Holistic Learning Design in Digital Environments for Adults: Integrating Cognitive, Emotional, Social, and Transformative Dimensions to Enhance Engagement and Learning Outcomes

Duarte Nuno Farbu Pinto[1], Inger Lise Valstad[2]

Nord University, Norway[1, 2]

Abstract

This article aims to explore how digital learning environments for adults can be designed to foster engagement and learning outcomes through the integration of cognitive, emotional, social, and transformative dimensions. The cognitive dimension emphasizes self-regulation, metacognition, and authentic problem-solving, while the emotional dimension includes motivation, self-efficacy, and emotional safety. The social dimension involves collaboration, social presence, and community building, and the transformative dimension pertains to critical reflection, perspective shifts, and changes in practice. These four dimensions form a comprehensive framework that illustrates how digital learning can support both knowledge acquisition and personal development. This knowledge is particularly important in an era where adult learning in digital contexts plays an increasingly vital role in lifelong learning, workforce adaptability, and societal participation. The study is based on a systematic and integrative literature review of 48 peer-reviewed sources from the period 2000–2025, selected according to explicit inclusion criteria and analyzed through thematic analyses. The findings indicate that effective learning design for adults requires more than structural facilitation; it must also address participants' needs for meaning, autonomy, belonging, and personal growth. The content of this article may offer useful insights for the development of digital learning programs, contribute to educator professional development, and inspire further interdisciplinary collaboration in the field of learning technologies. This study was guided by the following research question: How can learning design for digital learning environments integrate cognitive, emotional, social, and transformative dimensions to enhance adult learners' engagement and learning outcomes?

Keywords: *Learning design, cognitive dimension, emotional dimension, social dimension, transformative dimension, andragogy, adult learning.*

1. Introduction

Recent research indicates that learning engagement is a multidimensional phenomenon. For instance, Redmond *et al.* [1] argue that online student engagement comprises interwoven cognitive, social, and emotional components, as well as behavioral and collaborative aspects. These dimensions are particularly relevant when focusing on adult learners in digital learning environments, as their needs and prerequisites differ significantly from those of younger students. Digitalization has revolutionized adult education and continuing professional development, but success requires more than merely transferring traditional instruction to a screen.

According to Malcolm Knowles' principles of andragogy [2], adults tend to be more self-directed, experienced, and goal-oriented in their learning. This implies that the design of digital learning environments for adults must consider cognitive processes, emotional engagement, social interaction, and the potential for transformative learning. A holistic approach that integrates these four dimensions is assumed to enhance adult learners' engagement and improve their learning outcomes.

Adult participants in digital courses and training programs bring with them valuable experiences and clear expectations regarding relevance and practical applicability. These expectations must be addressed through purposeful and contextually relevant instructional design. They are motivated by clearly defined goals and the opportunity to apply newly acquired knowledge directly in their daily lives [2]. This necessitates that learning activities are tied to concrete problems and situations with which they can identify. Although adults often possess well-developed cognitive capacities, they typically balance learning with work and family responsibilities. Consequently, online instruction must be efficient, flexible, and tailored to individual needs. To maintain engagement, instructional design must support self-directed progression, optional resources, and a clear connection between learning activities and the participants' personal or professional goals [3]. Supporting this requires not only effective technical facilitation but also a pedagogical approach grounded in an understanding of how adults actually learn. Digital learning environments must therefore acknowledge participants' prior

knowledge and provide opportunities for them to share their own experiences and reflect on new information in light of what they already know [4].

For such facilitation to be pedagogically meaningful, it must be grounded in theories of how adults learn best in social and contextual settings. This perspective is supported by social constructivist approaches, as formulated by Vygotsky and Cole [5], who emphasized that learning occurs through social interaction and within the zone of proximal development, the space between what an individual can accomplish independently and what can be achieved with support. Jerome Bruner further developed this idea and, together with colleagues [6], introduced the concept of scaffolding to describe how teachers and peers can support learning through tailored guidance.

[7] contributes a practice-oriented perspective by demonstrating how learning occurs through participation in communities of practice, where identity is shaped through interaction with the surrounding environment. Illeris [8] emphasizes that all learning encompasses three interdependent dimensions: the cognitive (content and understanding), the emotional (motivation and engagement), and the social (interaction and sense of belonging). These theoretical perspectives provide a framework for understanding how adult learning can be supported in digital contexts. They highlight the importance of recognizing learners' experiences, offering targeted support, and fostering social connectedness. When adults feel that their backgrounds are acknowledged and actively integrated into the learning process, both cognitive engagement and emotional investment in the course are enhanced.

2. Method

To develop a theoretical framework for digital learning design targeted at adults, this study employs an integrative literature review. This is a systematic method for identifying, evaluating, and synthesizing relevant research and theory with the aim of achieving a comprehensive understanding of a particular phenomenon [9]. Unlike many other types of literature reviews, the integrative approach allows for the combination of both qualitative and quantitative research, as well as the inclusion of other relevant literature that may shed light on the topic [9]. Through this broad and flexible approach, it is possible to analyze existing empirical and theoretical contributions to generate new insights and lay the groundwork for theory development [10].

The choice of literature review as the methodological approach is based on the need to consolidate knowledge on digital learning design and adult learning, and to develop insights across disciplinary boundaries. Literature reviews are a well-established method in educational research and adult education, as they map the current state of knowledge, identify research gaps, and contribute to further research development [10]. A systematic approach was employed to ensure methodological rigor, with clearly defined inclusion criteria, search strategies, and analytical procedures [11].

2.1 Literature Search: Databases, Keywords, and Criteria

The literature search was conducted across multiple databases to ensure a comprehensive data foundation. Key databases within education and related disciplines were utilized, including the Education Resources Information Center (ERIC), Web of Science, Scopus, and PsycINFO. Additionally, Google Scholar was used as a supplementary source to capture relevant materials outside traditional databases, including book chapters and institutional reports [11; 12]. Reference lists of key articles were also manually reviewed to identify any additional studies (the so-called snowball method). This multi-source strategy aligns with recommendations to conduct broad searches across various databases in order to capture a heterogeneous body of literature [13].

2.2 Keywords and Search Strategy

The search combined keywords related to adult learners and digital learning/design. For example, Boolean operators and combinations of terms such as "adult learning," "adult learners," "adult education," and "andragogy" (to capture aspects of adult learning) were used alongside "digital learning," "online learning," "e-learning," "instructional design," and "learning design" (to address the digital learning design aspect). Keywords were adapted to each database, including relevant thesaurus or subject headings where applicable [11]. No strict time limitations were set initially, but the search primarily focused on literature from around the year 2000 to 2025 to capture recent research aligned with the development of digital learning formats. Older, seminal sources in adult learning theory were included if deemed conceptually central to the framework, such as Bandura [14], Knowles [2], Mezirow [15] and Vygotsky and Cole [5].

2.3 Inclusion and Exclusion Criteria

Clear criteria were defined in advance to determine which studies would be included in the review, in accordance with recommendations for conducting systematic literature studies [16].

2.4 The inclusion criteria [17] included:

- Relevance to adult learning in digital contexts: Studies had to focus on adults, defined here as students/participants aged 25 and above [18], (Research.com, n.d.), (OECD, n.d.), whether in formal education, continuing education, or other training settings, in the context of digital learning, online education, or technology-supported instructional design.
- Focus on learning design and/or pedagogical aspects: The literature had to address pedagogical design, didactics, learning strategies, or similar elements, thus, studies that solely described technology without a connection to the learning process were excluded. Both empirical evaluations of digital training programs for adults and theoretical articles on design principles were included.
- 'Scholarly quality: Primarily peer-reviewed journal articles and reputable conference publications were included, along with selected book chapters and reports from research institutions. The studies were required to present data, analyses, or theoretical reasoning that contribute to the understanding of the topic.

2.5 The exclusion criteria [17] ruled out studies that:

- Did not focus on adults or higher education: Literature focusing on children, secondary school, or purely K-12 settings was excluded unless it offered transferable insights relevant to adult learning.
- Lack of a digital component: Studies on adult learning in general without any connection to a digital context (e.g., purely classroom-based studies) were excluded, as the focus of this review is on digital learning design.
- Irrelevant or non-academic sources: Opinion pieces, letters to the editor, and non-scholarly publications were filtered out. Duplicate entries were also removed. Studies whose titles and abstracts clearly indicated they did not address the research focus were excluded during the initial screening phase.

The selection process followed a PRISMA-based approach involving identification, screening, and final inclusion [19]. First, all search results were collected and duplicates removed. Titles and abstracts were then reviewed against the inclusion and exclusion criteria (this phase led to the exclusion of a number of irrelevant studies). Finally, the remaining publications were read in full to determine final eligibility. This process resulted in a final corpus of 48 sources that met all criteria and formed the basis for further analysis. To ensure transparency and reproducibility, each step of the selection process was documented (including the number of studies identified, reasons for exclusion, etc.), in accordance with recommended reporting standards for systematic literature reviews [9].

3. Thematic Coding and Analysis

All included publications (articles and other sources) were imported into a qualitative analysis tool and analyzed using thematic coding. We chose a thematic analysis approach because it is a well-established and flexible method for identifying patterns or themes within qualitative data [20]. The analysis primarily followed the steps outlined by Braun and Clarke: first, all sources were carefully read to become familiar with the content (familiarization). Then, meaningful units and statements relevant to the research question were systematically coded. The coding was initially inductive, meaning that themes emerged from the data rather than being based on predefined categories. Each publication could contribute multiple codes if it addressed different themes. The coding included statements related to design principles, learning outcomes, challenges and success factors in digital learning for adults, as well as implicit or explicit references to learning theory.
Following the initial coding, related codes were consolidated and organized into higher-level themes. This was done through an iterative process in which the codes were reviewed multiple times and grouped based on similarity and conceptual proximity, a process often referred to as axial coding. Gradually, a set of overarching thematic categories emerged, recurring across the studies. These themes formed the building blocks of the emergent theoretical framework. Throughout the process, principles from qualitative synthesis methodology were also employed to ensure rigorous analysis, such as comparing findings across studies (constant comparison) and integrating relevant theory where appropriate. The use of qualitative analytical techniques on literature data is recommended by methodological sources to enhance the reliability of integrative reviews [20]. The analysis progressed

to the point of theoretical saturation, meaning that additional sources contributed little new in terms of code categories, indicating that the central themes had been sufficiently identified.

3.1 Coding Categories: Cognitive, Emotional, Social, and Transformative Dimensions

The thematic analysis resulted in a series of coding categories, which were subsequently organized under four broad dimensions of learning design for adults: a cognitive, an emotional, a social, and a transformative dimension. Below are examples of coding categories (subthemes) associated with each of these dimensions, as identified through our analysis of the literature:

- Cognitive Dimension: Codes related to mental processes and knowledge construction. The analysis revealed codes such as self-regulated learning (adults' ability to plan, execute, and evaluate their own learning processes in digital environments), metacognition (reflection on one's own thinking and learning strategies), cognitive load (how the quantity and complexity of information affect adult learners), and authentic problem-solving (design of learning activities that promote the application of knowledge in realistic scenarios). These codes address how digital design either supports or hinders intellectual processes in adult learners, highlighting the need for pedagogical awareness in the structuring and presentation of information. This aligns with Swellers' [21] *Cognitive Load Theory (CLT)*, which emphasizes the importance of designing learning activities that avoid overloading working memory and instead promote understanding and self-regulation.
- ***Emotional Dimension:*** Codes concerning the emotional and motivational aspects of learning. We identified codes such as motivation and engagement (design factors that enhance adults' intrinsic motivation, interest, and persistence in online learning), self-efficacy [14] in relation to digital learning (how the design can strengthen adults' belief in their own abilities through feedback or support structures), emotional support (design elements that foster students' sense of security and help reduce frustration and stress when encountering new technology), and relevance (the extent to which learning content is perceived as meaningful and connected to learners' personal experiences, often triggering positive emotions toward learning). These codes capture the affective dimension of adults' learning experiences in digital contexts and illustrate how instructional design can address adults' emotional needs.
- ***Social Dimension:*** Codes related to interaction, communication, and the learning community established in digital environments. A recurring theme was social belonging and presence, with codes encompassing elements such as collaborative learning (e.g., group assignments and discussion forums that foster a sense of community among adult online learners), social support (how peers and instructors support one another through digital tools), and the learning environment's culture (norms of sharing, openness, and respect in online courses for adults). The role of communication technologies was also coded, including how synchronous versus asynchronous tools influence social interaction, and the concept of social presence (the experience of real individuals behind the screen) within the design. These codes illustrate how digital learning design can either facilitate or hinder the social processes essential to adult learning, such as networking, experience-sharing, and dialogue. This aligns with Wenger's [7] theory of communities of practice, where learning is understood as a social process in which knowledge is developed through participation, shared engagement, and a sense of belonging.
- ***Transformative Dimension:*** Codes reflecting deeper processes of change or development in learners. This dimension, inspired by transformative learning theory [15], included codes such as critical reflection (how the design encourages adults to critically examine their assumptions and experiences, for instance through reflective tasks or discussions), perspective transformation (indications that the learning experience contributed to changes in participants' attitudes, self-perception, or worldview), empowerment (a sense of increased agency or autonomy resulting from the learning process), and practical transformation (how new knowledge is translated into changes in practice at work or in everyday life). These codes capture whether, and how, digital learning design for adults can facilitate learning that not only conveys knowledge but also transforms the learner's way of thinking or acting.

It is worth noting that these four dimensions and their underlying codes are not mutually exclusive; they overlap and influence one another. For instance, a design choice such as the use of collaborative projects may have cognitive effects (promoting deeper understanding), emotional effects (increasing motivation through social support), and social effects (enhancing a sense of community). Nonetheless, the division into dimensions serves as an analytical framework for organizing the findings. Moreover, these dimensions align with established theoretical perspectives in the literature. Illeris [8] argues that all adult learning involves an interaction between a cognitive dimension (knowledge and skills), an emotional dimension (feelings and motivation), and a social dimension

(interaction and cooperation). Our review confirmed the presence of these three dimensions, while also highlighting a distinct transformative dimension, in line with Mezirows' [15] theory that adult learning often entails a critical re-evaluation of fundamental assumptions, a transformation of perspective. Thus, the coding categories are grounded in well-established learning theory dimensions while also being empirically supported by the literature findings.

4. Results

Through thematic analysis of the included literature, we identified four overarching dimensions that are critical to the design of digital learning environments for adults: cognitive, emotional, social, and transformative dimensions. These dimensions emerged as recurring patterns across the studies, with each encompassing several subthemes that illuminate key aspects of adult learning in digital contexts.

Dimension	Focus Areas	Design Measures	Theoretical Support
Cognitive	Self-regulation, metacognition, cognitive load, authentic problem-solving, knowledge construction	Structured content, clear objectives, reflection tasks, feedback, practice-based cases	[8; 2; 1; 21]
Emotional	Motivation, self-efficacy, emotional safety, engagement, perceived relevance	Choice, recognition of prior experience, supportive language, emotional support, feedback	[14; 3; 8; 22; 1]
Social	Collaborative learning, social support, community, social presence, interaction, communication	Group discussions, forums, collaborative writing, synchronous/asynchronous tools, peer mentoring	[23; 8; 1; 5; 7]
Transformative	Critical reflection, perspective transformation, change in practice, empowerment, identity development, disorienting dilemmas	Reflective journals, dilemma-based tasks, practice-oriented projects, digital portfolios, mentor support	[24; 15] [25] [26; 27]

Fig. 1. Comprehensive overview: dimensions of digital learning design for adults

4.1 Cognitive Dimension

The studies emphasized the importance of structured content, clearly defined learning objectives, and support for metacognitive reflection as key factors in facilitating the cognitive processes of adult learners [2; 21]. According to Illeris [8], all learning involves an interplay between cognitive, emotional, and social dimensions, with the cognitive aspect concerning understanding, analysis, and problem solving. Digital learning environments that reduced cognitive load, through logically structured content and supportive guidance, were associated in several studies with improved learning outcomes and better self-regulation. Redmond *et al.* [1] highlight that student engagement in digital contexts requires support for metacognitive activity and authentic problem-solving tasks, which promote understanding and practical application rather than superficial memorization.

4.2 Emotional Dimension

The analysis revealed that emotional factors such as motivation, psychological safety, and self-efficacy are critical to adult learners' engagement [14; 3; 22]. In their self-determination theory, Deci and Ryan [3] emphasize the importance of addressing the needs for autonomy, relatedness, and competence to enhance intrinsic motivation. This was supported by findings indicating that choice, emotional support, and recognition of prior experience positively influenced emotional engagement in digital courses. Illeris [8] underscores that the emotional dimension of learning involves both motivational drive and affective responses, which must be addressed to ensure meaningful and

lasting learning. Redmond *et al.* [1] point out that affective factors, such as the experience of support and psychological safety in digital classrooms, are essential for sustaining learner engagement over time.

4.3 Social Dimension

Social presence and interaction were highlighted as essential to the quality of the learning environment and participants' sense of belonging [23; 7]. In line with Vygotsky and Cole's [5] sociocultural theory of learning, learning occurs through interaction with others, and digital tools must therefore support collaboration, communication, and peer support. Illeris [8] describes the social dimension as fundamental to meaning-making and knowledge development, particularly for adult learners. This is affirmed by Redmond *et al.* [1] in their model for online student engagement, where social presence and relationship building are emphasized as key components. Studies showed that group discussions, digital forums, and collaborative writing provided participants with a sense of community, which enhanced both learning and well-being.

4.4 Transformative Dimension

Several sources described how digital learning designs that challenge learners' established assumptions and invite critical reflection can facilitate deeper, transformative learning [24; 15]. According to Mezirow [15], transformative learning occurs when adults experience so-called "disorienting dilemmas" and reflect on their own perspectives, which can lead to changes in behavior and personal growth. This was supported in the studies by instructional designs incorporating reflective journals, ethical dilemmas, and practice-oriented projects. Cranton [26] and Freire [25] emphasize that learning also involves empowerment—the development of a stronger voice and greater agency in one's own life. Jarvis [27] further explains that transformative learning often entails an identity shift, offering learners the opportunity to reflect on who they are, what they believe, and how they act within society.

5. Discussion

The findings of this study suggest that digital learning design for adults benefits from a holistic understanding of learning that integrates cognitive, emotional, social, and transformative dimensions. This perspective is consistent with Illeris' [8] three-dimensional model and is further supported by Mezirows' [15] theory of transformative learning and Knowles' [2] principles of andragogy. The results indicate that learning experiences focusing solely on content transmission, i.e., cognitive stimulation alone, may not be sufficient to fully engage adult learners or to support meaningful, long term learning.

An important contribution to this review is the demonstration of how the four dimensions operate in interplay rather than in isolation. For example, several studies showed that metacognitive reflection tasks (a cognitive tool) also triggered emotional engagement, particularly when linked to participants' personal experiences. Similarly, collaborative activities (social dimension) were often reported as key sources of psychological safety and motivation (emotional support), and some case-based learning experiences acted as catalysts for critical reflection and personal transformation. This supports a central tenet in adult education theory: that adult learning is often context-dependent, relational, and value-laden [27]. Therefore, digital learning environments for adults should not be viewed as neutral platforms but as arenas where learners' identity, experience, and emotions are activated and processed. As such, digital design assumes both a pedagogical and ethical role, requiring careful consideration of how these principles can be effectively implemented in practice.

Not all educators, instructional designers, or educational platforms necessarily possess the knowledge or resources required to create learning experiences that balance all four dimensions. This study therefore also has implications for professional development: educational institutions and course providers should invest in interdisciplinary teams and professional development programs that incorporate insights from psychology, pedagogy, and technological development. In this context, it is relevant to draw on Wenger's [7] perspective, which highlights the importance of communities of practice, not only among students, but also among professionals involved in learning design. Such communities can serve as arenas for collective reflection, knowledge sharing, and educational innovation, where experiences from various disciplines are integrated into a shared understanding of effective learning. By facilitating ongoing interaction and mutual learning among developers, instructors, and technologists, institutions can build the capacity to develop more holistic and sustainable learning systems. This underscores the need to view professional development as a

social process in which professional identity and practice are shaped through collaborative learning processes.

Closely linked to the need for interdisciplinary collaboration is the strategic use of technology in digital learning environments. Technological tools can either support or hinder learning, depending on how they are pedagogically integrated. Decisions regarding the use of synchronous versus asynchronous tools, the degree of interactivity and flexibility, as well as the availability of opportunities for reflection and feedback, should be evaluated in relation to the specific learning dimensions one aims to enhance. A learning environment that combines flexible self-regulation with opportunities for social participation and critical reflection is more likely to support meaningful learning than systems that primarily focus on information delivery [4].

Building on this, it is important to acknowledge that while the thematic synthesis identified four primary dimensions – cognitive, emotional, social, and transformative –these do not represent an exhaustive framework. Several of the included studies, including Shonfeld *et al.* [4], also highlight the importance of aesthetic and ethical perspectives, as well as the necessity of cultural adaptation and the development of digital competence as fundamental prerequisites for both participation and learning outcomes in digital environments. This points to the need for further research on how digital learning design can accommodate cultural and social diversity, and how disparities in digital competence influence adults' opportunities for active participation and transformative learning. At the same time, these findings reinforce a broader understanding of learning as a deeply human and situated process.

The findings from the analysis suggest that effective digital learning design for adults must place equal emphasis on relational and existential support as on cognitive structure. Learning is not only about what participants acquire in terms of knowledge, but also about how they learn, why they engage, and with whom they interact. Several studies in the analysis indicate that motivation, a sense of belonging, and opportunities for critical reflection are just as crucial as academic content in achieving meaningful learning. When learning experiences create space for dialogue, recognition, and personal growth, both engagement and learning outcomes are enhanced. This requires a deliberate awareness in the design process of how to address adults' needs for autonomy, meaning, and social connection, and to recognize their prior experiences as valuable resources in the learning process.

Conclusion

This study has explored how digital learning environments for adults can be designed with consideration for cognitive, emotional, social, and transformative dimensions. Based on the research question, *How can the design of digital learning environments integrate cognitive, emotional, social, and transformative dimensions to enhance adult learners' engagement and learning outcomes?*, a systematic and thematic analysis of relevant literature identified a potential framework suggesting that adult learning is a complex interplay of thinking, emotion, relationships, and personal development, rather than a one-dimensional process.

The findings indicate that effective learning design for adults must address the whole learner, that is, the individual as a cognitive, emotional, social, and experience-based being, rather than being limited to the structured transmission of content. Measures that enhance motivation, provide emotional support, foster social interaction, and facilitate reflection appear to function as mutually reinforcing mechanisms that collectively contribute to both deeper cognitive understanding and transformative learning. The need to acknowledge adults' demands for autonomy, relevance, and the value of prior experience is particularly prominent. A central contribution of this study is its demonstration of how the various dimensions of learning design interact, thereby reinforcing the understanding of learning as a systemic rather than a linear process. This highlights the importance of interdisciplinary expertise and pedagogical insight in the development of digital learning environments for adult learners.

For practitioners and policymakers, this entails a responsibility to develop digital learning environments that not only meet technological standards but also address emotional needs, promote social grounding, and stimulate intellectual exploration. Such a holistic design enables adult learners not only to acquire knowledge but also to undergo deeper processes of recognition that can transform their understanding of themselves and their social and professional contexts—a prerequisite for lasting and meaningful learning. Future research should therefore focus on investigating how these principles are actually implemented across diverse digital learning contexts, and how factors such as cultural diversity, digital literacy, and individual learning experiences influence the quality of the design and the learning outcomes. Advancing knowledge in this area will be crucial for establishing sustainable and inclusive forms of learning that support both competence development and personal growth in adults' lifelong learning.

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