



Building a Powerful Learning Ecosystem: Educational Psychology for a Generation of Lifelong Learners

Endin Nasrudin¹, Aeni Latifah², Lia Trinuari Wahyuni³

¹ UIN Sunan Gunung Djati Bandung and endin.nasrudin@uinsgd.ac.id

² Universitas Madani Nusantara and aenilatifah@gmail.com

³ Universitas Madani Nusantara and trinuaria@gmail.com

Corresponding Author: endin.nasrudin@uinsgd.ac.id

ARTICLE HISTORY

Received Dec, 2024

Revised Dec, 2024

Accepted Dec, 2024

ABSTRACT

Rapid technological, economic, and social change has made the capacity to keep learning across the lifespan a central purpose of education, yet many school systems still concentrate on content coverage and short-term test performance. This article aims to synthesize findings from educational psychology into an integrated framework for designing learning environments that cultivate lifelong learners. Using an integrative qualitative literature review with thematic analysis, the study examined foundational theories, meta-analyses, and review articles on cognition, metacognition, self-regulated learning, motivation, emotion, social learning, assessment, and ecological influences on development. The analysis produced six interdependent themes: strategic and metacognitive learning, autonomous and value-based motivation, emotional safety and belonging, relational and social scaffolding, aligned instruction and feedback, and supportive family, community, digital, and policy contexts. These themes were integrated into the Learning Ecosystem Model, which positions the learner at the center of nested layers of influence and proposes six propositions explaining how psychological mechanisms operate across layers. The findings indicate that lifelong learning dispositions are unlikely to emerge from isolated interventions; they develop when classroom practices, teacher-student relationships, assessment systems, institutional culture, and community expectations reinforce the same psychological needs. Implications are offered for teachers, school leaders, teacher education programs, and policymakers, together with indicators for monitoring the health of a learning ecosystem. The article concludes with directions for empirical testing of the model in diverse cultural settings.

Keywords: *Educational Psychology; Learning Ecosystem; Lifelong Learning; Motivation; Self-Regulated Learning*

INTRODUCTION

Education systems around the world are being asked to prepare learners for futures that are difficult to predict. Advances in artificial intelligence and automation, shifting labor markets, environmental pressures, and the rapid circulation of information have shortened the useful life of specific knowledge and raised the importance of the ability to learn, unlearn, and relearn [1], [2]. The idea that learning should extend across the whole lifespan is not new. The International Commission on Education for the Twenty-first Century described learning to know, to do, to live together, and to be as the four pillars of education, and argued that they should be woven through a learning society rather than confined to schooling [3]. What has changed is the urgency. A graduate who leaves school with strong marks but weak habits of curiosity, self-monitoring, and persistence is poorly equipped for a career in which most of the relevant skills will be acquired after formal education has ended.

Lifelong learning has been defined in several ways. Candy [4] emphasized self-direction as both a personal attribute and a way of organizing instruction. Knapper and Cropley [5] portrayed

lifelong learners as people who hold positive attitudes toward learning, who know how to learn, and who are able to apply what they learn across contexts. Field [6] showed how policy discourse has gradually shifted responsibility for continued learning from institutions to individuals. Across these accounts a common thread is visible: lifelong learning is as much a psychological disposition as an educational provision. Motivation, metacognitive skill, emotional regulation, and an identity as someone who is capable of learning determine whether people continue to learn when no teacher, curriculum, or certificate compels them to do so. This is why educational psychology, the scientific study of how people learn and develop in educational settings, deserves a central place in any discussion of how to educate for a lifetime of learning.

Despite decades of research, the translation of educational psychology into everyday practice remains uneven. Three problems stand out. First, the knowledge base is fragmented. Theories of cognition, motivation, emotion, and social learning developed in separate traditions and are communicated through separate journals, and prospective teachers frequently meet them as unrelated topics in separate courses. Second, interventions are often introduced as add-on programs, such as a single growth mindset lesson, a study skills workshop, or a social-emotional curriculum, without changing the structures that communicate very different messages to students, including grading practices, timetables, and classroom routines [7], [8]. Third, much of the evidence originates in Western, high-income settings, which raises legitimate questions about transfer to contexts such as Indonesia, where collectivist values, religious education traditions, large classes, and uneven access to digital infrastructure shape the conditions of learning.

An ecological perspective offers one way to address fragmentation. Bronfenbrenner [9] and Bronfenbrenner and Morris [10] argued that human development is shaped by reciprocal interactions between the person and a set of nested environments, from the immediate settings in which the person participates to the broader cultural and policy systems that surround them, and that these interactions change over time. Applied to education, the metaphor of a learning ecosystem draws attention to interdependence. A motivating task is less effective in a classroom where mistakes are punished. A caring teacher cannot fully offset an assessment system that rewards only the reproduction of facts. A school that promotes curiosity will struggle if families and communities interpret learning only as preparation for examinations. The metaphor also implies that learning environments are living systems that can be healthy or degraded and that they require cultivation rather than only control. Darling-Hammond et al. [7] reached a similar conclusion when they synthesized the science of learning and development and called for whole-child, relationship-centered, and context-sensitive approaches to schooling.

The cultural setting of this article also deserves explicit mention. In Indonesia, recent curriculum reforms have emphasized student-centered learning, project-based work, and the development of character and independent learning. At the same time, Islamic educational traditions, which shape the experience of a large share of Indonesian learners, place the continuous pursuit of knowledge at the center of religious life. The first revealed verses call the reader to read and to learn (Qur'an 96:1–5), and the supplication "my Lord, increase me in knowledge" (Qur'an 20:114) expresses an orientation of continual growth. Al-Attas [11] argued that education should aim at the formation of a balanced and good human being rather than the accumulation of information alone. These ideas resonate with contemporary concepts of self-directed learning and holistic

development, yet they are seldom engaged in the English-language educational psychology literature. A framework that aspires to international relevance should therefore be able to dialogue with such traditions rather than assume that a single cultural model of the learner applies everywhere.

The present article responds to these issues. Existing reviews typically focus on one component of learning, such as motivation or self-regulation. Few offer an integrative model that links psychological mechanisms to the layers of the environment in which they operate, and fewer still consider how such a model might be interpreted in non-Western contexts. The article is guided by three research questions. First, which psychological mechanisms identified in educational psychology most consistently support the development of lifelong learning dispositions? Second, how do these mechanisms interact across the layers of a learning environment? Third, what practical implications follow for teachers, school leaders, teacher educators, and policymakers, and how might the health of a learning ecosystem be monitored?

The article contributes in three ways. Theoretically, it proposes the Learning Ecosystem Model, which integrates cognitive, motivational, emotional, social, and ecological perspectives and states a set of propositions that can be tested. Practically, it translates the model into recommendations for each group of actors and into a set of indicators that schools can use for self-assessment. Contextually, it discusses how the model can be read in settings that combine national curriculum reform with strong religious and community traditions of learning. The sections that follow describe the method of the review, present and discuss the synthesized themes and the integrative model, and conclude with implications and directions for future research.

RESEARCH METHODS

Research design

This study used an integrative qualitative literature review. An integrative review is appropriate when the aim is to combine perspectives from different bodies of work in order to generate new conceptual frameworks rather than to estimate the size of a single effect [12]. Because the topic of lifelong learning cuts across several sub-fields of educational psychology that rarely appear together, a design that permits conceptual synthesis was judged more suitable than a quantitative meta-analysis. The study is therefore theoretical and interpretive in nature. It does not report primary data collected from participants, and the findings should be read as a reasoned synthesis of existing evidence and theory.

Corpus and selection criteria

The corpus was assembled purposively from established sources in educational psychology and adjacent fields. Four types of sources were included: (a) foundational theoretical works that define the major constructs, such as self-efficacy, self-determination, the zone of proximal development, and cognitive load; (b) meta-analyses and large-scale reviews that estimate the strength of relationships or intervention effects; (c) high-quality review articles and handbook chapters that summarize research programs; and (d) international policy frameworks that articulate expectations for lifelong learning. Sources were retained when they met three criteria. They had to address learning, motivation, emotion, social interaction, instruction, assessment, or the environmental conditions of learning in educational settings. They had to be published in peer-

reviewed outlets or by recognized academic or international publishers. And they had to be relevant to at least one of the three research questions. Sources focused exclusively on clinical populations, on narrowly technical aspects of educational technology, or on topics unrelated to learning processes were excluded.

Because the selection was purposive, the corpus makes no claim to be exhaustive, and the article does not report counts of records screened as a formal systematic review would. Instead, priority was given to sources that are widely cited, that report converging evidence from multiple studies, or that made an influential theoretical contribution. Where findings from meta-analyses and from single studies differed, greater weight was given to the meta-analytic evidence, and where evidence was mixed this is acknowledged in the discussion.

Analytic procedure

Analysis followed the six phases of thematic analysis described by Braun and Clarke [13], adapted for a literature-based corpus. In the first phase, the sources were read repeatedly to become familiar with their central claims, definitions, and evidence. In the second phase, segments relevant to the research questions were coded, with codes capturing mechanisms (for example, retrieval practice, autonomy support, or belonging), conditions under which the mechanisms operated, and reported outcomes. In the third phase, codes were grouped into candidate themes by comparing how different theories described similar phenomena. In the fourth phase, candidate themes were reviewed against the coded segments and against the corpus as a whole to check that each theme was internally coherent and distinct from the others. In the fifth phase, the themes were named and defined. In the sixth phase, the themes were organized into the integrative model and written up.

The coding combined deductive and inductive approaches. The ecological framework of Bronfenbrenner and Morris [10] provided an initial structure for locating mechanisms at different levels of the environment, while themes about mechanisms themselves emerged inductively from the literature. A cross-theory matrix was used to compare constructs that appeared under different labels, for example, the notion of competence in self-determination theory, self-efficacy in social cognitive theory, and expectancy of success in expectancy-value theory, in order to identify points of convergence and points of genuine disagreement.

Trustworthiness and limitations of the method

Several strategies were used to strengthen the credibility of the synthesis. Triangulation across theoretical traditions was used so that no theme rested on a single theory. A simple hierarchy of evidence, in which meta-analyses and experimental studies were weighted more heavily than conceptual arguments, guided the treatment of conflicting claims. A written audit trail linking each theme to its supporting sources was maintained so that interpretive decisions could be traced. Finally, the author attempted to remain reflexive about the influence of her own professional position as a teacher educator in an Indonesian higher education institution, which inevitably shapes which issues appear salient. The limitations of the method are also acknowledged. The purposive corpus may under-represent literature published in languages other than English, and the integrative approach produces propositions rather than empirical tests. These limitations are revisited in the discussion.

RESULTS AND DISCUSSION

Overview of the synthesis

The thematic analysis identified six themes that together describe the psychological foundations of a learning ecosystem. The first three themes concern processes within the learner but are strongly shaped by the environment: strategic and metacognitive learning, autonomous and value-based motivation, and emotional safety and belonging. The remaining three concern the environment itself: relational and social scaffolding, aligned instruction, assessment, and feedback, and the wider family, community, digital, and policy contexts. Table 1 summarizes the theoretical pillars from which these themes were derived and indicates their main contribution to lifelong learning.

Table 1 Theoretical Pillars Informing the Learning Ecosystem Synthesis

Pillar	Core constructs	Representative sources	Contribution to lifelong learning
Cognition and metacognition	Working memory limits, cognitive load, retrieval, spacing, metacognitive monitoring	Sweller et al. [14]; Roediger & Karpicke [15]; Flavell [16]	Efficient, durable learning and the skill of learning how to learn
Self-regulated learning	Forethought, performance control, self-reflection, strategy use	Zimmerman [17]; Pintrich [18]; Panadero [19]	Capacity to direct learning without external supervision
Motivation and identity	Basic psychological needs, expectancy and value, self-efficacy, mindset, goal structures	Ryan & Deci [20]; Eccles & Wigfield [21]; Bandura [22]; Dweck [23]	Willingness to start and continue learning when rewards are absent
Emotion and belonging	Achievement emotions, social-emotional skills, sense of belonging	Pekrun [24]; Durlak et al. [25]; Walton & Cohen [26]	Resilience and positive associations with learning
Social and ecological context	Zone of proximal development, communities of practice, nested systems	Vygotsky [27]; Wenger [28]; Bronfenbrenner & Morris [10]	Conditions that sustain learning across settings and over time

Theme 1: Strategic and metacognitive learning

The first theme concerns what learners do with their minds when they learn and how well they understand and manage those processes. Cognitive load theory begins from the observation that working memory is severely limited when people deal with new information, whereas long-term memory can store large, well-organized bodies of knowledge [14], [29]. The implication for instruction is that tasks should be designed to manage the load placed on learners, for example by using worked examples for novices, gradually fading support as expertise grows, and removing unnecessary sources of distraction [30]. Mayer [31] extended this line of work to multimedia materials and showed that carefully designed combinations of words and images can support understanding, whereas poorly designed ones overload learners. For lifelong learning, the lesson is

that people who understand how their own cognitive system works are better placed to design effective learning for themselves.

A second body of evidence concerns which study strategies actually produce durable learning. Roediger and Karpicke [15] demonstrated that retrieving information from memory, as in practice testing, produced better delayed retention than repeated study of the same material. Dunlosky et al. [32] reviewed ten commonly used learning techniques and judged practice testing and distributed practice to have high utility, whereas highlighting, rereading, and summarization were rated as having low utility under most conditions. Bjork [33] argued that conditions which make learning feel more difficult in the short term, such as spacing and interleaving, often enhance long-term retention, which he termed desirable difficulties. A recurring finding is that learners are not good intuitive judges of which strategies work. Rereading creates a sense of fluency that is easily mistaken for understanding, and students therefore tend to prefer it. An ecosystem that aims to produce lifelong learners cannot leave strategy choice to intuition; it needs to teach learners why effortful strategies work and to give them repeated opportunities to experience their benefits.

Metacognition, defined by Flavell [16] as knowledge and regulation of one's own cognitive processes, is the capacity that allows learners to make such judgments. Models of self-regulated learning describe how learners set goals, select strategies, monitor progress, and reflect on outcomes. Zimmerman [17] described a cyclical process consisting of forethought, performance, and self-reflection phases, in which the outcomes of one cycle inform the next. Pintrich [18] emphasized that cognitive, motivational, and contextual factors jointly shape self-regulation, and Panadero [19], comparing six major models, concluded that they converge on the importance of cyclical phases, the role of motivation and emotion, and the possibility of teaching self-regulation. Meta-analytic evidence supports the teachability of these skills. Dignath and Büttner [34] found positive effects of self-regulation training on academic performance, strategy use, and motivation in primary and secondary education, and Donker et al. [35] reported positive effects of learning strategy instruction on performance, with stronger results when strategy teaching was combined with the development of metacognitive knowledge.

These findings have a clear implication for how strategy instruction is delivered. Self-regulation and metacognition appear most effective when taught within subject matter that students are actually learning, rather than as detached study-skills courses, because learners need to see when and why a strategy is useful. The classical notion of scaffolding describes how a more knowledgeable partner can provide initial structure and then withdraw it as the learner gains competence [36]. Applied to self-regulation, teachers first model strategies aloud, then guide students through practice with prompts and checklists, and finally allow students to plan and monitor their own work. This gradual release of control mirrors the transition from other-regulation to self-regulation that is the essence of becoming an independent learner. It is also consistent with the debate between advocates of direct instruction and advocates of inquiry. Kirschner et al. [37] argued that minimally guided instruction is ineffective for novices, whereas Hmelo-Silver et al. [38] countered that well-scaffolded problem-based and inquiry approaches are not minimally guided at all. The two positions converge on a practical principle: the amount of guidance should be calibrated to the learner's expertise and reduced over time.

Theme 2: Autonomous and value-based motivation

Lifelong learners continue to learn after external incentives have disappeared, and motivation research helps to explain what makes this possible. Self-determination theory proposes that people have three basic psychological needs, namely autonomy, competence, and relatedness, and that environments which satisfy these needs foster autonomous forms of motivation, in which people act out of interest or personally endorsed values, whereas environments that frustrate them foster controlled motivation, in which people act because of pressure or reward [20], [39]. A meta-analysis of experiments found that tangible rewards tended to undermine intrinsic motivation for interesting tasks [40], a finding that is important for classrooms in which grades, rankings, and prizes are the main sources of encouragement. The theory does not suggest that structure or guidance should be absent. It distinguishes autonomy support from permissiveness, and it recognizes that learners need clear expectations, informational feedback, and a rationale for why tasks matter in order to internalize their value.

Expectancy-value theory adds that achievement-related choices depend on two questions: can I succeed at this task, and do I want to do it? Wigfield and Eccles [41] and Eccles and Wigfield [21] described subjective task value as comprising attainment value, intrinsic value, utility value, and cost. The framework is useful for understanding why capable students sometimes disengage. If a task seems irrelevant to their goals or identity, or if it demands more effort or emotional risk than it appears to be worth, they may avoid it. Bandura [22] identified self-efficacy, the belief in one's capability to organize and execute the actions needed to produce given outcomes, as a powerful determinant of effort, persistence, and strategy use. Efficacy beliefs are shaped most strongly by mastery experiences, followed by vicarious experiences, social persuasion, and physiological and emotional states. A learning ecosystem therefore needs to provide tasks that are challenging yet achievable so that students accumulate genuine mastery experiences, and to ensure that praise and feedback are credible and specific.

Beliefs about the nature of ability are another important component. Dweck [23] distinguished fixed mindsets, in which ability is seen as a stable trait, from growth mindsets, in which ability is seen as something that can be developed through effort, strategies, and help from others. Yeager and Dweck [42] argued that growth beliefs promote resilience because setbacks are interpreted as information about what to change rather than as evidence of inadequacy. The empirical picture, however, is more nuanced than popular accounts suggest. A meta-analysis by Sisk et al. [43] found that the overall relationship between mindset and achievement, and the average effect of mindset interventions, were weak, although the effects were more promising for students at academic risk and for those from low-income backgrounds. A large national experiment in the United States found that a brief online growth mindset intervention improved the grades of lower-achieving adolescents and increased advanced mathematics course-taking, but the benefits were concentrated in schools where peer norms supported challenge seeking [44]. This result is highly relevant to the ecosystem argument. The same psychological intervention worked differently depending on the environment in which it was received, which suggests that beliefs are not simply private cognitions but are sustained or undermined by the social context.

The motivational climate of the classroom is a good example of such context. Ames [45] analyzed how classroom structures, including the design of tasks, the distribution of authority, the

recognition of achievement, the grouping of students, the evaluation practices, and the use of time, communicate whether learning or performance is valued. Classrooms emphasizing mastery goals encourage students to focus on improvement, effort, and understanding, while classrooms emphasizing performance goals focus attention on relative ability and public comparison. Over time, mastery-oriented climates are associated with deeper strategy use and greater willingness to seek help, which are behaviors that matter greatly in lifelong learning. In summary, the motivational evidence indicates that the dispositions required for continued learning, such as interest, perceived value, a sense of efficacy, and growth-oriented beliefs, are cultivated through the everyday structure of the learning environment and are not simply traits that students bring with them.

Theme 3: Emotional safety and belonging

Emotions are not peripheral to learning. Pekrun's [24] control-value theory proposes that achievement emotions such as enjoyment, hope, pride, anxiety, shame, and boredom arise from appraisals of control over activities and outcomes and of the value attached to them. These emotions in turn influence attention, motivation, strategy use, and self-regulation [46]. Positive activating emotions, such as enjoyment of learning, are generally associated with deeper processing and flexible strategy use, while intense anxiety can occupy working memory and push students toward superficial or avoidant strategies. Neuroscientific and psychological syntheses reach compatible conclusions. Immordino-Yang and Damasio [47] argued that emotion is deeply intertwined with the processes of memory, decision making, and the application of knowledge, and that education which ignores affect neglects part of the machinery of learning.

For lifelong learning, the emotional dimension has a long-term significance that goes beyond immediate performance. The emotional memories that people carry from their school years shape their willingness to return to learning as adults. This is an interpretive claim drawn from the convergence of the literature on achievement emotions and on the identity-related aspects of motivation, rather than a finding reported by a single study, but it is consistent with the observation that adults who recall humiliating experiences of failure are often reluctant to enroll in further education. Schools that produce competent but anxious or bored graduates may therefore be undermining the long-term goal they claim to serve.

Social and emotional learning programs aim to build the skills that support emotion regulation, empathy, relationship building, and responsible decision making. Durlak et al. [25] conducted a meta-analysis of 213 school-based universal programs involving more than 270,000 students and found that participants showed significant improvements in social and emotional skills, attitudes, and behavior, as well as an average gain in academic performance equivalent to about eleven percentile points compared with controls. The finding indicates that attention to emotional development is complementary to, rather than competing with, academic aims. The same review noted that programs were more effective when they used sequenced, active, focused, and explicit practices and when they were implemented well, again highlighting the importance of how an intervention is delivered within a setting.

A related line of work concerns belonging, the sense that one is accepted and valued as a member of a learning community. Walton and Cohen [26] showed that a brief intervention that framed early difficulties as normal and temporary improved academic and health outcomes for students from a stigmatized minority group in their first year of college. Such results do not mean

that short interventions can substitute for inclusive institutions. Rather, they suggest that students' interpretations of their experiences are sensitive to the cues available in the environment and that small changes in these cues can have lasting effects when the broader context supports them. In diverse societies such as Indonesia, where students differ in language, region, religion, and economic background, deliberate attention to belonging is a necessary part of the ecosystem and is not an optional extra.

Theme 4: Relational and social scaffolding

Learning is a social process before it is an individual one. Vygotsky [27] proposed that higher psychological functions originate in social interaction and are gradually internalized, and he introduced the zone of proximal development as the distance between what a learner can do independently and what they can do with guidance. Lave and Wenger [48] and Wenger [28] extended the social view by describing learning as participation in communities of practice, in which newcomers move from peripheral to full participation as they acquire the knowledge, norms, and identity of the community. For the development of lifelong learners, these perspectives suggest that students should experience classrooms as communities in which learning is a shared and valued activity, and not as sites of isolated competition.

The teacher–student relationship is the most immediate relational resource in this community. Roorda et al. [49] conducted a meta-analysis of the association between affective teacher–student relationships and students' engagement and achievement. They found that positive relationships were associated with higher engagement and achievement and that negative relationships were associated with lower engagement and achievement, with the associations being stronger for engagement than for achievement. Engagement itself is a multidimensional construct that includes behavioral, emotional, and cognitive components [50], and it is closely related to the motivational and emotional processes described above. Teachers who show warmth and interest, who communicate high expectations, and who respond to students' ideas thus influence the psychological conditions for learning in several ways simultaneously. They support the need for relatedness, they model emotion regulation and curiosity, and they provide the guidance that makes challenging tasks feel manageable.

Peers constitute a second relational resource. Johnson and Johnson [51] reviewed several decades of research on social interdependence theory and concluded that well-structured cooperative learning, in which students are mutually dependent for success and individually accountable, generally promotes higher achievement, more positive relationships, and better psychological adjustment than competitive or individualistic arrangements. The qualification is important: unstructured group work does not yield these benefits. Cooperative learning also provides practice in skills that adult learning depends on, including explaining one's reasoning, listening to alternative views, and negotiating shared understanding.

The relational theme also invites reflection on cultural traditions of teaching. In many Islamic educational settings in Indonesia, including pesantren and madrasah, the relationship between teacher and student is characterized by respect, moral guidance, and long-term mentoring, and learning is often embedded in communal routines such as group recitation, discussion, and shared responsibilities. These practices can be seen as culturally specific forms of scaffolding and community of practice. At the same time, hierarchical relationships can sometimes limit students'

opportunities to question and to express their own interpretations, which are important for autonomy and critical thinking. The task for a learning ecosystem in such contexts is not to replace local traditions with imported models but to identify how respect and authority can coexist with autonomy support, an approach consistent with the view of self-determination theory that autonomy does not mean independence from others but the experience of acting with a sense of volition [39]. The suggestion should be treated as a hypothesis for empirical investigation, since the interaction between traditional authority structures and autonomy support remains under-studied.

Theme 5: Aligned instruction, assessment, and feedback

The fifth theme concerns the way in which the instructional core of schooling is organized. Biggs [52] introduced the principle of constructive alignment, according to which the intended learning outcomes, the teaching and learning activities, and the assessment tasks should be coherent with one another. When a curriculum announces that it values critical thinking while assessment rewards memorized definitions, students quickly learn which signal to follow. Alignment is therefore not a technical nicety but a psychological issue, since it determines whether the messages that students receive about what counts as learning are consistent.

Assessment practices exert especially strong effects on motivation and strategy use. Black and Wiliam [53], in a landmark review, concluded that strengthening formative assessment, in which information about learning is gathered and used to adapt teaching and to guide students, produces substantial gains in achievement. Hattie and Timperley [54] analyzed the power of feedback and proposed that effective feedback answers three questions for the learner: where am I going, how am I going, and where to next. They distinguished feedback at the levels of the task, the process, self-regulation, and the self, and concluded that feedback focused on processes and self-regulation is generally more powerful than feedback on the self as a person, such as generalized praise. Panadero and Jonsson [55] reviewed the use of scoring rubrics and concluded that when they are used formatively, as tools for understanding criteria, self-assessment, and revision, rubrics can promote self-regulation and reduce anxiety. In a lifelong learning perspective, the aim of assessment is not only to certify achievement but to develop the ability to judge one's own work, because after leaving school there is usually no teacher available to provide an evaluation.

High-stakes summative assessment illustrates the problem of misalignment. While examinations serve legitimate purposes of certification and accountability, a system in which they dominate classroom life creates performance-oriented climates, increases evaluative anxiety, and narrows the curriculum to what is tested [24], [45]. The solution is not necessarily to abandon examinations. It is to balance them with assessment for learning, to provide opportunities for revision and resubmission, to use a range of tasks that require application and explanation, and to communicate to students that errors are normal parts of learning. Such practices connect directly to the motivational and emotional themes discussed above.

Another dimension of instructional design is responsiveness to learner diversity. The framework of Universal Design for Learning proposes that curricula should offer multiple means of engagement, representation, and action and expression so that barriers are reduced for the widest possible range of learners [56], [57]. The framework aligns well with the ecosystem perspective because it locates difficulty in the design of the environment rather than in deficits of the learner, although the empirical evidence base for the framework as a whole is still developing and should be

interpreted with caution. Experiential approaches that cycle through concrete experience, reflection, conceptualization, and experimentation [58], as well as problem-based learning designs [59], can also contribute by linking school learning to authentic problems, which strengthens the perceived value of learning and prepares students for the self-directed inquiry required in adulthood.

Theme 6: Family, community, digital, and policy contexts

Beyond the classroom and the school, learners are embedded in families, communities, digital environments, and policy systems. In Bronfenbrenner's terms, these include the mesosystem of connections between settings, the exosystem of settings that influence the learner indirectly, and the macrosystem of cultural values and institutions [9], [10]. Expectancy–value research notes that parents' beliefs and behaviors shape children's perceptions of their own competence and of the value of different activities [21]. Where families treat learning as a source of curiosity and growth, children are more likely to adopt similar orientations, while where learning is treated mainly as a means of avoiding punishment or achieving status, performance goals are likely to dominate. Religious institutions, community learning groups, and local cultural traditions contribute to the same process by providing additional contexts in which learning is practiced and valued, which is why partnerships between schools and communities are central to a robust ecosystem.

Digital environments now form a significant part of that ecosystem. The community of inquiry framework describes online and blended learning as depending on the interaction of social presence, cognitive presence, and teaching presence [60]. The framework is helpful because it emphasizes that technology does not by itself generate learning. Platforms, applications, and artificial intelligence tools can amplify the psychological mechanisms discussed in this article, for example by delivering spaced retrieval practice, timely feedback, or flexible access to resources, but they can also undermine them if they encourage passive consumption, reduce productive struggle, or weaken human relationships. Digital design that is consistent with cognitive and motivational principles, such as the multimedia principles proposed by Mayer [31], is therefore a requirement of a healthy ecosystem. In settings where access to devices and connectivity is unequal, digital strategies must also be planned so that they do not widen existing gaps.

At the macro level, policy frameworks shape what counts as success and therefore what schools and families prioritize. The OECD [1] Learning Compass proposes that learners need agency and co-agency, the capacity to set a direction and to act with others, as a foundation for navigating complex futures, and UNESCO [2] calls for humanistic approaches to education that treat it as a common good. These ideas are compatible with the psychological findings reviewed here, but they are only realized when policy instruments, such as curriculum design, assessment regimes, teacher training, and resource allocation, support them. For example, a curriculum that promotes independent learning will have limited effect if teacher workloads leave no time to provide formative feedback or if accountability measures reward only test scores.

The cultural and religious dimension discussed in the introduction becomes relevant again at this level. Frameworks that situate learning within a view of the whole person, including moral and spiritual development, may offer sources of intrinsic and identified motivation which are not captured by standard measures. For instance, when learning is understood as an act of worship and service, as many Muslim learners understand it, the value that students attach to learning may extend beyond personal advancement to include contribution to family and society. In self-

determination terms, this would correspond to the internalization of values and the integration of learning into one's identity. This interpretation is offered tentatively and calls for empirical research, but it illustrates how the ecosystem perspective can enrich rather than replace local conceptions of education [11].

The Learning Ecosystem Model

Bringing the six themes together, the Learning Ecosystem Model depicts the learner at the center of four nested layers of influence, as shown in Figure 1. The core of the model comprises the learner's cognitive and metacognitive resources, motivational beliefs and identity, and emotional and belonging experiences, which correspond to the first three themes. The first surrounding layer consists of the relationships with teachers and peers through which the learner participates in social learning. The second layer comprises instruction, assessment, and feedback, including the digital tools used in teaching. The third layer is the institutional culture and leadership of the school or university, which determines time, routines, norms, and professional learning for staff. The outer layer comprises family, community, and policy contexts. Development unfolds through time, so that experiences in one phase of education influence what learners bring to the next, and the intended outcome is a set of lifelong learning dispositions, namely curiosity, self-direction, resilience, collaboration, and reflection.

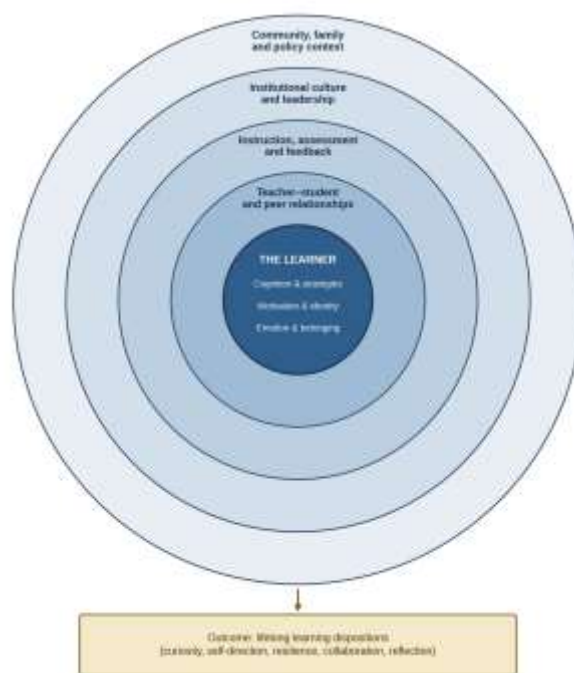


Figure 1 The Learning Ecosystem Model for Lifelong Learners

The model is not a simple hierarchy in which the outer layers determine the inner ones. Influence flows in both directions. A learner who experiences success and develops efficacy engages more actively, which elicits more supportive responses from teachers and peers, which in turn strengthens efficacy. Teachers who feel supported by school leaders and who experience professional growth are better able to support students. Communities that see evidence of student curiosity and growth may revise their expectations of schooling. These reciprocal processes are what

make the structure an ecosystem and not a chain of command, and they imply that change can be initiated from several points. Table 2 summarizes the layers, the psychological mechanisms most closely associated with each, and illustrative practices.

Table 2 Layers of the Learning Ecosystem, Psychological Mechanisms, and Illustrative Practices

Layer	Main psychological mechanisms	Illustrative practices
The learner	Metacognition, strategy knowledge, self-efficacy, autonomous motivation, emotion regulation	Explicit teaching of retrieval and spacing; goal setting and reflection journals; learner choice within structured tasks
Relationships	Relatedness, scaffolding, modeling, belonging	Warm and respectful teacher–student dialogue; structured cooperative learning; mentoring and peer tutoring
Instruction, assessment, and feedback	Competence support, mastery climate, constructive alignment, formative feedback	Worked examples that fade; rubrics used for self-assessment; revision opportunities; feedback focused on process
Institutional culture and leadership	Shared norms, professional learning, psychological safety for teachers	Time for collaborative planning; teacher inquiry groups; policies that value improvement over ranking
Family, community, and policy	Expectations, values, resource access, cultural meaning of learning	Home–school partnerships; community learning programs; curriculum and assessment policy that rewards deep learning

Propositions of the model

The synthesis suggests six propositions that specify how the layers interact and that may serve as a basis for future empirical tests. The first is the strategy knowledge proposition: lifelong learning dispositions depend on learners' explicit knowledge of effective strategies and metacognitive monitoring, which are most effectively developed when taught within subject content through modeling and gradual release of control. This proposition draws on research about retrieval, spacing, and self-regulation [17], [32], [34].

The second is the need support proposition: the motivation to continue learning beyond formal schooling is strongest when autonomy, competence, and relatedness are supported consistently across the settings in which students learn, including classrooms, homes, and communities [20], [39]. The third is the safety before challenge proposition: emotional safety and belonging are preconditions for students to accept productive challenge, take risks, and persist through difficulty, since anxiety and exclusion divert cognitive and emotional resources from learning [24], [26].

The fourth is the alignment proposition: the effect of any practice or program is amplified when adjacent layers of the ecosystem send congruent messages and weakened or reversed when they send contradictory ones. The evidence that mindset interventions work differently depending on peer norms [44] and the analyses of classroom structures that shape goal orientations [45] provide support for this proposition. The fifth is the reciprocity and development proposition: relationships

between layers are bidirectional and cumulative, such that early experiences of mastery and support create positive feedback loops, while early experiences of failure and exclusion create cycles of avoidance, and transitions between school levels are critical moments when the ecosystem can either reinforce or interrupt these cycles.

The sixth is the adult learner proposition: an ecosystem cannot cultivate lifelong learning in students unless the adults within it, namely teachers, leaders, and parents, are themselves visible and supported lifelong learners. This proposition draws on the logic of social cognitive theory, in which modeling is a primary source of learning and efficacy [22], and on research on communities of practice [28]. It carries particular significance for teacher education institutions, which are responsible for preparing future teachers to be both skilled instructors and exemplary learners.

Implications for practice

For teachers, the model suggests several practical priorities. Teachers can integrate the explicit teaching of learning strategies into regular lessons by regularly using low-stakes retrieval quizzes, spacing key content over time, and asking students to predict, monitor, and reflect on their performance. They can support autonomy by offering meaningful choices, explaining the relevance of tasks, and acknowledging students' perspectives, while retaining clear structure. They can shift the emphasis of feedback from grades and general praise to information about processes and next steps, and allow students to revise their work. They can build belonging through routines that learn and use students' names, value diverse contributions, and treat errors as opportunities for discussion. And they can model their own learning by sharing how they approach problems they do not yet know how to solve.

For school and university leaders, the main implication is that a learning ecosystem is created through structures and routines and not through slogans. Leaders can allocate time for collaborative planning and teacher inquiry, so that professional learning is a normal feature of working life. They can review grading, homework, and ranking practices to determine whether they signal mastery or performance, and they can protect psychological safety for teachers so that they can experiment and share failures. They can also build partnerships with families and community organizations, including religious institutions, to communicate a broad view of the purposes of education.

For teacher education programs, the implication is to integrate rather than separate the psychological foundations of learning. Rather than studying cognition, motivation, and assessment in isolated courses, prospective teachers can analyze the same classroom episode through several theoretical lenses and design lessons that explicitly address each layer of the ecosystem. Practicum experiences can include structured reflection and mentoring so that future teachers practice the self-regulation and reflection they will be expected to cultivate in their students. In faculties of education and Islamic teacher training, discussions of lifelong learning can draw on both contemporary educational psychology and Islamic educational thought, encouraging students to examine where the two traditions converge and where they differ.

For policymakers, the model implies that reforms are more likely to succeed when they are coherent. Policies on curriculum, assessment, teacher development, and school accountability should be reviewed together to ensure that they reward the practices they intend to promote. Investment in formative assessment capacity and in teacher professional learning may be more

effective for developing lifelong learners than adding new content to the curriculum. Policies should also attend to equity of access to digital resources and to the particular needs of students at risk of exclusion. Finally, for families and communities, the implication is to approach learning as an ongoing source of curiosity and growth and to respond to children's difficulties with encouragement and informative support rather than punishment.

Indicators for monitoring the health of a learning ecosystem

If a learning ecosystem is to be cultivated, its condition needs to be monitored in ways that go beyond examination results. Table 3 proposes a set of indicators, expressed as guiding questions, that schools and universities can use for self-assessment. They are intended to be used formatively, for improvement and not for ranking, and each can be addressed with a combination of brief student and teacher surveys, classroom observation, document review, and focus groups. Because the indicators are derived from a conceptual synthesis, they should be validated and adapted to local contexts before being used for formal evaluation.

Table 3 Indicators for Self-Assessment of a Learning Ecosystem

Layer	Indicator question	Possible data source
The learner	Do students describe and use effective strategies, and do they monitor and adjust their learning?	Student reflection logs; strategy inventories; interviews
Relationships	Do students report feeling respected, known, and safe to ask questions or make mistakes?	Student surveys; classroom observation
Instruction and assessment	Are goals, activities, and assessments aligned, and does feedback tell students how to improve?	Lesson plan and assessment review; samples of feedback
Institutional culture	Do teachers have time and support for collaboration and professional learning?	Teacher surveys; schedule analysis; meeting records
Family and community	Do families and community partners understand and support the school's learning goals?	Parent surveys; community forums; partnership records

Limitations and directions for research

Several limitations qualify the contribution of this synthesis. First, the review is conceptual and relies on purposively selected sources, so the Learning Ecosystem Model should be regarded as a set of testable propositions and not as an empirically validated theory. Second, much of the cited evidence originates in Western contexts, and the extent to which mechanisms operate in the same way in other cultural settings requires investigation. Self-determination theory, for example, claims that basic psychological needs are universal, but the ways in which they are satisfied are likely to vary across cultures [39]. Third, effect sizes for many interventions are modest and depend on implementation quality and context, as the mindset literature clearly shows [43], [44]. Fourth, much of the research concerns children and adolescents and the transfer of dispositions to adult life is largely inferred. Longitudinal studies that follow learners from school into work and community life are needed to examine this transfer directly.

Future research could test the model in several ways. Multilevel studies could examine whether the effects of classroom practices on student motivation and strategy use depend on school-level climate and family expectations, as the alignment proposition predicts. Design-based research conducted with teachers could develop and refine ecosystem interventions that combine several layers, such as strategy instruction, formative assessment reform, and family engagement. Cluster-randomized trials could evaluate such combined interventions, and qualitative and mixed-methods studies could explore how students, teachers, and parents in Indonesian schools and Islamic educational institutions interpret lifelong learning and which practices they find meaningful. Cross-cultural comparative studies would help to determine which components of the model are universal and which require local adaptation.

CONCLUSION

This article set out to synthesize educational psychology into an integrated framework for cultivating lifelong learners. Through an integrative qualitative review of foundational theories, meta-analyses, and policy frameworks, six themes were identified: strategic and metacognitive learning, autonomous and value-based motivation, emotional safety and belonging, relational and social scaffolding, aligned instruction and feedback, and supportive family, community, digital, and policy contexts. These themes were integrated into the Learning Ecosystem Model, in which the learner is situated within nested and mutually influencing layers of relationships, instruction, institutional culture, and wider social context.

In response to the first research question, the review indicates that the mechanisms most consistently associated with lifelong learning dispositions are the explicit development of effective strategies and metacognition, the satisfaction of the needs for autonomy, competence, and relatedness, the experience of emotional safety and belonging, and the availability of responsive scaffolding from teachers and peers. In response to the second research question, the review suggests that these mechanisms do not operate in isolation. Their effects are amplified when classroom practices, assessment systems, school culture, and community expectations are aligned, and are attenuated or reversed when they conflict. In response to the third research question, practical implications were outlined for teachers, leaders, teacher educators, policymakers, and families, and a set of indicators was proposed so that schools can monitor the health of their learning ecosystem.

The central message is that lifelong learners are not produced by a single program, lesson, or policy. They develop in environments in which the same psychological messages, that effort and strategy matter, that one belongs, that mistakes are informative, and that learning is valuable, are conveyed consistently by the adults and institutions around them. This implies that efforts to improve education should pay as much attention to the coherence of the ecosystem as to the quality of its separate components. It also implies that the adults within the ecosystem, particularly teachers and teacher educators, are the primary leverage point, since they model what it means to be a learner.

The recommendations that follow from this synthesis are fourfold. Schools should embed strategy and metacognitive instruction in subject teaching and use formative assessment to develop students' capacity for self-evaluation. Leaders should create the time, norms, and professional learning structures that allow teachers to work as lifelong learners themselves. Teacher education programs should integrate the psychological foundations of learning and encourage reflection on

how local educational traditions, including Islamic traditions of seeking knowledge, can be combined with contemporary evidence. Policymakers should review curriculum, assessment, and accountability policies together to ensure that they reinforce, and do not contradict, the goal of lifelong learning. Because the model is a conceptual synthesis, future research should test its propositions through multilevel, longitudinal, design-based, and cross-cultural studies. Only through such work can it be determined how a powerful learning ecosystem can be built in diverse settings, and for which generation of learners it will matter most.

REFERENCES

- [1] OECD, "OECD learning compass 2030: A series of concept notes," OECD Publishing, Paris, France, 2019.
- [2] UNESCO, "Rethinking education: Towards a global common good?," UNESCO, Paris, France, 2015.
- [3] J. Delors, "Learning: The treasure within," UNESCO, Paris, France, 1996.
- [4] P. C. Candy, *Self-direction for lifelong learning*. San Francisco, CA, USA: Jossey-Bass, 1991.
- [5] C. K. Knapper and A. J. Cropley, *Lifelong learning in higher education*, 3rd ed. London, U.K.: Kogan Page, 2000.
- [6] J. Field, *Lifelong learning and the new educational order*, 2nd ed. Stoke on Trent, U.K.: Trentham Books, 2006.
- [7] L. Darling-Hammond, L. Flook, C. Cook-Harvey, B. Barron, and D. Osher, "Implications for educational practice of the science of learning and development," *Appl. Dev. Sci.*, vol. 24, no. 2, pp. 97–140, 2020, doi: 10.1080/10888691.2018.1537791.
- [8] J. Hattie, *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. London, U.K.: Routledge, 2009. doi: 10.4324/9780203887332.
- [9] U. Bronfenbrenner, *The ecology of human development: Experiments by nature and design*. Cambridge, MA, USA: Harvard University Press, 1979.
- [10] U. Bronfenbrenner and P. A. Morris, "The bioecological model of human development," in *Handbook of child psychology: Vol. 1. Theoretical models of human development*, 6th ed., R. M. Lerner and W. Damon, Eds., Hoboken, NJ, USA: Wiley, 2006, pp. 793–828. doi: 10.1002/9780470147658.chpsy0114.
- [11] S. M. N. Al-Attas, *Aims and objectives of Islamic education*. Jeddah, Saudi Arabia: King Abdulaziz University, 1979.
- [12] H. Snyder, "Literature review as a research methodology: An overview and guidelines," *J. Bus. Res.*, vol. 104, pp. 333–339, 2019, doi: 10.1016/j.jbusres.2019.07.039.
- [13] V. Braun and V. Clarke, "Using thematic analysis in psychology," *Qual. Res. Psychol.*, vol. 3, no. 2, pp. 77–101, 2006, doi: 10.1191/1478088706qp063oa.
- [14] J. Sweller, J. J. G. van Merriënboer, and F. G. W. C. Paas, "Cognitive architecture and instructional design," *Educ. Psychol. Rev.*, vol. 10, no. 3, pp. 251–296, 1998, doi: 10.1023/A:1022193728205.
- [15] H. L. Roediger and J. D. Karpicke, "Test-enhanced learning: Taking memory tests improves long-term retention," *Psychol. Sci.*, vol. 17, no. 3, pp. 249–255, 2006, doi: 10.1111/j.1467-9280.2006.01693.x.
- [16] J. H. Flavell, "Metacognition and cognitive monitoring: A new area of cognitive-developmental inquiry," *Am. Psychol.*, vol. 34, no. 10, pp. 906–911, 1979, doi: 10.1037/0003-066X.34.10.906.
- [17] B. J. Zimmerman, "Becoming a self-regulated learner: An overview," *Theory Pract.*, vol. 41, no. 2, pp. 64–70, 2002, doi: 10.1207/s15430421tip4102_2.
- [18] P. R. Pintrich, "A conceptual framework for assessing motivation and self-regulated learning in college students," *Educ. Psychol. Rev.*, vol. 16, no. 4, pp. 385–407, 2004, doi: 10.1007/s10648-004-0006-x.
- [19] E. Panadero, "A review of self-regulated learning: Six models and four directions for research," *Front. Psychol.*, vol. 8, Art. no. 422, 2017, doi: 10.3389/fpsyg.2017.00422.
- [20] R. M. Ryan and E. L. Deci, "Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being," *Am. Psychol.*, vol. 55, no. 1, pp. 68–78, 2000, doi: 10.1037/0003-066X.55.1.68.
- [21] J. S. Eccles and A. Wigfield, "Motivational beliefs, values, and goals," *Annu. Rev. Psychol.*, vol. 53, pp. 109–132, 2002, doi: 10.1146/annurev.psych.53.100901.135153.
- [22] A. Bandura, *Self-efficacy: The exercise of control*. New York, NY, USA: W. H. Freeman, 1997.

- [23] C. S. Dweck, *Mindset: The new psychology of success*. New York, NY, USA: Random House, 2006.
- [24] R. Pekrun, "The control-value theory of achievement emotions: Assumptions, corollaries, and implications for educational research and practice," *Educ. Psychol. Rev.*, vol. 18, no. 4, pp. 315–341, 2006, doi: 10.1007/s10648-006-9029-9.
- [25] J. A. Durlak, R. P. Weissberg, A. B. Dymnicki, R. D. Taylor, and K. B. Schellinger, "The impact of enhancing students' social and emotional learning: A meta-analysis of school-based universal interventions," *Child Dev.*, vol. 82, no. 1, pp. 405–432, 2011, doi: 10.1111/j.1467-8624.2010.01564.x.
- [26] G. M. Walton and G. L. Cohen, "A brief social-belonging intervention improves academic and health outcomes of minority students," *Science (80-.)*, vol. 331, no. 6023, pp. 1447–1451, 2011, doi: 10.1126/science.1198364.
- [27] L. S. Vygotsky, *Mind in society: The development of higher psychological processes*. Cambridge, MA, USA: Harvard University Press, 1978. doi: 10.2307/j.ctvjf9vz4.
- [28] E. Wenger, *Communities of practice: Learning, meaning, and identity*. Cambridge, U.K.: Cambridge University Press, 1998. doi: 10.1017/CBO9780511803932.
- [29] J. Sweller, "Cognitive load during problem solving: Effects on learning," *Cogn. Sci.*, vol. 12, no. 2, pp. 257–285, 1988, doi: 10.1207/s15516709cog1202_4.
- [30] F. Paas, A. Renkl, and J. Sweller, "Cognitive load theory and instructional design: Recent developments," *Educ. Psychol.*, vol. 38, no. 1, pp. 1–4, 2003, doi: 10.1207/S15326985EP3801_1.
- [31] R. E. Mayer, *Multimedia learning*, 2nd ed. New York, NY, USA: Cambridge University Press, 2009. doi: 10.1017/CBO9780511811678.
- [32] J. Dunlosky, K. A. Rawson, E. J. Marsh, M. J. Nathan, and D. T. Willingham, "Improving students' learning with effective learning techniques: Promising directions from cognitive and educational psychology," *Psychol. Sci. Public Interes.*, vol. 14, no. 1, pp. 4–58, 2013, doi: 10.1177/1529100612453266.
- [33] R. A. Bjork, "Memory and metamemory considerations in the training of human beings," in *Metacognition: Knowing about knowing*, J. Metcalfe and A. Shimamura, Eds., Cambridge, MA, USA: MIT Press, 1994, pp. 185–205.
- [34] C. Dignath and G. Büttner, "Components of fostering self-regulated learning among students: A meta-analysis on intervention studies at primary and secondary school level," *Metacognition Learn.*, vol. 3, no. 3, pp. 231–264, 2008, doi: 10.1007/s11409-008-9029-x.
- [35] A. S. Donker, H. de Boer, D. Kostons, C. C. Dignath van Ewijk, and M. P. C. van der Werf, "Effectiveness of learning strategy instruction on academic performance: A meta-analysis," *Educ. Res. Rev.*, vol. 11, pp. 1–26, 2014, doi: 10.1016/j.edurev.2013.11.002.
- [36] D. Wood, J. S. Bruner, and G. Ross, "The role of tutoring in problem solving," *J. Child Psychol. Psychiatry*, vol. 17, no. 2, pp. 89–100, 1976, doi: 10.1111/j.1469-7610.1976.tb00381.x.
- [37] P. A. Kirschner, J. Sweller, and R. E. Clark, "Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching," *Educ. Psychol.*, vol. 41, no. 2, pp. 75–86, 2006, doi: 10.1207/s15326985ep4102_1.
- [38] C. E. Hmelo-Silver, R. G. Duncan, and C. A. Chinn, "Scaffolding and achievement in problem-based and inquiry learning: A response to Kirschner, Sweller, and Clark (2006)," *Educ. Psychol.*, vol. 42, no. 2, pp. 99–107, 2007, doi: 10.1080/00461520701263368.
- [39] R. M. Ryan and E. L. Deci, "Intrinsic and extrinsic motivation from a self-determination theory perspective: Definitions, theory, practices, and future directions," *Contemp. Educ. Psychol.*, vol. 61, Art. no. 101860, 2020, doi: 10.1016/j.cedpsych.2020.101860.
- [40] E. L. Deci, R. Koestner, and R. M. Ryan, "A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation," *Psychol. Bull.*, vol. 125, no. 6, pp. 627–668, 1999, doi: 10.1037/0033-2909.125.6.627.
- [41] A. Wigfield and J. S. Eccles, "Expectancy-value theory of achievement motivation," *Contemp. Educ. Psychol.*, vol. 25, no. 1, pp. 68–81, 2000, doi: 10.1006/ceps.1999.1015.
- [42] D. S. Yeager and C. S. Dweck, "Mindsets that promote resilience: When students believe that personal characteristics can be developed," *Educ. Psychol.*, vol. 47, no. 4, pp. 302–314, 2012, doi: 10.1080/00461520.2012.722805.
- [43] V. F. Sisk, A. P. Burgoyne, J. Sun, J. L. Butler, and B. N. Macnamara, "To what extent and under which circumstances are growth mind-sets important to academic achievement? Two meta-analyses," *Psychol. Sci.*, vol. 29, no. 4, pp. 549–571, 2018, doi: 10.1177/0956797617739704.

- [44] D. S. Yeager *et al.*, "A national experiment reveals where a growth mindset improves achievement," *Nature*, vol. 573, no. 7774, pp. 364–369, 2019, doi: 10.1038/s41586-019-1466-y.
- [45] C. Ames, "Classrooms: Goals, structures, and student motivation," *J. Educ. Psychol.*, vol. 84, no. 3, pp. 261–271, 1992, doi: 10.1037/0022-0663.84.3.261.
- [46] R. Pekrun, T. Goetz, W. Titz, and R. P. Perry, "Academic emotions in students' self-regulated learning and achievement: A program of qualitative and quantitative research," *Educ. Psychol.*, vol. 37, no. 2, pp. 91–105, 2002, doi: 10.1207/S15326985EP3702_4.
- [47] M. H. Immordino-Yang and A. Damasio, "We feel, therefore we learn: The relevance of affective and social neuroscience to education," *Mind, Brain, Educ.*, vol. 1, no. 1, pp. 3–10, 2007, doi: 10.1111/j.1751-228X.2007.00004.x.
- [48] J. Lave and E. Wenger, *Situated learning: Legitimate peripheral participation*. Cambridge, U.K.: Cambridge University Press, 1991. doi: 10.1017/CBO9780511815355.
- [49] D. L. Roorda, H. M. Y. Koomen, J. L. Spilt, and F. J. Oort, "The influence of affective teacher-student relationships on students' school engagement and achievement: A meta-analytic approach," *Rev. Educ. Res.*, vol. 81, no. 4, pp. 493–529, 2011, doi: 10.3102/0034654311421793.
- [50] J. A. Fredricks, P. C. Blumenfeld, and A. H. Paris, "School engagement: Potential of the concept, state of the evidence," *Rev. Educ. Res.*, vol. 74, no. 1, pp. 59–109, 2004, doi: 10.3102/00346543074001059.
- [51] D. W. Johnson and R. T. Johnson, "An educational psychology success story: Social interdependence theory and cooperative learning," *Educ. Res.*, vol. 38, no. 5, pp. 365–379, 2009, doi: 10.3102/0013189X09339057.
- [52] J. Biggs, "Enhancing teaching through constructive alignment," *High. Educ.*, vol. 32, no. 3, pp. 347–364, 1996, doi: 10.1007/BF00138871.
- [53] P. Black and D. Wiliam, "Assessment and classroom learning," *Assess. Educ. Princ. Policy Pract.*, vol. 5, no. 1, pp. 7–74, 1998, doi: 10.1080/0969595980050102.
- [54] J. Hattie and H. Timperley, "The power of feedback," *Rev. Educ. Res.*, vol. 77, no. 1, pp. 81–112, 2007, doi: 10.3102/003465430298487.
- [55] E. Panadero and A. Jonsson, "The use of scoring rubrics for formative assessment purposes revisited: A review," *Educ. Res. Rev.*, vol. 9, pp. 129–144, 2013, doi: 10.1016/j.edurev.2013.01.002.
- [56] D. H. Rose and A. Meyer, *Teaching every student in the digital age: Universal design for learning*. Alexandria, VA, USA: ASCD, 2002.
- [57] CAST, "Universal Design for Learning guidelines version 2.2," CAST, Wakefield, MA, USA, 2018.
- [58] D. A. Kolb, *Experiential learning: Experience as the source of learning and development*. Englewood Cliffs, NJ, USA: Prentice Hall, 1984.
- [59] C. E. Hmelo-Silver, "Problem-based learning: What and how do students learn?," *Educ. Psychol. Rev.*, vol. 16, no. 3, pp. 235–266, 2004, doi: 10.1023/B:EDPR.0000034022.16470.f3.
- [60] D. R. Garrison, T. Anderson, and W. Archer, "Critical inquiry in a text-based environment: Computer conferencing in higher education," *Internet High. Educ.*, vol. 2, no. 2–3, pp. 87–105, 2000, doi: 10.1016/S1096-7516(00)00016-6.