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Learning experience design and postdigital pedagogy in elementary learning environments: A theoretical approach

Çağatay Ergan [1]

[1] Distance Education Application and Research Center, Ordu University, Ordu, Türkiye

ABSTRACT

The aim of this study is to theoretically examine the design processes of instructional technologies and digital learning environments developed at the elementary school level within the framework of postdigital pedagogy principles. Students born in the digital age are no longer merely users of digital technologies; they participate in learning processes as natural members of digital culture. This situation necessitates a holistic and experience-based approach that goes beyond traditional instructional design methods. Learning Experience Design (LXD) provides a framework that can address this need in the design processes of instructional technologies and digital learning environments by focusing on learner-centered, affective, interactive, and contextual dimensions. Postdigital pedagogy contributes to learning experience design processes by transcending the digital-physical distinction and considering learning within the human-technology-environment continuum. In this study, the concepts of Learning Experience Design and postdigital pedagogy are conceptually examined together for the learning processes of elementary school students. Accordingly, a conceptual framework is proposed on how these two approaches can be integrated in the design of students' learning experiences, and recommendations are developed for the design of instructional technologies and digital learning environments at the elementary level.

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CORRESPONDENCE

Çağatay Ergan

Introduction

Technology, an indispensable part of our lives, has initiated a digital transformation in the field of education and altered habits related to instructional processes. This transformation is observed not only in learning environments but also in the nature of learning itself (Hodges et al., 2020; OECD, 2021). Today's elementary school students, referred to as "Generation Alpha," are born and raised in a world where technology is an inseparable part of their lives (McCrindle & Fell, 2020). These students do not merely use technology as a tool; they generate meanings, form social relationships, and shape their lives through technology. From this perspective, the learning styles, methods, and instructional practices of today's students differ significantly from those of previous generations (Höfrová et al., 2024).

Research on the learning processes of contemporary students indicates that interaction, experience, speed, visuality, and instant feedback are critical determinants of learning tendencies. Moreover, these students show a strong preference for video-based and gamified content (Deniz & Yıldırım, 2024). Prensky (2001) emphasizes that digital natives process information in non-linear ways and learn more effectively in highly interactive and visually dense environments. Similarly, Tapscott (2009) highlights that the learning style of this generation is trial-and-error based, exploratory, and participatory in nature. This perspective supports the rise of gamification and experiential learning strategies in current educational technologies.

On the other hand, the widely held belief that Generation Alpha students have shorter attention spans and a higher tolerance for multitasking is a matter of debate in the academic literature. Researchers such as Kirschner and De Bruyckere (2017) strongly argue that these claims lack neurological foundations and that both the concepts of "digital native" and "multitasking" are essentially 'myths'.

In traditional elementary classrooms, instructional technologies are developed and utilized according to a teacher-centered, linear, and cognitively focused instructional design logic that prioritizes knowledge transmission. This approach limits students' active roles in the learning process and diminishes their motivation to learn. In this context, it can be argued that existing learning environments and technologies fail to capture students' interest, inadequately support active participation, and hinder the enrichment of the learning experience (Selwyn, 2016). Indeed, post-2020 remote learning experiences have shown that technology has often been used not for pedagogical transformation but for the "digitization" of existing didactic methods, which has proven insufficient in enhancing student engagement (Bozkurt & Sharma, 2020).

However, research indicates that teachers often interpret students' learning tendencies superficially. In integrating instructional technologies into learning processes, many teachers limit digital tool usage to merely showing videos, opening presentations, or playing pre-prepared content (Kurt, 2013; Türel,2012). For example, in the classroom use of digital platforms such as EBA, Morpa Kampüs, or similar environments, teachers generally treat these platforms as "supporting materials" and do not actively integrate them into the pedagogical design process (Bozkurt, 2017; Göktaş et al., 2013). This situation indicates that technology is perceived not as a transformative tool for the learning experience but as a "presentation environment" that digitalizes traditional instruction. Therefore, developing teachers' pedagogical awareness in technology use is seen as a critical requirement for designing learning experiences that are more aligned with the learning characteristics of digital natives (Ertmer & Ottenbreit-Leftwich, 2010).

Developing teachers' pedagogical awareness in technology use is regarded as essential for creating learning experiences that align with the characteristics of digital natives. Ertmer and Ottenbreit-Leftwich (2010) define this issue not as "first-order barriers" (technical deficiencies) but as "second-order barriers" (teachers' pedagogical beliefs and approaches), indicating that the core need is a mindset transformation. While it is recognized that designing or organizing effective learning activities involves creating experiences in different contexts and environments for learning, this process can transform students' perceptions in engaging and challenging situations and enhance their motivation to participate (UNESCO, 2013). In this context, it becomes evident that it is not sufficient to merely equip learning environments with digital tools; the learner experience must be designed in a holistic manner.

Traditional instructional design models (e.g., ADDIE, Dick & Carey model) approach the learning process within a linear and modular structure. While it is not assumed that these models completely fail to respond to the experiential and interactive learning styles of digital natives, they typically focus on cognitive outcomes, often overlooking the learner's individual context and affective responses (Stefaniak et al., 2025). In this regard, to address these limitations and to ensure that students' affective characteristics are not disregarded, the concept of Learning Experience Design (LXD) offers an innovative framework emerging at the intersection of cognitive science, user experience (UX), and instructional technologies (Tawfik et al., 2022).

Learning Experience Design is an interdisciplinary design approach that integrates cognitive, affective, and behavioral dimensions, bringing together UX design, learning sciences, and pedagogy (Vrieling et al., 2018). LXD perceives learning as an "experience," placing the learner's emotions, motivation, context, and identity at the center. This approach represents a paradigm shift from the traditional instructional design focus on "content delivery" toward the goal of "designing a meaningful and memorable journey for the learner" (Phommanee et al., 2023).

Furthermore, the effects of digitalization in education are now evaluated in a "post-digital" era (Jandrić et al., 2018). The post-digital concept refers to a context in which the boundaries between digital and physical lives are no longer clear, technology is no longer regarded as extraordinary or exceptional, and it becomes a natural part of daily life and educational processes (Castañeda & Selwyn, 2018). This is particularly evident with "invisible" technologies such as the Internet of Things (IoT), wearable technologies, or Ambient Intelligence. For example, a smart ring or clothing that measures a student's attention levels or blood sugar in real time creates an "experience" intertwined with biometric data, rather than merely serving as a "tool" (Hernández-Mustieles et al., 2024). In this context, human-technology interaction in learning environments has become a significant component of learning. From the perspective of postdigital pedagogy, technology is regarded not merely as a tool but as an integral element of learning culture (Jandrić, 2022). This pedagogical perspective aims to redefine learning as an "entangled" and interactive process between humans, technology, and the environment (Schmidt et al., 2024). Indeed, Fawns (2022) argues

that technology should be considered not only as a tool but as an "entangled" element of the learning experience, intertwined with its socio-cultural, material, and affective dimensions.

The post-digital perspective represents a way of thinking in which digital technologies are no longer seen as "new" or "separate" phenomena but are accepted as a natural part of everyday life, culture, and learning processes (Jandrić et al., 2018). This perspective treats technology as an "entangled" element of the learning experience, inseparable from its socio-cultural, material, and affective dimensions (Fawns, 2022). By considering this "entangled" interaction between humans, technology, and the environment as an intrinsic component of the learning process, postdigital pedagogy provides a foundation for revisiting epistemological approaches to the design of instructional technologies. This requires a way of thinking that views learning not merely as an individual cognitive process but as a practice intertwined with technology and context (Gourlay, 2020). This multi-layered understanding of learning opens a discussion on how the Learning Experience Design approach, which extends beyond cognitive processes and focuses on learners' experiential, affective, and contextual interactions, can be theoretically addressed in the context of instructional technologies at the elementary level. In this regard, Learning Experience Design prioritizes learning as a "meaningful journey" and emphasizes affective and holistic experience, in contrast to the traditional instructional design goal of "content delivery" (Phommanee, 2023).

Despite the increasing use of digital technologies in elementary school environments, a structural misalignment exists between the lived practices of contemporary learners and the frameworks provided by traditional instructional design models. Current models predominantly adopt an 'instrumentalist' perspective, treating technology as an extrinsic element to be merely integrated into physical classrooms. However, for the child of the postdigital age, such dualism is obsolete; as noted by Jandrić and Knox (2021), learners' daily lives reflect an experience where biological, digital, and social spheres are inextricably intertwined.

Neglecting this reality during the design process results in the fragmentation of the learning experience and the emergence of practices that are detached from the learner's reality. Elucidating this condition through the concept of 'entangled eclecticism,' Schmidt et al. (2024) emphasize the necessity of addressing the sociotechnical and pedagogical dimensions of learning as a unified whole. However, the extant literature reveals a lack of a holistic guide to navigate this complexity. Consequently, an approach bridging Learning Experience Design (LXD) and postdigital pedagogy is essential for developing sustainable designs tailored to the multimodal nature of 21st-century elementary classrooms and for constructing future-ready learning environments.

This study aims to theoretically explain how the Learning Experience Design approach can be addressed within the framework of postdigital pedagogy in the design of instructional technologies at the elementary level. Accordingly, the study seeks to provide a theoretically grounded, holistic perspective on the design processes of instructional technologies that can respond to the learning needs of elementary school students growing up in the digital age.

Learning experience design

Definition of learning experience design

Learning Experience Design (LXD) is a design approach that treats learning as a holistic experience, ensuring that technologies used in learning processes are effective, engaging, and sensitive to the learning context by integrating instructional design, human-centered design, and user experience elements (Schmidt & Huang, 2022). The concept first emerged in the early 2000s at the intersection of learning sciences, cognitive psychology, user experience, and human-computer interaction (HCI). The primary aim of Learning Experience Design is to create meaningful and lasting learning experiences that enhance learners' cognitive and affective engagement.

Although Learning Experience Design (LXD) is frequently defined in literature through various components, contemporary approaches situate these definitions within a more holistic framework. Traditionally viewed as the intersection of human-computer interaction and pedagogy, LXD has recently been reconceptualized by Schmidt et al. (2024) through the lens of 'entangled eclecticism.' Accordingly, LXD is not merely a process of preparing instructional materials but the design of a non-linear ecosystem where sociocultural, technological, and pedagogical dimensions mutually influence one another. Similarly, in defining LXD, Tawfik et al. (2024) emphasize a shift in focus from solely cognitive outcomes to the learner's empathetic and aesthetic interaction with technology. Consequently, in the postdigital age, LXD should be defined as an interdisciplinary design practice that centers on learner subjectivity, rather than as a technical production process. Distinct from traditional instructional design, Learning Experience Design holistically targets the affective, cognitive, and social-emotional dimensions of learning; by enhancing learner

motivation and engagement, it supports students in achieving learning goals more rapidly and effectively through lived experiences (Diaz et al., 2024; Georgiou et al., 2021; Robinson et al., 2017).

The traditional content-centered instructional design perspective typically focuses on content organization, targeted cognitive behaviors, and assessment dimensions when developing instructional technologies. In contrast, Learning Experience Design, as a human-centered approach, incorporates the subjective, emotional, and social dimensions of learning into the design process. This requires the designer to understand the learner's perspective, motivations, and emotions. Tools such as empathy maps or learner personas can be employed to achieve this in LXD (Stefaniak et al., 2025). Therefore, the Learning Experience Design paradigm shifts the focus from creating "learning products" or "content packages" to designing "learning experiences" (Mavri et al., 2025). This redefines the designer's role from a "content provider" to an "experience architect" who shapes the learner's holistic journey (Tawfik et al., 2022).

Core principles of learning experience design

The focus of Learning Experience Design (LXD) extends beyond cognitive processes to include affective skills as part of the learning process. In this respect, LXD differs from traditional instructional design processes by framing learning as a human-centered experience design process. In designing a human-centered experience, features such as empathy, interaction, contextualization, personalization, and affective coherence come to the forefront. The LXD process brings together disciplines such as art, psychology, sociology, and engineering to understand human behavior and needs, thereby enabling the development of innovative perspectives in the design process (Auernhammer & Roth, 2021).

Although the human-centered approach is based on placing the individual at the center of learning experience design and addressing their cognitive, emotional, and social dimensions as a whole, it emphasizes that the learning process cannot be reduced merely to knowledge transmission. Instead, it requires a design process centered on learners' needs, interests, and life context, linking the starting point of the design process to the concept of empathy (Stefaniak et al., 2025).

Designers of learning experiences customize their designs by attempting to understand the learner's perspective, closely examining developmental characteristics, attention spans, learning pace, curiosity, and sources of motivation. For elementary school students, this process involves not only age-appropriate cognitive tasks but also the integration of play, exploration, and affective interaction needs into the learning process (Undheim, 2022). In learning environments designed in this manner, students become not only consumers but also producers of knowledge. The concept of interaction within the LXD process is defined in a holistic manner, consistent with the philosophy of postdigital pedagogy, encompassing not only technological tool interactions but also physical materials, peer collaborations, and teacher guidance (Fawns, 2022).

Another key principle, contextualization, emphasizes that the experiences acquired in the learning process should be related to the student's lived world, and that learners derive meaning from their experiences within their environment and cultural context. Accordingly, instructional technologies, learning content, and digital materials should be presented not as abstract knowledge transmission but in connection with everyday events, problems, and societal contexts in the learner's life. This approach is considered to make learning more meaningful and durable through the connections students establish with their own world (Schmidt & Huang, 2022). In the design of instructional process elements, it is considered important that the aforementioned structural and theoretical foundations are not limited to the conceptual level but are also effectively implemented in practice. Therefore, the Learning Experience Design process requires interdisciplinary collaboration, bringing together experts from different fields—such as instructional designers, educators, cognitive scientists, and user experience designers—to create comprehensive and holistic learning experiences (Schmidt & Huang, 2022; Weigel, 2015). Recent systematic reviews on Learning Experience Design confirm that this approach expands the scope of learning experiences and enables designers to establish stronger affective and cognitive interactions with students (Ahn et al., 2019; Phommanee et al., 2024; Weigel, 2015). In this way, it provides a contemporary framework that makes it possible to produce effective, motivating, and engaging instructional content for learners (students).

Application of learning experience design in elementary learning environments

In the elementary context, Learning Experience Design (LXD) requires that students' cognitive, affective, and social developmental characteristics be considered holistically throughout the learning process (Aloizou et al., 2025). In elementary education, learning is understood not merely as the acquisition of knowledge but also as an experience shaped by meaning-making, emotional engagement, and social interaction (Biccard & Wessels, 2011). Therefore, the LXD approach should focus not only on the content of activities in instructional processes but also on how these activities provide experiences for students and how these experiences make students feel. Designing learning experiences for elementary students thus

necessitates environments that are developmentally appropriate, play-based, emotionally supportive, and interactive.

Learning at this age occurs primarily through concrete experiences and social interactions (Piaget, 1972). Accordingly, LXD should be designed around curiosity, exploration, and play rather than abstract knowledge transmission, and the audiovisual richness of digital materials should be used to enhance students' emotional engagement (Guan et al., 2022). In the process of designing learning experiences, instructional technologies can be viewed as "experience mediators," where technology is not the primary objective of instruction but a tool aimed at enriching the learning process experientially.

Tools that enable students to engage in interactive experiences—such as augmented reality (AR), virtual laboratories, and game-based learning environments—support elementary students' curiosity and exploration, transforming learning into an experiential process (Basumatary & Maity, 2023; Guan et al., 2022). Digital materials used in learning processes should be designed to stimulate children's natural curiosity, play needs, and exploratory drive, employing approaches such as game-based learning, storytelling, affective interaction, and multiple representation formats (Lv et al., 2022). In such a designed learning experience, students are no longer passive recipients of knowledge; they become active participants in meaning-making processes. Interactive story platforms, virtual laboratories, or game-based learning environments enable children to concretize abstract concepts, engage in problem-solving processes, and experience learning as a discovery-driven activity (Aloizou et al., 2025).

As is well known, Bruner's (1966) constructivist approach asserts that individuals make sense of knowledge through their own activities. This perspective provides a foundation for one of the core principles of Learning Experience Design (LXD)—positioning the learner as an active agent in the meaning-making process. Similarly, Kolb's (1984) experiential learning cycle emphasizes that learning is not solely a cognitive process but a lived experience encompassing concrete experience, observation, reflection, and application stages. The LXD approach translates this cycle to the design level, structuring learning experiences not merely around the question "How should it be taught?" but also "What kind of experience does the learner have during this process?" In this context, LXD represents a design approach that centers on learners engaging with, feeling, and co-constructing meaning throughout the learning process (McLeod, 2020). This perspective views learning not as the transmission of specific content but as the construction of experiences in which the child finds meaning in their own world. Instructional technologies used in these processes are positioned not at the center of learning but as part of the experience. Technology functions not as a conduit for information but as an interface that enriches the affective, cognitive, and social dimensions of learning. Accordingly, Learning Experience Design in elementary learning environments aims less at planning instruction and more at designing learning experiences that are meaningful, lasting, and emotionally resonant within the learner's own world.

At this point, the factor determining the quality of learning experiences is not only pedagogical design but also the nature of the era in which digital and physical contexts of learning are intertwined. Contemporary students—digital natives—experience technology as a habitual part of the natural flow of life. Consequently, a process emerges in which the boundary between the digital and the physical becomes increasingly blurred. While this ambiguity may be perceived by digital natives as a natural part of life, it can sometimes appear as an impenetrable fog to teachers who guide them. From this perspective, instructional communication issues may arise between teachers, who manage the learning process, and students. Technologies used by teachers in their lessons (e.g., a topic-specific Web 2.0 application) may seem mundane to students, potentially negatively affecting their engagement and motivation (Fawns, 2019; Knox, 2019). Such circumstances require rethinking Learning Experience Design not merely as a pedagogical issue but within a broader postdigital pedagogical perspective. Redefining Learning Experience Design in a postdigital context entails not only the technological enhancement of instructional environments but also theoretically examining how the digital, as a natural component of life, can be integrated into the processes of learning experiences.

Postdigital pedagogy

The postdigital concept and its reflections on pedagogy

The postdigital concept is used to describe a period in which digital technologies are no longer considered "special" or "novel" but have become a natural component of everyday life (Jandrić et al., 2018). The term "postdigital" refers to a stage in which the boundaries between digital and non-digital (physical-analog) realms have blurred or disappeared. Accordingly, instructional processes in the postdigital era should not be designed around digital materials or processes as central elements; rather, they should be conceptualized with a pedagogical understanding that digital processes are a natural extension of daily life.

For contemporary digital natives, technology is not an "additional—external tool" in learning processes but an inherent context embedded within the natural flow of learning (Smith, 2020). From this perspective, postdigital pedagogy treats digital and physical processes as an inseparable whole. The aim of postdigital pedagogy is therefore not merely to integrate technological tools but to make it understandable how these tools become intrinsic to the nature of learning experiences under current conditions. The use of instructional technologies in learning processes is no longer simply as tools or materials; they are part of meaning-making processes that shape instruction at the intersection of physical, social, and digital environments (Ginzburg et al., 2023). In this context, to make instructional processes more suitable and effective for digital natives at the elementary level, technology should not be considered solely as a tool supporting specific learning objectives. Instead, it should be seen as an element that transforms the learning process itself. Instructional technologies are understood not as external aids for achieving learning goals but as components that redefine the formation of the learning experience, the channels of interaction, and the levels of cognitive engagement. Therefore, instructional technologies must be repositioned at the center of pedagogical decision-making and redefined as an intrinsic element of the Learning Experience Design process.

The implementation of postdigital pedagogy in elementary education necessitates a fundamental redefinition of teacher competencies. While the Technological Pedagogical Content Knowledge (TPACK) framework, prevalent in current literature, serves as a primary reference point for classifying teachers' technology integration skills, the postdigital condition requires that these knowledge domains be utilized not as distinct categories, but as a fluid whole. Mavri et al. (2025) highlight the importance of positioning teachers not merely as implementers, but as 'co-designers' within the development processes of educational technologies. In this context, the teacher of the postdigital age is not defined as someone who possesses isolated knowledge of technology, content, and pedagogy; rather, they are an 'experience architect' capable of critically evaluating and orchestrating the sociomaterial reality created by these components. Consequently, teacher education must transcend technical tool proficiency and focus on the competence to navigate complex learning ecologies where digital and physical layers are inextricably intertwined."

Understanding how instructional technologies become intrinsic to the nature of learning experience processes in contemporary contexts involves not only considering the cognitive development levels of children but also their digital literacy, empathy, and self-regulation skills in the design of elementary learning experiences. The postdigital approach prioritizes the creation of learning experiences that foster critical thinking, responsibility, and creativity in students' interactions with digital technologies. In this context, the postdigital perspective emphasizes that the sharp boundaries between real and digital life have dissolved, making these two realms inherently interconnected and permeable. Learning experiences occur not solely beyond the screen or exclusively in offline environments but within a hybrid plane where both worlds interact. Accordingly, elementary learning processes should be designed so that students can relate their experiences in digital environments to real-life contexts and establish meaningful transitions between the two domains. The fundamental aim of postdigital pedagogy is to view the digital not as a privileged tool but as a natural component of life, supporting students in participating critically, productively, and consciously within this integrated world.

Fundamental principles of postdigital pedagogy

The fundamental principles of postdigital pedagogy are critically important for understanding how the digital and physical dimensions of learning processes intertwine, how the interaction between the learner and technology is shaped, and how these processes encompass emotional and social dimensions. These principles address not only the use of technology in education but also how pedagogical strategies, the diversity of learning environments, and interdisciplinary interactions can be integrated into the design of learning experiences. Moreover, the postdigital pedagogical approach emphasizes that learning should not be limited to cognitive gains; it must also support students' affective and social skills, such as motivation, curiosity, empathy, and collaboration. In this context, the fundamental principles of postdigital pedagogy provide a theoretical framework that allows learning experiences to be approached from a multidimensional and holistic perspective.

Digital–Physical Integration: One of the core principles of postdigital pedagogy is that learning should be viewed as a hybrid process in which online and face-to-face experiences are seamlessly integrated (Lamb et al., 2022). This approach rejects the rigid distinction between digital and analog (physical) and emphasizes that learning processes should not be regarded merely as applications of technological tools (Fawns, 2019). The postdigital condition encompasses a complex and unpredictable environment where digital and analog, technological and non-technological, and biological and informational phenomena coexist (Jandrić & Hayes, 2022). In this context, digital technologies are considered an inseparable part of human life and pedagogical activity. Learning emerges as a continuous, intertwined, and co-constitutive experience,

reflecting the high-level convergence of biology, information, technology, and society (Jandrić & Knox, 2019). The COVID-19 pandemic has clearly demonstrated that biological, informational, and social phenomena are interdependent, underscoring the necessity to update educational paradigms.

Human–Technology Interaction: In postdigital pedagogy, the learner is not viewed as a passive user of technology but as an active agent who shapes learning through interaction with it. This perspective rejects both the instrumentalist view, which treats technology as a neutral tool, and the technological determinist approach, which posits that technology alone dictates social processes. Instead, technologies are understood as part of complex human and non-human networks that shape and transform educational experiences rather than unilaterally determining them (Fawns, 2022). Within this framework, educational technologies are not merely tools supporting learning but components of co-constitutive dynamics that jointly shape teaching and learning processes. Students and teachers are active agents who recognize these co-constitutive relationships and develop critical inquiries rather than assuming that technology functions in a standardized, predetermined manner.

Affective and Experiential Learning: Postdigital pedagogies emphasize that learning extends beyond cognitive dimensions to encompass emotional, ethical, social, and societal aspects. Engagements with educational technologies demand attention to social, political, economic, and environmental dimensions alongside measurable learning outcomes. Research conducted post-COVID-19 indicates that online learning environments significantly impacted teachers' and students' well-being, health, social justice, and mobility (Jandrić, 2020). In this context, postdigital pedagogies necessitate an eco-pedagogical approach that is sensitive to environmental degradation and digital-social vulnerabilities. Such eco-pedagogies reject fantasies of political, bodily, or digital immunity, embracing randomness, uncertainty, and interdependent fragility (Jandrić & Hayes, 2022). Therefore, the learner's relationship with technology should be conceptualized not merely as a cognitive process but as a complex experience encompassing embodied, social, ethical, and political dimensions.

Intersection of learning experience design and postdigital pedagogy

Learning Experience Design (LXD) and postdigital pedagogy exhibit a strong theoretical and practical intersection in addressing learning not merely as a cognitive process of data processing, but as an affective, experiential, and contextual whole (Floor, 2023). While LXD provides an applied framework for constructing learning experiences, postdigital pedagogy constitutes the philosophical, cultural, and ethical foundation of these designs. This synergy shifts learning processes away from technocentric approaches, transforming them into empathy-oriented ecosystems where technology integrates seamlessly with human experience (Lamb et al., 2022; Schmidt et al., 2023). Particularly at the elementary level, this approach redefines learning as an aesthetic process shaped through individual curiosity, emotional responses, and multi-sensory interactions. An augmented reality (AR) activity designed with a postdigital perspective dissolves the boundaries between digital and physical environments, thereby enhancing student curiosity while simultaneously ensuring the affective depth of the process (Moreau, 2025).

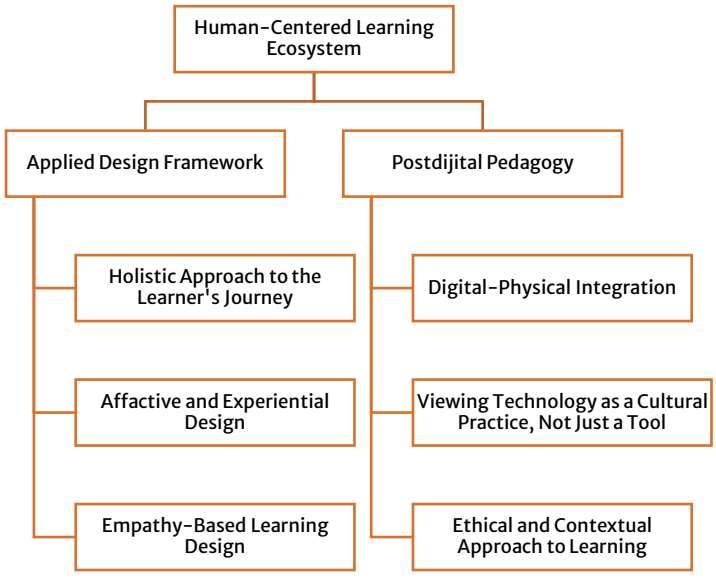

Figure 1. Components of the Human-Centered Learning Ecosystem

In this context, the integration of physical and digital environments necessitates a radical transformation of teacher competencies. In postdigital pedagogy, the teacher moves beyond the traditional role of knowledge transmitter to become a curator and designer of the learning experience. While this new role builds upon Mishra and Koehler's Technological Pedagogical Content Knowledge (TPACK) framework, it requires the teacher to possess a 'sociotechnical vision' in line with the 'entangled eclecticism' theory of Schmidt et al. (2024). The teacher must perceive the classroom not as an isolated space, but as an ecology where social, technological, and physical elements are intertwined.

Furthermore, the developmental characteristics of elementary school children require the teacher to employ the skill of 'multimodal orchestration.' As emphasized by Aloizou et al. (2025), managing hybrid scenarios where visual, auditory, and kinesthetic representations merge seamlessly with digital tools becomes a fundamental design competency for the teacher. This design process is not unidirectional; as indicated by Mavri et al. (2025), the teacher must now act as a 'co-designer,' involving students and other stakeholders in the process. Finally, the quality of these designed experiences must be evaluated through the principle of 'pedagogical usability,' as highlighted by Tawfik et al. (2025). In other words, the teacher must act as a researcher capable of measuring not just the technical functionality of a tool, but the quality of interaction that serves learning goals.

Consequently, this integrated structure, which combines digital-physical unity, a culture of co-design, and pedagogical usability, offers a sustainable learning model that supports not only academic achievement but also student well-being, social justice, and ethical awareness. The student experiences technology not as a passive consumer, but as an active and critical participant in an experiential learning ecosystem shaped collaboratively with their teacher (Phommanee et al., 2023).

Conclusion and recommendations

This study has discussed how the Learning Experience Design (LXD) approach can be repositioned in the design of educational technologies at the elementary school level in accordance with the principles of postdigital pedagogy. The theoretical insights obtained indicate that the learning process is not limited to the use of digital tools; rather, it constitutes an experience shaped within a multilayered network of relationships among humans, technology, and context. This perspective emphasizes that educational technologies carry not only functional but also affective and cultural dimensions.

The core principles of postdigital pedagogy—digital-physical integration, affective learning, contextuality, and human-centeredness—highlight an approach that places the learner's experience at the center of designs developed for elementary education. These principles necessitate rethinking learning environments not merely as channels for information transmission but as holistic experiential spaces that enhance students' curiosity, sense of belonging, and engagement. Learning Experience Design provides an applicable framework for this transformation. Empathy-based design, analysis of the learner's journey, and prototyping of experiences serve as practical tools to concretize the human-centered aspects of postdigital pedagogy.

Based on this theoretical framework, it is recommended that educational technologies developed for elementary-level learners:

- Be empathy-driven, addressing not only cognitive but also affective needs of students.
- Harmonize online and offline learning naturally, considering the integration of digital and physical environments.
- Promote active student participation through game-based and interaction-focused learning scenarios.
- Support affective learning by enhancing curiosity, excitement, and a sense of achievement.

These recommendations underscore the necessity of moving beyond perceiving technology as a mere pedagogical "tool" and embedding it within the fabric of the learning experience. Particularly at the elementary level, where students' attitudes and motivation toward learning are being shaped, affectively enriched postdigital learning experiences may contribute to the long-term development of productive learning habits.

Future research should empirically examine the effects of postdigital pedagogical designs grounded in Learning Experience Design on students' learning motivation, self-regulation, and cognitive performance. Additionally, teachers' adoption and implementation competencies regarding this approach should be investigated through qualitative and mixed-methods studies. Collaboration among educational technology developers, teachers, and policymakers is critical to ensure the sustainable dissemination of this new design paradigm.

In conclusion, educational environments in the postdigital era should be reimagined not only as spaces enhanced with digital tools but as learning environments integrated with meaning, emotion, and experience. This study provides a conceptual foundation for understanding the theoretical bases of such a transformation and offers insights for future educational designers.

Declarations

Ethics statements

Ethical review and approval were not required for this study as it is a theoretical review and conceptual analysis relying on existing literature and secondary sources.

Informed consent

Informed consent was not applicable as this study did not involve human participants.

Availability of data and materials

Data sharing is not applicable to this article as no new datasets were generated or analyzed during the current study.

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Authors' contributions

All stages of this study were conducted by the sole author, who also read and approved the final version of the manuscript.

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