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INTEGRATION OF PROJECT-BASED LEARNING AND ARTIFICIAL INTELLIGENCE TECHNOLOGIES IN FOREIGN LANGUAGE TRAINING OF HIGHER EDUCATION STUDENTS

ІНТЕГРАЦІЯ ПРОЄКТНОГО НАВЧАННЯ ТА ТЕХНОЛОГІЙ ШТУЧНОГО ІНТЕЛЕКТУ В ІНШОМОВНІЙ ПІДГОТОВЦІ ЗДОБУВАЧІВ ВИЩОЇ ОСВІТИ

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The purpose of this article is to identify effective mechanisms for integrating project-based learning and artificial intelligence (AI) technologies in the development of foreign language communicative competence among higher education students. The article highlights the role of artificial intelligence as a systemic factor in transforming the educational environment, leading to changes in traditional learning models, particularly within foreign language education, and to a re-conceptualisation of the teacher’s role as a facilitator, moderator and consultant in the organisation of learning activities.

The integration of project-based learning with artificial intelligence tools is conceptualised as a didactically grounded approach that combines language practice with the development of critical thinking, research skills and learner autonomy. In this context, particular attention is given to various types of project activities, including information-research, analytical problem-based, practice-oriented and interdisciplinary projects. Such activities promote the use of foreign language resources within a meaningful communicative environment and integrate linguistic practice with analytical and cognitive engagement.

Special emphasis is placed on the functional role of artificial intelligence technologies, notably intelligent language models, adaptive learning platforms, automated feedback systems and digital assistants, which contribute to enhancing the quality of the educational process, optimising communication and supporting the individualisation of learning. The study demonstrates that the use of AI tools in the form of analytical tasks, mini-projects and personalised learning assignments facilitates the development of academic argumentation, critical analysis, and conscious language choice, while maintaining the learner’s central role in the acquisition of foreign language knowledge.

The article also addresses methodological aspects of implementing digital technologies in foreign language training and emphasises the importance of systematic pedagogical support and a differentiated approach to task design. Such an approach ensures the conscious use of linguistic resources and increases the effectiveness of integrating AI technologies into project-based activities.

In conclusion, the combination of project-based learning and artificial intelligence technologies constitutes a holistic linguodidactic model aimed at developing professionally oriented, cognitive, and intercultural skills among higher education students. This integrated approach enhances the effectiveness of the educational process and supports the development of foreign language communicative competence within the context of the digital transformation of higher education.

Key words: project-based learning, artificial intelligence, foreign language communicative competence, language education, critical thinking.

Метою статті є визначення ефективних лінгводидактичних методів поєднання проєктного навчання та технологій штучного інтелекту (ШІ) для формування іншомовної комунікативної компетентності здобувачів вищої освіти. У статті висвітлюється роль ШІ як системного чинника трансформації освітнього середовища, що обумовлює зміну традиційних моделей навчання, зокрема у сфері іншомовної підготовки, та переосмислення ролі викладача як фасилітатора, модератора й консультанта в процесі організації навчальної діяльності.

Розглянуто інтеграцію проєктного навчання з інструментами ШІ як дидактично обґрунтований метод, що поєднує мовну практику з розвитком критичного мислення, дослідницьких умінь та автономності здобувачів освіти. У цьому контексті акцент робиться на різні види проєктної діяльності: інформаційно-дослідницькі, аналітико-проблемні, практико-орієнтовані та міждисциплінарні проєкти, що забезпечують використання іншомовних ресурсів у змістовному комунікативному середовищі та поєднують мовну практику з аналітичною та пізнавальною діяльністю.

Окремо висвітлюється функціональна роль технологій ШІ, зокрема інтелектуальних мовних моделей, адаптивних навчальних платформ, систем автоматизованого зворотного зв’язку та цифрових асистентів, які сприяють підвищенню якості освітнього процесу, оптимізації комунікації та індивідуалізації навчання. Встановлено, що застосування інструментів ШІ у формі аналітичних вправ, мініпроєктів і персоналізованих навчальних завдань забезпечує розвиток академічної аргументації, критичного аналізу та свідомого мовного вибору, водночас зберігаючи провідну роль здобувача освіти у процесі засвоєння іншомовних знань.

Висвітлено методичні аспекти впровадження цифрових технологій у процес іншомовної підготовки, підкреслено необхідність системного педагогічного супроводу та диференційованого підходу до завдань, що забезпечує усвідомлене використання мовних ресурсів і підвищує ефективність інтеграції ШІ-технологій у проєктну діяльність.

У підсумку, поєднання проєктного навчання з технологіями ШІ формує цілісну лінгводидактичну модель, спрямовану на розвиток професійно орієнтованих, когнітивних і міжкультурних умінь здобувачів вищої освіти, підвищує

результативність освітнього процесу та забезпечує формування іншомовної комунікативної компетентності в умовах цифрової трансформації вищої освіти.

Ключові слова: проєктне навчання, штучний інтелект, іншомовна комунікативна компетентність, мовна освіта, критичне мислення.

Statement of the Problem. Within an educational environment undergoing intensive digitalisation and the active integration of artificial intelligence technologies, there is a growing need to reconceptualise approaches to the organisation of foreign language training in higher education institutions. While digital resources offer expanded opportunities for the development of communicative competence and language use, their uncritical or methodologically unsystematic application may result in a diminished depth of analytical engagement with linguistic material. In this context, project-based learning emerges as an effective pedagogical approach for integrating digital technologies into foreign language education, as it is grounded in learner-centred activity and the functional use of language. This pedagogical alignment underscores the relevance and direction of the present study.

Review of Recent Research and Publications. Recent studies and publications demonstrate considerable scholarly interest in the integration of contemporary educational technologies into the training of higher education students. In particular, Kalko R., Dekusar H., and Lahun K. substantiate the theoretical and practical foundations for the application of artificial intelligence methods in foreign language learning [1]. Serhieieva V. examines the potential of project-based technology as an effective means of developing foreign language communicative competence among students of non-linguistic specialisations [2].

At the same time, Horodnycha L., Shkira A. and Kyian I. explore the didactic potential of artificial intelligence tools in teaching English-language academic communication to master's students [3]. Related issues are addressed by Zhukevych I. and Spiricheva O., who consider artificial intelligence as a key factor in transforming the process of language learning [4]. Similarly, Ponomarenko N., Tymchenko H. and Neustroieva H. emphasise the comprehensive impact of artificial intelligence technologies on language education [5].

Of particular relevance to the project-based approach is the study by Nikolashyna T., Siladi V. and Pohorila S., which conceptualises project technologies as an effective method for developing communicative competence in higher education students through collaboration and reflective learning practices [6]. This scholarly discourse is further enriched by the work of Astapova T. and Izotova L., who outline methodologically grounded directions for the use of artificial intelligence in foreign language teaching within higher education institutions [7]. In turn, Bilak M. analyses the application of artificial intelligence resources in developing foreign language communicative competence during English language classes [8].

Furthermore, the study by Kyselova O. substantiates the effectiveness of combining project-based learning with artificial intelligence tools as an integrated pedagogical model oriented towards the development of learner autonomy, critical thinking and foreign language communicative competence among higher education students [9].

Despite the growing body of research, there remains a clear need for further systematic investigation of this issue, particularly with regard to pedagogically balanced and methodologically justified models of integrating artificial intelligence technologies into project-based foreign language education.

Purpose of the article is to identify effective mechanisms for integrating project-based learning and artificial intelligence technologies in developing foreign language communicative competence among higher education students.

Theoretical and Methodological Framework. Within contemporary scholarly discourse, artificial intelligence is conceptualised as a systemic factor driving profound social, economic and cultural transformations that directly affect the development of the educational sphere and prompt a reconsideration of the nature of knowledge and the ways in which it is acquired. Notably, under conditions of digitalisation, the educational space of higher education institutions is undergoing a substantial renewal of traditional learning models, particularly in the field of foreign language training. This process foregrounds the need to redefine the professional role of the foreign language teacher within environments shaped by intelligent digital systems. In this regard, an effective response to current challenges presupposes continuous professional development of educators, the advancement of their digital and methodological competence and the gradual overcoming of entrenched perceptions of the teacher as the sole source of knowledge [5, p. 188].

Under these conditions, the transition towards an updated model of foreign language education entails a shift in emphasis from the transmission of ready-made information to the organisation of learning activities, within which the teacher assumes the roles

of facilitator, moderator and academic consultant. In this context, the integration of project-based learning with artificial intelligence technologies emerges as a didactically grounded approach that enables the alignment of language training with the development of learner autonomy, critical thinking and research skills among higher education students.

Within this framework, project-based learning in the development of foreign language communicative competence is implemented through a variety of educational activities, including information-research, analytical problem-solving, practice-oriented and interdisciplinary projects. It is important to emphasise that each of these formats provides opportunities for the use of foreign language resources within a meaningful communicative environment, while simultaneously integrating language practice with analytical and cognitive engagement.

Notably, the integration of artificial intelligence technologies into project-based learning involves the utilisation of multiple tools, including intelligent language models for text analysis and generation, adaptive learning platforms, automated feedback systems, semantic analysis instruments and digital assistants to support instructional interaction. The application of these technologies contributes to enhancing the quality of the educational process by optimising communication between teachers and learners and by expanding opportunities for the individualisation of learning.

At the same time, the use of artificial intelligence within the educational environment opens additional perspectives for enhancing learning, primarily through changes in the nature of interaction among participants in the educational process. Of fundamental importance is the fact that the teacher retains autonomy in selecting the forms and modes of applying relevant technologies, adapting them to specific didactic objectives and to the level of learners' preparedness. As a result, artificial intelligence functions as a tool for developing key competences required for effective participation in the information society, including critical thinking, creativity, communication, collaboration, teamwork, decision-making and complex problem-solving, while also serving as a factor in increasing learners' academic motivation [9].

The practical implementation of the above-mentioned principles involves the design of learning tasks in which foreign language activity is organically integrated with analytical engagement with linguistic material. In this regard, tasks focused on the analysis of lexical collocations within the framework of project-based activities, supported by artificial intelligence tools, prove to be particularly effective. Specifically, within a problem-oriented project, higher education students are invited to conduct a pragmatic and discourse-based analysis of English collocations functioning as means of argumentation in academic foreign language discourse. At the preparatory stage, learners use an artificial intelligence tool (for example, a large language model (LLM)) to compile a representative set of collocations commonly employed in academic texts (e.g. *"evidence-based approach", "key contributing factors", "long-term implications", "emerging challenges"*). This is followed by an analytical stage, during which the communicative function of each collocation is identified (e.g. justification, generalisation, establishment of cause–effect relationships or forecasting) as well as the conditions governing its appropriate use within the structure of an academic utterance.

At the subsequent stage, students complete a micro-project that involves modelling a fragment of an academic text (an introduction or an analytical section), in which previously analysed collocations are consciously selected and employed in accordance with the intended communicative purpose. The resulting text is then discussed within the group, with particular emphasis placed on the justification of linguistic choices, while an artificial intelligence tool is used to provide formative feedback on the logical coherence and stylistic appropriateness of the produced text.

Thus, the didactic value of the proposed task lies in fostering higher education students' ability to integrate linguistic analysis with communicative planning of academic discourse. At the same time, artificial intelligence in this context facilitates learners' awareness of their own language production and supports purposeful improvement, which is consistent with the linguodidactic principles underlying the integration of project-based learning and digital innovations in foreign language training.

It should also be noted that the ongoing development of artificial intelligence technologies contributes to the emergence of individualised foreign language learning as a coherent pedagogical technology aligned with contemporary requirements of educational digitalisation. Accordingly, this approach involves the design of personalised trajectories for the acquisition of language knowledge, taking into account individual learner characteristics, including cognitive profiles, learning pace, and the level of development of language skills. Systems of this type are capable of considering learners' emotional stability, either by informing the teacher of potential difficulties or by autonomously adjusting the learning

programme in response to changes in the educational context [1, p. 183].

In this regard, the identified capabilities of artificial intelligence underscore the need to reconsider the didactic foundations of foreign language training in higher education. Accordingly, individualisation of learning within the context of the digital transformation of education acquires a distinct linguodidactic dimension, as it entails the integration of adaptive algorithms with methodologically grounded forms of organising learning activities. Within this framework, project-based learning assumes particular significance, as it enables the implementation of personalised educational trajectories within a context of meaningful and communicatively rich language practice.

Consequently, the integration of artificial intelligence resources into the process of teaching English facilitates the development of personalised learning through the construction of individual learning pathways adapted to learners' language proficiency levels, learning styles and working pace. Adaptive platforms analyse learning outcomes and offer tasks of an optimal level of difficulty, thereby ensuring a gradual and guided development of language skills. In addition, AI-based educational systems are capable of automating the checking of grammatical accuracy, assessment, and analytical processing of written work, which significantly reduces the volume of routine activities performed by the teacher and allows greater focus on creative and methodological aspects of instruction [8, p. 70].

At the same time, the effectiveness of employing such resources is determined primarily by the nature of their pedagogical integration into the educational process. In this respect, the combination of artificial intelligence technologies with various types of project-based learning (such as research-oriented, problem-based, practice-oriented and creative projects) ensures a shift in emphasis from automated task completion to conscious and purposeful foreign language activity. Accordingly, this approach involves the use of diverse AI technologies, including adaptive learning systems, text-analysis language models, automated formative assessment tools and intelligent assistants designed to support the educational process.

In view of the above, the practical implementation of the outlined linguodidactic principles involves the introduction of learning tasks in which project-based activities are organically combined with analytical processing of foreign language material and the use of artificial intelligence tools. For example, within the research project *"Personalised Language Learning in Digital Environments"*, students are invited to analyse English terminological collocations used to describe individualised learning (e.g. *"learner-centred instruction", "adaptive learning systems", "individualised feedback mechanisms", "self-regulated learning strategies"*). At the initial stage, learners employ artificial intelligence tools to identify contexts in which these collocations occur in academic articles or analytical reports.

As a result, the didactic value of this task lies in the integration of linguistic analysis with the modelling of professionally relevant foreign language activity. In this process, artificial intelligence performs the function of analytical and informational support, while the leading role is assigned to learners' independent language production. Such an organisation of learning activities ensures the development of foreign language communicative competence as an integrated outcome of the interaction between project-based learning, digital technologies, and the conscious use of linguistic resources.

At the same time, artificial intelligence tools implemented through digital educational platforms are increasingly employed in the development of foreign language communicative competence, particularly in fostering listening, reading, writing and speaking skills. However, the effectiveness of their use largely depends on the teacher's pedagogical expertise, the level of digital literacy among higher education students and the didactic appropriateness of integrating these tools into the educational process. In this regard, the identification of methodological conditions for the pedagogically grounded use of artificial intelligence in language education is of particular relevance [7, p. 34].

Continuing this analysis, it should be emphasised that the use of artificial intelligence tools in higher education institutions should be regarded as a holistic process that requires consideration of a set of interrelated factors. Among the most significant are the well-grounded selection of digital tools, their methodologically appropriate integration into educational programmes, systematic support for teachers during the implementation of innovations and ongoing monitoring of students' learning outcomes. Within this framework, the organisation of learning interaction that stimulates collaboration, reflection, and communicative activity among learners occupies a central place [4, p. 52].

In the integration of project-based learning with artificial intelligence technologies, particular attention should be paid to linguodidactic principles that shift the focus from the reproductive acquisition of language material to its analytical interpretation and

practical application in authentic communicative situations. Notably, project-based activity enhanced by artificial intelligence tools creates favourable conditions for developing students' ability to work independently with foreign language material, to conduct linguistic analysis, and to make well-reasoned communicative decisions.

Within this context, the use of learning tasks aimed at developing academic argumentation and critical analysis of foreign language material through artificial intelligence tools is especially appropriate. For instance, students may be engaged in working with online discussions or short academic texts in English addressing issues related to artificial intelligence in higher education. By employing generative and analytical AI tools, learners identify key arguments, logical markers, and collocations characteristic of academic discourse (e.g. *"adaptive learning systems"*, *"ethical implications of AI"*, *"personalised learning pathways"*). Subsequently, these units are classified according to their communicative functions (such as explanation, justification, generalisation, or forecasting) and evaluated in terms of their effectiveness in constructing academic texts in English. The results of this analysis are then integrated into students' own written argumentative texts or short presentations in English, in which they articulate their positions and substantiate their arguments.

The methodological value of the task lies in the fact that students develop skills of critical analysis of foreign language material, gain an awareness of the functional role of linguistic units in academic texts and construct their own academic argumentation in English. Accordingly, artificial intelligence tools function as a means of cognitive support, assisting in the structuring of information and the identification of patterns, while not replacing learners' thinking or analytical activity.

At the same time, the effective integration of artificial intelligence technologies into the educational process of higher education institutions presupposes the presence of purposeful and systematic pedagogical guidance. Educational practice demonstrates that the use of artificial intelligence without appropriate methodological regulation may result in learners' cognitive overload as well as in the uncritical acceptance of automatically generated instructional content. In this respect, it is essential to take into account individual cognitive characteristics of students and to foster their ability to consciously analyse and evaluate the outputs of intelligent systems [3, p. 153].

This consideration, in turn, moves the issue of artificial intelligence use beyond a purely technological dimension and situates it within the domain of linguodidactic reflection. Pedagogical guidance in this context involves both instructional support and the deliberate organisation of learning situations in which students learn to relate language material proposed by intelligent systems to communicative intent, genre-specific features, and conditions of use. Such an approach enables the integration of the potential of digital technologies with the development of critical thinking and learner autonomy in foreign language activity.

Within this context, the tools and methods of project-based learning are oriented towards active interaction among participants in the educational process, collaborative problem-solving of learning and communicative tasks and the creation of collective or individual learning outcomes. Accordingly, project-based pedagogy is grounded in the principles of learner agency, interdisciplinary integration, goal-oriented activity and the practical relevance of the final product. Its didactic potential in the development of foreign language communicative competence is realised through the creation of a meaningful linguistic environment in which learners exchange ideas, justify their positions, engage in reflection and make joint decisions [6].

The practical application of linguodidactic principles may be achieved through tasks that combine the analysis of English-language material with project work and the use of artificial intelligence tools. For example, students may be assigned a mini-project entitled *"Analysing AI-Generated Academic Texts"*, within which they work with linguistic units automatically generated by artificial intelligence for instructional texts such as *"effective communication strategies"*, *"learner engagement enhancement"*, *"automated feedback mechanisms"*. In the course of the task, learners identify the functional role of each collocation, assess its compliance with academic writing conventions and critically analyse the appropriateness of its use in authentic educational or professional contexts.

The methodological value of the task lies in the development of students' analytical and critical skills as well as in fostering a conscious and reflective attitude towards the outcomes of artificial intelligence applications in language education. The project-based format promotes active interaction and the development of communicative competence, while artificial intelligence functions as a supportive tool for identifying patterns and structuring material, without replacing learners' own analytical efforts.

Summarising the above, it can be stated that project-based technology in the process of teaching English to higher education students of non-lin-

guistic specialisations has become established as an effective linguodidactic tool aimed at developing professionally oriented, intercultural and cognitive skills essential for future professional engagement in a globalised environment. The implementation of instructional, research-oriented, information-analytical and practice-oriented projects demonstrates that the integration of language training with authentic professional tasks enhances the meaningfulness of the educational process, actualises its content, and strengthens learners' intrinsic motivation for foreign language activity [2, p. 104].

At the same time, the effectiveness of project-based learning is determined by the substantive design of tasks and the didactically balanced organisation of educational interaction. In this context, the differentiation of project activity types, including instructional-research, problem-oriented, interdisciplinary, team-based, and individual projects, is of particular importance. This methodological approach enables the adaptation of educational strategies to learners' language proficiency levels, professional interests and cognitive characteristics, thereby creating favourable conditions for the systematic development of language skills within the framework of authentic professional communication.

In this respect, the involvement of artificial intelligence technologies as an instrumental component of project-based learning is considered pedagogically appropriate. Accordingly, the organisation of students' project activity with the use of artificial intelligence tools entails the staged definition of project aims and objectives, the selection of relevant digital instruments, the development of skills for interacting with these tools, the provision of systematic methodological support and comprehensive assessment of learning outcomes. The application of intelligent systems, particularly language models such as ChatGPT and similar services, contributes to the structuring of project components, optimisation of information search and processing processes and enhancement of the quality of research-related decisions in the course of learning tasks [9].

It is important to emphasise that the integration of artificial intelligence technologies into project-based activity serves to intensify the learning process. Within this model of educational interaction, artificial intelligence functions as a catalyst for analytical thinking, reflection and conscious language choice. At the same time, intelligent systems act as instrumental mediators that support the development of lexical and grammatical accuracy, discourse coherence, and pragmatic appropriateness in foreign language production.

To illustrate the didactic potential of this integrated approach, it is appropriate to consider an example of an analytically oriented learning task implemented within the framework of project-based learning. Specifically, students are assigned a mini-project entitled *"Artificial Intelligence in My Future Profession"*. At the initial stage, learners use an artificial intelligence tool to generate an analytical text of 300–350 words in English, outlining the role of artificial intelligence technologies in their future professional activity. The second stage involves a linguistic and discourse-based analysis of the generated text, including the identification of terminological vocabulary, analysis of logical and semantic connections between paragraphs, evaluation of stylistic appropriateness in relation to the given communicative situation and subsequent editing in accordance with the norms of academic discourse.

The proposed task combines elements of research-oriented and analytical project work, encouraging students to engage in the conscious use of foreign language resources and to critically reflect on the outcomes of their interaction with intelligent systems. In the process of completing the task, learners develop the ability to produce texts and to evaluate their quality, logical organisation and communicative appropriateness, which constitute key components of foreign language communicative competence.

Thus, the integration of various types of project-based learning with artificial intelligence tools gives rise to a holistic linguodidactic model in which foreign language training acquires an applied, analytical and professionally oriented character. This model corresponds to contemporary challenges in higher education and addresses students' needs for the development of competitive communicative skills.

Conclusions. The present study demonstrates that the integration of project-based learning and artificial intelligence technologies into the foreign language training of higher education students constitutes an effective linguodidactic approach. This integration promotes the development of communicative competence, critical thinking and research skills. The use of intelligent systems, including language models and adaptive learning platforms, enables the analytical and discourse-based examination of foreign language material, the structuring of information and the identification of key patterns and argumentative constructions, while simultaneously providing cognitive support to learners. It has been established that the combination of different project-based formats (such as instructional-research, problem-oriented, interdisciplinary, individual, and team projects) creates con-

ditions for adapting instruction to students' language proficiency, professional interests and cognitive characteristics, thereby facilitating the systematic development of language skills within the context of authentic professional communication.

At the same time, experience with the implementation of these methodologies indicates that the effectiveness of artificial intelligence integration depends on pedagogical appropriateness, a differentiated approach to task design and systematic methodological guidance. Artificial intelligence technologies serve as instruments for stimulating analytical thinking, independent processing of material and conscious selection of linguistic resources. Furthermore, the practical application of linguodidactic principles through mini-projects and analytical exercises, particularly in English, ensures the development of students' ability to combine linguistic analysis with communicative planning, to strengthen academic argumentation and to evaluate critically the outcomes of interactions with intelligent systems.

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