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PEDAGOGY AND EDUCATION

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Artificial intelligence in foreign language learning: cognitive, metacognitive and intercomprehension perspectives

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Abstract.
This article examines the impact of artificial intelligence (AI) on the cognitive and metacognitive processes involved in the learning of Romance languages within intercomprehension-based pedagogies. Drawing on recent research, it argues that AI-supported environments, when designed ethically and implemented critically, enhance key cognitive functions such as attention, memory, reasoning and metacognitive regulation. Through adaptive feedback and personalized learning pathways, AI fosters self-regulated learning, motivation and reflective practice. The study highlights the role of hybrid cognitive models that integrate human mediation with intelligent digital tools, promoting higher-order processes including inference, problem-solving and strategic planning. Methodological considerations emphasize mixed-method and longitudinal approaches, combining cognitive, behavioral and qualitative data to evaluate the effectiveness of AI-enhanced learning. Ethical and intercultural dimensions are foregrounded, underscoring the importance of equitable access, data confidentiality and critical digital literacy. The findings suggest that AI, far from replacing human pedagogy, acts as a strategic cognitive partner that transforms how learners construct linguistic knowledge and regulate learning processes. The article concludes that sustainable integration of AI requires ongoing teacher training, interdepartmental collaboration and reflective practices that balance automation with human guidance.

Keywords:
artificial intelligence (AI)
intercomprehension
cognition
multilingual education
hybrid pedagogy
digital literacy
adaptive learning

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1. Introduction

The digital transformation of higher education has profoundly reshaped pedagogical paradigms, particularly in the field of foreign language learning. This transformation unfolds within a global context characterized by the unprecedented acceleration of technological innovation and the rapid evolution of social and economic demands, which collectively necessitate a re-evaluation of traditional approaches to teaching and learning. The emergence of artificial intelligence (AI) – particularly generative models based on deep neural networks and machine learning – offers new and significant opportunities to enhance educational systems by enabling the development of more flexible, dynamic, and interactive learning environments.

These advanced technologies make it possible to design cognitively stimulating and personalized learning environments that foster the development of linguistic skills, motivation, autonomy, creativity, and critical thinking. They also enable real-time analysis of learners' behavior and progress, allowing for the instant adjustment of learning pathways and the adaptation of content to diverse cognitive profiles, learning styles, and varying levels of proficiency.

The introduction of AI into language education, however, presents significant theoretical and practical challenges, particularly concerning its influence on the core cognitive functions essential to language acquisition – attention, memory, reasoning, metacognition, cognitive flexibility and the regulation of cognitive load. It is therefore imperative to investigate how these cognitive mechanisms can be optimized through AI and to determine the pedagogical conditions under which its integration yields the greatest benefits.

Furthermore, intercomprehension, as a multilingual pedagogical paradigm, aligns closely with this transformative dynamic. It engages higher-order cognitive strategies such as analysis, comparison, and inference, enabling learners to comprehend multiple related languages without the need for exhaustive study. When combined with digital technologies, intercomprehension not only promotes multilingual awareness but also cultivates transferable competences that hold significant value in professional and intercultural contexts.

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The objective of this article is to investigate how the integration of artificial intelligence (AI) – particularly within the framework of intercomprehension – can foster the development of cognitive and metacognitive skills essential to second language acquisition. The analysis aims to elucidate the cognitive mechanisms activated by these innovative approaches while identifying the pedagogical conditions necessary for their effective, balanced and ethically responsible implementation.

2. Theoretical Framework

2.1. Cognitive and Metacognitive Dimensions of Language Learning

Foreign language learning depends on the coordination of several core cognitive functions, including sustained attention, working memory, logical reasoning, inference, critical analysis and metacognitive regulation. These interdependent processes underpin not only linguistic comprehension and production but also the transfer of knowledge and the ability to solve complex problems within multilingual contexts.

Findings from neuroscience research applied to education indicate that foreign language learning simultaneously activates multiple brain networks – most notably, the prefrontal cortex, which is associated with planning and executive control; the hippocampus, responsible for memory consolidation; and the temporal regions, which support language processing. The integration of adaptive technologies grounded in AI has the potential to optimize these mechanisms by calibrating task difficulty in accordance with each learner's cognitive load, thereby fostering targeted neural plasticity and improving long-term retention (Kurbatova et al., 2025).

Metacognition plays a central role in language learning by enabling learners to plan, monitor and regulate their learning strategies. It enhances learner autonomy and cognitive efficiency, contributing to the durable integration of knowledge into long-term memory (Flavell, 1979; Schraw & Dennison, 1994). Recent studies confirm the positive influence of metacognitive strategies on both reading and listening comprehension in English as a Foreign Language (EFL)

and multilingual contexts. For example, Yulita and Napitupulu (2023) demonstrate that the application of metacognitive strategies before, during and after reading significantly improves text comprehension. Similarly, Iobidze (2019) highlights that these strategies enhance motivation, facilitate knowledge integration, and foster cognitive flexibility as well as intercultural adaptability.

Motivation and emotional engagement play a pivotal role in the effectiveness of learning processes. AI, through the personalization of learning pathways and the provision of immediate, adaptive feedback, can strengthen learner autonomy and perseverance. The integration of systems capable of monitoring emotional engagement, such as voice analysis or facial expression recognition, offers promising opportunities for tailoring instruction to learners' affective and cognitive needs.

Innovative educational initiatives in Eastern Europe and Ukraine have incorporated multilingual pedagogical approaches grounded in intercomprehension and explicit metacognitive strategy training. These programs, including multilingual workshops, critical reading modules and intercultural simulations, demonstrate that a reflective and strategic approach to language learning simultaneously enhances communicative competence, attentional regulation, cognitive resilience and adaptability within complex multilingual environments (Savytska et al., 2025). The skills cultivated through these approaches extend beyond language proficiency, contributing to cognitive transferability that holds significant value in both academic and international professional contexts. These findings suggest that the thoughtful integration of AI into multilingual learning environments can further amplify cognitive and metacognitive benefits while promoting individualized and adaptive learning tailored to the diverse profiles of learners.

2.2. Intercomprehension as a Multilingual and Cognitive Paradigm

Intercomprehension refers to the ability to understand several related languages without necessarily being able to speak them fluently. It involves a range of receptive linguistic skills, including lexical inference, morphosyntactic recognition and interlinguistic comparison.

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European initiatives such as Galatea, EuRom5, and InterRom have demonstrated that this approach capitalizes on learners' pre-existing linguistic knowledge and fosters advanced cognitive strategies, including inductive reasoning, systematic comparison and the development of interconnected mental representations.

Activities grounded in intercomprehension include, for example, the comparative reading of related texts, the identification of lexical and syntactic similarities and the reformulation of sentences across multiple languages. Such exercises encourage active inference, enhance working memory and promote heightened metalinguistic awareness (Degache, 2023).

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Regular engagement with intercomprehension strategies enhances cognitive flexibility and the ability to shift between linguistic systems, as well as selective attention and cognitive planning. Learners develop skills for structuring and organizing multilingual information, which facilitates the consolidation of knowledge and its transfer to new linguistic and professional contexts.

The integration of digital tools, such as interactive reading platforms or adaptive exercises, further amplifies

these benefits. Such systems can provide immediate feedback on comprehension, adjust task difficulty according to the learner's proficiency level and offer multilingual synthesis activities, thereby stimulating memory, attention and inferential abilities.

Fonseca and Gajo (EuRomania Project, 2015) demonstrate that intercomprehension fosters cognitive fluency and enhances the capacity to navigate between different linguistic systems. It prepares learners for multilingual environments by promoting cognitive flexibility, metalinguistic awareness and the ability to transfer and infer knowledge across languages. Consequently, intercomprehension extends beyond linguistic efficiency to function as a pedagogical model grounded in cognitive agility and comparative reasoning.

3. Artificial Intelligence in Teaching Foreign Languages

The integration of artificial intelligence (AI) into the teaching of Romance languages constitutes a significant advancement in the personalization of learning and the enhancement of cognitive functions. AI-driven systems, such as adaptive learning platforms, virtual tutors, and automated analysis tools, facilitate the creation of flexible, learner-centered pathways that provide activities tailored to individual learning paces, cognitive styles and proficiency levels.

Adaptive platforms employ algorithmic models to deliver exercises calibrated to each learner's profile. This personalization not only sustains learner engagement but also stimulates sustained attention, working memory and knowledge consolidation – core components of long-term learning. For example, interactive activities based on linguistic pattern recognition and simulations of authentic language use promote focused attention and activate both short- and long-term memory processes (Kukulska-Hulme, 2021). Furthermore, certain platforms incorporate tasks for the recognition and production of complex grammatical structures, interactive dictations with real-time feedback and virtual role-playing scenarios designed to simulate multilingual professional contexts. These activities not only increase learner motivation but also reinforce multiple cognitive functions simultaneously.

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Intelligent feedback and automated error analysis further enhance metacognitive awareness by encouraging learners to reflect on their strategies and regulate their own learning processes (Zawacki-Richter et al., 2019). In this sense, AI functions as a pedagogical partner capable of guiding learners in the critical analysis of their performance while relieving instructors of repetitive tasks, thereby enabling them to focus on strategic and reflective support.

The integration of collaborative features – such as interactive forums or online projects – enables learners to share strategies, compare outcomes and co-construct knowledge, thereby fostering the development of both social and cognitive skills.

Moreover, AI contributes to the reduction of extrinsic cognitive load by automating repetitive operations (e.g., spelling correction, formatting, syntactic verification), thus freeing cognitive resources for higher-level tasks such as argumentation, analysis, and creative writing. The incorporation of authentic, contextualized tasks consistently engages higher-order cognitive processes, reinforcing both language acquisition and the development of transferable skills, including critical thinking, problem-solving and cognitive flexibility. Advanced AI-based systems may also include adaptive monitoring mechanisms that track response times, recurring errors and individual learning patterns. Such data enable the dynamic adjustment of task difficulty and the design of personalized learning trajectories, thereby maximizing cognitive efficiency and learner engagement.

Despite these advantages, several challenges persist. Digital literacy is essential for the critical evaluation of AI-generated suggestions and for preventing overreliance on automated systems. Furthermore, ethical considerations, data protection and the potential over-standardization of learning tasks must be carefully addressed. Teachers continue to play a central role in contextualizing, interpreting and complementing digital tools, thereby maintaining an appropriate balance between learner autonomy and pedagogical guidance. The implementation of inclusive and ethical practices, such as ensuring accessibility for learners with specific needs, promoting algorithmic transparency and

safeguarding personal data, is crucial. These measures not only guarantee equitable access but also foster user trust and motivation within digital learning environments.

Thus, AI should not be viewed merely as a corrective or repetitive tool but as a cognitive and pedagogical mediator capable of creating adaptive and dynamic learning contexts. It simultaneously stimulates attention, memory, reasoning and metacognitive regulation while enhancing learner motivation and autonomy.

4. Intercomprehension and AI: Towards Hybrid Cognitive Models

Intercomprehension, as a pedagogical paradigm centered on the receptive understanding of related languages, is particularly conducive to the integration of artificial intelligence (AI) technologies. Digital tools make it possible to design authentic and adaptive learning tasks through which learners can compare, infer and transfer linguistic knowledge across languages while benefiting from automated cognitive support. In this context, AI functions as a mediating agent that strengthens attentional and metacognitive mechanisms, thereby promoting knowledge consolidation in plurilingual learning environments.

Recent neuroscience research in language acquisition indicates that interaction with adaptive digital environments simultaneously activates multiple brain regions associated with memory, problem-solving and attention. The integration of AI enables the real-time modulation of task complexity, optimizing cognitive load and facilitating learning through mechanisms such as spaced repetition and immediate feedback (Broda et al., 2025; Kurbatova et al., 2025).

Hybrid cognitive models combine the adaptive capacities of artificial intelligence (AI) systems – which can adjust the level and nature of activities to meet individual needs – with human pedagogical guidance, which remains essential for contextualizing learning tasks, ensuring cultural and ethical relevance and fostering critical reflection. This hybridization transcends simple automation by creating learning environments in which higher-order cognitive processes are actively engaged. The integration of AI within these hybrid models also enhances learner motivation and emotional engagement. Adaptive tools, combined with authentic

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and meaningful tasks, provide personalized learning pathways, monitor progress and recognize individual achievements, thereby establishing a virtuous cycle of learning in which cognition and emotion are closely intertwined.

A variety of activities exemplify AI's potential to support intercomprehension by integrating immersion, adaptivity and cognitive stimulation. These activities extend beyond the scope of language acquisition to promote the transfer of cognitive skills across contexts, thereby enhancing mental flexibility and the ability to adapt to diverse multilingual situations. By simulating complex learning environments and dynamically adjusting scenarios to the learner's profile, AI facilitates this transfer and supports the development of generalizable learning strategies. Such tasks engage a wide range of cognitive processes, including attention, working memory, reasoning and metacognition, and enable dynamic interaction between the learner, the target languages and the digital environment.

One illustrative example involves the comparative reading of multilingual texts in Spanish, Italian and French. In such activities, learners identify lexical transparencies, parallel syntactic structures and characteristic discourse patterns across the languages. Artificial intelligence (AI) adjusts the level of difficulty according to each learner's linguistic profile, offers interactive annotations and provides immediate feedback on comprehension errors. This approach promotes inductive learning, the construction of interlinguistic representations and the development of plurilingual awareness, while simultaneously reinforcing selective attention and inferential strategies (Mhatli, 2025).

Another activity type consists of simulated multilingual professional negotiations between speakers of different languages. In these role-playing scenarios, learners engage in interactional exchanges while AI functions as an analytical mediator, evaluating the relevance of arguments, proposing contextually adapted reformulations and monitoring individual progress. These simulations are grounded in theoretical perspectives that conceptualize the plurilingual speaker as an agent capable of mobilizing multiple linguistic codes and

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communication strategies according to situational demands (Coste et al., 2009). Furthermore, as Piccardo (2013) emphasizes, the emotional and pragmatic dimensions of language use are crucial: by participating in immersive simulations, learners develop not only linguistic competence but also strategic thinking, intercultural sensitivity and the ability to regulate discourse across diverse communicative contexts.

A third modality involves linguistic problem-solving tasks, such as partial translation exercises, the detection of interlinguistic errors or the completion of multilingual sentences. These activities place significant demands on working memory and metacognitive control. Artificial intelligence (AI) provides differentiated support by offering targeted corrections and fostering cognitive self-regulation through the adaptive adjustment of challenge levels for each learner. A recently proposed model integrates attention mechanisms with syntactic analysis to identify and correct translation errors, thereby enabling precise and context-sensitive feedback (Liu & Zhang, 2025). This evidence suggests that linguistic problem-solving tasks can be rendered more effective when diagnostic and remedial AI mechanisms are incorporated into the learning process.

Finally, multilingual synthesis activities require learners to produce coherent summaries based on source documents written in multiple Romance languages. These tasks call for advanced cognitive planning, organizational skills and integrative thinking. Research indicates that AI models can be trained to generate summaries of complex texts, thereby prompting learners to identify key ideas and condense information effectively (Galeshchuk, 2023). Post-interpretation summarizing exercises further enhance learners' ability to organize ideas, structure discourse and make informed formulation choices. At the same time, AI tools help to reduce cognitive load by providing formulation assistance, multilingual spelling verification and structured guidance in discourse organization.

Another advantage of hybrid models lies in their capacity to reduce extrinsic cognitive load. Automated systems can assume responsibility for repetitive and mechanical tasks, such as spelling assessment, document formatting and

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syntactic correction, thereby allowing learners to allocate cognitive resources to higher-order processes, such as complex analysis and creative production. This optimized distribution of cognitive effort not only facilitates target language acquisition but also fosters the development of transferable skills, including critical thinking, problem-solving and cognitive flexibility.

However, the effective implementation of hybrid models requires careful pedagogical and ethical guidance. Learners must develop adequate digital literacy to critically evaluate AI-generated suggestions and avoid excessive dependence on technological assistance. Teachers therefore remain central actors in ensuring pedagogical coherence, cultural relevance, and adherence to ethical standards. Achieving a balanced integration between human intervention and technological automation constitutes the principal challenge in the application of hybrid cognitive models to foreign language education.

The integration of AI into the teaching of Romance languages further paves the way for a gradual reconfiguration of intercomprehension-based pedagogical practices. This approach, which exploits lexical, morphosyntactic and discursive similarities among related languages, has been extensively documented by Escudé and Janin (2010) as an effective means of developing plurilingual competence through inductive and efficient learning processes.

In this context, artificial intelligence (AI) can play a facilitative role by supporting key cognitive processes through comprehension aids and personalized learning pathways. Adaptive AI systems create new opportunities to foster learner autonomy, adjust task complexity in real time and deliver individualized formative feedback. Although empirical research on the direct interaction between AI and intercomprehension remains in its early stages, the potential synergies between these technological and didactic dimensions point toward cognitively enriched environments that enhance learners' strategic engagement in multilingual contexts.

Thus, AI extends beyond a merely corrective function to act as a catalyst for plurilingual learning. It facilitates the dynamic integration of knowledge, the co-construction of

skills and the strengthening of reflective autonomy. The convergence of intercomprehension and AI gives rise to cognitively enriched, adaptive and motivating learning environments that offer an innovative response to the challenges of plurilingualism while optimizing the development of learners' cognitive and metacognitive abilities.

5. Methodological Considerations

Evaluating the impact of artificial intelligence (AI) on the cognitive and metacognitive processes involved in learning Romance languages requires a rigorous, context-sensitive and methodologically robust approach based on mixed methods. Recent studies indicate that the integration of AI in language instruction not only enhances linguistic performance, particularly in reading comprehension, grammar, and vocabulary, but also increases learner motivation and promotes the development of self-regulation strategies, especially within university settings (Wei, 2023).

To ensure the validity and reliability of the findings, it is advisable to employ multiple data collection methods, including cognitive assessments, metacognitive questionnaires, qualitative observations and behavioral measures. Such methodological triangulation enables a more comprehensive and nuanced understanding of how AI technologies influence cognitive strategies and learning regulation.

Experimental designs frequently employ pre-/post-test frameworks to evaluate cognitive functions such as working memory, sustained attention and linguistic reasoning. Tasks including completion exercises, interlinguistic comparisons and linguistic problem-solving are commonly used within this context, particularly in adaptive digital learning environments. The incorporation of longitudinal measures further enables researchers to monitor individual learner trajectories and to observe changes in performance over time (Luckin et al., 2016).

The application of eye-tracking technologies provides precise insights into attentional dynamics and the cognitive management of multimodal information. As illustrated in Jarodzka's (2021) study, the analysis of fixation zones, visual processing times, and reading paths offers a deeper

understanding of the cognitive mechanisms engaged during AI-assisted learning.

Experimental designs may incorporate control groups, repeated measures and transfer tasks to evaluate the durability of cognitive gains. For instance, the inclusion of interlinguistic transfer tests or exercises situated in simulated professional contexts enables a more comprehensive understanding of the generalization of acquired skills. Such detailed protocols support a fine-grained assessment of the cognitive effects of interventions and help identify optimal pedagogical conditions.

Concurrently, qualitative approaches capture learners' subjective experiences. Semi-structured interviews, reflective journals and classroom observations provide valuable insights into perceived support, shifts in learning beliefs and the development of self-regulation strategies. Metacognition occupies a central role in this process and can be examined through self-evaluation grids, planning tools or the monitoring of learning time. Certain AI-based platforms, such as Promova, Xeropan, and Preply, offer personalized tracking features and metacognitive feedback, thereby enhancing learners' awareness and control over the cognitive processes involved.

Beyond technical considerations, ethical and inclusive dimensions are essential. Research protocols must ensure equitable access, safeguard data confidentiality and mitigate algorithmic biases that could influence evaluation outcomes. The integration of responsible-use guidelines and digital literacy sessions promotes critical reflection on AI technologies, ultimately reinforcing learners' autonomy and capacity for informed judgment.

Analyzing the effects of AI on learning also benefits from a longitudinal perspective. Long-term studies enable researchers to assess the stability of cognitive gains, their transfer to other linguistic competencies or professional contexts and the evolution of learners' attitudes and motivation toward digital tools. The adoption of multimodal approaches, integrating the simultaneous analysis of linguistic interactions, gestures, digital traces and visual data, provides a nuanced understanding of the underlying

cognitive mechanisms, including attentional orientation, memory consolidation and the dynamic adjustment of learning strategies.

Moreover, research involving AI must systematically incorporate ethical and critical dimensions. Recent studies, notably Selwyn (2022), underscore the importance of ensuring confidentiality, informed consent and transparency in the collection and processing of personal data. Additional challenges relate to equitable access to technology and the potential influence of algorithmic biases on the recommendations or evaluations produced by intelligent systems. Developing learners' critical digital literacy strengthens their ability to assess the reliability and limitations of AI tools while promoting a reflective and responsible approach to their use.

In conclusion, the integration of rigorous experimental designs, complementary quantitative and qualitative measures, longitudinal and multimodal analyses and strong ethical principles constitutes a robust methodological framework for evaluating the cognitive and metacognitive impact of AI. This comprehensive approach not only yields empirically grounded findings but also supports critical reflection on the pedagogical and epistemological transformations driven by AI in language education.

6. Discussions

The findings confirm that artificial intelligence (AI), when integrated within a pedagogical framework grounded in intercomprehension, serves as a powerful catalyst for the development of cognitive and metacognitive skills. The adaptability of AI systems and their capacity to deliver immediate, individualized feedback enhance memory, sustained attention and cognitive flexibility, while supporting the regulation of learning processes. Hybrid pedagogical approaches that combine human guidance with intelligent digital tools foster learning environments in which higher-order cognitive processes are deliberately and contextually activated.

These dynamics can be illustrated through concrete examples of hybrid learning activities, such as:

1) the comparative analysis of multilingual texts with automated feedback.

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2) AI-guided multilingual negotiation simulations;
3) multilingual synthesis exercises.

Such activities exemplify how AI can actively stimulate attention, memory and metacognitive engagement, thereby reinforcing both the depth and autonomy of language learning.

This dynamic depends on several essential conditions. Foremost among these is the quality and relevance of the proposed tasks: only activities explicitly designed to stimulate analysis, inference, and interlinguistic comparison can fully engage learners' cognitive potential. Equally important is the level of digital literacy among users; disparities in digital competence may generate pedagogical and cognitive divides, thereby hindering effective interaction with intelligent learning environments.

The integration of an intercultural dimension is also crucial. Learning content should reflect linguistic and cultural diversity to enhance cognitive flexibility and strengthen learners' ability to transfer skills across international contexts.

Finally, human mediation remains indispensable to ensure ethical oversight and critical guidance. Autonomy supported by AI necessitates explicit training in critical thinking, rigorous evaluation of sources and careful analysis of algorithmic recommendations. The cultivation of critical digital literacy thus emerges as a key transversal competence, enabling AI to function not merely as a tool but as a genuine cognitive partner in the learning process.

From this perspective, the role of educational practitioners evolves toward that of facilitators of personalized learning pathways and guarantors of metacognitive processes. The establishment of spaces for pedagogical co-construction and reflective practice promotes a coherent articulation between algorithmic assistance and human mediation, thereby enriching the overall learning dynamic.

Recent research on the interrelations among language, cognition, and neural processes highlights that linguistic structures and conceptual metaphors shape the ways in which learners construct mental models and interpret reality (Kurbatova et al., 2025). When combined with studies on the

pedagogical applications of AI, these findings demonstrate that the integration of innovative methodologies, anchored in hybrid cognitive systems and the exploration of deep linguistic concepts, significantly enhances attention, memory, and metacognitive regulation.

These insights open promising avenues for future research, including longitudinal investigations into the durability of cognitive gains, cross-cultural analyses to assess effectiveness across institutional contexts and neurocognitive studies aimed at deepening our understanding of the mechanisms underlying hybrid learning.

However, the impact AI on learning largely depends on learners' capacity to critically analyze linguistic and conceptual representations. In the absence of well-developed linguistic and metacognitive awareness, there is a risk of uncritical assimilation of culturally determined models as universal norms.

The experience of Ukrainian higher education institutions, particularly the Simon Kuznets Kharkiv National University of Economics, demonstrates that the integration of AI, interlinguistic analysis and conceptual approaches can effectively activate cognitive and metacognitive processes. Sustainable implementation, however, requires:

1) the establishment of long-term interdepartmental or interuniversity research projects with systematic monitoring of AI tool effectiveness;

2) continuous training in digital and information literacy for learners, alongside the enhancement of teachers' critical competencies;

3) maintaining an appropriate balance between automated systems and human mediation to preserve the emotional, cultural and ethical dimensions of education.

Furthermore, it is recommended to:

1) systematically document students' and teachers' feedback;

2) adopt a collaborative framework between language departments and IT services to improve adaptive learning platforms;

3) incorporate debriefing and post-activity metacognitive reflection sessions to strengthen learner autonomy and self-

regulation.

When used critically and contextually, AI thus transcends its role as a mere automation tool: it becomes a strategic pedagogical partner capable of transforming the construction of cognitive models and optimizing the development of linguistic and metacognitive competencies in multilingual learning environments.

7. Conclusions

The integration of artificial intelligence (AI) into foreign language teaching, particularly within intercomprehension frameworks, constitutes a significant advancement in learner-centered pedagogic that emphasizes cognitive development, metacognitive reflection and personalized learning. When implemented critically and ethically, AI can effectively support core cognitive functions such as attention, memory, reasoning and metacognition, while simultaneously enhancing motivation, engagement and learner autonomy. Through immediate feedback, adaptive guidance and individualized learning pathways, AI enables learners to refine their strategies, develop self-regulatory skills and engage in sustained reflective practice.

Hybrid cognitive models that combine human mediation with intelligent digital tools promote a dynamic, reflective and adaptive approach to language learning. These models create environments in which higher-order cognitive processes, such as problem-solving, inferencing, selective attention and strategic planning, are actively mobilized. AI facilitates the automation of routine tasks, thereby freeing cognitive resources for more complex operations, including analysis, synthesis and critical evaluation. At the same time, human mediation remains essential to ensure that cultural, ethical, and pedagogical dimensions are preserved, maintaining an equilibrium between learner autonomy and structured guidance.

Effective implementation of AI-supported intercomprehension requires the fulfillment of several key conditions. Pedagogical tasks should be rigorous, authentic and cognitively demanding, encouraging analysis, comparison, inference and synthesis across related languages. Learners' digital literacy must be systematically developed to enable

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the critical evaluation of AI-generated suggestions and a deeper understanding of underlying algorithmic reasoning. Ethical considerations, including data privacy, equitable access and the mitigation of algorithmic bias, must also be explicitly addressed. Teachers remain indispensable as facilitators, mentors and instructional designers, guiding learners' reflective and strategic engagement while situating AI use within coherent pedagogical frameworks.

Importantly, AI-supported learning environments extend beyond the enhancement of language acquisition to foster transferable competencies essential for academic, professional and intercultural success. Through activities such as comparative analysis, problem-solving, and multilingual synthesis, AI contributes to the development of cognitive flexibility, adaptive reasoning and cross-linguistic awareness. These capabilities strengthen learners' ability to navigate multilingual contexts and to transfer their skills effectively beyond the classroom setting.

Intercultural and inclusive considerations are likewise central to the effective integration of artificial intelligence (AI) in language education. Learning materials and pedagogical tasks should reflect linguistic, cultural and social diversity, thereby fostering empathy, metalinguistic awareness and cognitive adaptability. AI can facilitate the creation of adaptive scenarios and simulations that incorporate cultural nuances, enabling authentic multilingual communication and promoting both cognitive and affective competencies such as intercultural sensitivity, perspective-taking and socially responsible decision-making.

From a research perspective, the long-term effects of AI on cognition, metacognition and learning outcomes remain a critical area for further investigation. Longitudinal studies are required to evaluate the durability of cognitive gains, the transfer of skills across languages and contexts and the sustained impact on learner motivation, engagement and autonomy. Multimodal approaches that integrate behavioral, neurocognitive and qualitative measures will contribute to a more comprehensive understanding of how AI supports complex cognitive processes. Furthermore, cross-cultural research can elucidate how institutional, cultural and linguistic factors mediate the effectiveness of AI-enhanced intercomprehension

and shape diverse learner experiences.

Ultimately, artificial intelligence (AI) does not replace human pedagogy; rather, it enriches, complements and transforms it. When thoughtfully integrated, AI functions as a strategic cognitive and pedagogical partner, supporting the co-construction of multilingual, critical and autonomous competencies. The synergy between AI, human mediation and reflective practice fosters adaptive, cognitively stimulating and personalized learning environments that enhance self-regulation, critical thinking and skill transfer, while promoting multilingualism, intercultural competence and holistic learner development.

By embracing this vision, educational institutions can cultivate learning ecosystems that are technologically advanced, ethically grounded, inclusive and pedagogically coherent. The integration of adaptive AI, human mentorship and reflective pedagogical strategies offers a sustainable framework for developing cognitive, metacognitive and intercultural competencies, thereby preparing learners to thrive within complex academic, professional and global contexts.

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