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AI-ASSISTED DEVELOPMENT OF ACADEMIC TERMINOLOGICAL COMPETENCE IN ENGLISH FOR ACADEMIC PURPOSES

This article examines the effectiveness of using generative artificial intelligence tools in developing the academic terminological competence of students learning English for academic purposes. The relevance of this research stems from the digital transformation of higher education, the growing importance of academic literacy, and the need to improve methods for teaching specialist terminology against the backdrop of the widespread adoption of AI technologies. The aim of the study was to assess the pedagogical potential of generative artificial intelligence for developing skills in understanding, interpreting and correctly using academic terminology in scholarly communication. The study was conducted using a mixed-methods approach, combining quantitative and qualitative methods of analysis. The experiment involved 68 undergraduate and postgraduate students enrolled in EAP programs. Empirical data were collected through pre- and post-tests, questionnaires, semi-structured interviews and an analysis of the students' interactions with AI tools. The results obtained indicate a measurable increase in academic terminological competence, an improvement in the quality of academic writing, an expansion of vocabulary, and the development of self-directed learning skills. The most notable positive changes were observed in the use of academic terminology in the context of academic writing and professional communication. The study also revealed a high level of acceptance of AI technologies among students and their positive impact on motivation to learn. At the same time, it highlighted the need to develop AI literacy, critical thinking and the ability to verify the accuracy of automatically generated information. It has been concluded that generative artificial intelligence can serve as an effective component of the modern educational ecosystem, provided it is integrated in a pedagogically sound manner and supported by active methodological guidance from the teacher.

Keywords: artificial intelligence, generative artificial intelligence, academic terminology, academic terminological competence, English for academic purposes, academic writing, academic literacy.

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Академиялық мақсаттағы ағылшын тілінде академиялық терминологиялық құзыреттілікті жасанды интеллект көмегімен дамыту

Бұл мақала академиялық мақсатта ағылшын тілін оқитын студенттердің академиялық терминологиялық құзыреттілігін дамытуда генеративті жасанды интеллект құралдарын қолданудың тиімділігін зерттейді. Бұл зерттеудің өзектілігі жоғары білім берудің цифрлық трансформациясынан, академиялық сауаттылықтың өсіп келе жатқан маңыздылығынан және жасанды интеллект технологияларын белсенді енгізу мәнісінде мамандандырылған терминологияны оқыту әдістерін жетілдіру қажеттілігінен туындайды. Зерттеудің мақсаты – студенттердің ғылыми коммуникацияда академиялық терминологияны түсіну, интерпретациялау және дұрыс қолдану дағдыларын дамытуда генеративті жасанды интеллекттің педагогикалық әлеуетін бағалау. Зерттеу сандық және сапалық талдау әдістерін біріктіретін аралас әдістеме негізінде жүргізілді. Экспериментке ЕАП бағдарламалары бойынша білім алатын бакалавриат пен магистратураның 68 білім алушысы қатысты. Эмпирикалық деректер алдын ала және соңғы тестілеу, сауалнама, жартылай құрылымдалған сұхбат және студенттердің жасанды интеллект құралдарымен өзара әрекеттесуін талдау арқылы жиналды. Нәтижелер академиялық терминологиялық құзыреттіліктің айқын өсуін, академиялық жазу сапасының жақсаруын, сөздік қорының кеңеюін және өзін-өзі басқару оқу дағдыларының дамуын көрсетеді. Ең маңызды оң

коммуникация үдерісінде академиялық терминологияны орынды әрі дәл қолдану барысында байқалды. Зерттеу нәтижелері білім алушылардың жасанды интеллект технологияларын жоғары деңгейде қабылдайтынын және олардың оқу мотивациясын арттыруға оң ықпал ететінін көрсетті. Сонымен қатар, жасанды интеллект сауаттылығын (AI literacy), сыни ойлау дағдыларын және жасанды интеллект негізінде автоматты түрде генерацияланған ақпараттың сенімділігі мен дәлдігін бағалай білу құзыреттерін дамыту қажеттілігі анықталды. Зерттеу нәтижелері генеративті жасанды интеллект педагогикалық тұрғыдан негізделген түрде білім беру үдерісіне кіріктіріліп, оқытушы тарапынан мақсатты әдістемелік қолдау қамтамасыз етілген жағдайда, қазіргі жоғары білім беру жүйесінің тиімді құрамдас бөлігі бола алатынын көрсетті.

Түйін сөздер: жасанды интеллект, генеративті жасанды интеллект, академиялық терминология, академиялық терминологиялық құзыреттілік, академиялық мақсаттағы ағылшын тілі, академиялық жазу, академиялық сауаттылық.

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Развитие академической терминологической компетенции в английском языке для академических целей с применением искусственного интеллекта

Статья посвящена исследованию эффективности использования инструментов генеративного искусственного интеллекта при формировании академической терминологической компетенции студентов, изучающих английский язык для академических целей. Актуальность исследования обусловлена цифровой трансформацией высшего образования, ростом значимости академической грамотности и необходимостью совершенствования методов обучения специализированной терминологии в условиях активного внедрения AI-технологий. Цель исследования заключалась в оценке педагогического потенциала генеративного искусственного интеллекта для развития навыков понимания, интерпретации и корректного использования академической терминологии в научной коммуникации. Исследование выполнено с использованием смешанного метода, объединяющего количественные и качественные методы анализа. В эксперименте приняли участие 68 студентов бакалавриата и магистратуры, обучавшихся по программам ЕАР. Эмпирические данные были получены посредством входного и итогового тестирования, анкетирования, полу структурированных интервью и анализа взаимодействия обучающихся с AI-инструментами. Полученные результаты свидетельствуют о заметном повышении уровня академической терминологической компетенции, улучшении качества академического письма, расширении словарного запаса и развитии навыков самостоятельного обучения. Наиболее заметные положительные изменения были зафиксированы при использовании академической терминологии в контексте научного письма и профессиональной коммуникации. Исследование также показало высокий уровень принятия AI-технологий студентами и их положительное влияние на мотивацию к обучению. Вместе с тем выявлена необходимость развития AI literacy, критического мышления и навыков проверки достоверности автоматически генерируемой информации. Сделан вывод о том, что генеративный искусственный интеллект способен выступать эффективным компонентом современной образовательной экосистемы при условии его педагогически обоснованной интеграции и активного методического сопровождения со стороны преподавателя.

Ключевые слова: искусственный интеллект, генеративный искусственный интеллект, академическая терминология, академическая терминологическая компетенция, английский язык для академических целей, академическое письмо, академическая грамотность.

Introduction

The rapid development of artificial intelligence technologies is having a significant impact on modern education, transforming approaches to foreign language teaching, the development of academic literacy and the acquisition of professional terminological competence. Against the backdrop of the

digitalization of higher education, the use of AI tools for mastering academic terminology – which is an integral part of successful scholarly communication, academic writing and research activities – is becoming particularly relevant. A command of academic terminology enables students to effectively comprehend scholarly texts, engage in professional discourse, publish research findings in international

academic journals and integrate into the global academic community.

In recent years, artificial intelligence has ceased to be viewed solely as a technological innovation and has become an important pedagogical tool for personalized learning. Modern generative models, intelligent language assistants and adaptive learning platforms are capable of automatically selecting learning materials, explaining the meaning of specialist terms, providing contextual examples of their use, generating exercises of varying levels of difficulty, and providing instant feedback to learners. Such opportunities make it possible to significantly improve the effectiveness of academic vocabulary acquisition and help students to become more independent in their learning (Woo & Choi, 2021).

Foreign researchers have made a significant contribution to research into the application of artificial intelligence in education. For example, Rosemary Luckin (Luckin, 2018) views artificial intelligence as a means of providing intellectual support for the educational process and emphasizes its potential for creating personalized learning pathways. Wayne Holmes (Holmes, 2021) emphasizes the need for the pedagogically sound implementation of AI technologies and for equipping learners with the skills to engage critically with intelligent systems.

Charles Fadel (Fadel et al., 2015) and Andreas Schleicher (Schleicher, 2018) have also made a significant contribution to the development of the concept of the digital transformation of education, viewing the development of 21st-century skills as the foundation for training the professionals of the future. Recent research shows that AI tools significantly boost learners' motivation, enable personalized learning and facilitate more effective mastery of professional and academic terminology.

The acquisition of academic terminology is a complex cognitive process that involves not only learning the meanings of specialized terms, but also understanding their conceptual relationships, how they function in various academic discourses, their typical collocations and their pragmatic characteristics. In this context, academic terminological competence is regarded as one of the key components of students' academic literacy and professional communicative competence. A study by Averil Coxhead (2000) on the development of the Academic Word List (AWL) demonstrated that mastery of academic vocabulary is one of the most important factors in successfully understanding academic texts and academic writing. Subsequently, Gardner and Davies (2014), using corpus linguistics methods, developed

the Academic Vocabulary List (AVL), which reflects the contemporary use of academic vocabulary across various academic disciplines. These studies have formed the methodological basis for contemporary approaches to the teaching of academic terminology and are actively utilized in the development of intelligent educational systems (Holmes & Tuomi, 2022).

The emergence of generative artificial intelligence has significantly expanded the possibilities for developing academic terminological competence. Modern large language models are capable of automatically explaining the meaning of terms, generating examples of their usage in various academic contexts, adapting the complexity of learning materials to learners' proficiency levels, creating tasks of varying levels of difficulty, and providing prompt, personalized feedback. As noted by Kasnici et al. (2023), generative artificial intelligence is capable of acting as an intelligent educational assistant that supports students' independent learning; however, its use must be accompanied by the development of critical thinking and the ability to verify the accuracy of the information received. Labadze, Grigolia and Machaidze (2023) reach similar conclusions, emphasizing the high potential of AI chatbots for personalized learning, provided they are integrated into the educational process in a pedagogically sound manner.

Recent research emphasizes that the effectiveness of artificial intelligence is determined not by the technological capabilities of the systems themselves, but by the quality of their pedagogical design. Holmes and Tuomi (2022) suggest viewing AI as a component of the educational ecosystem, in which intelligent technologies should contribute to the development of learners' thinking, independence and academic autonomy, rather than replacing human educational activities. The authors emphasize the need to develop AI literacy, which includes the ability to critically evaluate the results produced by intelligent systems, understand the limitations of algorithms and use them consciously in educational and research activities.

The development of artificial intelligence is intrinsically linked to the concept of 21st-century competences. According to the Four-Dimensional Education model proposed by Charles Fadel, Maya Bialik and Bernie Trilling (2015), the modern education system must ensure the comprehensive development of knowledge, skills, personal qualities and metacognitive abilities, enabling graduates to function effectively in the digital economy. Andreas

Schleicher (2018), analyzing the results of international OECD studies, notes that the competitiveness of graduates is determined not by the volume of information they have acquired, but by their ability to apply knowledge in new situations, think critically, collaborate, use digital technologies and engage in continuous learning. It is precisely these skills that are now regarded as the foundation for training specialists for the knowledge society and an economy based on artificial intelligence.

For the Republic of Kazakhstan, this issue is of particular relevance in the context of the digital transformation of higher education, the internationalization of universities and the integration of domestic science into the global academic community. According to the Concept for the Development of Higher Education and Science in the Republic of Kazakhstan for 2023-2029, one of the priority areas is the introduction of digital educational technologies, the development of research competencies and the improvement of the quality of training for specialists capable of working effectively in the digital economy. Issues relating to the modernization of language education and the development of academic competences in the context of internationalization are consistently addressed in the works of S.S. Kunanbayeva (2013; 2022), who justifies the need to transition to a competence-based model of professional training, focused on the development of academic communication, learner autonomy and the integration of modern digital technologies into the process of foreign language learning. Contemporary research by Kazakhstani academics on the use of artificial intelligence in higher education is also of considerable interest. For instance, N.T. Shyngyssova, E.I. Dudinova and M.O. Negizbaeva (2025) note that the successful integration of AI into the educational process requires the development of AI literacy, critical thinking and digital competences among both students and lecturers. Similar conclusions are presented in the study by Kurakbayeva and Xembayeva (2025), which demonstrates that digital educational technologies contribute to the development of professional competences, student autonomy and the enhancement of the effectiveness of the educational process at Kazakhstani universities.

Materials and methods

This study was conducted using a mixed-methods approach, combining quantitative and qualitative methods of analysis, which enables a compre-

hensive assessment of the effectiveness of artificial intelligence tools in the acquisition of academic English terminology by students at higher education institutions. The use of a mixed-methods approach stems from the need not only to measure changes in the level of students' academic terminological competence, but also to identify the characteristics of their interaction with AI tools and to determine the advantages and limitations of using generative artificial intelligence in the educational process.

The theoretical framework of the study was based on contemporary concepts of academic literacy, terminological competence, personalized learning and the pedagogically sound application of artificial intelligence in education. The methodological framework was based on the competence-based, communicative, cognitive and activity-based approaches, which view the acquisition of academic terminology as a process of developing the ability to understand, interpret and correctly use specialized vocabulary in various forms of academic and professional communication.

The study involved 68 undergraduate and postgraduate students studying English for Academic Purposes (EAP), as well as those enrolled in degree programs that involve the preparation of academic publications in English. Participants were selected using purposive sampling, which allowed the study to include respondents with a comparable level of English proficiency who were interested in developing their academic terminological competence. All participants were informed in advance of the aims of the study and gave their voluntary consent to take part in the experiment in accordance with the principles of academic ethics.

Modern generative artificial intelligence systems and intelligent language platforms, which enable interactive work with academic terminology, were used as the primary educational tools. AI tools were used to explain the meanings of specialized terms, create contextualized examples of their usage, automatically generate exercises of varying degrees of difficulty, develop thematic glossaries, check the correct use of terms in written work, and provide personalized feedback. The use of several intelligent services made it possible to compare their functional capabilities and identify the most effective strategies for developing academic terminological competence.

Empirical data were collected using a range of complementary methods. At the initial stage, diagnostic testing was carried out to determine the

baseline level of proficiency in academic terminology. The test tasks included defining the meanings of terms, selecting the correct contexts for their use, analyzing terminological collocations, academic writing tasks, and the application of specialized vocabulary in academic discourse. Following the completion of the experimental training, a final assessment was carried out, the structure of which corresponded to the initial diagnostic assessment, thereby ensuring the comparability of the results obtained.

An additional source of data was provided by questionnaires and semi-structured interviews, which aimed to identify students' attitudes towards the use of artificial intelligence in the process of learning academic terminology, their level of satisfaction with their learning, the perceived usefulness of AI tools, and the difficulties they encountered when using them. To obtain a more objective picture, we also analyzed automatically recorded data on students' interactions with intelligent educational systems, including their query history, the nature of the tasks completed and patterns of feedback usage.

Quantitative data were analyzed using descriptive statistical methods to determine mean values, standard deviations and indicators of improvement in learning outcomes. Comparative analysis was used to assess differences between the results of the pre-test and post-test. Qualitative data obtained through interviews and the analysis of participants' open-ended responses were subjected to thematic analysis, which made it possible to identify the main categories characterizing the use of artificial intelligence in the study of academic terminology, as well as to determine the most significant pedagogical advantages and limitations of the technology in question.

To ensure the validity of the research findings, methodological triangulation was employed, involving the comparison of data obtained using various research methods. The reliability of the interpretation of the results was ensured using validated diagnostic materials, standardized criteria for assessing academic terminological competence, and a comprehensive analysis of both quantitative and qualitative data. This research design made it possible to comprehensively assess the impact of AI tools on the development of students' academic terminological competence and to identify promising avenues for their integration into the practice of teaching English for academic purposes.

Literature review

The development of generative artificial intelligence has become one of the most significant factors driving the transformation of modern language education. Research in recent years indicates that AI is gradually moving beyond the scope of traditional computer-assisted language learning (CALL) systems and is becoming an intelligent tool capable of supporting personalized learning, fostering students' academic autonomy and providing continuous feedback. Of particular interest is the use of generative language models in teaching English for Academic Purposes, as they are capable of considering learners' individual levels of proficiency and adapting the learning content to their educational needs.

Recent research into the acquisition of academic vocabulary shows that the effectiveness of developing terminological competence is determined not only by the number of terms learnt, but also by the depth of their semantic understanding, the ability to use them in various communicative situations, and to integrate them into academic discourse. Nagy and Townsend (2012) view academic vocabulary as a tool for developing academic literacy, emphasizing that the successful acquisition of terminology requires its regular use in reading, writing and academic communication. This approach is consistent with contemporary principles of teaching English for academic purposes, which focus on the development of functional language competence.

The use of artificial intelligence as a tool for vocabulary development is of considerable interest. Alharbi and Khalil (2023) note that AI systems help to boost students' motivation through the provision of instant feedback, interactive engagement and personalized recommendations. The authors emphasize that intelligent language models can significantly reduce the time spent searching for information and make the process of learning academic vocabulary more flexible and self-directed. Similar findings are presented in the study by Wang et al. (2024), which suggests that the use of AI tools has a positive impact on the quality of academic vocabulary acquisition, the development of self-directed learning skills and the long-term retention of new terms.

Research into generative artificial intelligence in language education occupies a prominent place in contemporary academic literature. Law (2024), having reviewed current research on the application of Generative AI in foreign language teaching, concludes that the most promising areas are

the automatic generation of teaching materials, the adaptation of tasks to learners' levels, intelligent support for written language, and the development of academic communication. At the same time, the author notes a lack of empirical research specifically devoted to the teaching of specialized academic terminology.

A systematic review by Ogunleye et al. (2024), covering more than three hundred studies, demonstrates a rapid increase in academic interest in the use of generative artificial intelligence in higher education. The authors conclude that the most effective areas of application for GenAI are personalized learning, automated feedback, intelligent teaching support and the development of adaptive educational resources. At the same time, they emphasize the need for further research into the effectiveness of AI in the study of specific linguistic components, including academic terminology.

Researchers are paying close attention to the use of ChatGPT and other large language models in English language teaching. Lo, Yu, Xu and Jong (2024), having analyzed seventy empirical studies, found that generative artificial intelligence contributes to the development of writing skills, the expansion of vocabulary, an improvement in the quality of academic writing, and increased learner engagement. At the same time, the authors highlight the need to foster a critical approach to automatically generated content, as inaccuracies, factual errors and a reduction in students' independence are possible.

Studies focusing specifically on the study of vocabulary using artificial intelligence deserve special attention. Ngo (2024) notes that ChatGPT provides an effective combination of deliberate and incidental vocabulary acquisition through the explanation of word meanings, the generation of contextual examples and the facilitation of dialogue-based interaction. The author concludes that AI is capable of significantly enhancing the effectiveness of academic vocabulary learning compared to traditional electronic dictionaries and reference resources; however, it requires pedagogical support and the development of learners' information literacy.

The most recent systematic review by Simonnet, Loiseau and Lavoué (2025), on vocabulary learning technologies, shows that digital intelligent tools significantly improve the quality of specialized terminology acquisition through a combination of adaptive learning, spaced repetition, automated

knowledge assessment and personalized analysis of learning outcomes. The authors emphasize the need for further experimental research to quantitatively assess the impact of AI on the development of academic terminological competence among university students.

Thus, an analysis of the current literature indicates that generative artificial intelligence holds significant potential for English language learning and the development of academic vocabulary. At the same time, most existing studies focus on the general development of language skills, the use of ChatGPT in academic writing, or foreign language learning in general. The issues surrounding the development of academic terminological competence through generative artificial intelligence in English for Academic Purposes courses remain under-researched, which highlights the relevance and scientific novelty of this study.

Results and discussion

The study conducted a comprehensive assessment of the effectiveness of using artificial intelligence tools in developing academic terminological competence among students learning English for academic purposes. Analysis of quantitative and qualitative data showed that the integration of generative AI tools has a positive impact on the acquisition of academic terminology, the development of skills in working with academic texts, and the enhancement of students' academic autonomy.

In the first stage of the study, the results of the pre-test and post-test, designed to assess the level of proficiency in academic terminology, were compared. The diagnostic tasks included defining the meanings of terms, selecting the correct academic context, analyzing terminological collocations, using specialized vocabulary in academic writing, and interpreting terms in various academic genres.

The results obtained indicate a positive trend across virtually all the indicators assessed. The most marked improvement was observed in tasks requiring the use of terminology in the context of academic writing and scientific communication, whilst the smallest changes were recorded in tasks involving the recognition of individual terms without contextual support. This supports the hypothesis that AI is most effective in fostering functional mastery of academic terminology, rather than the mere memorization of lexical items.

Table 1*Results of the initial and final tests of academic terminological competence*

Indicator	Before learning(%)	After learning (%)	Increase (%)
Understanding academic terminology	61,8	84,6	22,8
Use of terms in context	58,4	83,1	24,7
Academic collocations	56,9	80,8	23,9
Academic writing	54,7	81,6	26,9
Average overall score	57,9	82,5	24,6

Note. The table was prepared by the authors

As can be seen from Table 1, the overall level of academic terminological competence increased by a quarter. A particularly marked improvement was observed in academic writing, where the use of AI enabled students to receive immediate feedback on their choice of terminology, stylistic correctness and adherence to the norms of academic English. This result can be explained by the fact that modern generative models ensure that terms are repeated multiple times in various communicative situations, which aligns with the cognitive mechanisms involved in the long-term acquisition of new vocabulary.

The findings are consistent with the research by Dwivedi et al. (2023), who note that generative artificial intelligence is capable of significantly improving the quality of the educational process through personalized learning, intelligent support for learners and automated feedback. The authors emphasize that AI is most effective precisely when performing complex cognitive tasks related to information analysis, academic writing and the development of professional communication skills.

The analysis also revealed that the use of generative artificial intelligence had significantly altered the nature of students' independent study. Whilst at the initial stage most participants limited themselves to using traditional electronic dictionaries and search engines; after completing the experimental training, students turned to AI much more frequently to clarify specialist terms, generate examples of their usage, check their own texts and prepare academic essays. Artificial intelligence has thus come to function as an interactive educational assistant, supporting the learning process at virtually every stage.

Of particular interest is the change in the quality of terminology use in students' written work. An analysis of the final academic essays revealed a marked increase in the variety of academic vocabulary, a reduction in the number of terminologi-

cal errors, and a more confident use of established academic phrases. Whilst prior to the start of the study many students used academic terms in isolation; after completing the course they used them significantly more often as part of typical academic constructions, which indicates the development of discursive competence.

These findings are consistent with those of Moorhouse, Yeo and Wan (2023), who note that ChatGPT and similar large language models are capable of significantly improving the quality of academic writing by generating contextualized recommendations and explanations. At the same time, the researchers emphasize that the maximum educational benefit is achieved only with active pedagogical support, where the teacher acts not only as a source of knowledge but also as a moderator of students' interactions with intelligent systems.

Further analysis showed that AI tools proved particularly effective when studying multi-component terms and terminological phrases. Most students noted that traditional dictionaries often provide only a literal definition of a term, whereas generative artificial intelligence is capable of explaining the nuances of its usage, providing examples from academic discourse, comparing different usage variants and adapting explanations to the learner's level of proficiency. This significantly facilitated their understanding of specialist literature and the preparation of their own academic texts.

At the same time, the study identified a number of issues relating to the use of artificial intelligence. Despite the high accuracy of most responses, some AI systems occasionally generated definitions of specialised terms that were not entirely correct, or provided examples that were not relevant to the specific academic field. Such instances were more frequently observed when dealing with highly specialised terminology characteristic of specific fields of

knowledge. In light of this, lecturers are advised to help students develop the skills to critically evaluate automatically generated information and to ensure that terminological definitions are verified against authoritative academic sources.

The findings confirm the conclusions of Tlili et al. (2023), according to which the implementation of generative artificial intelligence must be accompanied by the development of AI literacy, academic integrity and digital literacy. The authors emphasise that the effectiveness of AI is determined not by the technical characteristics of the system, but by the quality of the instructional design, the level of digital competence among teachers and the development of critical thinking skills among learners.

It should be noted that the most significant improvements were observed among students with an intermediate level of English. This is likely due to the fact that students in this category already possess a sufficient linguistic foundation to comprehend complex academic information, but still experience difficulties when using specialist terminology independently. In this case, generative artificial intelligence acts as an effective bridge between theoretical knowledge and its practical application.

An interesting observation was the change in the nature of the students' learning activities. Whilst at the initial stage of the study the majority of participants used AI primarily to look up definitions of terms, by the end of the experiment there had been a significant increase in the proportion of students who used intelligent systems to analyse academic articles, edit their own texts, compile subject-spe-

cific glossaries and prepare presentations. This indicates a gradual shift from the passive consumption of information to the active use of artificial intelligence as a tool for academic work.

Thus, the results of the quantitative analysis provide compelling evidence that the use of generative artificial intelligence contributes to the development of academic terminological competence, improves the quality of academic writing, and fosters a higher level of student autonomy. At the same time, the limitations identified confirm the need for the pedagogically sound integration of AI into the educational process and for the development of students' skills in critically engaging with intelligent systems.

In addition to analysing the test results, particular attention was paid to examining students' attitudes towards the use of generative artificial intelligence in the process of learning academic terminology. The questionnaire survey revealed that the majority of participants viewed the use of AI tools in the learning process positively and expressed a willingness to use them in their future study of English for academic purposes.

The data obtained suggests that students view artificial intelligence not as a replacement for a lecturer, but as an additional educational resource that provides immediate support during self-directed learning. The most sought-after AI functions were explaining the meaning of academic terms, checking their correct usage, editing academic texts, and generating examples of how specialised vocabulary is used in an academic context.

Table 2

Results of the student questionnaire following the completion of the pilot teaching program

Question on the questionnaire	Completely agree (%)	Tend to agree (%)	Found it difficult to answer (%)	Disagree (%)
AI makes it easier to understand academic terms	66,2	29,4	2,9	1,5
AI boosts motivation to learn English	61,8	30,9	4,4	2,9
AI helps with writing academic texts	70,6	23,5	4,4	1,5
AI facilitates self-directed learning	73,5	20,6	4,4	1,5
AI should be used in EAP classes	75,0	19,1	4,4	1,5

Note. The table was prepared by the authors

As shown in Table 2, over 95 per cent of respondents rated the potential of artificial intelligence for learning academic terminology positively. The highest scores were recorded for questions relating

to the development of self-directed learning and the appropriateness of integrating AI into English for Academic Purposes courses. This indicates a high level of acceptance of new digital technologies

among learners and confirms trends observed in international educational practice.

It is worth noting that many students highlighted the psychological comfort they felt when working with natural language processing models. The ability to ask questions repeatedly without fear of making a mistake, to receive instant explanations and to complete additional exercises helped to reduce language anxiety. This effect was particularly pronounced among students who experienced difficulties in using academic vocabulary in both spoken and written language.

At the same time, the interview results indicate that students have a fairly mature attitude towards the use of generative artificial intelligence. Most participants understood that automatically generated answers require further verification, particularly when working with academic publications and spe-

cialist terminology. A significant proportion of students reported that, after receiving an AI-generated answer, they would cross-check the definitions of terms against academic dictionaries, academic articles or their lecturer's recommendations.

These findings are consistent with the conclusions of Cotton, Cotton and Shipway (2024), according to whom generative artificial intelligence becomes an effective educational tool only if students possess well-developed critical thinking skills and the ability to assess the reliability of information. The authors emphasize that AI should not be regarded as a source of definitive answers but should be used as a means of providing intellectual support for educational activities.

Further analysis of logs recording students' interactions with AI has made it possible to identify the most sought-after features of intelligent systems

Table 3

The most sought-after AI functions when studying academic terminology

AI function	Frequency of use (%)	Performance rating (on a 5-point scale)
Explanation of the meaning of the terms	94,1	4,8
Generating usage examples	89,7	4,7
Academic writing assessment	86,8	4,8
Creating exercises	76,5	4,5
Compilation of subject-specific glossaries	72,1	4,4
Translation of specialist terminology	67,6	4,3

Note. The table was prepared by the authors

As can be seen from Table 3, the functions most in demand were those directly related to the development of academic terminological competence. The explanation of terms and the checking of academic writing received particularly high ratings. This suggests that generative artificial intelligence is used most effectively not for finding ready-made answers, but as a tool to support the learning process.

It should be noted that the use of AI has changed the nature of students' engagement with academic texts. Whereas previously most students confined themselves to translating individual terms, following the conclusion of the experiment there was a significant increase in the proportion of students who analyzed the specific features of how terminology functions across various genres of academic discourse, compared how different authors used terms,

and independently compiled thematic terminology databases.

The findings are consistent with the research by Lim et al. (2023) on the educational potential of generative artificial intelligence. The authors note that the greatest educational impact is achieved when AI is used as a tool to support students' research activities, fostering the development of analytical thinking, reflection and academic independence.

Despite the generally positive trend, the study identified a number of limitations in the use of artificial intelligence. Firstly, the quality of the AI's responses depended significantly on the wording of the user's prompt. Prompts that were not specific enough often resulted in the generation of superficial or overly general explanations of academic terms. Secondly, when dealing with highly specialized ter-

minology in specific scientific fields, terminological inaccuracies were sometimes observed, requiring additional expert verification.

Furthermore, some students were initially inclined to place unquestioning trust in automatically generated answers. Following specialized sessions on developing AI literacy, the number of such instances decreased significantly. This confirms the need to incorporate elements of training in the responsible use of artificial intelligence into university students' study programs.

Another important finding of the study was the changing role of the teacher in the educational process. The use of generative artificial intelligence did not diminish the teacher's importance; on the contrary, it strengthened their role as an organizer of learning activities, a consultant and an expert in assessing the quality of information. Teachers increasingly took on the role of facilitators, guiding students as they worked with intelligent educational systems.

The findings are consistent with UNESCO's (2023) concept, according to which artificial intelligence should enhance human capabilities rather than replace pedagogical interaction. Miao, Holmes, Huang, and Zhang (2021) take a similar position, emphasizing that the successful integration of AI into education is impossible without changing pedagogical approaches and developing new digital competencies among teachers.

It should be emphasized that this study has certain limitations. First, the experiment was conducted as part of a single "English for Academic Purposes" course; therefore, the results obtained require further verification using larger samples of students from various fields of study. Second, the duration of the experimental instruction did not allow for an assessment of the long-term retention of the acquired terminological competence. Third, the study focused primarily on generative language models and did not cover the capabilities of specialized intelligent systems designed exclusively for terminology learning.

Despite these limitations, the study's findings have significant practical implications. They demonstrate that the pedagogically sound integration of generative artificial intelligence contributes to the development of academic terminological competence, the improvement of academic writing, the formation of independent research skills, and an increase in students' motivation to learn English for academic purposes.

Thus, the results of the quantitative and qualitative analyses confirm the effectiveness of using AI tools in teaching academic terminology. The most significant positive changes were observed in students' understanding of terminology, their use of specialized vocabulary in academic writing, the development of self-directed learning skills, and the cultivation of academic autonomy. At the same time, the success of generative artificial intelligence depends not only on the functional capabilities of the technologies used, but also on the quality of pedagogical support, the students' level of AI literacy, and their ability to critically evaluate the results produced by intelligent systems. This allows us to view generative artificial intelligence as a promising component of the modern educational ecosystem, contributing to the improvement of the quality of student preparation for academic and research activities.

Conclusion

This study aimed to evaluate the effectiveness of using artificial intelligence tools in developing academic terminology competence among students learning English for academic purposes. The results suggest that the pedagogically sound integration of generative AI tools contributes to a significant improvement in the quality of academic terminology acquisition, the development of academic literacy, the refinement of academic writing skills, and the fostering of students' independence in the process of learning a foreign language.

The results of the quantitative analysis showed positive trends across all indicators studied. Upon completion of the experimental training, an increase in the level of understanding of academic terms was observed, along with more confident use of specialized vocabulary in written and oral academic communication, as well as an improvement in students' ability to correctly apply terminological units in various academic contexts. Particularly noticeable progress was observed in tasks related to academic writing and the use of terminological collocations, which indicates the positive impact of generative artificial intelligence not only on the acquisition of individual terms but also on the development of functional academic competence.

A qualitative analysis of the data collected through surveys, interviews, and observations of students' interactions with AI systems confirmed a high level of acceptance of intelligent educational

technologies among students. Most participants noted that the use of artificial intelligence helped them understand the meanings of complex academic terms more quickly, provided contextualized examples of their usage, allowed them to correct errors in a timely manner, and helped them organize their independent work more effectively. At the same time, the study showed that the success of AI implementation directly depends on students' developed skills in critically analyzing information, their ability to correctly formulate queries, and their capacity to verify the accuracy of automatically generated answers.

The results confirm the current trend of shifting from the use of artificial intelligence solely as a technical tool for automating specific educational processes to viewing it as an intellectual component of the educational ecosystem. When integrated effectively into teaching, generative language models can serve as personalized educational assistants, ensuring that learning materials are tailored to students' individual needs, providing continuous feedback, and supporting the development of academic autonomy. At the same time, the study showed that artificial intelligence does not replace the instructor but rather transforms their professional role. In today's context, the instructor becomes an organizer of the educational environment, a consultant, an expert, and a facilitator who guides students in the meaningful use of intelligent technologies.

The practical significance of this study lies in the potential to apply the findings in the development of English for Academic Purposes courses, academic literacy programs, courses in academic writing and professional communication, as well as in the design of digital educational resources for universities. The developed approach can be adapted for various fields of study where the successful mastery of academic terminology is a prerequisite for professional education, research, and publishing. Furthermore, the research findings can be used to prepare instructors to work with generative artificial intelligence, to develop recommendations for fostering AI literacy, and to improve methodologies for applying intelligent technologies in higher education.

Despite the positive results obtained, the study has certain limitations. The experiment was conducted on a limited sample of students enrolled in English for Academic Purposes programs, which calls for caution when generalizing the findings to other categories of learners. Furthermore, the dura-

tion of the study did not allow for an assessment of the long-term sustainability of the developed academic terminological competence or for tracking the retention of the achieved results over a longer period. Further study is also needed on the specifics of using generative artificial intelligence in mastering highly specialized terminology in specific academic disciplines, as well as on the impact of various AI models on the quality of academic writing, scientific translation, and professional communication.

Future research opportunities include conducting multicenter comparative experiments at universities in various countries, expanding the study's participant pool, and applying more sophisticated statistical methods to analyze the effectiveness of AI tools. It seems appropriate to study the impact of various generative AI models on specific components of academic terminological competence, to identify optimal pedagogical strategies for integrating them into the educational process, and to develop models for fostering AI literacy that ensure the responsible, ethical, and critically informed use of intelligent technologies by students and instructors. Of particular interest is the study of the possibilities for combining generative artificial intelligence with corpus linguistics, intelligent systems for the automatic assessment of academic writing, and adaptive educational platforms focused on personalized learning.

Thus, the results of this study confirm that generative artificial intelligence has significant potential for improving English language learning for academic purposes and for developing students' academic terminology competence. The effectiveness of AI use is determined not only by the technical capabilities of intelligent systems, but above all by the quality of their pedagogical integration, methodological support, and the development of critical thinking, academic integrity, and digital literacy among learners. A comprehensive combination of modern AI technologies with scientifically grounded teaching methods makes it possible to significantly improve the quality of students' language training, expand the possibilities for personalized learning, and create conditions for the successful integration of future professionals into the international academic and professional community.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

Zh. Kulekenova developed the research concept, designed the methodology, and prepared the original draft of the article; A. Tazhenova collected and systematized the material and conducted the data

analysis; M. Serikbay was responsible for visualization, validation of the results, and participation in the discussion; S. Suleimenova coordinated the research process, and edited the final version of the manuscript.

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