

Pedagogical Foundations of Active Learning: Rethinking Teaching Approaches for the Next Generation of Educators

Liam D Johnson ^{*1}, Miyejav Ramos ²

^{1,2} University of Sydney, Australia, Indonesia

*Corresponding author email: liam.djson@gmail.com

Received: 22-09-2026 Accepted: 07-10-2026 Published: 10-10-2026

Abstract

Active learning is widely promoted to enhance learner participation and meaningful learning, yet its conceptualization remains fragmented across instructional techniques, engagement processes, teacher roles, and emerging technological contexts. This conceptual article reconsiders active learning as a coherent pedagogical orientation and develops an integrative account of its pedagogical foundations for the next generation of educators. Drawing on a thematic synthesis of relevant literature, the article identifies interconnected dimensions comprising pedagogical purpose, meaningful learning activity, cognitive engagement, teacher facilitation, learner agency, feedback, relational conditions, and digital/AI environments. The synthesis positions cognitive engagement as a central mechanism through which purposeful activities contribute to meaningful learning, while teacher facilitation and learning conditions sustain this process. The resulting framework conceptualizes active learning as a dynamic, interdependent, and recursive pedagogical system, rather than a linear sequence or collection of techniques. Digital and AI technologies are positioned as contextual pedagogical affordances whose value depends on purposeful integration and critical use. The framework repositions teachers as pedagogical designers and facilitators who orchestrate learning conditions while sustaining learner agency. This conceptualization provides a coherent foundation for understanding active learning and preparing educators to design meaningful, learner-centered environments responsive to contemporary educational demands.

Keywords: Active Learning; Pedagogical Reorientation; Cognitive Engagement; Teacher Facilitation

Johnson, L. D., & Ramos, M. (2026). Pedagogical Foundations of Active Learning: Rethinking Teaching Approaches for the Next Generation of Educators. *JINEA: Journal of Innovation in Education and Learning*, 2(3), 189-204. <https://doi.org/10.66031/jinea.v2i3.701>

Copyright ©2026 to the Author (s). Published by CV. Ihsan Cahaya Pustaka
This is an open access article under the [CC BY-SA](#) license



INTRODUCTION

Contemporary education faces a fundamental pedagogical challenge: preparing learners not merely to acquire and reproduce knowledge, but to engage in inquiry, reasoning, problem-solving, collaboration, reflection, and knowledge construction. Increasingly complex social, professional, and technological environments require learners to interpret information, evaluate alternatives, generate ideas, and apply knowledge in unfamiliar situations. Active learning responds to this shift by positioning meaningful learner activity at the center of instruction, emphasizing thinking, discussion, problem-solving, exploration, and reflection rather than passive reception (Braun et al., 2017; Doolittle et al., 2023). Its growing relevance is also associated with the development of complex thinking and competencies required in contemporary educational environments (Patiño et al., 2023;

Børte & Zeivots, 2026). The pedagogical question therefore shifts from how teachers transmit knowledge toward how teaching creates conditions for learners to actively construct and apply it.

Active learning can be enacted through diverse approaches, including collaborative, problem-based, project-based, flipped, gamified, and technology-supported learning (Bossi & Schimiguel, 2020; Vale & Barbosa, 2023; Patiño et al., 2023). Problem-based learning engages learners in meaningful problems, while project-based and flipped approaches reorganize learning across individual, collaborative, and classroom settings (Broseghini et al., 2024; Fitrah et al., 2025; Sein-Echaluce et al., 2024). Technology-supported learning can further extend interaction and authentic learning contexts (Cahyono & Ludwig, 2019; Sánchez-Rivas et al., 2023). These approaches demonstrate the flexibility of active learning, but their diversity also raises a critical question: what pedagogical conditions make learner activity educationally meaningful?

Activity alone does not guarantee active learning. Learners may participate in group work, discussion, projects, or digital activities while engaging minimally with the intellectual demands of learning. The conceptual complexity of active learning and the barriers that constrain substantive participation have been documented in the literature (Doolittle et al., 2023; Børte et al., 2023), while students' experiences indicate that the value of active methodologies depends on how activities are designed and enacted (Chung-Pinzás et al., 2024). Active learning should therefore be distinguished from activity for its own sake. Its educational value depends on the alignment of learning purposes, task demands, interaction, reflection, and learner engagement.

This distinction places pedagogical foundations above the selection of instructional techniques. Teaching approaches are shaped by teachers' underlying conceptions and can change according to professional and contextual conditions (Ilie et al., 2024). Effective learning design similarly requires alignment between pedagogy and technology rather than treating technological tools as independent solutions (Børte & Lillejord, 2024). Teacher facilitation is consequently central: teachers design learning conditions, orchestrate interaction, support inquiry, and provide feedback while maintaining connections between learner activity and intended learning goals (Bezanilla et al., 2019). This role increasingly requires digital and pedagogical competence because effective technology integration depends on teachers' capacity to make informed instructional decisions (Lohr et al., 2024).

The transformation of teaching becomes more significant with the expansion of digital technologies and generative artificial intelligence. Digital environments can extend learning spaces, representations, interaction, and authentic contexts (Cahyono & Ludwig, 2019; Lee et al., 2025), whereas generative AI creates possibilities for feedback, collaboration, personalization, and knowledge creation while introducing concerns regarding agency, critical thinking, and responsible use (Giannakos et al., 2025; Hall, 2024). Teachers' perspectives indicate that AI implementation requires pedagogical judgment rather than technological adoption alone (Kaplan-Rakowski et al., 2023), while student–AI collaboration can become productive when embedded within purposeful learning design (Kim et al., 2022; Pahi et al., 2024). Hybrid intelligent feedback further illustrates the need to integrate technological capabilities with pedagogical principles (Banihashem et al., 2026). Technology therefore reinforces, rather than replaces, the need for strong pedagogical foundations.

Active learning also depends on the environments and relationships in which participation occurs. Active-learning spaces can support flexible interaction, while digital and gamified environments may foster connected forms of learning (Lee et al., 2025; Bamford & Moschini, 2025). Relational pedagogies further demonstrate that recognition, connection, and students' experiences of mattering shape participation and learning (Gravett et al., 2024; Gravett & Lygo-Baker, 2025). In mathematics education, active methodologies similarly connect participation with reasoning, application, and knowledge construction, particularly through authentic and experiential learning contexts (Bossi & Schimiguel, 2020; Ludwig & Jablonski, 2021; Vale & Barbosa, 2023). Such evidence indicates that active learning is inherently multidimensional, involving cognitive, social, relational, environmental, and technological conditions.

These developments are particularly relevant to preparing the next generation of educators. Contemporary teacher education requires integration of disciplinary knowledge with communication, collaboration, critical thinking, creativity, and digital competence (Dahlan et al., 2024). At the same time, digital distraction can undermine sustained engagement, while emerging AI environments require stronger digital and data literacy (Muhammed et al., 2026; Sidik et al., 2025). Although research has extensively examined particular active-learning strategies, technologies, and contexts, the literature remains fragmented across these domains (Børte et al., 2023; Broseghini et al., 2024; Fitrah et al., 2025; Pahi et al., 2024). Less attention has been given to integrating the pedagogical principles that explain how purposeful activity, student engagement, teacher facilitation, learning environments, feedback, and technology collectively support meaningful learning.

This conceptual gap motivates a reconsideration of active learning as a coherent pedagogical orientation rather than a collection of instructional techniques. Accordingly, this article develops a conceptual account of the pedagogical foundations of active learning by synthesizing pedagogical purpose, meaningful learning activity, cognitive engagement, teacher facilitation, learner agency, feedback, relational conditions, and digital/AI environments. The proposed framework positions cognitive engagement as a central mechanism through which purposeful and meaningful activity contributes to meaningful learning, while teacher facilitation and learning conditions shape and sustain this process. This perspective shifts attention from which instructional methods or technologies teachers should adopt toward the pedagogical conditions and relationships through which active learning becomes purposeful, meaningful, and responsive to the evolving demands of contemporary education.

METHOD

This study employed a conceptual research approach using a critical and integrative synthesis of relevant literature. The approach was selected to identify and organize the pedagogical principles underlying active learning and to develop a conceptual framework for rethinking teaching approaches for the next generation of educators. Rather than evaluating the effectiveness of particular instructional methods, the study examined active learning as a pedagogical orientation concerned

with meaningful learner engagement, purposeful activity, and knowledge construction (Doolittle et al., 2023).

The analysis proceeded through three stages. First, conceptual identification involved examining relevant literature to identify recurring principles and characteristics of active learning and to distinguish substantive intellectual engagement from activity that merely reflects visible participation. Second, conceptual categorization organized the identified concepts into seven interconnected dimensions: pedagogical purpose, meaningful learning activity, student engagement, teacher facilitation, learning environment, feedback, and responsible technology integration. Third, relational synthesis examined how these dimensions are conceptually connected and how their interaction contributes to the enactment of active learning.

Particular attention was given to the role of teacher facilitation as a pedagogical condition through which instructional purposes, learning activities, interaction, and learner engagement are organized and supported. This emphasis reflects the importance of teachers' pedagogical interpretation in translating instructional approaches into meaningful learning experiences (Bezanilla et al., 2019). Technology was treated as a pedagogical resource whose educational contribution depends on its alignment with learning purposes and instructional design rather than on technological adoption alone (Børte & Lillejord, 2024). Generative artificial intelligence was incorporated as an emerging educational context that further requires teachers to reconsider how technology, learner agency, and pedagogical purposes are coordinated in teaching and learning (Giannakos et al., 2025).

The final stage integrated the identified dimensions and their conceptual relationships into a conceptual framework of the pedagogical foundations of active learning. The framework positions student engagement as a central mechanism through which purposeful learning activity can become meaningful learning, while teacher facilitation functions as a key pedagogical condition that structures and sustains such engagement. Learning environments, feedback, and responsible technology integration are conceptualized as interconnected conditions that shape the quality of active-learning processes.

The framework is presented as a conceptual synthesis rather than a validated empirical model. It does not assume a fixed linear sequence or establish causal relationships among its components. Instead, it specifies theoretically meaningful relationships among the identified dimensions to provide a basis for rethinking teaching approaches and for guiding subsequent empirical investigation. The methodological contribution therefore lies in integrating dispersed perspectives on active learning into a coherent pedagogical account rather than in testing the framework empirically.

RESULTS AND DISCUSSION

Active Learning as a Pedagogical Reorientation

Active learning represents a fundamental reorientation of pedagogical purpose, challenging the conception of teaching as primarily the transmission of established knowledge. In a transmission-oriented model, teachers organize, explain, and deliver disciplinary content, while learners are

positioned mainly as recipients expected to acquire and reproduce what has been presented. Braun et al. (2017) provide a disciplinary basis for challenging this orientation by emphasizing that meaningful learning involves active engagement with disciplinary ideas and practices. In mathematics, this reorientation also concerns what counts as legitimate mathematical work, shifting emphasis from reproducing demonstrated procedures toward constructing and justifying reasoning. The pedagogical center consequently shifts from the delivery of knowledge toward the intellectual work through which learners develop understanding.

Doolittle et al. (2023) further complicate the conceptualization of active learning by showing that definitions of the construct are frequently articulated in contrast to passive reception rather than through a single, stable set of defining features. This definitional pattern is significant because it indicates that active learning cannot be reduced to a discrete instructional procedure. Activity becomes pedagogically meaningful when learners interpret information, connect ideas, examine relationships, apply concepts, and develop understanding through substantive intellectual work. The critical distinction is therefore not whether learners are active in a visible sense, but whether their activity is directed toward meaningful engagement with the object of learning.

This conceptualization has implications for learner agency. Active learning assigns learners an intellectual role in developing understanding through interpretation, connection-making, examination of assumptions, explanation, and revision. Braun et al. (2017) situate meaningful disciplinary learning in engagement with the conceptual and practical structures of a field, while Doolittle et al. (2023) place purposeful involvement at the core of active learning. Their convergence suggests that agency should not be equated with unrestricted autonomy; rather, it concerns learners' substantive participation in knowledge construction within purposeful pedagogical and disciplinary boundaries. Learner agency is therefore an epistemic dimension of active learning, expressed through learners' active contribution to the development of understanding.

The distinction between pedagogical orientation and instructional technique is equally important. Active methodologies position learner participation as an integral component of the learning process (Bossi & Schimiguel, 2020), while strategies provide means through which active learning can be enacted in practice (Vale & Barbosa, 2023). This distinction establishes a clear conceptual hierarchy: active learning constitutes the pedagogical orientation, whereas methodologies and strategies represent possible ways of enacting it. Discussion, collaboration, projects, or inquiry do not become inherently active merely by virtue of their format. Their pedagogical value depends on whether they engage learners meaningfully in understanding and constructing knowledge. The method does not define active learning; the pedagogical logic governing its use does.

The continued development of active learning within an evolving educational landscape suggests that its significance lies in a pedagogical logic capable of adapting beyond particular instructional formats (Børte & Zeivots, 2026). Its durability therefore rests not on preserving specific techniques, but on maintaining the principle that meaningful learning requires purposeful intellectual engagement with knowledge. Taken together, the literature positions active learning as a reorientation of pedagogical logic rather than a replacement of one set of techniques with another (Braun et al., 2017; Doolittle et al., 2023). Its defining contribution lies in reshaping how teaching, learning, and knowledge are conceived, establishing a conceptual foundation for examining the forms and processes through which this orientation is enacted.

From Teaching Transmission to Learner Agency

The transition from transmission-oriented teaching to active learning fundamentally repositions the learner within the pedagogical process. In transmission-oriented settings, teachers retain primary control over content, instructional processes, and evaluation, while learners predominantly receive, process, and reproduce knowledge. Active learning challenges this distribution by expanding learners' participation in the intellectual work of learning and their responsibility for how knowledge is explored and evaluated. The shift can therefore be conceptualized as learner as recipient → participant → agent. This progression represents more than increased classroom activity; it reflects a redistribution of participation, responsibility, and decision making in knowledge construction (Patiño et al., 2023; Vale & Barbosa, 2023).

Participation marks an important shift in the learner's position, yet participation alone does not necessarily imply agency. In active learning, learners engage with problems, questions, explanations, and perspectives through which they contribute to the development of understanding rather than simply receive instructional content (Vale & Barbosa, 2023). The distinction becomes important when participation remains largely prescribed by the teacher: learners may discuss, collaborate, or complete tasks actively while having limited influence over what to investigate, how to approach a problem, or how to assess the result. Agency involves a greater degree of responsibility for these processes. It is reflected in learners' capacity to formulate questions, consider alternatives, develop strategies, make decisions, and examine the consequences of their choices. This orientation is consistent with the emphasis of active learning on complex thinking, in which learners are required to engage with problems and ideas through reasoning rather than merely follow predetermined procedures (Patiño et al., 2023). The shift is not simply from passive reception to active participation, but toward participation that carries increasing responsibility for the direction and substance of learning.

Learner agency becomes more tangible in pedagogies that provide structured opportunities for inquiry, problem solving, collaboration, and sustained knowledge construction. Problem-based learning can require learners to identify what needs to be understood, consider alternatives, negotiate interpretations, and construct responses to complex problems (Broseghini et al., 2024). Cooperative methodologies distribute responsibility through interaction, coordination, and shared decision making (Solera-Alfonso et al., 2025), while project-based learning enables learners to investigate questions, determine strategies, make decisions, and develop meaningful outcomes (Sánchez-Rivas et al., 2023). Flipped and project-based configurations can further expand responsibility by allocating classroom time to application, inquiry, problem solving, and collaborative knowledge construction (Fitrah et al., 2025). These approaches collectively indicate that agency emerges when pedagogical design provides legitimate opportunities for initiative, judgment, and responsibility within meaningful disciplinary tasks.

Agency, however, does not imply the withdrawal of teacher authority or unrestricted learner control. Active learning instead transforms pedagogical control from direct regulation of learner activity to intentional regulation of learning conditions. Teachers remain responsible for learning purposes, task design, scaffolding, resources, and monitoring, while learners gain greater opportunities to choose, explore, question, develop strategies, collaborate, and reflect. This balance is critical because increased responsibility can become a barrier when learners lack sufficient preparation, structure, or guidance (Børte et al., 2023). Learner experience is likewise shaped by the opportunities and constraints embedded in pedagogical design, indicating that agency develops through the interaction between learner initiative and structured conditions (Gravett et al., 2024).

The progression from participation to agency to ownership represents the deeper pedagogical consequence of this reorientation. As learners formulate questions, select strategies, negotiate perspectives, evaluate evidence, and reflect on outcomes, they increasingly assume responsibility for constructing and revising understanding. Ownership therefore does not mean independence from teachers but growing responsibility for the direction and quality of learning. Active learning is consequently significant not because it makes learners merely more active, but because it repositions them as increasingly responsible agents of knowledge construction. The teacher's role is not diminished but redefined through the design of conditions that enable productive learner agency while maintaining disciplinary direction and intellectual rigor.

Cognitive Engagement as the Core Mechanism of Active Learning

Active learning should not be identified merely by the visible intensity of classroom activity. Talking, moving, working in groups, manipulating technology, or participating in games may indicate observable participation, yet none of these behaviors is sufficient to establish meaningful learning.

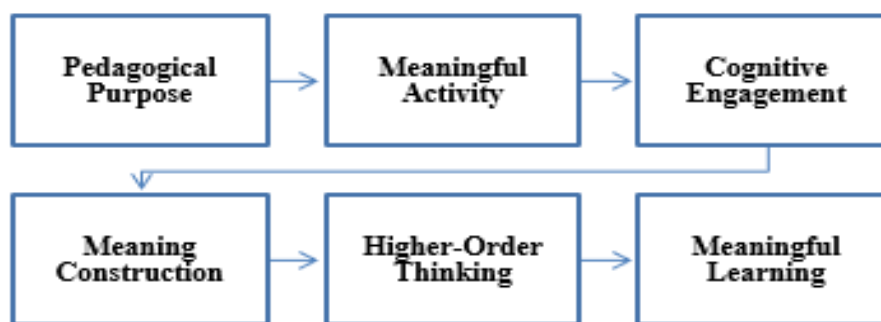
Doolittle et al. (2023) distinguish activity from learning by locating active learning in what learners cognitively do with an activity. The critical issue is therefore whether an activity requires learners to think, reason, explain, connect, evaluate, and construct meaning. Braun et al. (2017) similarly position intellectual activity as a defining dimension of active learning, shifting attention from behavioral involvement toward the quality of learners' cognitive work.

From this perspective, cognitive engagement functions as the central mechanism through which meaningful activity becomes active learning. Behavioral activity provides the observable entry point, but it becomes pedagogically consequential only when learners invest cognitive effort in interpreting information, formulating questions, identifying relationships, justifying claims, comparing alternatives, or reconsidering existing ideas. Thus, learning does not emerge simply because learners are doing something; it emerges when activity requires learners to think with, about, and through the content. Such cognitive engagement involves active processing in which learners interpret, question, connect, and evaluate information rather than passively receive it (Vale & Barbosa, 2023). Through these intellectual processes, learners can construct and reorganize understanding, creating the conditions for more complex forms of thinking, including critical thinking (Bezanilla et al., 2019), and higher-order competencies (Dahlan et al., 2024). Cognitive engagement therefore functions not merely as an indicator of participation but as the mechanism through which activity is transformed into meaning construction and, ultimately, higher-order thinking.

Cognitive engagement is also the process through which learners construct and reorganize meaning. When learners question, interpret, explain, compare, connect, and justify, they relate new information to prior knowledge, resolve discrepancies, and restructure their understanding. Meaning construction therefore represents the critical transformation between cognitive engagement and learning: learners move from merely *participating in an activity* to *making sense of what the activity means*. For example, illustrate this process through authentic mathematization, in which learners construct mathematical relationships through meaningful situations (Ludwig & Jablonski, 2021).

Meaning construction subsequently provides the foundation for higher-order thinking. As learners reorganize understanding, they can analyze relationships, evaluate alternatives, reason from evidence, solve unfamiliar problems, generate explanations, and reflect on their thinking. Higher-order thinking is therefore not an automatic outcome of participation but an extension of cognitively engaged meaning construction.

The conceptual mechanism can thus be expressed as:



Pedagogical purpose functions as a design condition that directs meaningful activity, while behavioral activity represents the observable manifestation of learner engagement. The relationship is conceptual rather than a rigid, linear sequence. Its central proposition is that not all participation can be categorized as active learning. An activity becomes active learning when it elicits cognitive engagement that enables learners to construct and reorganize meaning, which subsequently supports higher-order thinking. Gamification, collaboration, digital technologies, and problem-based learning may increase participation, but their pedagogical value is determined by the depth of cognitive processing they require from learners (Udjaja et al., 2018; Bossi & Schimiguel, 2020). Thus, active learning is not defined by the intensity of activity, but by the quality of the cognitive processes generated by that activity to construct understanding and develop higher-order thinking.

From Teacher Transmission to Pedagogical Facilitation

A fundamental implication of active learning is not the reduction of teachers' instructional roles, but their pedagogical reorientation. As learners become more involved in questioning, discussing, problem-solving, collaborating, and constructing knowledge, teaching shifts from the transmission of predetermined content toward the intentional design and facilitation of meaningful learning experiences. This shift makes the teacher's role more, rather than less, pedagogically complex because active participation does not automatically produce meaningful learning. It requires intentional design, purposeful facilitation, continuous monitoring, adaptive support, and informed pedagogical judgment. Bezanilla et al. (2019) show that approaches oriented toward critical thinking require teachers to create conditions in which learners can reason, question, evaluate, and justify ideas, while Ilie et al. (2024) emphasize that teaching approaches are grounded in pedagogical orientations rather than instructional techniques alone.

This reorientation can be conceptualized as a movement from teacher transmission to pedagogical facilitation. In a transmission-oriented model, teachers primarily organize and communicate content, whereas learners largely receive and reproduce what is presented. In active learning, teachers remain responsible for intellectual direction and alignment with learning outcomes

but increasingly organize the conditions through which learners encounter, interrogate, apply, and reconstruct knowledge.

Table 1. Reorienting Teacher Roles from Transmission to Pedagogical Facilitation

Teacher Transmission	Pedagogical Facilitation
Transmitter of content	Designer of learning experiences
Instructor and controller	Facilitator of learning processes
Content provider	Mediator of meaning-making
Lecturer	Questioner and interaction facilitator
Evaluator of learning	Provider of formative feedback
Authority through instructional control	Authority through pedagogical judgment
Monitor of task completion	Monitor of learning processes
Teacher-directed activity	Supported learner agency

Importantly, this shift is not from teacher control to teacher withdrawal, but from direct instructional control toward intentional pedagogical guidance through design, scaffolding, interaction, feedback, and judgment. Teachers select and structure tasks, pose questions, provide appropriate support, monitor emerging understanding, facilitate productive interaction, and offer formative feedback. These functions require continuous pedagogical judgment about when to intervene, scaffold, redirect, provide feedback, or step back, maintaining a productive balance between teacher guidance and learner agency. Learners assume greater responsibility for reasoning, decision-making, collaboration, and knowledge construction, while teachers create and adapt the conditions that make such agency intellectually productive.

Pedagogical facilitation extends beyond participation to reflection and metacognition, supporting learners in articulating reasoning, evaluating strategies, comparing perspectives, reconsidering assumptions, and recognizing how their understanding develops. Active learning therefore becomes meaningful when activity is connected to cognitive engagement, knowledge construction, and reflection rather than visible participation alone. It should not be reduced to a collection of techniques for increasing learner activity, but understood as a pedagogical reorganization of the relationship between teacher guidance and learner agency. The fundamental shift is not from teacher-led to learner-led learning, but from teacher-controlled transmission toward intentionally facilitated learning, with teachers remaining designers, facilitators, mediators, monitors, and pedagogical decision-makers who sustain intellectual direction while enabling learner agency.

Active Learning in Digital, AI-Mediated, and Relational Learning Environments

Active learning is increasingly enacted within digital and technologically mediated environments that reshape how learning activities are designed, facilitated, and experienced. However, technological change does not replace the pedagogical foundations of active learning; rather, it provides new contexts in which these principles must be enacted more deliberately. In mathematics education, digital environments can support students' active engagement when

technology is used to facilitate learning processes rather than merely to deliver instructional content (Cahyono & Ludwig, 2019). The growing connectedness of learning environments further expands opportunities for student participation and interaction through flexible and digitally mediated learning designs (Lee et al., 2025; Lohr et al., 2024). In this context, Bamford and Moschini (2025) emphasize the importance of understanding how digital environments shape students' learning experiences and participation. Accordingly, digitalization should not be equated with pedagogical transformation. The pedagogical value of technology depends on how its digital affordances are intentionally integrated into learning designs that promote purposeful activity, learner agency, interaction, and opportunities to construct and negotiate meaning.

Generative artificial intelligence increasingly extends digital learning environments by creating new opportunities for feedback, personalization, idea generation, and support for complex learning tasks (Giannakos et al., 2025; Hall, 2024; Kaplan-Rakowski et al., 2023). Research on AI-supported and adaptive learning further highlights its potential to complement learning processes through more responsive feedback and support tailored to learners' needs (Kim et al., 2022; Pahi et al., 2024; Banihashem et al., 2026). However, AI should be positioned as a pedagogical resource rather than as a defining feature of active learning. Its pedagogical value depends on how it is integrated into learning activities that require learners to think, evaluate, make decisions, and construct understanding. When learners simply accept AI-generated outputs as final answers, opportunities for inquiry and reasoning may be diminished. Conversely, when AI-generated outputs are questioned, verified, compared, and critically reflected upon, AI can serve as a resource for strengthening cognitive engagement. AI-mediated learning therefore requires critical and responsible use, extending digital literacy toward the capacity to critically evaluate AI-generated information (Sidik et al., 2025). From an active-learning perspective, this orientation shifts the emphasis from AI automation toward human–AI pedagogical collaboration, in which teachers design learning activities that harness AI capabilities without diminishing learners' agency and intellectual responsibility.

Active learning also depends on the relational and environmental conditions surrounding digital and AI-mediated participation. Learning emerges through interaction, collaboration, belonging, and meaningful participation within particular learning spaces, rather than from technological affordances alone (Gravett et al., 2024; Gravett & Lygo-Baker, 2025; Lee et al., 2025). Teachers therefore remain essential in structuring dialogue, collaboration, critical engagement, and purposeful use of technology. Moreover, digital environments can simultaneously expand participation and undermine attention through distraction, multitasking, and fragmented information flows (Muhammed et al., 2026). Thus, technological intensity or visible activity should not be mistaken for active learning. The defining condition remains cognitively and socially meaningful participation.

Taken together, digital, AI-mediated, and relational environments should be viewed as contemporary contexts for the pedagogical enactment of active learning, not as ends in themselves. Technology becomes transformative only when learning design, learner agency, teacher facilitation, critical engagement, and meaningful interaction remain central. The contemporary transformation of active learning is therefore fundamentally a pedagogical reorientation rather than a technological.

An Integrative Pedagogical Framework for the Next Generation of Educators

The conceptual synthesis positions *active learning* as an integrative pedagogical system connecting pedagogical purpose, meaningful learning activity, cognitive engagement, and meaningful learning. Pedagogical purpose provides direction for designing activities that require participation, reasoning, interaction, and meaning construction. This process is enacted through teacher facilitation and shaped by the learning environment, relational conditions, feedback, and digital/AI conditions that influence the quality of learning experiences. Learner agency operates as a cross-cutting dimension, enabling learners to make decisions, regulate their engagement, evaluate information, and assume responsibility for their learning.

The framework conceptualizes *active learning* as a dynamic, interdependent, and recursive system, rather than a linear sequence of stages. Pedagogical purpose, activity, cognitive engagement, teacher facilitation, learner agency, feedback, environmental conditions, and digital/AI conditions continuously interact to shape the learning process. Its central concern is not the quantity of learner activity or the intensity of technology use, but the pedagogical orchestration of these conditions to foster meaningful cognitive and social participation. The conceptual framework below visualizes the interrelationships among these dimensions as the pedagogical foundation for *active learning* in preparing the next generation of educators.

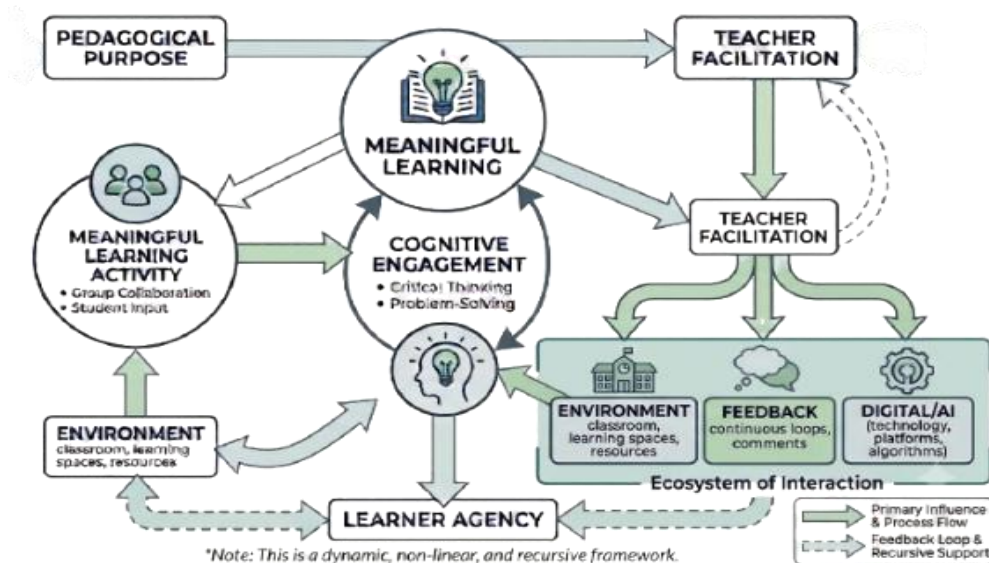


Figure 1. An Integrative Pedagogical Framework for Active Learning

Figure 1 illustrates the core pedagogical flow of *active learning*, beginning with Pedagogical Purpose as the basis for designing Meaningful Learning Activities. These activities create opportunities for Cognitive Engagement through inquiry, reasoning, interaction, problem solving, and reflection, leading to Meaningful Learning. This core process is designed and facilitated through Teacher Facilitation, which connects learning processes with the Learning Environment, Relational Conditions, Feedback, and Digital/AI Conditions. These conditions shape how learning activities are designed, experienced, and adapted throughout the learning process. Learner Agency operates across the process, enabling learners to make decisions, regulate their engagement, evaluate information,

respond to feedback, and assume responsibility for their learning. The relationships among these components are dynamic and recursive rather than strictly linear, allowing learning outcomes and learner responses to continuously inform subsequent pedagogical decisions.

The framework conceptualizes *active learning* as an integrative pedagogical system constituted through the interrelationship among pedagogical purpose, meaningful learning activity, cognitive engagement, teacher facilitation, learner agency, and learning conditions. Digital and AI technologies function as contextual *affordances* whose pedagogical value emerges when intentionally integrated into learning design, while relational conditions and feedback strengthen the quality of cognitive and social participation. This perspective extends the role of educators beyond delivering learning activities toward designing and orchestrating pedagogical processes that connect these conditions to support learners in constructing, evaluating, and transforming knowledge. *Active learning* is therefore not defined by the intensity of activity or technology use, but by the quality of pedagogical orchestration through which active participation, learner agency, and meaningful learning are sustained over time.

CONCLUSION

This article conceptualizes *active learning* as a coherent pedagogical orientation and integrative system rather than a collection of instructional techniques. The synthesis identifies pedagogical purpose, meaningful learning activity, cognitive engagement, teacher facilitation, learner agency, feedback, relational conditions, and digital/AI environments as interconnected dimensions shaping meaningful learning. The framework positions cognitive engagement as the central mechanism through which purposeful activities become meaningful learning, while teacher facilitation and learning conditions sustain and regulate this process. Its central contribution lies in shifting attention from which methods or technologies teachers should adopt toward the pedagogical conditions through which active learning becomes purposeful, meaningful, and sustainable.

For the next generation of educators, this perspective calls for preparation that extends beyond procedural knowledge of active-learning techniques toward pedagogical judgment, facilitative expertise, relational competence, learner-centered design, and critical digital/AI literacy. Teachers need to orchestrate activities, interactions, feedback, and technologies in ways that strengthen rather than replace learner agency and cognitive engagement. As a conceptual synthesis, this article does not claim exhaustive coverage of the literature; the proposed relationships therefore require further empirical examination across disciplines and educational contexts. Future research should investigate how these dimensions interact over time and under different learning conditions. The framework nevertheless provides a coherent conceptual foundation for rethinking active learning as an evolving pedagogical system responsive to contemporary educational demands.

REFERENCES

- Banihashem, S. K., Noroozi, O., Khosravi, H., Schunn, C. D., & Drachsler, H. (2026). Pedagogical framework for hybrid intelligent feedback. *Innovations in Education and Teaching International*, 63(2), 554–570. <https://doi.org/10.1080/14703297.2025.2499174>

- Bamford, J., & Moschini, E. (2025). Co-creation of connected and relational learning spaces: A digital and gamified approach in higher education. *Higher Education Research & Development*, 44(1), 205–221. <https://doi.org/10.1080/07294360.2024.2429443>
- Bezanilla, M. J., Fernández-Nogueira, D., Poblete, M., & Galindo-Domínguez, H. (2019). Methodologies for teaching-learning critical thinking in higher education: The teacher's view. *Thinking Skills and Creativity*, 33, 100584. <https://doi.org/10.1016/j.tsc.2019.100584>
- Bossi, K. M. L., & Schimiguel, J. (2020). Active methodologies in the teaching of mathematics: State of the art. *Research, Society and Development*, 9(4), e47942819. <https://doi.org/10.33448/rsd-v9i4.2819>
- Braun, B., Bremser, P., Duval, A., Lockwood, E., & White, D. (2017). What does active learning mean for mathematicians? *Notices of the American Mathematical Society*, 64(2), 124–129. <https://doi.org/10.1090/noti1472>
- Børte, K., & Lillejord, S. (2024). Learning to teach: Aligning pedagogy and technology in a learning design tool. *Teaching and Teacher Education*, 148, 104693. <https://doi.org/10.1016/j.tate.2024.104693>
- Børte, K., Nesje, K., & Lillejord, S. (2023). Barriers to student active learning in higher education. *Teaching in Higher Education*, 28(3), 597–615. <https://doi.org/10.1080/13562517.2020.1839746>
- Børte, K., & Zeivots, S. (2026). Active learning in higher education: Inheriting pasts and emerging futures. *Active Learning in Higher Education*, 27(2), 207–219. <https://doi.org/10.1177/14697874261426575>
- Brosegghini, A., Lõoke, M., Brscic, M., Raffaghelli, J. E., Cardazzo, B., Lotti, A., & Marinelli, L. (2024). Exploring the effectiveness of problem-based learning in an international undergraduate program in veterinary sciences: Students' satisfaction, experience and learning. *Veterinary Sciences*, 11(3), Article 104. <https://doi.org/10.3390/vetsci11030104>
- Cahyono, A. N., & Ludwig, M. (2019). Teaching and learning mathematics around the city supported by the use of digital technology. *EURASIA Journal of Mathematics, Science and Technology Education*, 15(1), Article em1658. <https://doi.org/10.29333/ejmste/99514>
- Chung-Pinzás, A. R., Inche-Mitma, J. L., & Cruz-Chuquizuta, C. (2024). Student perception of the application of active methodologies in a computer-aided design course. *Revista Electrónica Educare*, 28(2), 78-97. <https://doi.org/10.15359/ree.28-2.18444>
- Costa, I. E. F., Oliveira, S. R. B., Elgrably, I. S., Guerra, A. D. S., Soares, E. M., & Costa, I. V. F. (2023). Using active methodologies for teaching and learning of exploratory test design and execution. *Education Sciences*, 13(2), Article 115. <https://doi.org/10.3390/educsci13020115>
- Dahlan, T., Judijanto, L., & Hali, F. (2024). Improving the quality of mathematics teacher education: An integrated approach to the 4C skills. *JRAMathEdu (Journal of Research and Advances in Mathematics Education)*, 9(1), 16–31. <https://doi.org/10.23917/jramathedu.v9i1.2687>
- Doolittle, P., Wojdak, K., & Walters, A. (2023). Defining active learning: A restricted systematic review. *Teaching & Learning Inquiry*, 11, 1–24. <https://doi.org/10.20343/teachlearningqu.11.25>
- Fitrah, M., Sofroniou, A., Setiawan, C., Widiastuti, Y., Yarmannetti, N., Jaya, M. P. S., Panuntun, J. G., Arfaton, A., Beteno, S., & Susianti, I. (2025). The impact of integrated project-based learning and flipped classroom on students' computational thinking skills: Embedded mixed methods. *Education Sciences*, 15(4), Article 448. <https://doi.org/10.3390/educsci15040448>

- Giannakos, M., Azevedo, R., Brusilovsky, P., Cukurova, M., Dimitriadis, Y., Hernandez-Leo, D., Järvelä, S., Mavrikis, M., & Rienties, B. (2025). The promise and challenges of generative AI in education. *Behaviour & Information Technology*, 44(11), 2518–2544. <https://doi.org/10.1080/0144929X.2024.2394886>
- Gravett, K., & Lygo-Baker, S. (2025). Affective encounters in higher education. *Studies in Higher Education*, 50(2), 228–238. <https://doi.org/10.1080/03075079.2024.2332427>
- Gravett, K., Taylor, C. A., & Fairchild, N. (2024). Pedagogies of mattering: Re-conceptualising relational pedagogies in higher education. *Teaching in Higher Education*, 29(2), 388–403. <https://doi.org/10.1080/13562517.2021.1989580>
- Hall, R. (2024). Generative AI and re-weaving a pedagogical horizon of social possibility. *International Journal of Educational Technology in Higher Education*, 21(1). <https://doi.org/10.1186/s41239-024-00445-6>
- Ilie, M. D., Petegem, P. V., Mladenovici, V., & Maricuțoiu, L. P. (2024). Dynamics of change of academics' teaching approaches: A latent profile transition analysis. *Studies in Educational Evaluation*, 81, Article 101349. <https://doi.org/10.1016/j.stueduc.2024.101349>
- Johnson, L. C. (2025). Rethinking teaching strategies in digital environments to foster critical thinking and innovation skills. *Nusantara Education*, 4(2), 45–59. <https://doi.org/10.66325/nusantaraeducation.v4i2.251>
- Kaplan-Rakowski, R., Grotewold, K., Hartwick, P., & Papin, K. (2023). Generative AI and teachers' perspectives on its implementation in education. *Journal of Interactive Learning Research*, 34(2), 313–338. <https://doi.org/10.70725/815246mfssgp>
- Kim, J., Lee, H., & Cho, Y. H. (2022). Learning design to support student–AI collaboration: Perspectives of leading teachers for AI in education. *Education and Information Technologies*, 27(5), 6069–6104. <https://doi.org/10.1007/s10639-021-10831-6>
- Lee, D., Colorado-Resa, J. T., & Huh, Y. (2025). Designing an active learning space. *TechTrends*, 69(2), 310–330. <https://doi.org/10.1007/s11528-025-01038-4>
- Lin, J. W., Zhao, S. L., Darmawan, P., & Fatqurhohman, F. (2025). Evaluation of Junior High School Students' Representation Skills in Differentiated Learning. *SMARTH: Journal of Mathematics Education and Learning*, 1(2), 63–76. <https://doi.org/10.66031/smarth.v1i2.169>
- Lohr, A., Sailer, M., Stadler, M., & Fischer, F. (2024). Digital learning in schools: Which skills do teachers need, and who should bring their own devices? *Teaching and Teacher Education*, 152, Article 104788. <https://doi.org/10.1016/j.tate.2024.104788>
- Ludwig, M., & Jablonski, S. (2021). Step by step: Simplifying and mathematizing the real world with MathCityMap. *Quadrante*, 30, 242–268. <https://doi.org/10.48489/quadrante.23604>
- Muhammed, H., Syuhada, I. N., Noor, R., & Fatqurhohman, F. (2026). Digital Distraction in University Students: A Critical Analysis for Higher Education Instructional Design. *JINEA: Journal of Innovation in Education and Learning*, 2(1), 41–54. <https://doi.org/10.66031/jinea.v2i1.162>
- Pahi, K., Hawlader, S., Hicks, E., Zaman, A., & Phan, V. (2024). Enhancing active learning through collaboration between human teachers and generative AI. *Computers and Education Open*, 6, Article 100183. <https://doi.org/10.1016/j.caeo.2024.100183>
- Patiño, A., Ramírez-Montoya, M. S., & Buenestado-Fernández, M. (2023). Active learning and education 4.0 for complex thinking training: Analysis of two case studies in open education. *Smart Learning Environments*, 10(1), Article 8. <https://doi.org/10.1186/s40561-023-00229-x>

- Saidi, S., Suryowati, E., Sholihah, U., & Fatqurhohman, F. (2025). Literature Review on the Role of School Principals in the Society 5.0: Strategies and Future Challenges. *RESET: Review of Education, Science, and Technology*, 1(1), 55-64. <https://doi.org/10.66031/reset.v1i1.20>
- Sánchez-Rivas, E., Ramos-Núñez, M. F., Linde-Valenzuela, T., & Sánchez-Rodríguez, J. (2023). Percepción del alumnado universitario respecto al aprendizaje basado en proyectos con tecnología. *Revista Electrónica Interuniversitaria de Formación del Profesorado*, 26(1), 71–84. <https://doi.org/10.6018/reifop.543281>
- Sein-Echaluze, M. L., Fidalgo-Blanco, Á., Balbín, A. M., & García-Peñalvo, F. J. (2024). Flipped Learning 4.0: An extended flipped classroom model with Education 4.0 and organisational learning processes. *Universal Access in the Information Society*, 23(3), 1001–1013. <https://doi.org/10.1007/s10209-022-00945-0>
- Sidik, D. P., Irawijayanti, F., & Fatqurhohman, F. (2025). The Role of Artificial Intelligence in Enhancing Digital and Data Literacy among Secondary School Students: A Systematic Literature Review. *JINEA: Journal of Innovation in Education and Learning*, 1(3), 173-188. <https://doi.org/10.66031/jinea.132025.38>
- Solera-Alfonso, A., Delfa-De-la-Morena, J. M., Marconnot, R., Mijarra-Murillo, J.-J., García-González, M., Romero-Parra, N., & Bores-García, D. (2025). University students' perception of the application of a cooperative methodology in the initial training of physical education teachers: A qualitative study. *Retos*, 63, 306–316. <https://doi.org/10.47197/retos.v63.108012>
- Udjaja, Y., Guizot, V. S., & Chandra, N. (2018). Gamification for elementary mathematics learning in Indonesia. *International Journal of Electrical and Computer Engineering*, 8(5), 3860–3865. <https://doi.org/10.11591/ijece.v8i5.pp3860-3865>
- Vale, I., & Barbosa, A. (2023). Active learning strategies for effective mathematics teaching and learning. *European Journal of Science and Mathematics Education*, 11(3), 573–588. <https://doi.org/10.30935/scimath/13135>