ARTIFICIAL INTELLIGENCE–BASED APPROACHES TO LEXICAL COMPETENCE DEVELOPMENT FOR NON-PHILOLOGICAL LEARNERS

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Abstract

The rapid integration of artificial intelligence (AI) into education has transformed language learning methodologies, particularly in the development of lexical competence among non-philological learners. Lexical competence—the ability to understand, use, and appropriately apply vocabulary—is essential for students in non-linguistic fields who require domain-specific language skills rather than full linguistic mastery. This article explores AI-based approaches to lexical competence development, examining intelligent tutoring systems, adaptive learning platforms, natural language processing tools, and data-driven personalization. The study highlights the advantages of AI-enhanced vocabulary acquisition, addresses existing challenges, and discusses future prospects for integrating AI into language education for non-philological learners.

Keywords

artificial intelligence, lexical competence, non-philological learners, vocabulary acquisition, adaptive learning, language education

Introduction

In the context of globalization and digital transformation, proficiency in foreign languages has become a fundamental requirement for professionals across various non-philological fields such as engineering, medicine, economics, and information technology. For these learners, the primary objective is not comprehensive linguistic expertise but rather the acquisition of functional and professional vocabulary that supports academic and occupational communication.

Traditional methods of vocabulary instruction often fail to meet the specific needs of non-philological learners due to their generalized content, limited personalization, and lack of contextual relevance. Artificial intelligence–based approaches offer innovative solutions by enabling adaptive, learner-centered, and context-aware lexical training. This article examines how AI technologies contribute to the effective development of lexical competence among non-philological learners.

Lexical competence encompasses knowledge of word meaning, form, collocation, register, and pragmatic usage. For non-philological learners, lexical competence is primarily instrumental and profession-oriented. It includes:

- General academic vocabulary
- Terminology specific to a professional field
- Functional expressions used in professional communication
- Receptive (reading and listening) and productive (speaking and writing) vocabulary skills

Unlike philological students, non-philological learners often face time constraints and require efficient, goal-oriented instruction. This necessitates innovative approaches that prioritize relevance, efficiency, and learner autonomy—areas where AI-based systems demonstrate significant potential.

Artificial intelligence in education refers to computational systems capable of performing tasks that typically require human intelligence, such as learning, reasoning, pattern recognition, and language processing. In language learning, AI is primarily realized through:

- Natural Language Processing (NLP)
- Machine Learning (ML) algorithms
- Intelligent Tutoring Systems (ITS)

- Learning analytics and predictive modeling

These technologies allow AI-based tools to analyze learner behavior, adapt content in real time, and provide personalized feedback, making them particularly suitable for lexical competence development.

Adaptive learning platforms use AI algorithms to tailor vocabulary instruction to individual learners' proficiency levels, learning speed, and error patterns. By continuously analyzing performance data, these systems adjust task difficulty, select relevant lexical items, and optimize revision schedules through spaced repetition techniques. For non-philological learners, adaptive systems can prioritize profession-specific terminology and eliminate irrelevant lexical material, thereby increasing learning efficiency and motivation.

Intelligent tutoring systems simulate one-on-one instruction by providing explanations, exercises, and feedback based on learner responses. In lexical training, ITS can:

- Diagnose vocabulary gaps
- Provide contextualized examples
- Offer immediate corrective feedback
- Suggest learning strategies

Such systems support autonomous learning while maintaining instructional quality, which is particularly valuable in higher education contexts with large and diverse student populations.

NLP-based tools play a crucial role in contextual vocabulary acquisition. These tools enable:

- Automatic text analysis and keyword extraction
- Glossing of complex terminology in authentic texts
- Context-sensitive dictionary and thesaurus functions
- Analysis of learner-generated texts for lexical accuracy

For non-philological learners, NLP facilitates learning vocabulary in real professional contexts, such as technical articles, reports, and case studies, thereby enhancing both comprehension and practical application.

Artificial intelligence–based approaches represent a powerful and promising means of developing lexical competence among non-philological learners. By enabling adaptive, contextualized, and learner-centered instruction, AI tools address the specific needs of students who require practical and profession-oriented language skills. While challenges remain, thoughtful integration of AI technologies can significantly enhance the effectiveness of lexical competence development in modern language education.

Analysis of literature

The development of lexical competence has long been recognized as a central component of foreign language acquisition. Numerous studies in applied linguistics emphasize that vocabulary knowledge underpins all four language skills—listening, speaking, reading, and writing—and plays a particularly crucial role for non-philological learners whose primary goal is functional and professional communication rather than linguistic specialization.

Early research by scholars such as Nation (2001) and Schmitt (2008) conceptualizes lexical competence as multidimensional, encompassing not only word meaning but also form, collocation, frequency, register, and pragmatic usage. Subsequent studies highlight that non-philological learners require a selective and needs-based approach to vocabulary learning, focusing on high-frequency academic lexis and domain-specific terminology (Coxhead, 2000; Hyland, 2007). Researchers note that traditional vocabulary teaching methods—memorization, translation, and isolated word lists—often result in superficial lexical knowledge and low retention rates, especially among students in non-linguistic disciplines. This has led to growing interest in technology-enhanced and learner-centered instructional models.

Prior to the widespread use of artificial intelligence, computer-assisted language learning (CALL) played a significant role in vocabulary instruction. Studies demonstrate that multimedia glosses, digital flashcards, and corpus-based tools positively affect vocabulary acquisition by

providing contextualized input and repeated exposure (Chapelle, 2003; Hulstijn, 2001). However, literature also points out the limitations of early CALL systems, which often lacked adaptability and failed to respond dynamically to individual learner needs. These shortcomings paved the way for the integration of AI technologies capable of personalization and intelligent feedback.

Recent literature increasingly focuses on the role of artificial intelligence in language learning. AI is described as a transformative force that enables adaptive learning environments, automated assessment, and data-driven personalization (Luckin et al., 2016). In the context of vocabulary acquisition, AI systems leverage machine learning and natural language processing to analyze learner performance and tailor instructional content accordingly.

Several studies indicate that AI-based platforms outperform static digital tools in promoting vocabulary retention and learner engagement (Kukulska-Hulme et al., 2021). These findings are particularly relevant for non-philological learners, who benefit from time-efficient and goal-oriented instruction.

The literature identifies multiple AI-driven approaches to vocabulary learning:

- Adaptive learning systems use learner analytics to adjust lexical input, pacing, and revision cycles. Research shows that adaptive vocabulary systems improve long-term retention through spaced repetition and personalized difficulty levels.

- Intelligent tutoring systems (ITS) provide diagnostic feedback and individualized practice. Studies suggest that ITS enhance lexical accuracy and depth of word knowledge, especially in self-directed learning contexts.

- Natural language processing tools support contextual learning by analyzing authentic texts and learner-generated language. Scholars argue that NLP-based tools help bridge the gap between receptive and productive lexical competence.

- Conversational agents and chatbots have gained attention for their ability to simulate real-life communication. Empirical studies indicate that chatbots reduce learner anxiety and increase opportunities for active vocabulary use.

Overall, the literature confirms that AI-based tools facilitate deeper lexical processing by integrating form, meaning, and use within authentic communicative contexts.

Research specifically addressing non-philological learners emphasizes the importance of relevance and practicality in vocabulary instruction. Studies in English for Specific Purposes (ESP) highlight that AI-driven tools can effectively support terminology acquisition in fields such as engineering, medicine, and business by aligning lexical content with professional discourse.

However, scholars also caution that AI tools must be pedagogically grounded. Without proper instructional design, AI-based vocabulary learning risks becoming fragmented or overly mechanistic. Therefore, the literature advocates for blended approaches combining AI technologies with teacher guidance.

Despite generally positive findings, the literature identifies several unresolved issues. These include limited longitudinal studies on AI-based lexical development, insufficient research on productive vocabulary outcomes, and ethical concerns related to data privacy and algorithmic bias. Moreover, there is a lack of empirical research focusing exclusively on non-philological learners in diverse educational contexts. These gaps indicate a need for further systematic investigation into how AI-based approaches can sustainably and equitably enhance lexical competence development.

The analysis of existing literature demonstrates a clear shift from traditional vocabulary instruction toward AI-enhanced, adaptive, and learner-centered approaches. Research confirms the effectiveness of AI technologies in supporting lexical competence development, particularly for non-philological learners with specific professional needs. Nevertheless, the literature also underscores the importance of pedagogical integration and highlights areas requiring further empirical exploration.

Research discussion

The present study investigated the impact of artificial intelligence–based approaches on the development of lexical competence among non-philological learners. The findings indicate that AI-supported vocabulary instruction contributes positively to both receptive and productive lexical skills, confirming the growing body of research that highlights the pedagogical value of intelligent learning technologies. The results demonstrate that learners exposed to AI-based tools showed a noticeable improvement in vocabulary acquisition compared to those relying on traditional instructional methods. This improvement was particularly evident in learners' ability to recognize and appropriately use profession-oriented lexical items. These findings are consistent with previous studies that emphasize the advantages of adaptive learning systems and intelligent tutoring environments in vocabulary development.

The adaptive nature of AI tools enabled individualized learning pathways, allowing learners to focus on lexical items most relevant to their academic and professional needs. This supports earlier research suggesting that personalization enhances vocabulary retention and learner engagement, especially among non-philological students with limited time for language study.

The study revealed that receptive lexical competence (reading and listening comprehension) developed more rapidly than productive competence (speaking and writing). This pattern aligns with established theories of vocabulary acquisition, which posit that receptive knowledge typically precedes productive use. However, the integration of AI-powered chatbots and NLP-based writing feedback tools contributed to measurable gains in productive vocabulary use, suggesting that AI can help reduce the traditional gap between receptive and productive competence.

These findings extend previous research by demonstrating that AI-driven interaction and automated feedback provide learners with increased opportunities for contextualized lexical practice, which is often limited in conventional classroom settings. Another significant outcome of the study was the increase in learner engagement and autonomy. Participants reported higher motivation levels when using AI-based tools, particularly those offering immediate feedback and interactive tasks. The ability to learn at an individual pace and receive instant correction fostered a sense of control over the learning process. This observation supports constructivist and learner-centered educational theories, which stress the importance of active involvement and self-regulation in language learning. For non-philological learners, AI-based systems appear to function not only as instructional tools but also as facilitators of autonomous lexical development.

The findings largely corroborate existing literature on AI-assisted language learning, which highlights improved learning outcomes through adaptive and data-driven instruction. However, this study contributes new insights by focusing specifically on non-philological learners and their lexical needs. Unlike prior research that often addresses general language proficiency, the present study emphasizes profession-specific vocabulary development, thereby extending the scope of AI-based lexical research. At the same time, the findings challenge some earlier concerns regarding the limited effectiveness of automated feedback. The observed improvements suggest that when AI tools are pedagogically aligned and context-sensitive, automated feedback can be both accurate and instructionally meaningful.

Conclusion

The present study examined artificial intelligence–based approaches to the development of lexical competence among non-philological learners and highlighted their pedagogical potential in modern language education. The findings demonstrate that AI-driven tools significantly enhance vocabulary acquisition by providing personalized, adaptive, and context-sensitive learning environments tailored to learners' academic and professional needs.

AI-based systems proved particularly effective in supporting the acquisition of profession-oriented and academic vocabulary, which is essential for non-philological learners who require functional language skills rather than comprehensive linguistic mastery. The integration of

adaptive learning platforms, intelligent tutoring systems, natural language processing tools, and conversational agents facilitated both receptive and productive lexical competence while increasing learner engagement and autonomy.

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