 2020 and 2025 to ensure the data reflects the most real-time and contemporary advancements in the field. Furthermore, the selection was limited to the Social Humanities and Education subject areas, document types restricted to "Article", publication stage set to "Final", written in English, and involving both qualitative and quantitative research methods. (Yadav, S., 2025).

Exclusion Criteria

To ensure the quality and focus of the literature reviewed, a set of rigorous exclusion criteria was established to ensure alignment with educational technology issues in the digital era, as detailed in Table 2. This framework served as the primary filter during the screening process, ensuring that only high-quality, peer-reviewed research published between 2020 and 2025 was included. By excluding non-article formats, such as book chapters and conference proceedings, also focusing specifically on journals indexed in Scopus and SINTA 2-4, the study maintains a high standard of academic validity. Furthermore, any articles from discontinued journals or those that did not directly address the integration of AI, educator mastery, and deep learning competencies were systematically removed to prevent data bias and ensure the findings are relevant to the current digital education discourse. This verification culminated in a final selection of 25 highly relevant articles/journals that provide the core data for this systematic literature review related to the designated topics (Ansori, I., Arianto, F., & Khotimah, K., 2024).

Table 2. Search Strings Inclusion and Exclusion Criteria

Search Query (TITLE-ABS-KEY) "	Inclusion Criteria	Exclusion Criteria
"Artificial intelligence" AND "student learning models" "Technological mastery" AND "educators" AND "AI" "AI-supported learning" AND "deep learning competencies"	1. Research articles (Journal) 2. Publication period: 2020–2025 3. Written in the English language 4. Indexed in Scopus or SINTA (Grade 2–4) 5. Qualitative, Quantitative, and Mixed-Method studies 6. Focus on AI integration, educator mastery, and deep learning	1. Publication before 2020 2. Not published in the form of a peer-reviewed article 3. Review papers, book chapters, or proceeding papers 4. The journal is discontinued or no longer exists 5. The article is not accessible or cannot be downloaded 6. Irrelevant to the digital

Figure 2 shows that this research began with a search for articles using the keyword "Artificial Intelligence (AI) to Support Student Learning Model" in the Scopus and SINTA 2-4 database for the 2020–2025 period. This search identified 25 articles that were then reviewed based on stages: a search for articles, import articles in the Rayyan and Mendeley application software, then analyzed by mapping of discussion topics (Utami, D. F., Sutikno, P. Y., Widiarti, N., & Yuwono, A., 2025).

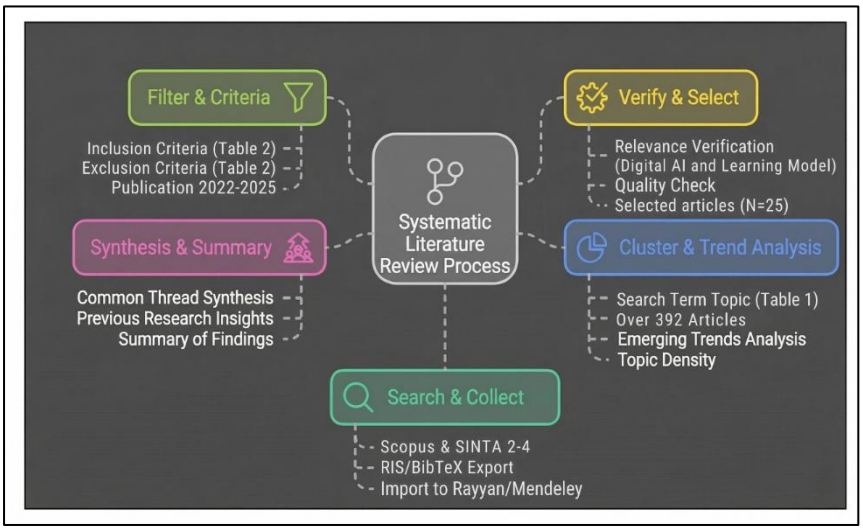

Figure 2. SLR Research Method

RESULTS AND DISCUSSION

Results

There are three components in the student learning model framework, namely learning to learn, relationships, and aspirations. The results of the literature review in this study answer the research questions regarding how artificial intelligence (AI) influences the student learning model and what AI technologies, applications, or platforms can be utilized to optimize the learning process. The synthesis and summary of selected articles results are summarized in table 3, while the cluster and trend analysis is presented in table 4 as follows:

Table 3. The Synthesis and Summary Finding Result

Learning Model Dimension	Core Findings	Supporting Technologies & Platforms	Strategic Impact (Discussion)
Model Learning to Learn	Increased **metacognition** and **self-regulation**. Students can monitor progress, analyze their own understanding, and adjust materials independently.	ALEKS, Knewton, Grammarly, Codecademy, ITS, ChatGPT.	AI reduces **cognitive load** and enhances learning efficiency through adaptive content personalization and autonomous decision-making.
Model Relationship	Strengthening **collaboration** and **time management**. Students are more active in group dialogues, teacher-student interactions are more	Chatbots, LLMs (ChatGPT), Bayesian Networks, Neural Networks, Collaborative Writing Tools.	AI helps students overcome emotional barriers such as **learning anxiety** through supportive discussion spaces and real-time feedback.

Learning Model Dimension	Core Findings	Supporting Technologies & Platforms	Strategic Impact (Discussion)
	productive, and environments are more inclusive.		
Model Aspirations	Enhanced **self-efficacy** and **intrinsic motivation**. Particularly helpful for *low achievers* in building confidence and taking academic risks.	Gamification (Points, Leaderboards), Smart Sparrow, Reinforcement Learning (RL), ChatGPT.	Gamification and AI connect learning to the **real world**, fostering high goal orientation and 21st-century competency readiness.

Summary of Analysis

Based on the synthesis of the 25 reviewed articles, AI consistently supports three main dimensions within the Student Learning Model. The findings indicate that technologies such as ALEKS, Knewton, and LLMs (e.g., ChatGPT) enhance students' metacognition and self-regulation. AI reduces cognitive load through adaptive content personalization, allowing students to monitor their own progress independently. This aligns with findings that AI provides full autonomy for students to become designers of their own learning strategies (Self-Regulated Learning), rather than mere passive recipients of information. Beyond the enhancement of individual learning capabilities, AI also plays a transformative role in the social dynamics of the educational environment.

In the relationship component, the use of Chatbots and AI-powered collaborative writing tools has been proven to strengthen interactions between teachers and students, as well as among peers. Learning environments become more inclusive as AI helps overcome emotional barriers, such as learning anxiety, through supportive discussion spaces and real-time feedback. AI has evolved from a simple tool into a collaborative partner capable of managing the socio-emotional aspects of learning. The evolution of AI into a collaborative partner serves as a foundation for broader psychological impacts, specifically regarding student motivation.

AI was found to enhance students' self-efficacy and intrinsic motivation, particularly through gamification systems and AI-supported peer feedback. The integration of this technology is crucial for low-achieving students to rebuild a sense of competence and the courage to take academic risks. By connecting learning with real-world contexts, AI assists students in setting higher learning goals. A comprehensive synthesis of these detailed observations reveals three primary thematic pillars that define the current impact of AI on student learning models:

1. Personalization as the key: The findings indicate that technologies like Intelligent Tutoring Systems (ITS) and Large Language Models (LLM) provide students with full autonomy. Students are no longer passive recipients of information but active designers of their own Self-Regulated Learning strategies.
2. Transformation of Technology's Role: Technology has evolved from a simple tool into a collaborative partner. The use of Bayesian Networks and Neural Networks to monitor group dynamics shows that AI can manage the socio-emotional aspects of learning, not just the cognitive ones.

3. Impact on Motivation (Aspirations): The integration of gamification and AI-supported peer feedback is proven effective in reducing the fear of failure. This is crucial for lower-performing students to regain a sense of competence.

However, while these findings highlight a significant shift in student agency and engagement, the integration of such powerful tools requires a nuanced perspective. This leads to a Critical Balance: While ChatGPT and LLMs offer ease in research and information processing, the literature (e.g., Kasneci et al., 2023) emphasizes the importance of a balanced approach to ensure that critical thinking skills are not undermined. AI must remain a tool that supports the thinking process rather than a substitute for independent human reasoning.

Table 4. Cluster and Trend Analysis of SLR References

Cluster Name	Key Authors (References)	Thematic Focus	Evolutionary Trend
Cluster 1: AI Tools & Large Language Models (LLMs)	Adiguzel et al. (2023); Kasneci et al. (2023); George (2023).	Focuses on **ChatGPT**, generative AI, and the transformative potential of LLMs in classroom settings.	**Emerging (2023-2025):** Shift from general AI theory to specific, accessible generative tools that revolutionize writing and research.
Cluster 2: Personalized & Adaptive Learning Models	Alamri et al. (2020); Hwang et al. (2020); Chen et al. (2020); Alalawi et al. (2025).	Focuses on **Intelligent Tutoring Systems (ITS)**, learner autonomy, and machine learning for performance prediction.	**Stabilizing (2020-2025):** Moving toward "Learning Analytics" and precision intervention to support individual student needs.
Cluster 3: Pedagogical Frameworks & Engagement	Fullan et al. (2017); Quinn et al. (2019); Brown et al. (2022); O'Regan et al. (2023).	Focuses on **Deep Learning**, student engagement frameworks, and 21st-century skill development.	**Foundational:** Provides the theoretical "common thread" that connects AI technology to human-centric learning outcomes.
Cluster 4: Technological Integration (Mobile & Gamification)	Kalogiannakis et al. (2022); Ansori et al. (2024); Parsons et al. (2024); Utami et al. (2025).	Focuses on **Mobile Learning (m-Learning)**, Gamification, and Interactive Media specifically for Science Education/HOTS.	**Expanding (2024-2025):** Increasing focus on high-level cognitive skills (HOTS) facilitated by portable and interactive AI-driven media.

Analysis of Trends

Beyond performance variations, the literature presents a strict warning regarding the systemic risks, algorithmic biases, and ethical limitations inherent in unmediated AI adoption. A critical challenge highlighted across emerging trends (e.g., Kasneci et al., 2023) is the potential degradation of Higher Order Thinking Skills (HOTS). When generative tools like ChatGPT are utilized as shortcuts for research and information processing rather than supportive cognitive catalysts, they inadvertently promote passive intellectual dependency, thereby undermining independent human reasoning and critical reflection. Furthermore, deep contextual challenges persist on the ground. Algorithmic designs frequently reflect data biases that marginalize local wisdom and diverse student profiles, while the continuous tracking of learner behaviors triggers severe data privacy concerns. Therefore, to successfully align AI with Fullan's Deep Learning framework (Fullan, et all., 2017), educational institutions must actively transition from a state of technological convenience to one of pedagogical intentionality

and establishing rigorous ethical safeguards that position AI strictly as an enhancer of human thought, rather than its algorithmic substitute.

Trend analysis shows a significant shift from general AI theories toward specific Generative AI applications (such as ChatGPT) between 2020 and 2025. The primary focus is no longer just technical mastery but empowering students with essential life skills. However, the literature also warns of the importance of a balanced approach to ensure that the ease of information processing provided by LLMs does not undermine students' critical thinking skills. AI must remain positioned as a tool to support the thinking process, not a substitute for independent reasoning and critical reflection.

This evolving landscape, which prioritizes student empowerment while maintaining a critical pedagogical balance, is further substantiated by the following key research trends identified in the literature:

1. The "Generative" Shift (2020–2025): Research has shifted dramatically from general AI concepts (Sadiku et al., 2022) to the specific application of Large Language Models like ChatGPT. The trend highlights a move toward "empowering students with life skills" (Sagheer et al., 2025) rather than just technical mastery.
2. From Theory to Bibliometric Evidence: There is a rising trend in meta-research. Early papers focused on "Vision and Challenges" (Hwang et al., 2020), while recent publications use Bibliometric Analysis (Talan, 2022; Guo et al., 2024) to map the vast growth of the field, reflecting a maturing research domain.
3. Emphasis on HOTS and Deep Learning: Current literature (Ansori et al., 2024; Fullan et al., 2017) emphasizes that AI integration must result in Higher Order Thinking Skills (HOTS). The trend is no longer just about using AI, but about using AI to achieve "Deep Learning" competencies that allow students to "engage and change the world.
4. Regional Comparative Studies: Newer studies (Utina et al., 2024) have begun exploring geographical variations (e.g., Indonesia vs. Thailand), suggesting a trend toward understanding how cultural and regional educational policies affect AI adoption.

Discussion

A critical synthesis of the 25 reviewed studies reveals a powerful convergence regarding the transformative capacity of AI in educational settings. The literature consistently aligns on the fact that advanced tools like Large Language Models (LLMs) and Intelligent Tutoring Systems (ITS) significantly diminish cognitive load, thereby functioning not merely as technical aids but as collaborative partners that foster student self-regulation and intrinsic motivation (Adiguzel et al., 2023; Kasneci et al., 2023). However, a stark divergence emerges when evaluating the structural equity of these digital outcomes. While mainstream studies celebrate rapid gains in learner autonomy among high-achieving students, regional comparative literature (Utina et al., 2024) points out a significant pedagogical disparity: low-achieving students or those in resource-constrained regional contexts often experience severe instructional anxiety and alienation when forced into AI-driven environments without strong human scaffolding. This friction emphasizes that the perceived success of AI integration is highly conditional, fluctuating heavily based on the students' pre-

existing digital literacy and the socioeconomic readiness of their educational ecosystems.

Based on the synthesis of the reviewed studies, artificial intelligence (AI) technologies significantly strengthen the three core dimensions of the Student Learning Model: cognitive, social, and motivational. In the "Learning to Learn" (cognitive) dimension, AI supports students' metacognitive abilities and self-regulation through adaptive feedback and personalized content. Technologies such as Intelligent Tutoring Systems (ITS) and adaptive platforms (e.g., ALEKS or Knewton) allow students to monitor their own progress independently. As a result, students demonstrate increased autonomy in managing learning activities and aligning their projects with specific academic goals, particularly in literacy-related competencies (Brown, A., Lawrence, J., Basson, M., & Redmond, P., 2022).

Transitioning from individual cognitive mastery to the social sphere, AI also acts as a catalyst in the "Relationships" dimension. In the relationship component, AI-supported platforms facilitate interaction, collaboration, and communication among students and educators. Learning technologies enable students to develop effective learning strategies, manage time efficiently, and engage actively in discussions, teamwork, and collaborative problem solving. These technologies also contribute to reducing learning anxiety and encouraging students to recognize their learning potential within inclusive learning environments (Singelmann, L. N., & Ewert, D. L., 2022). The synergy between cognitive autonomy and social support ultimately culminates in the "Aspirations" (motivational) dimension. In the aspirations component, the findings show that AI strengthens students' motivation, confidence, and self-efficacy. Students demonstrate increased willingness to overcome fear of failure, set higher learning goals, and connect academic learning with real-world contexts. Personalized feedback, collaborative learning experiences, and AI-supported tools contribute to enhancing intrinsic motivation and fostering long-term learning aspirations (Alalawi, K., Athauda, R., & Chiong, R., 2025).

The effectiveness of these three dimensions is driven by the specific technological architectures identified in this study. These include gamification, ITS, machine learning models, and—most notably—Large Language Models (LLMs) like ChatGPT. While most technologies serve specific indicators, LLMs have emerged as a versatile tool capable of stimulating competencies across all three components simultaneously. This versatility allows students to engage in reflective learning and critical thinking while maintaining collaborative ties with their peers (Zheng, W., Wen, S., Lian, B., & Nie, Y., 2023).

When viewed holistically, these findings align with the concept of "Deep Learning." The integration of AI does not merely automate tasks; it connects students with global resources and provides meaningful, personalized experiences that allow them to "engage and change the world." This interaction creates a mutually reinforcing cycle: strong relationships increase confidence (Aspirations), which in turn drives students to take a more active role in their own development (Learning to Learn). This creates a holistic environment where cognitive, social, and motivational growth occur simultaneously (O'Regan, C., Walsh, N., Hall, T., Mannion, G., & Millar, M., 2023). Consequently, this study suggests a necessary shift in educational perspectives. Research should move beyond evaluating how AI affects "teaching performance" and instead focus on its impact on "student learning performance." By utilizing the Student Learning Model as a framework, educators can better understand how AI empowers students to be active designers of their own education. This shift ensures that AI

remains a tool for empowerment and deep engagement, rather than just a mechanism for instructional efficiency (Guo, S., Zheng, Y., & Zhai, X., 2024).

Several technology bases were identified to stimulate skills in particular components of the student learning model framework. However, some technologies are able to stimulate competencies across the three components simultaneously, particularly Large Language Model (LLM) based applications that assist students in writing, critical thinking, collaboration, and reflective learning processes. The findings of this study are consistent with the concept of deep learning, where the use of artificial intelligence can support deeper learning when it connects students with global resources, expands opportunities for collaboration, and provides more personalized and meaningful learning experiences (Parsons, D., Palalas, A., Nikou, S., & Rodulfo, S., 2024). Therefore, the perspective used to examine the impact of artificial intelligence in education should not only focus on how AI affects teaching performance, but also on how AI influences student learning performance.

To understand this impact, one relevant framework is the student learning model. This model emphasizes the active role of students in the learning process and focuses on three main components, namely learning to learn, relationships, and aspirations. These components are interconnected and mutually supportive in shaping effective learning experiences (Alamri, H., Lowell, V., Watson, W., & Watson, S. L., 2020). In summarize, the literature confirms that AI-supported environments facilitate a more adaptive and student-centered model. This is consistent with previous research showing that when AI is integrated thoughtfully, it improves engagement, collaboration, and learning confidence (Kalogiannakis, M., Papadakis, S., & Zourmpakis, A. I., 2022).

This interaction between learning to learn, relationships, and aspirations creates a holistic learning environment that supports deeper engagement and meaningful learning processes. Previous studies also show similar patterns where artificial intelligence supported learning environments contribute to improved motivation, engagement, collaboration, and learning confidence (Adiguzel et al., 2023; Kasneci et al., 2023; Chen et al., 2020; Hwang et al., 2020). However, as the field matures from general theory toward specific applications like Generative AI, maintaining a balance between technological ease and the preservation of critical thinking remains the ultimate pedagogical challenge.

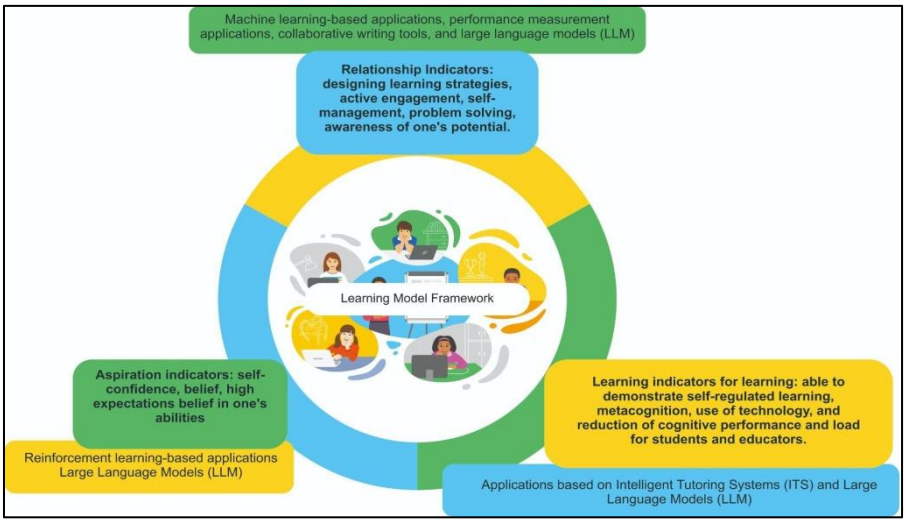

Figure 3. Model Artificial Intelligence (AI) to Support Student Learning Model

CONCLUSION

The findings of this study underscore that the integration of artificial intelligence (AI) in education transcends mere instructional efficiency, acting instead as a catalyst for transforming the student learning model. Through the analysis of current literature, it is evident that AI technologies—particularly Intelligent Tutoring Systems (ITS) and Large Language Models (LLMs)—effectively strengthen students' cognitive, social, and motivational dimensions. In the Learning to Learn component, AI fosters metacognition and self-regulation; in the Relationships component, it facilitates inclusive collaboration; and in the Aspirations component, it builds the self-efficacy necessary for students to pursue ambitious academic goals.

By enabling students to explore complex concepts and receive personalized, real-time feedback, AI-supported environments encourage a shift from rote memorization toward Deep Learning. This approach emphasizes understanding conceptual relationships and connecting academic knowledge with real-world contexts, thereby positioning students as active designers of their own learning trajectories. However, this study also highlights a critical caveat: while AI offers significant ease in information processing, it must remain a supportive tool that augments, rather than replaces, independent reasoning and critical reflection. Maintaining this balance is essential to ensure that the pursuit of technological convenience does not undermine the development of higher-order thinking skills. While this systematic review provides valuable insights, its generalizability is strictly limited by its reliance on a localized sample of 25 articles selected exclusively from Scopus and SINTA 2-4 databases within the 2020–2025 timeframe, which may omit emerging open-access findings or non-indexed regional educational policies.

Moreover, these conclusions lead to several practical and theoretical implications, beginning with the necessity for educators and academic institutions to shift toward student-centered integration strategies that prioritize learner autonomy and meaningful engagement over mere technical mastery. A deeper understanding of the interplay between artificial intelligence (AI) and learner-related factors, such as motivation and self-efficacy, may contribute to the advancement of more responsive and inclusive learning systems. At the same time, sustained attention to ethical governance, digital equity, and data privacy is required to ensure that the educational

benefits of AI are realized in a responsible and equitable manner. Ultimately, when implemented with pedagogical intentionality and ethical oversight, artificial intelligence has the potential to elevate the quality of education by fostering deeper, more resilient, and more effective learning processes for the digital age.

CONFLICT OF INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

REFERENCES

Adiguzel, T., Kaya, M. H., & Cansu, F. K. (2023). Revolutionizing education with AI: Exploring the transformative potential of ChatGPT. *Contemporary educational technology*, *15*(3).

Alamri, H., Lowell, V., Watson, W., & Watson, S. L. (2020). Using personalized learning as an instructional approach to motivate learners in online higher education: Learner self-determination and intrinsic motivation. *Journal of Research on Technology in Education*, *52*(3), 322–352.

Alalawi, K., Athauda, R., & Chiong, R. (2025). An extended learning analytics framework integrating machine learning and pedagogical approaches for student performance prediction and intervention. *International Journal of Artificial Intelligence in Education*, *35*(3), 1239-1287.

Ansori, I., Arianto, F., & Khotimah, K. (2024). The role of Mobile learning in facilitating science learning to enhance higher order thinking skills (HOTS): a systematic review. *Indonesian Journal of Instructional Media and Model*, *6*(2), 79-88.

Brown, A., Lawrence, J., Basson, M., & Redmond, P. (2022). A conceptual framework to enhance student online learning and engagement in higher education. *Higher Education Research & Development*, *41*(2), 284-299.

Carrera-Rivera, A., Ochoa, W., Larrinaga, F., & Lasa, G. (2022). How-to Conduct a Systematic Literature Review: A Quick Guide for Computer Science Research. *MethodsX*, *9*, 101895.

Chen, X., Xie, H., Zou, D., & Hwang, G. J. (2020). Application and theory gaps during the rise of Artificial Intelligence in Education. In *Computers and Education: Artificial Intelligence* (Vol. 1). Elsevier B.V.

Fullan, M., Quinn, J., & McEachen, J. (2017). *Deep learning: Engage the world change the world*. Corwin Press.

George, A. S. (2023). Preparing students for an AI-driven world: Rethinking curriculum and pedagogy in the age of artificial intelligence. *Partners Universal Innovative Research Publication*, *1*(2), 112-136.

González-Pérez, L. I., & Ramírez-Montoya, M. S. (2022). Components of Education 4.0 in 21st century skills frameworks: systematic review. *Sustainability*, *14*(3), 1493.

Guo, S., Zheng, Y., & Zhai, X. (2024). Artificial intelligence in education research during 2013–2023: A review based on bibliometric analysis. *Education and information technologies*, *29*(13), 16387-16409.

Hwang, G. J., Xie, H., Wah, B. W., & Gašević, D. (2020). Vision, challenges, roles and research issues of Artificial Intelligence in Education. In *Computers and Education: Artificial Intelligence* (Vol. 1). Elsevier B.V.

Joo, K. H., & Park, N. H. (2024). Teaching and learning model for artificial intelligence education. *Procedia Computer Science*, *239*, 226-233.

Kalogiannakis, M., Papadakis, S., & Zourmpakis, A. I. (2022). Gamification in science education. A systematic review of the literature. *Education Sciences*, *11*(1), 1–36.

Kasneci, E., Sessler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., Gasser, U., Groh, G., Günnemann, S., Hüllermeier, E., Krusche, S., Kutyniok, G., Michaeli, T., Nerdel, C., Pfeffer, J., Poquet, O., Sailer, M., Schmidt, A., Seidel, T., … Kasneci, G. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. In *Learning and Individual Differences* (Vol. 103). Elsevier Ltd.

O'Regan, C., Walsh, N., Hall, T., Mannion, G., & Millar, M. (2023). Conceptualising student engagement as a theoretical framework for innovative higher education practices: A literature review. *All Ireland Journal of Higher Education*, *15*(2).

Parsons, D., Palalas, A., Nikou, S., & Rodulfo, S. (2024). Mobile learning frameworks and pedagogy: A systematic review. *European Journal of Education*, *59*(2), e12601.

Q, Quinn, J., McEachen, J., Fullan, M., Gardner, M., & Drummy, M. (2019). *Dive into deep learning: Tools for engagement*. Corwin Press.

Sadiku, M. N. O., Ashaolu, T. J., Ajayi-Majebi, A., & Musa, S. M. (2022). Artificial Intelligence in Education. *International Journal of Scientific Advances*, *2*(1). www.ijscia.com

Sagheer, H., Saleem, A., & Urooj, T. (2025). Role of AI Enhanced Education System in Empowering Students with Life Skills. *Research Journal for Social Affairs*, *3*(5), 775-786.

Singelmann, L. N., & Ewert, D. L. (2022). Leveraging the innovation-based learning framework to predict and understand student success in innovation. *IEEE Access*, *10*, 36123-36139.

Talan, T. (2022). Artificial Intelligence in Education: A Bibliometric Study. *International Journal of Research in Education and Science*, 822–837.

Utami, D. F., Sutikno, P. Y., Widiarti, N., & Yuwono, A. (2025). A Literature Review on the Effectiveness of Interactive Media in Elementary School Science Learning. *Indonesian Journal of Instructional Media and Model*, *7*(2), 157-180.

Utina, S., Chusniyah, T., Inseachiangmai, J., Angelina Zahra, G., Setyo Pambudi, K., & Sultan Amai Gorontalo, I. (2024). *Bulletin of Social Informatics Theory and Application A comparative study of artificial intelligence in education psychology: the cases of Indonesia and Thailand*. *8*(1), 70–85.

Yadav, S. (2025). Leveraging AI to enhance teaching and learning in education: The role of artificial intelligence in modernizing classroom practices. In *Optimizing research techniques and learning strategies with digital technologies* (pp. 211-238). IGI Global Scientific Publishing.

Zheng, W., Wen, S., Lian, B., & Nie, Y. (2023). Research on a sustainable teaching model based on the OBE concept and the TSEM framework. *Sustainability*, *15*(7), 5656.