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The Integration of Andragogy, Pedagogy, and Inclusive Technology in Language Education: A Systematic Literature Review of 21st Century Online Learning

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ABSTRACT

The rapid growth of digital technologies has transformed online language learning, yet the integration of pedagogical structure and andragogic autonomy remains insufficiently synthesized. This study aims to systematically review how digital learning technologies are integrated with pedagogical and andragogical principles in online language learning and to develop an integrative conceptual framework. A PRISMA-guided systematic literature review was conducted on 15 peer-reviewed articles published between 2015 and 2025, selected using the PICOS framework. The analysis employed thematic synthesis to identify patterns of technology use, pedagogical approaches, and andragogic principles. The findings show that technologies such as learning management systems, mobile learning, artificial intelligence, and immersive environments function as mediating tools linking structured pedagogical scaffolding with learner autonomy. However, their effectiveness is highly context-dependent and constrained by instructional design and learner readiness. Based on the synthesis, this study proposes the Integrated Pedagogical–Andragogical (IPA) Model, which conceptualizes technology as an epistemic mediator facilitating a gradual transition from guided instruction to self-directed learning. This review offers an integrative theoretical contribution to digital language education without making generalized causal claims.

Keywords: Digital Language Learning; Pedagogy–Andragogy Integration; Educational Technology; IPA Model.

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1. INTRODUCTION

The rapid advancement of digital technology over the past two decades has fundamentally transformed educational practices and learning ecosystems. Innovations such as flipbooks, Learning Management Systems (LMS), mobile-assisted language learning (MALL), artificial intelligence (AI), augmented reality (AR), and virtual reality (VR) have enabled more flexible, adaptive, and data-driven learning environments (Santosa et al., 2025; van der Merwe, 2020). The growing volume of publications indexed in Google Scholar and Scopus since 2020 reflects a global academic focus on digital transformation in education (Boude & González, 2023). This trend necessitates renewed theoretical and pedagogical frameworks capable of explaining not only technological adoption, but also its pedagogical and epistemic implications for learning design.

Within this transformation, a central theoretical issue concerns the relationship between pedagogy and andragogy in digital learning environments. Pedagogy traditionally emphasizes structured, teacher-guided learning, particularly for younger learners, with scaffolding grounded

in socio-cultural theory (Vygotsky, 1978). In contrast, andragogy prioritizes learner experience, autonomy, relevance, and self-direction, especially in adult education contexts (Knowles, 1980). In online learning, these two orientations increasingly coexist rather than operate as dichotomies. Digital technologies enable personalization, self-regulated learning, and adaptive feedback across learner groups, creating conditions in which pedagogical structure and andragogical autonomy can be integrated within a single instructional environment.

Empirical studies suggest that technology can enhance interaction, flexibility, and learner engagement when aligned with instructional goals. Collaborative digital tools, microlearning applications, and Open Educational Resources (OER), for example, have been shown to support language learning across diverse learner profiles (Merwe, 2020; Santosa et al., 2025; Nicora et al., 2022). In this sense, technology functions as a mediating element that connects pedagogical scaffolding with andragogic characteristics such as learner independence and relevance (Holton & Swanson, 2015; Moore et al., 2011). However, the effectiveness of such mediation remains highly contingent on human, instructional, and contextual factors rather than on technological features alone.

A substantial body of research indicates that technology integration is strongly influenced by teachers' attitudes, readiness, and professional competence (Berthelsen & Tannert, 2020). Positive dispositions toward technology are associated with more effective digital implementation (Oz & Kayalar, 2021), while optimism, innovation, and perceived usefulness play critical roles in educators' capacity to design meaningful digital learning materials (Akın et al., 2025). Moreover, socio-cultural contexts shape how teachers interpret, adapt, and enact technology in learning environments (Kartini et al., 2019). These findings suggest that technology integration cannot be understood solely as a technical process, but must be examined through interconnected pedagogical, andragogical, and contextual perspectives.

Despite the expanding body of literature, existing studies tend to examine pedagogy, andragogy, and technology in fragmented ways. Research on teacher competence and digital readiness Gonscherowski et al. (2025); Karademir et al. (2021) often focuses on isolated dimensions, such as technical skills or attitudes, without sufficiently addressing how these competencies translate into integrative instructional designs. Similarly, studies on digital affordances and learning technologies Berthelsen & Tannert (2020); Kartini et al. (2019) rarely explore how pedagogical and andragogical principles intersect across different learner age groups. Consequently, there remains a limited number of frameworks that systematically explain how technology mediates the transition from structured, teacher-guided learning to more autonomous, learner-managed learning in digital language education (Wain et al., 2019).

Based on a review of literature published between 2015 and 2025, three interrelated research gaps can be identified. First, a conceptual gap persists in the absence of integrative models that explicitly combine pedagogical and andragogical principles within online and digital learning contexts (Boude & González, 2023; Chamo et al., 2023). Second, a methodological gap is evident in the predominance of studies that report isolated findings, such as teacher readiness, technology acceptance, or learning outcomes, without synthesizing these dimensions into a coherent analytical framework (Gonscherowski et al., 2025; Karademir et al., 2021; Oz & Kayalar, 2021). Third, an implementation gap remains, particularly in the limited availability of digital language learning designs that systematically account for learner age, autonomy preferences, digital literacy, and experiential backgrounds (Ratnawati et all., 2021).

Responding to these gaps, this study aims to systematically examine how digital technologies, such as flipbooks, LMS, mobile learning, AI, and AR/VR, are integrated with pedagogical and

andragogical principles in online language learning. Specifically, this review addresses three research questions: (RQ1) how are digital learning technologies integrated with pedagogy and andragogy in the 2015–2025 literature?; (RQ2) what trends and gaps characterize this integration?; and (RQ3) how can learning technologies enhance language learning and communication skills through the integration of pedagogical and andragogical approaches?.

The contribution of this study lies in its analytical and conceptual synthesis of existing literature, positioning technology not merely as an instructional medium but as an epistemic mediator that bridges structured pedagogical learning and autonomous andragogical learning. Through a PRISMA-guided systematic literature review of 15 selected studies, this research proposes an Integrated Pedagogical–Andragogical (IPA) and Technology in Language Learning Model that conceptualizes the progressive role of technology in facilitating transitions from guided instruction toward learner autonomy. This contribution is intended to advance theoretical discussions on pedagogy–andragogy integration in digital learning without making empirical or causal claims, while offering a coherent conceptual framework to inform adaptive and inclusive language learning design in contemporary educational contexts.

2. METHODS

2.1 Research Design

This study employed a Systematic Literature Review (SLR) design to identify, evaluate, and synthesize empirical and conceptual studies addressing the integration of pedagogy, andragogy, and digital technology in 21st-century language learning. The SLR approach was selected because it enables a structured, transparent, and replicable synthesis of evidence across diverse research designs, while minimizing bias through explicit procedural control (Moher et al., 2020; Liberati et al., 2009; Pope et all., 2007). To ensure methodological rigor and reporting quality, the review was conducted in accordance with the PRISMA 2020 guidelines (Page et al., 2021).

The analytical strategy combined systematic screening procedures with thematic synthesis, allowing the review to move beyond descriptive aggregation toward the generation of integrative conceptual insights. This design is particularly appropriate for addressing fragmented findings in prior studies and for constructing a coherent analytical framework that links pedagogical structure, andragogical principles, and the mediating role of digital technology in language learning contexts. The overall research design is summarized in Table 1. This table provides a conceptual overview of the study design, including the research approach, data sources, analytical method, and expected outputs. Detailed procedures for literature selection and data analysis are presented in the subsequent subsections.

Table 1. Research Design of the Study

Research Component	Description
Research approach	Systematic Literature Review (SLR) guided by PRISMA 2020
Research objective	To synthesize empirical evidence on the integration of pedagogy, andragogy, and digital technology in online language learning
Data sources	Scopus and Google Scholar databases
Time span	Publications from 2015–2025
Screening framework	PICOS (Population, Intervention, Comparison, Outcome, Study design)
Population focus	Prospective language teachers and language education students

Research Component	Description
Types of studies included	Experimental, quasi-experimental, qualitative, and mixed-methods studies
Analytical method	Thematic synthesis (Thomas & Harden, 2008)
Analytical output	Cross-study themes and the Integrated Pedagogical–Andragogical (IPA) and Technology in Language Learning Model
Quality assurance	Quality assurance

2.2 Literature Search Procedure

The literature search was conducted using the Scopus and Google Scholar databases, selected due to their extensive coverage of peer-reviewed and high-impact educational research (Bramer et al., 2016; Higgins & Green, 2011; Falagas et al., 2008). The search was carried out in January 2025 and limited to articles published between 2015 and 2025 to capture recent developments in digital learning technologies and learning theories. Search terms were constructed using Boolean operators to ensure precision and relevance (Booth et all., 2016). Reference management and preliminary screening were supported by Mendeley and Rayyan, which facilitated duplicate removal and reduced selection bias during the screening process (Ouzzani et al., 2016). Table 2 summarizes the search strategy, including databases, time range, document type, language, keywords, and the total number of records identified in the initial search (341 articles).

Table 2. Search Strategy

Component	Fill
Database	Scopus, Google Scholar
Search time	January 2025
Year range	2015–2025
Publication language	English
Document type	Journal articles (Q1–Q4)
Main keywords	“digital learning materials”, “interactive digital materials”, “multimedia learning”, “pedagogical principles”, “andragogy”, “language teacher education”, “materials development”
Operator Boole	AND, OR, " ", ( )
Initial search results	341 items

2.3 Inclusion Exclusion Criteria (PICOS)

The inclusion and exclusion criteria were determined using the PICOS framework (Population, Intervention, Comparison, Outcome, Study design), which is widely recommended to enhance clarity, validity, and reproducibility in systematic reviews (Collins et al., 2013; Higgins & Green, 2011). PICOS was selected because it allows explicit control over the scope of analysis while maintaining alignment with the research objectives. In this study, the population was restricted to prospective language teachers, language education students, and participants in teacher education or training programs. This restriction was intentional to ensure analytical coherence, as these populations occupy a transitional position between pedagogical and andragogical learning orientations. While this focus strengthens the conceptual alignment of findings, it also implies that the results may not be fully generalizable to in-service teachers or general learner populations.

The intervention included digital learning technologies and instructional designs grounded in pedagogical and andragogical principles, while non-instructional technologies and purely traditional materials were excluded. The outcomes focused on learning effectiveness, perceptions, skills development, and instructional impact. Eligible study designs included experimental, quasi-experimental, qualitative, and mixed-methods studies, whereas literature reviews, bibliometric analyses, conference proceedings, and opinion papers were excluded. Table 3 details the inclusion and exclusion criteria across all PICOS components and clarifies the scope and boundaries of the review.

Table 3. Inclusion-Exclusion Criteria

Component	Inclusion (Siddaway, Wood, & Hedges, 2019)	Exclusion (Tranfield, Denyer, & Smart, 2003)
Population (P)	Prospective language teachers, language education students, and teacher training participants	In-service teachers, general learners
Intervention (I)	The use of digital learning technology, material design based on pedagogical theory, and andragogy	Digital non-learning technologies; Traditional Teaching Materials
Comparison (C)	Digital vs. conventional; Pedagogical and Andragogical vs. Non-integrative Intervention (I)n	Doesn't provide relevant comparisons
Result (O)	Understanding, skills, perceptions, and effectiveness of the use of technology	Not providing results related to prospective language teachers
Study Design (S)	Experimental, quasi-experimental, qualitative, mixed methods	Literature review, bibliometrics, opinions, conferences

2.4 Literature Selection Process (PRISMA)

The article selection process followed the PRISMA protocol to ensure transparency and replicability (Liberati et al., 2009; Moher et al., 2009; Page et al., 2021). The selection involved five sequential stages: (1) identification, (2) duplicate removal, (3) title and abstract screening, (4) full-text assessment, and (5) final inclusion. From the initial 341 records identified through database searches, duplicates and ineligible records were removed during preliminary screening. After title and abstract screening, 43 articles were assessed in full text. Based on the predefined PICOS criteria, 13 articles met the inclusion requirements, and an additional two relevant studies were identified through manual searching, resulting in a total of 15 studies included in the final synthesis. Table 4 summarizes the quantitative progression of article selection at each stage, while Table 5 provides the justification for inclusion and exclusion decisions to enhance procedural transparency. The entire process is visually represented in the PRISMA flowchart (Figure 1).

Table 4. Literature Selection Process

Phase	Sum	Explanation
Early identification	341	Scopus search results
Duplicates removed	24	Identical articles
Not in accordance with the year	65	Beyond the range of 2015–2025
No abstract	8	Cannot be analyzed
Screening of titles and abstracts	220	Articles eligible for preliminary review
Issued	177	Irrelevant to PICOS
Full-text article collection	43	Asked to be analyzed

Phase	Sum	Explanation
Not available	30	Full-text is not accessible
Full-text dianalisis	13	Meet PICOS
Additional resources	2	Found through manual search
Totally inclusive	15	Final studies in SLR

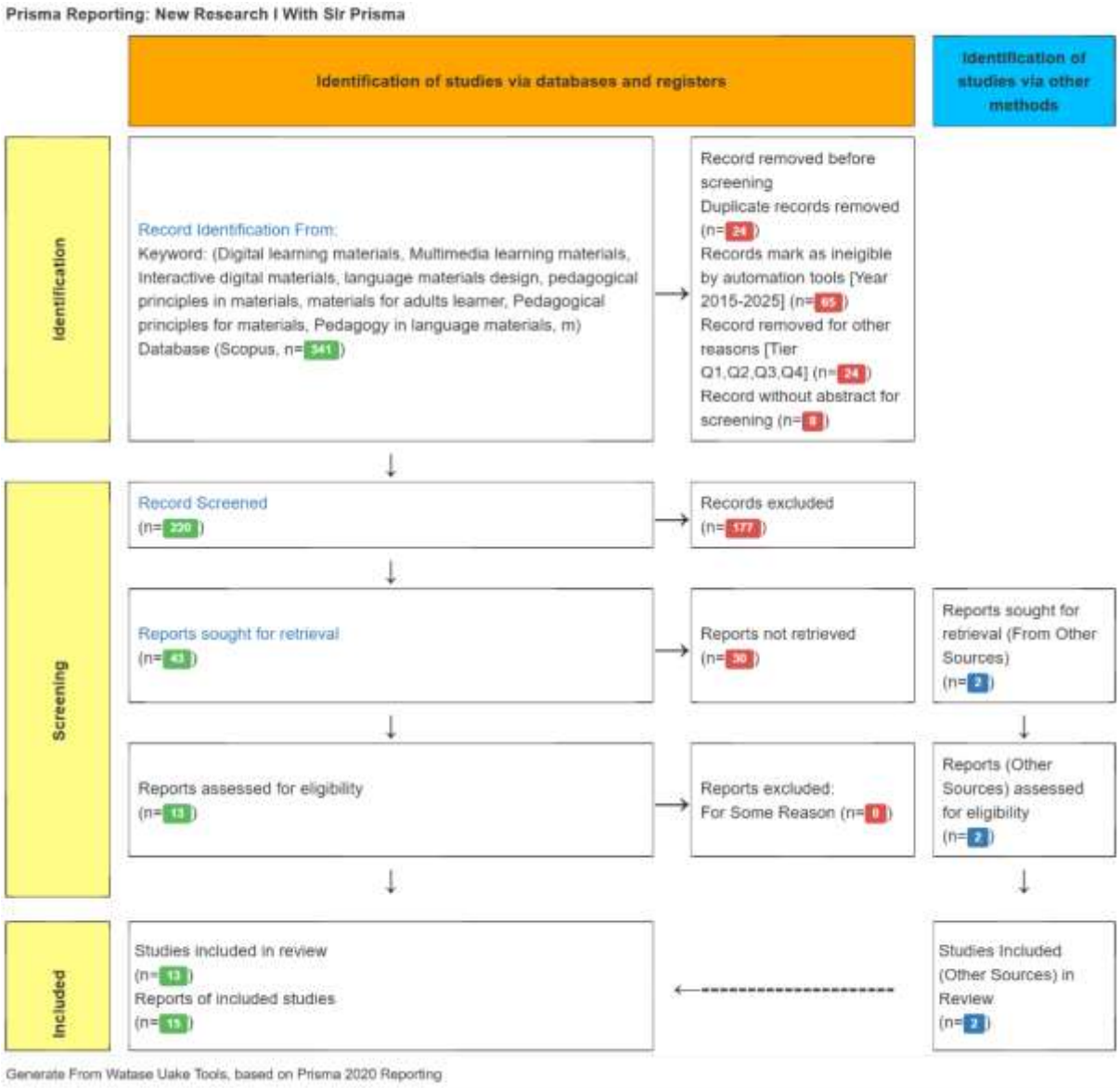

Figure 1. PRISMA FlowChart

Table 5. PRISMA Justification

Phase	Justification
Elimination of duplication	Avoid double analysis
Screening by year	Focus on the development of the last decade
Exclusion without abstract	Cannot be analyzed
Selection of titles and abstracts	Focus on the relevance of PICOS
Full text accessible	Guarantee comprehensive analysis
Addition of manual studies	Expand coverage when relevant studies are not indexed

2.5 Data Analysis

Data analysis was conducted using a thematic synthesis approach as proposed by Thomas and Harden (2008) and reinforced by Liberati et al. (2009), which is appropriate for integrating empirical findings and theoretical insights across heterogeneous study designs. The analysis process began after the final set of articles was identified through the screening stage. At the initial stage, the selected studies were organized and managed using a data extraction matrix to classify articles based on publication year, research context, methodological approach, and thematic focus. Data extraction was then carried out to systematically capture key information from each study, including research objectives, theoretical frameworks, methods, principal findings, limitations, and recommendations. To ensure the credibility of the synthesis, the included studies were reviewed for methodological clarity, relevance to the research focus, and consistency between findings and conclusions. The core analytical process involved four stages of thematic coding and synthesis, as summarized in Table 6.

Table 6. Data Analysis

Stages of Analysis	Procedure	Output
Open coding	Identify keywords and initial findings from each article	List of initial codes
Axial coding	Grouping of codes based on similarity of meanings	Initial theme
Selective coding	Integration of cross-study themes and concept formation	Main themes & IPA models
Triangulation	Cross-check antarpeneliti (peer checking)	Consistency of findings

First, open coding was applied to identify key concepts, findings, and instructional features related to pedagogy, andragogy, and digital technology in each study. Second, axial coding was conducted to group related codes into broader categories based on conceptual similarity. Third, selective coding was used to integrate categories into cross-study themes and to support the development of the Integrated Pedagogical–Andragogical (IPA) Model. Fourth, triangulation was implemented through peer checking among researchers to enhance analytical consistency and credibility.

The role of the researchers in the synthesis process involved independent coding followed by comparative discussion to resolve discrepancies and refine thematic interpretations. This collaborative validation process minimized subjective bias and strengthened the transparency and trustworthiness of the analytical outcomes. The synthesized themes were subsequently interpreted to identify research gaps and to draw conclusions aligned with the objectives and research questions of the review.

3. RESULT AND DISCUSSION

3.1 Result

a. Characteristics of the Selected Studies

A total of 15 studies met the inclusion criteria and were analyzed using thematic synthesis. These studies were published between 2020 and 2025 and represent diverse educational contexts, including Indonesia, South Korea, Japan, Spain, Hong Kong, the United Kingdom, Europe, and Ukraine. This diversity provides a broad descriptive overview of how digital technologies are implemented in online language learning across different institutional and cultural settings.

Methodologically, the studies employed experimental, survey-based, qualitative, mixed-methods, and systematic review designs. Across these designs, technology was not positioned merely as a delivery medium but as an instructional component shaping interaction patterns, learning strategies, and reflective processes. The primary technologies identified include flipbooks, LMS, mobile-assisted language learning (MALL), artificial intelligence (AI), AR/VR, and robot-assisted learning. Table 7 summarizes the key characteristics of the selected studies, including research context, technology used, research design, sample size, and principal findings, providing a descriptive foundation for subsequent thematic analysis.

Table 7. Key Characteristics of the Study

No	Author & Year	Country/ Context	Key Technologies	Study Design	Sample	Key Findings
1	Maharani,et al. (2024)	Indonesia	Flipbook, E-module	Survey	150	94% of students need digital modules
2	He Min, et al. (2025)	Ekuador	AI, ChatGPT, NLP	Mixed	120	Increased engagement: 85%, high effectiveness
3	Song, et al. (2023)	South Korea	FRI	Eksperimen	112	Retention 75%, cognitive load down 50%
4	Golub, et al. (2023)	Ukraine	AI (Duolingo, ChatGPT)	Qualitative	40	AI as a pedagogical complement
5	Niyozov, et al. (2023)	Uzbekistan	ChatGPT	Eksperimen	95	Vocabulary increased by 25%, grammar by 19%, comprehension by 90%
6	Belda-Medina, et al. (2022)	Spanyol	AR	Mixed	85	Positive attitude, mixed learning outcomes
7	Mohebbi (2025)	Iran	AI chatbot, VR	Systematic Review	–	SRL increases, risks of AI dependence
8	Yuen & Schlote (2024)	Hong Kong	Template AI	Mixed	130	Effective for beginners; Improvements are not visible at advanced levels
9	Bergdahl (2022)	Sweden	LMS	Qualitative	52	There are 12 elements of engagement; Implementation still faces challenges
10	Deng, et al. (2024)	Japan	Robot-assisted	Systematic Review	–	Positive emotions, high engagement
11	Karsenti et al. (2020)	Canada	Digital tech, LMS	Survey	220	Weak teacher TPK; Dominant technical focus
12	Obae et al. (2024)	Europe	VR/AR/MR	Qualitative	60	Increased emotional engagement
13	Sura (2020)	Ukraine	MALL	Qualitative	47	Increased flexibility and interactivity
14	Androutsopoulos (2021)	Jerman	Digital/social media	Qualitative	55	Multiliteracy and skills transfer
15	Kukulska-Hulme and Viberg (2018)	United Kingdom	MALL, gamification	Mixed	100	Increased motivation and interactivity

b. Integration of Digital Learning Technology in Language Learning (RQ1)

The synthesis identified five dominant categories of digital technologies: (1) AI-powered tools, (2) immersive technologies (VR/AR/MR), (3) MALL, (4) LMS and digital resources, and (5) emerging technologies. These categories reflect varying instructional purposes and learner needs rather than a uniform pattern of application. AI-based technologies were the most frequently reported and were associated with improvements in engagement, vocabulary, grammar, and comprehension within specific study contexts (Niyozov et al., 2023; Fritzner et al., 2025). However, these quantitative improvements are reported within bounded samples and instructional designs and should therefore be interpreted as context-specific outcomes rather than generalizable effects.

Immersive technologies such as VR and AR were primarily associated with enhanced retention, reduced cognitive load, and emotional engagement when aligned with constructivist learning designs (Song et al., 2023; Obae et al., 2024; Belda-Medina et all., 2022). MALL was consistently reported as effective for beginner learners due to accessibility and flexibility, although several studies identified a ceiling effect for intermediate and advanced learners (Yuen & Schlote, 2024; Sura, 2020). LMS and digital modules functioned as foundational infrastructures providing scaffolding, monitoring, and multimodal content integration (Maharani et al., 2024). Table 8 presents the distribution of technologies across the 15 studies, highlighting implementation examples and reported impacts.

Table 8. Distribution of Technology in 15 Studies

Category Technology	Number of Studies	Implementation Examples	Impact
AI-powered tools	5	ChatGPT, NLP, chatbot	Engagement increases, anxiety decreases, vocabulary increases, grammar increases
Immersive tech (VR/AR/MR)	4	VR-CCL, AR tasks	Retention increases, cognitive load decreases, emotional engagement increases
MALL	3	Duolingo, mobile apps	Increased accessibility, increased motivation, and high flexibility
LMS & digital resources	2	LMS synchronous-asynchronous, flipbook	Scaffolding, tracking, multimodal learning
Emerging tech	2	Robot-assisted, digital twins	Positive emotions, realistic experiences

c. Integration of Pedagogical Approaches in Digital Language Learning (RQ2)

Five studies explicitly employed constructivist pedagogical principles, particularly through VR/AR environments that supported problem-solving, collaboration, and situated learning (Song et al., 2023). Three studies adopted the TPACK framework and consistently identified technological pedagogical knowledge (TPK) as the weakest domain, indicating that technology integration often remains at a substitution level rather than transforming learning design (Karsenti et al., 2020; Puentedura, 2014). Two studies emphasized engagement-based pedagogy, reporting challenges in designing activities that simultaneously address cognitive, affective, social, and behavioral engagement (Bergdahl,

2022). Experiential learning principles were most clearly supported in VR-based studies, which enabled full learning cycles from concrete experience to reflective observation. Table 9 summarizes the pedagogical approaches identified in the analyzed studies and their instructional implications.

Table 9. Distribution of Pedagogical Approaches in Studies

Pedagogical Approach	Number of Studies	Form of Implementation	Findings
Constructivism	5	Real-situation-based VR tasks	Active and contextual learning
TPACK	3	Digital competency training	The weakest TPK; Integration is not optimal without design
Focus on engagement	2	Multidimensional engagement design	Teachers struggle to create balanced engagement
Experiential learning	2	VR Simulation	Fully support Kolb cycles

d. Integration of Andragogic Principles in Online Learning (RQ3)

Across the studies, technology-supported learning environments were closely aligned with key andragogic principles, including self-regulated learning, autonomy, experiential relevance, and flexibility. AI-driven tools were reported to support metacognitive monitoring and self-reflection (Mohebbi, 2025), while MALL facilitated learning anytime and anywhere, particularly for adult learners with time constraints (Sura, 2020). Several studies also reflected the principles of Self-Determination Theory, demonstrating how personalization and adaptive feedback support learners' sense of autonomy and competence (Ryan & Deci, 2000). These findings remain descriptive and context-bound, emphasizing tendencies rather than universal effects. Table 10 outlines how andragogic principles were operationalized through different technologies across the studies.

Table 10. Integration of Andragogic Principles with Technology

Principles of Andragogi	Number of Studies	Technology Implementation	Impact
Learning self-regulation	5	Metacognitive prompts berbasis AI	Autonomy and self-monitoring increased
Self-Determination Theory	2	AI-driven personalization	Increased competence and autonomy
Heutagogi / Self-Paced Learning (SDL)	3	Personalized learning paths	Increased learning agency
Lifelong learning	2	MALL learn anytime, anywhere	Accessibility is very high

e. Integrative Synthesis: The Relationship of Technology, Pedagogy, and Andragogy

The thematic synthesis revealed a patterned relationship between technology use, pedagogical structure, and andragogic autonomy. Evidence from multiple studies indicates a progression across three phases: (1) structured learning supported by LMS and digital

modules, (2) transitional learning facilitated by immersive and intelligent technologies, and (3) autonomous learning enabled by adaptive and personalized systems.

This synthesis informed the development of the Integrated Pedagogical–Andragogical (IPA) Model, which conceptualizes technology as an epistemic mediator linking guided instruction and learner-managed learning. The strength of this model lies in its grounding in convergent evidence from multiple contexts rather than reliance on isolated findings. Table 11 maps the relationship between pedagogical indicators, andragogic indicators, and the mediating role of technology, forming the conceptual foundation of the IPA Model.

Table 11. Synthesis of Pedagogical Integration of Andragogy

Component	Pedagogical Indicators	Indicator Andragogis	The Role of Technology
Learning structure	Clear purpose, scaffolding	Gradual independence	LMS, flipbook
Learning interactions	Collaboration, peer learning	Learning independence	VR/AR, digital collaboration
Feedback	Directional instructions	Self-monitoring	AI–NLP feedback
Context	Authentic tasks	Implementation of real situations	VR-based cultural simulation
Valuation	Formative	Self-assessment	AI-based evaluation tools

3.2 Discussion

a. Interpretation of the Role of Technology in Pedagogy–Andragogy Integration

The findings of this review indicate that digital technology contributes to language learning effectiveness only when it is embedded within coherent pedagogical and andragogic designs. Consistent with Hussain (2024), technology functions as an epistemic tool when it actively supports knowledge construction, meaning-making, and reflective learning processes, rather than serving merely as a technical delivery medium. In this sense, AI-driven applications and immersive technologies enhance engagement, contextualization, and interaction, while LMS-based systems provide the instructional structure necessary for guided learning.

Importantly, the quantitative improvements reported in several studies, such as gains in vocabulary, grammar, retention, and engagement, must be interpreted with caution. These outcomes were generated from context-specific interventions, employing diverse samples, instructional durations, and research designs. Consequently, the findings indicate potential instructional value rather than universally transferable effects, reinforcing the need for careful contextual consideration when adopting digital technologies in language learning.

b. Strengthening the IPA Model through Evidence-Based Synthesis

The Integrated Pedagogical–Andragogical (IPA) Model is supported by recurring thematic patterns identified across the reviewed studies. Early instructional stages tend to emphasize pedagogical scaffolding through LMS platforms and structured digital materials (Maharani et al., 2024). Transitional stages increasingly leverage immersive technologies and AI to support experiential, dialogic, and exploratory learning processes (Fritzner et al., 2025). More advanced learning stages prioritize autonomy, self-regulation,

and reflective learning through adaptive and personalized technologies (Yuen & Schlote, 2024).

Crucially, the relative strength and prominence of each component of the IPA Model vary according to learning context, learner characteristics, instructional goals, and technological affordances. The model does not imply a fixed or linear progression, nor does it assert causal relationships. Instead, its strength lies in synthesizing convergent evidence across heterogeneous studies to explain how pedagogical structure, technological mediation, and andragogic autonomy may interact dynamically within digital language learning environments.

c. Theoretical and Practical Implications

From a theoretical perspective, this study makes three significant contributions. First, the findings reinforce the view that technology is effective only when positioned as an epistemic tool that supports thinking and learning processes through the integration of pedagogy and andragogy, rather than as a purely technical medium. This insight deepens theoretical understanding of how technological affordances interact with instructional design. Second, the IPA Model strengthens existing literature on TPACK, constructivism, and andragogy by explaining how technology can mediate the transition from highly structured learning toward independent learning grounded in self-regulated learning (SRL) and self-directed learning (SDL). Third, this study highlights the role of technology in supporting learner motivation and autonomy through the lens of Self-Determination Theory, offering a refined theoretical perspective on how digital learning environments can foster competence, autonomy, and relatedness in language learning contexts.

From a practical standpoint, three implications emerge. First, educators should integrate technology deliberately by strengthening technological pedagogical knowledge (TPK) and ensuring that AI, VR/AR, and MALL are aligned with instructional objectives. Second, educational institutions must support teachers through adequate digital infrastructure and literacy development, while anticipating challenges such as digital access disparities and the risk of overdependence on AI through appropriate scaffolding. Third, technology should be positioned as a learning support system that enables adaptive feedback, authentic learning experiences, and personalized instruction for both child and adult learners.

d. Comparison with Previous Research

The findings of this review largely support previous studies emphasizing the importance of pedagogical alignment in technology-enhanced learning (Hodges et al., 2020; Sun & Chen, 2016). Consistent with earlier research, this study confirms that technology alone does not guarantee learning effectiveness and must be embedded within intentional instructional design. However, this review extends prior work by explicitly integrating pedagogy and andragogy within a single analytical framework, addressing gaps identified by Wain et al. (2019). Unlike earlier SLRs that examine learner age groups, technologies, or pedagogical approaches in isolation, the IPA Model synthesizes evidence across contexts to explain the progressive and context-sensitive mediating role of technology, thereby offering added conceptual clarity and theoretical integration beyond existing reviews.

e. Remaining Challenges

Despite the positive trends identified, several challenges persist. Persistent gaps in TPK continue to limit the transformative use of technology (Karsenti et al., 2020), while

unequal digital access constrains the implementation of immersive learning technologies. Additionally, overreliance on AI tools may undermine learners' self-regulation if not balanced with appropriate pedagogical scaffolding (Mohebbi, 2025). These challenges underscore the importance of cautious, reflective, and context-sensitive application of digital technologies in language learning.

4. CONCLUSION

This systematic literature review set out to examine how digital technologies are integrated with pedagogical and andragogical principles in online language learning, to identify prevailing trends and gaps, and to synthesize an integrative framework explaining this relationship. The findings demonstrate that these objectives have been achieved through a structured synthesis of 15 peer-reviewed studies published between 2015 and 2025. First, in response to RQ1, the review shows that digital technologies, such as LMS, mobile learning, AI-based tools, and immersive technologies, are consistently positioned not merely as instructional media but as mediating mechanisms that shape learning structure, interaction patterns, and learner autonomy. However, their instructional effectiveness is highly contingent upon pedagogical alignment and contextual conditions. Quantitative improvements reported in vocabulary acquisition, engagement, and retention should therefore be interpreted as context-specific tendencies rather than universal effects, reflecting the bounded nature of the empirical evidence.

Second, addressing RQ2, the review identifies that pedagogical approaches in digital language learning remain predominantly grounded in constructivist, engagement-based, and TPACK-oriented frameworks. While these approaches provide essential scaffolding and support structured learning, the synthesis also reveals persistent limitations in teachers' technological pedagogical knowledge, which constrain the transformative potential of digital technologies. This finding reinforces the need to move beyond fragmented pedagogical or technological perspectives toward more integrated instructional designs. Third, with regard to RQ3, the findings indicate that andragogic principles particularly learner autonomy, self-regulation, experiential relevance, and flexibility are increasingly supported through adaptive and personalized technologies. Nevertheless, these principles are not uniformly embedded across learning stages or learner profiles, underscoring the importance of intentional design decisions that take into account learner readiness, digital literacy, and learning context.

From a theoretical perspective, this study contributes by proposing the Integrated Pedagogical–Andragogical (IPA) Model, which conceptualizes technology as an epistemic mediator bridging structured pedagogical instruction and autonomous andragogical learning. This contribution should be understood as theoretically integrative rather than predictive, as it is grounded in convergent qualitative and quantitative evidence synthesized from diverse educational contexts. The strength of the IPA Model lies in its capacity to explain patterned relationships across studies, rather than in making causal or universally generalizable claims. Future empirical research may further examine and validate the applicability of the IPA Model across specific learning contexts, learner groups, and instructional designs.

In practical terms, the findings carry several implications for educators and language learning institutions. For educators, the review highlights the importance of aligning technological choices with pedagogical objectives and levels of learner autonomy, rather than adopting digital tools based solely on availability or novelty. Structured scaffolding through LMS and digital modules should be strategically complemented by experiential and adaptive technologies as learners progress toward greater independence. For institutions, the results underscore the need for

sustained professional development that strengthens teachers' technological pedagogical competence, as well as institutional policies that support inclusive, reflective, and context-sensitive digital learning environments. In conclusion, this study emphasizes that effective digital language learning does not arise from technology alone, but from the deliberate integration of pedagogical structure, andragogic principles, and technological affordances. By providing a systematic synthesis and an integrative conceptual model, this review offers a coherent foundation for future empirical inquiry and informed practice in digital language education.

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