



Teaching agricultural university students a professional foreign language using technological solutions based on artificial intelligence

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Abstract

Importance. The use of artificial intelligence (AI)-based technological solutions for specific aspects of a foreign language or types of speech activity is currently one of the most relevant vectors in the development of foreign language teaching methodology. The rapidly growing body of research by domestic and international scientists, dedicated to determining the linguodidactic potential of specific AI tools and step-by-step teaching methodologies, provides a necessary scientific foundation for creating models of systematic and comprehensive foreign language instruction based on AI. This involves integrating students' language work with AI into traditional teaching. The aim of the study is to develop a methodology for comprehensive teaching of professional foreign language to students of an agricultural university using AI-based technological solutions.

Materials and Methods. The study is conducted at Voronezh State Agrarian University named after Emperor Peter the Great. The participants are first-year students enrolled in the degree program 35.03.06 – “Agricultural Engineering”. In the control group ($N = 38$), a traditional methodology for teaching professional foreign language is used, based on the principles of Language for Specific Purposes with elements of Content and Language Integrated Learning. In the experimental group ($N = 38$), in addition to the traditional methodology, students engaged in practice with AI-based technological solutions. This practice took place outside of class hours. Mathematical processing of the results is performed using Student's t -test method.

Results and Discussion. The experimental study confirmed the effectiveness of the author's methodology for teaching professional foreign language to agricultural university students by supplementing traditional instruction with extracurricular practice using AI-based technological solutions. Statistical analysis of the results at the control stage revealed the effectiveness of the innovative method across all five diagnostic indicators: acquisition of professional vocabulary ($t = 3.43$ at $p \leq 0.05$), mastery of grammatical structures ($t = 2.91$ at $p \leq 0.05$), further reading skills' development ($t = 2.91$ at $p \leq 0.05$), oral dialogic speech ($t = 3.95$ at $p \leq 0.05$), written monologic speech ($t = 3.68$ at $p \leq 0.05$).

Conclusion. The novelty of the study lies in the development and validation of a comprehensive methodology for teaching professional foreign language to agricultural university students using AI-based technological solutions. The prospects of the research are that its results can be utilized in designing models for integrated foreign language instruction for students of both linguistic and non-linguistic degree programs and specialties.

Keywords: artificial intelligence, agricultural university, professional foreign language, integrated learning

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Обучение студентов аграрного вуза профессиональному иностранному языку с использованием технологических решений на базе искусственного интеллекта

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Аннотация

Актуальность. Использование технологических решений на базе искусственного интеллекта (ИИ) аспектам иностранного языка или видам речевой деятельности в настоящее время выступает одним из наиболее актуальных векторов развития методики обучения иностранным языкам. Динамично появляющиеся исследования отечественных и зарубежных ученых, посвященные определению лингводидактического потенциала конкретных инструментов ИИ и поэтапных методик обучения, создают необходимую научную базу для создания моделей системного и комплексного обучения иностранному языку (ИЯ) на базе ИИ, когда языковая работа студентов с ИИ интегрируется в традиционное обучение. Цель исследования – разработать методику комплексного обучения студентов аграрного вуза профессиональному ИЯ на основе технологических решений на базе ИИ.

Материалы и методы. Исследование проводилось на базе ФГБОУ ВО «Воронежский государственный аграрный университет им. императора Петра I». Участниками были студенты 1 года обучения направления подготовки 35.03.06 – «Агроинженерия». В контрольной группе (КГ) ($N = 38$) студентов использовалась традиционная методика обучения профессиональному иностранному языку на основе принципов обучения языку для специальных целей с элементами предметно-языкового интегрированного обучения. В экспериментальной группе (ЭГ) ($N = 38$) в качестве дополнения к традиционной методике была добавлена практика студентов с технологическими решениями на базе ИИ. Практика проходила во внеаудиторное время. Математическая обработка результатов осуществлялась на основе метода t -критерия Стьюдента.

Результаты исследования. Экспериментальное обучение доказало эффективность авторской методики обучения студентов аграрного вуза профессиональному иностранному языку путем добавления к традиционному обучению внеклассной практики студентов с техноло-

гическими решениями на базе ИИ. Статистический анализ результатов среза на контрольном этапе выявил эффективность инновационного метода по всем пяти диагностируемым показателям: овладению профессиональным тезаурусом ($t = 3,43$ при $p \leq 0,05$), овладению грамматическим материалом ($t = 2,91$ при $p \leq 0,05$), дальнейшим развитием умений чтения ($t = 2,91$ при $p \leq 0,05$), устной диалогической речи ($t = 3,95$ при $p \leq 0,05$), письменной монологической речи ($t = 3,68$ при $p \leq 0,05$).

Выводы. Новизна работы состоит в разработке и доказательстве эффективности методики комплексного обучения профессиональному иностранному языку студентов аграрного вуза на основе технологических решений на базе ИИ. Перспективы данного исследования состоят в том, что его результаты могут использоваться в разработке моделей комплексного обучения иностранному языку учащихся и студентов языковых и неязыковых направлений подготовки и специальностей.

Ключевые слова: искусственный интеллект, аграрный вуз, профессиональный иностранный язык, интегрированное обучение

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IMPORTANCE

Currently, artificial intelligence (AI) technologies are penetrating deeper and deeper into the process of teaching disciplines in higher education. Scientists note that the integration of AI into the educational process can significantly expand students' opportunities in the formation of professional skills and, thus, contributes to the more effective development of future specialists. In addition, in our opinion, as stated by Ya.I. Kuzminov, E.V. Kruchinskaya, I.A. Gruzdev and A.A. Naumov [1], the widespread use of AI in education will divide universities and students into two categories: “laggards” and “outperformers”. In those universities where AI will not be officially integrated into the process of forming students' professional competencies, students will continue to use generative neural networks to perform unauthorized homework and write research papers, attributing to themselves the authorship of AI feedback materials. And those educational institutions where AI will be used to solve only some organizational and

routine tasks will be able to create an educational environment for more effective student learning using traditional means and technological solutions based on AI. P.V. Sysoyev calls such changes the transfer of the educational process “to a higher degree of solving cognitive tasks level” [2]. At the same time, developers of educational materials and teachers need to clearly distinguish the tasks that a) can be delegated to AI.; b) it should definitely remain the prerogative of the students.

Over the past few years, many studies have appeared in the scientific literature in which scientists have considered and described the didactic possibilities of AI-based technological solutions in shaping the professional skills of students in various fields of study or specialties. For example, V. Zhang, M. Kai, H. Lii, R. Evans, K. Zhu, K. Ming [3], K. Chan, N. Zari [4] describe the possibilities of using AI tools in medical education; S. Feuerriegel, J.R. Shrestha, G. von Krogh, K. Zhang give examples of the use of AI-based technological solutions in the training of economists and managers [5]; J. Kok,

U. Salinas-Hernandez, B. Pepin [6] study the potential of the generative ChatGPT network in the education of engineering students; P.V. Sysoyev and M.N. Evstigneev [7] propose a methodological system for training foreign language teachers based on the integrated implementation of AI tools in the language, speech and methodological practice of students and their research work; N. Vaisberg, A. Hudek [8], M.V. Gavrilov, P.V. Sysoyev, V.V. Kharin, S.Y. Bulochnikov [9–11] – consider the possibilities of integrating professional AI tools into the process of training students in the field of Law, including in the context of subject-language integrated learning.

Several studies have been conducted on the introduction of AI technologies into the training of agricultural university students. D.M. Johnson, V. Doss and K.M. Estep [12] consider the possibilities of the generative ChatGPT network in teaching microcontroller programming to students of agricultural specialties. In accordance with user promptings, ChatGPT prescribes the code for the equipment, and students study and correct the compiled AI code. I. Bernetti, T. Borzini and I. Capecci [13] describe the possibilities of virtual reality and AI in agropanning based on specialized applications.

Teaching a professional foreign language is one of the indispensable components of training specialists in the agricultural sector of the economy. Scientists have published several scientific articles on the use of AI-based technological solutions in the language training of agricultural university students. Yu.V. Tokmakova and E.S. Sayenko reveal the possibilities of using corrective feedback from generative AI tools in teaching agricultural university students professional communication in the studied language [14]. T.V. Baydikova develops a methodology for teaching professional thesaurus in the process of foreign language speech practice using AI tools [15]. At the same time, despite the existing potential of AI, the integration of AI-based technological solutions into the process of teaching agricultural university students professional AI has not found a systematic solution.

The purpose of the study is to develop a methodology for comprehensive teaching of a professional foreign language to students of an agricultural university based on AI-based technological solutions.

LITERATURE REVIEW

2023 was the year of a surge in scientific publications devoted to the use of AI technologies in AI education. The researchers described the methodological functions of AI-based technological solutions and developed step-by-step learning algorithms. At the moment, it can be stated that almost all key aspects related to AI training have been sanctified in the works of scientists. We will conduct a review of research in the field of methods of teaching students and students aspects of foreign language and the development of types of speech activity.

Professional vocabulary training. Mastering the meaning of a word and developing the skills to correctly use vocabulary in speech in a foreign language based on AI-based technological solutions are considered by many methodologists. The research focuses on the methodological potential of specific technological solutions based on AI. In his works, R. Liu [16], M. Tangpidzhaikul [17], I.V. Kharlenko [18] describe the methodological potential of chatbots and specialized web applications based on AI in the formation of students' lexical speech skills; V.V. Klochikhin and O.G. Polyakov [19; 20] study the methodological possibilities of corpus artificial intelligence technologies in the formation of students' collocation competence; T.V. Baydikova [15] offers a step-by-step methodology for students to form a professional thesaurus based on the use of the PolyBuzz AI-based web platform.

Teaching English grammar. Many works have been devoted to teaching foreign grammar based on AI. A.P. Avramenko, A.S. Akhmedova, E.R. Bulanova [21] consider the potential of chatbots in the formation of grammar skills of students. Scientists claim that independent training of students on the basis of a chatbot will allow them to better master grammatical material.

P.I. Lobeeva's research [22] focuses on the development of the stages of formation of lexical and grammatical skills among students of a technical university in the process of language practice with a chatbot. The work is based on phrasal verbs. E.A. Cherkasova [23] studies the methodological possibilities of teaching English grammar using AI-based chatbots.

Teaching oral and written dialogic speech. A number of studies by domestic and foreign scientists are devoted to the use of voice assistants and chatbots in the development of students' oral and written dialogic speech skills. The subject of study in the works of E. Adamoroulou and L. Mousiadis [24], D. Khan [25], H. Kim, Y. Cha, N.Y. Kim [26], F. Chakmaka [27], A.P. Avramenko and A.A. Tarasov [28], the technology of speech recognition by AI tools for the development of oral speech skills of schoolchildren in preparation for the Unified State Exam, P.V. Sysoyev and E.M. Filatov [29] – the methodological capabilities of the Replika chatbot and the stages of teaching students written interaction in a foreign language based on their practice with these AI-based technological solutions; D.O. Sorokin [30] – the ability to teach oral communication based on Google Assistant; E.M. Filatov [31] – the potential of Character.AI to form foreign language communication skills.

Teaching written monologue speech students and students based on generative AI tools

are considered in the works of many scientists in Russia and abroad. The first programs for automated control of students' written work appeared in the USA and were constantly being improved as technology developed. Currently, many of them operate on the basis of AI and are able to provide the user with both evaluative feedback and recommendations for completing the essay. Currently, there are several specialized AI-based technological solutions that can be used in teaching writing. J. Park [32], A. Perdana, M. Farida [33] use the Grammarly AI-based web platform as a tool for automated evaluation of written work.; M.R. Manap, N.F. Ramli, A.A.M. Kassim [34] – web platform PaperRater.com; G. Gou and D. Wang [35], P.V. Sysoyev and E.M. Filatov, N.I. Khmarenko and S.S. Murunov [36–37] – OpenAI's ChatGPT generative neural network. P.V. Sysoyev, E.M. Filatov, N.I. Khmarenko and S.S. Murunov came to interesting conclusions in the course of their research, in which the authors compare the quality of feedback from a teacher and the ChatGPT AI tool [37]. The study showed that ChatGPT (version 4.0) has now compared with teachers in evaluating students' essays according to criteria such as the content of the essay, the organization and structure of the essay, confirmation of ideas and arguments, and surpassed teachers in terms of language correctness.

Table 1

Set of AI-based technological solutions
used in teaching agricultural university students professional AI

The learning aspect	AI-based technological solutions
Professional Thesaurus	GigaChat, ChatGPT, YandexGPT, Replika
Grammar	GigaChat, ChatGPT, YandexGPT, Replika
Oral (dialogical) speech	Google Assistant, YandexGPT, Replika
Written (monologue) speech	GigaChat, DeepSeek, Grammarly, PaperRater

Source: compiled by the authors based on the analysis of scientific literature.

These conclusions once again emphasize the significant methodological potential of generative AI tools in teaching students writing.

The study of these and many other works testifies to the great linguistic and didactic potential possessed by modern AI tools. At the same time, it is important, according to P.V. Sysoyev [38], that the practice of students with the AI tool is integrated into the traditional teaching methodology, preventing opportunities for AI plagiarism and creating additional conditions for the formation of universal and professional competencies among students.

It should be noted that the issue of integrating AI technologies into education has been systematically and comprehensively addressed at Tambov State University named after G.R. Derzhavin, where future foreign language teachers are trained. The author's team consisting of P.V. Sysoyev, M.N. Evstigneev, O.G. Polyakov and others. [7; 39] developed a structural model for the training of future foreign language teachers based on AI and a matrix of AI tools used in linguistic and methodological training of students. The matrix, in turn, formed the basis for the development of private methods of teaching aspects of foreign language, types of speech activity, the formation of methodological competence and the organization of research work of students. The experience and results of the Tambov methodical school can be used as a basis for the development of comprehensive methods of teaching a foreign language to students of various fields of study and specializations.

Based on the literature analysis, we present a set of technological solutions based on AI, which can be used in teaching agricultural university students professional AI (Table 1).

The proposed set of AI-based technological solutions does not separately identify receptive types of speech activity: reading and listening. This is due to the fact that at the present stage, the integration of AI into learning does not bring anything radically new to the development of these two types of speech activity. The proposed complex formed the basis for the development of the author's methodology for teaching agricultural university students professional skills

using technological solutions based on artificial intelligence.

MATERIALS AND METHODS

Experimental training was conducted to evaluate the effectiveness of systematic and comprehensive teaching of a professional foreign language to students of an agrarian university. The approbation took place at the Voronezh State Agrarian University named after Emperor Peter the Great. The participants of the training were first-year students of the training area 03/35/06 – “Agroengineering”. The control group (CG) ($N = 38$) of students used the traditional method of teaching a professional foreign language based on the principles of language teaching for special purposes with elements of subject-language integrated learning. In the experimental group (EG) ($N = 38$), extracurricular training of participants with AI-based technological solutions was added as an addition to the traditional teaching methodology. When studying a new professional thesaurus and grammar, students performed exercises and tasks (discussions on the topic with an AI tool or composing monologues on the topic with further correction of the linguistic utterance using AI). The development of dialogic speech skills took place in the process of verbal interaction with one of the AI tools (Google Assistant or Replicka chatbot). When completing monologue tasks related to the description of technological processes of processing raw materials, analyzing the operation of equipment, or describing the operation of the device, students completed written tasks using a professional thesaurus, and then based on corrective feedback from Grammarly web platforms. PaperRater.com or the generative neural networks GigaChat, DeepSeek, ChatGPT refined their answers. Students brought materials from extracurricular practice with AI-based technological solutions to subsequent classes for discussion.

The professional foreign language course at CG and EG included the study of the following topics: “Engine”, “Brake system”, “Transmission”, “Ignition system”, “Milking machines and

equipment for processing and storing milk”, “Equipment for meat processing”, “Equipment for processing and drying grain”. Experimental training was carried out in three stages. At the

ascertaining stage, the initial level of students' proficiency in a professional foreign language was determined. The study participants completed a text that includes tasks on proficiency in

Table 2

Statistical data from the comparison of assessment results in the control group and experimental group at the diagnostic stage

Indicator	CG average ($\bar{x}$)	EG average ($\bar{x}$)	Student's <i>t</i> -test
Professional Thesaurus	2,31	2,40	1,78*
Grammar	3,51	3,42	1,35*
Reading	4,08	4,00	1,78*
Oral (dialogical) speech	3,88	3,82	1,43*
Written (monologue) speech	2,18	2,20	1,00*

Note. * – $p > 0,05$.

Source: calculated and compiled by the authors based on the results of cross-sections at the ascertaining and control stages of training.

Table 3

Statistical data from the comparison of assessment results in the control group and experimental group at the diagnostic and control stages

Indicator	CG Student's <i>t</i> -test	EG Student's <i>t</i> -test
Professional Thesaurus	15,69*	17,20*
Grammar	4,76*	7,66*
Reading	2,92*	5,67*
Oral (dialogical) speech	2,66*	6,35*
Written (monologue) speech	18,13*	17,33*

Note. * – $p \leq 0,05$.

Source: calculated and compiled by the authors based on the results of cross-sections at the ascertaining and control stages of training.

Table 4

Statistical data from the comparison of assessment results in the control group and experimental group at the control stage

Indicator	CG average ($\bar{x}$)	EG average ($\bar{x}$)	Student's <i>t</i> -test
Professional Thesaurus	4,05	4,31	3,43*
Grammar	3,91	4,11	2,91*
Reading	4,28	4,48	2,91*
Oral (dialogical) speech	4,05	4,37	3,95*
Written (monologue) speech	3,34	3,68	4,21*

Note. * – $p \leq 0,05$.

Source: calculated and compiled by the authors based on the results of cross-sections at the ascertaining and control stages of training.

a professional thesaurus, grammar, oral dialogic and written monologue speech.

At the formative stage of their studies, students of CG and EG studied a professional foreign language based on traditional (in CG) and experimental (in EG) methods. At the control stage of experimental training, the indicators were re-measured, as well as at the ascertaining stage in order to identify the effectiveness of the author's teaching methodology.

RESEARSH RESULTS

The IBM SPSS Statistics 21 software was used for mathematical processing of the cross-section results at the ascertaining and control stages of training. The Student's *t*-test has become the method of data comparison. Statistical data on the comparison of the results of the sections are presented in Tables 2–4.

An analysis of the results of the cut-off at the constitutional stage showed that equal groups of students participated in experimental training according to all indicators. The *P*-value is for students' proficiency in the professional thesaurus, grammar, development of reading skills, oral dialogical and written monologue speech – >0.05 . Special attention needs to be paid to the interpretation of data on students' initial proficiency in a professional foreign language. The lowest values were obtained for students' proficiency in a professional thesaurus (CG: $\bar{x} = 2.32$; EG: $\bar{x} = 2.4$) and the development of writing skills (CG: $\bar{x} = 2.18$; EG: $\bar{x} = 2.2$). The data obtained mean that before participating in the experiment, the students of CG and EG had practically no knowledge of the professional thesaurus and the subject content of written speech. Of all the aspects diagnosed in the study, the students were the best at reading (CG: $\bar{x} = 4.08$; EG: $\bar{x} = 4.0$), this reflects the general trend among students in mastering the types of speech activity in a foreign language. Traditionally, reading is given the most time and attention, so students have developed this type of speech activity to a greater extent than others.

A comparison of the results of the ascertaining and control sections separately in CG and

EG showed that in both groups the increase in all five indicators was statistically significant. Such mathematical analysis data suggests that both methods – (a) traditional and (b) experimental with the systematic and integrated use of AI-based technological solutions in the learning process – have proved effective. The largest increase in both groups occurred when students mastered the professional thesaurus (CG: $t = 15.69$; EG: $t = 17.20$ at $p < 0.05$) and written monologue (CG: $t = 18.13$; EG: $t = 17.33$ at $p < 0.05$). During their studies, students have mastered professional vocabulary and the ability to compose written texts using active vocabulary. The smallest increase was observed in the development of reading skills (CG: $t = 2.92$; EG: $t = 5.67$ at $p < 0.05$) and oral speech (CG: $t = 2.66$; EG: $t = 6.35$ at $p < 0.05$) due to the fact that these students' skills were developed at a fairly high level immediately prior to their participation in experimental training. A relatively small but statistically significant increase was observed in terms of mastery of grammatical material (stating section: CG: $\bar{x} = 3.51$; EG: $\bar{x} = 3.42$; control section: CG: $\bar{x} = 3.91$; EG: $\bar{x} = 4.11$). Students have mastered most of the grammatical tenses of a foreign language within the framework of the school curriculum. The university repeated previously studied grammatical material.

The effectiveness of the author's teaching methodology is proved by comparing the results of the control section in CG and EG. The presence of statistical significance in the differences between the two groups in all five indicators is recorded. Extracurricular additional practice of students with AI-based technological solutions contributed to more effective mastery of a foreign language in such aspects of control as professional thesaurus, grammar, reading, oral dialogic speech, written monologue speech.

CONCLUSION

In the course of the conducted experimental training, the effectiveness of the author's methodology for teaching agricultural university students professional AI was proved by adding ex-

tracurricular practice of students with AI-based technological solutions to traditional training. Statistical analysis of the results of the cut at the control stage revealed the effectiveness of the proposed methodology in all five diagnostic indicators: mastery of the professional thesaurus ($t = 3.43$ at $p < 0.05$), mastery of grammatical material ($t = 2.91$ at $p < 0.05$), further develop-

ment of reading skills ($t = 2.91$ at $p < 0.05$), oral dialogic speech ($t = 3.95$ at $p < 0.05$), written monologue ($t = 3.68$ at $p < 0.05$).

The prospects of this research are that its results can be used in the development of models of comprehensive foreign language teaching for students and students of linguistic and non-linguistic fields of study and specialties.

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