



Professional thesaurus formation of agricultural university students in the process of speech practice with artificial intelligence tools

Tatiana V. Baydikova 

Voronezh State Agrarian University named after Emperor Peter the Great
1 Michurina St., Voronezh, 394087, Russian Federation
november22@rambler.ru

Abstract

Importance. There are many artificial intelligence (AI) tools that can be used in teaching students a foreign language, including the formation of their lexical competence. However, the formation of a professional thesaurus for students of non-linguistic specialties through participation in foreign language practice on professional topics with AI is not the subject of a separate study. The goal of the study is to develop a step-by-step technology for the professional thesaurus formation of agricultural university students through practice with AI tools and to test its effectiveness in experimental training.

Materials and Methods. The experiment is conducted by the Voronezh State Agrarian University named after Emperor Peter the Great. The training is attended by undergraduates of the study field 35.04.04 – “Agronomy”. The participants of the control group (CG) ($N = 15$) are trained according to the traditional teaching method based on the elements of subject-language integrated learning and a foreign language for special purposes. The participants of the experimental group (EG) ($N = 15$), in addition to the traditional teaching methodology, participated in the practice of professional foreign language communication with the PolyBuzz web application. Statistical analysis of learning outcomes is carried out based on the Student’s t -test method.

Results and Discussion. The experiment proved the effectiveness of a step-by-step technology for the formation of a professional thesaurus for students of an agricultural university using extracurricular practice with the PolyBuzz web application ($t = 2.25$ at $p < 0.05$).

Conclusion. The novelty of the study consists in the step-by-step technology development for the professional thesaurus formation for students of an agricultural university using extracurricular practice with the PolyBuzz web application. The prospects of the conducted research consist in further study of the linguodidactic and methodological potential of specific AI tools in the professional training of agricultural university students.

Keywords: artificial intelligence, agricultural university, professional foreign language, professional thesaurus, PolyBuzz

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Формирование профессионального тезауруса студентов аграрного вуза в процессе речевой практики с инструментами искусственного интеллекта

Татьяна Вячеславовна Байдикова 

ФГБОУ ВО «Воронежский государственный аграрный университет им. императора Петра I»
394087, Российская Федерация, г. Воронеж, ул. Мичурина, 1
november22@rambler.ru

Аннотация

Актуальность. Существует много инструментов искусственного интеллекта (ИИ), которые могут использоваться при обучении студентов иностранному языку, включая формирование их лексической компетенции. Однако формирование профессионального тезауруса студентов неязыковых специальностей посредством участия в иноязычной практике на профессиональные темы с ИИ не выступало предметом отдельного исследования. Цель исследования – разработка пошаговой технологии формирования профессионального тезауруса студентов аграрного вуза посредством практики с инструментами ИИ и проверка ее эффективности в экспериментальном обучении.

Материалы и методы. Площадкой эксперимента выступило ФГБОУ ВО «Воронежский государственный аграрный университет им. императора Петра I». В обучении приняли участие магистранты направления подготовки 35.04.04 – «Агрономия». Участники контрольной группы (КГ) ($N = 15$) обучались по традиционной методике обучения на основе элементов предметно-языкового интегрированного обучения и иностранного языка для специальных целей. Участники экспериментальной группы (ЭГ) ($N = 15$) в дополнении к традиционной методике обучения участвовали в практике профессионального иноязычного общения с веб-приложением PolyBuzz. Статистический анализ результатов обучения проводился на основе метода t -критерия Стьюдента.

Результаты исследования. Эксперимент доказал эффективность пошаговой технологии формирования профессионального тезауруса у студентов аграрного вуза с использованием внеаудиторной практики с веб-приложением PolyBuzz ($t = 2,25$ при $p \leq 0,05$).

Выводы. Новизна работы состоит в разработке пошаговой технологии формирования профессионального тезауруса у студентов аграрного вуза с использованием внеаудиторной практики с веб-приложением PolyBuzz. Перспективы проведенного исследования состоят в дальнейшем изучении лингводидактического и методического потенциала конкретных инструментов ИИ в профессиональной подготовке студентов аграрного вуза.

Ключевые слова: искусственный интеллект, аграрный вуз, профессиональный иностранный язык, профессиональный тезаурус, PolyBuzz

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IMPORTANCE

One of the main tasks in foreign language training of agrarian university students is the formation of their professional thesaurus, the possession of which plays an important role in professional communication in the studied language. The emergence and spread of new innovative teaching tools, which include modern digital technologies, have contributed to the development of practical methods of teaching foreign language vocabulary to pupils and students on the basis of specific technologies or tools. In particular, T.A. Chernyakova [1; 2] offers a step-by-step algorithm for the formation of lexical skills of students of linguistic specialties when using text corpora, A.A. Kokoreva and P.V. Sysoyev [3; 4] – method of teaching future economists a professional thesaurus using a corpus of parallel texts. Some researchers have considered the possibility of forming students' lexical skills in the process of developing their foreign-language speech skills. Such works include the publications of Y.I. Semich [5; 6], in which the researcher develops a method for teaching foreign-language professional communication to journalism students, A.G. Solomatina [7], T.V. Baydikova [8], Yu.V. Tokmakova [9], in which scholars describe the methods of forming professional foreign-language communicative competence of agrarian university students in the conditions of content and language integrated learning. In these publications, many researchers have argued that in the modern realities of limited classroom load, the use of digital tools that involve the organization of students' project activities in a blended learning format creates the most favorable conditions for the formation of students' professional thesaurus. Participation in online projects based on modern Internet services is a significant motivator for

students to learn a foreign language and use it in educational communicative situations.

The rapid emergence and spread of artificial intelligence (AI) tools gave a new turn to the research devoted to the study of the language didactic potential of AI in the formation of learners' lexical competence. The analysis of scientific publications for 2022–2024 shows that domestic and foreign scientists are studying the language didactic potential of AI tools in teaching foreign language vocabulary. I.V. Kharlamenko [10–12] considered the modern possibilities of chatbots and augmented reality tools in the formation of learners' lexical speech skills. V.V. Klochikhin and O.G. Polyakov [13], V.V. Klochikhin [14] and E.V. Tikhonova and A.V. Kraider [15] studied the potential of corpus artificial intelligence tools AntConc, LexTutor, VersaText, Sketch-Engine, VersaText, Sketch-, and SKELL in teaching students and pupils the combination of words and new vocabulary. At the same time, the issue of forming professional thesaurus of students of non-language universities on the basis of the practice of communication with AI tools has not been the subject of a separate study.

The aim of the research: to develop a step-by-step technology of forming professional thesaurus of students of agrarian university on the basis of practice with AI tools and to check its effectiveness in the course of experimental training.

Achievement of the set goal was implied by the following tasks: a) to develop a step-by-step technology of teaching students of agrarian higher education institution the professional thesaurus on the basis of practice of communication with the AI tool PolyBuzz; b) to conduct an experimental testing of the algorithm during the experimental training; c) to describe the results of the experimental training.

LITERATURE REVIEW

In education, AI can be used to solve some tasks. Among them, P.V. Sysoyev includes: “1) education management; 2) individualization of learning; 3) optimization of the process of teacher preparation for classes; 4) organization of the learning process; 5) optimization of the learning process of specific disciplines” [16]. The last task involves the organization of additional training practice of students within the discipline under study. This means that in order to form professional competencies of students, teachers can use AI tools to organize extracurricular practice and create conditions for the formation of the necessary competencies.

One of the most widespread and popular AI tools among foreign language teachers and students are chatbots. Following P.V. Sysoyev and E.M. Filatov, chatbots are understood as “a dialogue training program capable of developing foreign-language oral and written speech skills of the learner by means of maintaining a dialogue with the learner and imitating human speech on the basis of natural language and machine learning technologies and algorithms of human speech behavior embedded in it” [17, p. 68]. The educational potential of chatbots has been studied by many domestic and foreign researchers. At the same time, the range of issues is quite wide. In particular, I.V. Kharlamenko [10–12] considered chatbots to be an innovative tool for the formation of students’ lexical speech skills; J. Park [18], O.V. Toporkova, O.A. Evtushenko, E.V. Novozhenina and O.A. Sychev [19] and A.P. Avramenko, A.S. Akhmedova and E.R. Bulanova [20], E.A. Cherkasova [21] – as a tool for autonomous mastering of foreign language grammar. Many works are devoted to the possibility of organizing the training of pupils and students in oral and written speech communication on the basis of practice with voice assistants and chatbots. D. Han [22], F. Chakmak [23], H.S. Kim, Y. Cha, N.Y. Kim [24], J. Junaidi, B. Hamuddin, K. Dulita, Ф. Rahman, T. Derin [25], D.O. Sorokin [26] in their works consider methodological aspects and develop step-by-step technologies for the development of

foreign language oral communication skills of high school and college students when communicating with voice assistants. P.V. Sysoyev, E.M. Filatov and D.O. Sorokin offer a method for teaching written speech communication to pupils and students based on practice with the chatbot Replika [27; 28]. In addition, E.M. Filatov [29] and D.O. Sorokin [30] defined the stages of teaching students written communication based on the web application Character.ai.

In our opinion, the combination of the possibility of practicing active vocabulary in foreign language speech communication with a virtual interlocutor, on the one hand, and the possibility of implementing personalized learning, when a chatbot provides feedback on student’s requests, creates optimal conditions for the formation of students’ professional thesaurus on the basis of practice with a chatbot.

The study of the above-mentioned works shows that students’ foreign language practice with a chatbot has already proved its effectiveness in terms of both oral and written communication skills development. However, as P.V. Sysoyev and E.M. Filatov rightly argue [28], students’ foreign language practice with chatbot, which takes place outside of class time, should be clearly planned. In terms of subject-thematic content it should coincide with the academic section of the course, and the level of linguistic complexity of interaction with AI should correspond to the level of foreign language proficiency of students. The authors also argue that the proof of the fact of students’ participation in communication with AI can be the printouts of dialogues, which are recommended to study and discuss in class, highlight the grammatical constructions or lexical units used, show how communicative tasks were solved in the process of communication. Through discussion and reflection students better consolidate the learning material.

Based on the analysis of works devoted to the development of the stages of the method of teaching foreign-language speech communication on the basis of practice with a chatbot, the research proposes a step-by-step technology for

teaching a foreign-language professional thesaurus. The technology will consist of four steps.

Step one. The teacher introduces students to active professional vocabulary using traditional teaching methods – from translation to semantisation.

Step two. Students consolidate new vocabulary in training exercises and tasks for developing speech activities (reading, speaking, and listening).

Step three. Students receive an integrated task to discuss a professional issue with the virtual interlocutor PolyBuzz. During the discussion, students have to solve the same communicative tasks that they would solve in real professional situations. The teacher provides the setting and a list of communicative tasks that students should solve during the interaction with the AI tool. This stage is realized outside the class time. Upon completion of the interaction with the AI, students prepare printouts of the educational practice of communication with the chatbot for further discussion in class.

Step four. Students in small groups of 3–4 people discuss: a) solving professional tasks in the course of interaction with AI; b) show the use of active professional thesaurus in the course of communication with AI; c) identify situations of communicative failures and ways out of them; d) discuss other issues that arose in the course of practice with AI.

It should be noted that the proposed four steps of training are integrated into the traditional method of teaching professional foreign language to students of agrarian university, creating additional conditions for the use of foreign language for professional communication.

MATERIALS AND METHODS

To determine the effectiveness of the developed step-by-step technology of teaching students of agrarian university a professional thesaurus, an experimental training was conducted.

The platform of the experiment was Voronezh State Agrarian University named after Emperor Peter the Great. Master students of training direction 35.04.04 – “Agronomy” took part in the training. Participants of the control group (CG) ($N = 15$) were trained according to the traditional teaching method based on the elements of content and language integrated learning and foreign language for special purposes. Participants of the experimental group (EG) ($N = 15$) in addition to the traditional teaching method participated in the practice of professional foreign language communication with a chatbot. The web platform PolyBuzz was used as an AI tool. Interaction with AI in EG was carried out once a week. The course topics, professional thesaurus and sample tasks for each topic are presented in Table 1.

The experiment was conducted in three stages: 1) an initial survey showing the initial level of the students’ mastery of the professional thesaurus; 2) training according to the traditional (CG) and experimental (EG) methods; 3) a control survey, fixing the final level of the students’ mastery of the professional thesaurus and proving or disproving the effectiveness of the author’s proposed training method.

RESULTS AND DISCUSSION

In order to determine whether or not there is or absence of statistical significance in the differences between the results of the method of statistical testing was used to identify the presence or absence of statistical significance in the differences between the results of the control and control sections in CG and EG. Student’s *t*-criterion statistical test: for independent samples when comparing the results of CG and EG among themselves before and after the experimental training and for dependent samples when comparing the results in each group before and after the experiment. Table 2 summarizes the results of the cutoffs.

Table 1

Course topics, professional thesaurus, and sample assignments for each topic

No. in order	Topic	Professional thesaurus	Assignment for professional speech interaction with AI
1	2	3	4
1	Seeds	der Samen, der Samenaufbau, die Auslese, die Aussaat, die Züchtung, das Süßgras, das Getreidekorn, die Hüte, die Schicht, der Mehlkörper, kohlenhydratreich, der Ballaststoff, die Frühjahrsaussaat, die Vegetationsperiode, löslich, die Schale, die Fruchtschale, die Samenschale, die Aleuronschicht, der Keim, die Keimung, der Keimling, reif, einkeimblättrig, zweikeimblättrig, das Blatt, das Keimblatt, die Blattscheide, der Stängel, die Wurzel, versorgen, wachsen, die Sproßanlage, einbetten, durchstoßen	1. Specify the time of sowing period and the amount of seeds needed per square meter when planting wheat, rye, oats, barley in Germany. 2. Discuss the difference in the time of first sprouts from wheat, rye, oats, and barley seeds. 3. Describe what the copepods of wheat, rye, oats, and barley look like. 4. Examine a half grain in longitudinal section and discuss its structure. 5. The cereal family is divided into the subfamilies Fescue, Rice, Prosoob-raznye, and Bearded. Describe the differences between the various cereal plants
2	Cereals	das Getreide, der Weizen, der Emmer, der Roggen, die Gerste, der Hafer, das Futtergetreide, der Büschel, die Kronenwurzel, die Standfestigkeit, der Halm, der Getreidehalm, der Halmknote, das Internodium, die Ähre, das Blattöhrchen, das Blatthäutchen, die Kolbe, die Blüte, der Deckspelze, die Selbstbefruchtung, die Fremdbefruchtung, säen, ernten, die Selbstbestäubung, das Hüllblatt, das Lieschblatt, das Körner, das Pollenkörner, der Narbenfaden, zweizeilig, mehrzeilig, der Vorkommen, der Fruchtstand, der Stiel, die Aussatzeit, der Ertrag, die Winterfestigkeit, das Wärmebedürfnis	1. Discuss the stages of growth of cereal crops. 2. Identify the characteristics of the root system of cereal crops. 3. Tell about the main types of cereal crops. 4. Find out how many types of inflorescences are in cereal crops? How do they differ from each other? 5. Discuss the quality classes into which wheat varieties are divided in Germany. 6. Compare wheat and oats in terms of sowing and harvesting time and their use in food processing
3	Plants for energy production in biogas plants	der Rohstoff, der Kraftstoff, die Energiequelle, die Energiegewinnung, die Biogasanlagen, speichern, das Kohlenstoffdioxid, das Kohlenhydrat, der Sauerstoff, wandeln, verdunsten, der Kreislauf, der Faserstoff, die Stärke, der Energielieferant, häckseln, einlagern, die Verbrennung, die Vergasung, die Verflüssigung, gewinnen, freisetzen, der Gärbehältern, die Lagerfähigkeit, die Gasausbeute, reduzieren, geruchlos, entzündlich, die Säure, die Essigsäure, die Hefe, der Vorgang, umwandeln, die Methangärung, der Methanertrag, die Verstromung, die Stromspannung, der Treibhauseffekt	1. Discuss what biogas is and how it is produced. 2. Identify which agricultural plants are leading the way in the production of energy-intensive biomass. 3. Why has the production of biogas as an energy source increased strongly in German agriculture in recent decades? 4. Discuss what the me-tan content of the biogas depends on. 5. What are the reasons why maize is the leading plant used for energy production?

End of Table 1

1	2	3	4
4	Influence of soil fertility and crop rotation on yields	die Schicht, die Schutzschicht, die Erdkruste, der Boden, der Wüstenboden, die Bodenbearbeitung, die Bodenqualität, die Verunreinigung, langfristig, die Parabraunerde, der Bestandteil, die Verwitterung, die Verrottung, der Sand, der Lehm, zerfallen, die Fruchtbarkeit, das Gestein, der Inhaltsstoff, der Nährstoff, speichern, die Verankerung, die Versorgung, die Produktionsgrundlage, die Forstwirtschaft, der Gartenbau, die Nahrungskette, die Austrocknung, die Untersaat, das Unkraut, die Bedingung, die Fruchtfolge, die Zwischenfrucht	1. Discuss which physical processes are particularly important in the formation of soil. 2. Tell what soil consists of and what functions it performs. 3. How is the growing layer of soil (humus) formed? 4. Describe the activities that are necessary to improve soil fertility. 5. Discuss the reasons why farmers use crop rotation. Give examples of it. 6. Discuss the regions of Germany that have the highest and lowest crop yields. What are the reasons for this?
5	Effect of fertilisers on soil quality	die Düngung, die Gründüngung, die Kalkdüngung, die Kalkung, der Kalk, das Kalkgestein, der Branntkalk, das Calciumcarbonat, verdichten, sauer, die Zugabe, die Nährstoffverfügbarkeit, der Säureeintrag, die Versauerung, die Strukturverschlechterung, die Wirkung, der Humusgehalt, gelangen, der Verlust, verursachen, die Pufferwirkung, das Tonmineral, der pH-Wert, die Anhebung, die Bodenbeschaffenheit, der Bodenverlust, der Bodenschutz, die Lösung, die chemischen Bindung, die Oberfläche, die Ackerfläche, liefern, abpuffern, die Pufferung, die Düngekalkart	1. Identify the effects of lime fertilizer on soil. 2. Discuss the reaction that occurs when calcium oxide comes in contact with water. 3. Discuss the types of lime fertilizers. 4. Compare the reactions of quicklime and calcium carbonate in soil. 5. Discuss the effect of the amount of clay and gu-mus on soil pH. 6. How is the amount of lime needed to fertilize the soil calculated?

Source: compiled by the author.

Table 2
The ascertaining and control sections' results in CG and EG

Slice and t-criterion / Group and t-criterion	CG average ($\bar{x}$)	EG average ($\bar{x}$)	t-criterion (CG vs. EG)
Concluding cut	2.26	2.33	1*
Control cutoff	4.2	4.46	2.25**
t-test (confirmatory vs. control)	12.61**	16**	

Note. * – $p > 0.05$; ** – $p \leq 0.05$.

Source: calculated by the author based on the results of the experiment.

RESEARCH RESULTS

The experiment proved the effectiveness of the proposed step-by-step technology of professional thesaurus formation among students of agrarian university using extracurricular practice with Polybuzz web application. The data of Table 2 show that before participation in the experimental training the participants of CG and EG possessed the professional thesaurus at the same level (CG: $\bar{x} = 2.26$; EG: $\bar{x} = 2.33$; $t = 1$ at $p > 0.05$).

Comparing the results of the two cutoffs separately in CG and EG showed the effectiveness of both teaching methods (CG: $t = 12.61$ at $p \leq 0.05$; EG: $t = 16$ at $p \leq 0.05$). This means that the traditional method of teaching a professional foreign language, based on a combination of elements of Content and language integrated learning and foreign language for special purposes, and the innovative method, adding to the traditional method the extracurricular practice of communication on a professional topic of students with a virtual interlocutor, which was the web application of AI PolyBuzz.

Contribute to the development of foreign-language professional communication skills and the formation of professional thesaurus. At the same time, the comparison of the data of the control section in CG and EG between themselves shows the presence of statistical significance in the differences of average values in favor of the innovative method ($t = 2.25$ at $p \leq 0.05$). Integration of extracurricular practice of students of agrarian university with the PolyBuzz web-application contributed to more effective mastering of professional thesaurus by students. The practice of PolyBuzz web-application application in the extracurricular work of students of agrarian university also allowed designating several aspects for scientific discussion. The first aspect is related to student motivation. E. Haryanto and R. Ali [31] argued that the use of new technologies for the educational system, including artificial intelligence technologies, contributes to the formation and maintenance of students' motivation to use them

in the learning process. We also state that the participants of the experiment consistently expressed interest in participating in speech practice on professional topics with the AI tool PolyBuzz. They enthusiastically discussed in small groups the results of this practice, communicative failures when communicating with AI, and ways out of them. Figure 1 shows screenshots of students' interactions with PolyBuzz when discussing professionally oriented issues in a foreign language.

The second aspect concerns the potential of AI technologies in the organization of personalized foreign language learning. In their works, P.V. Sysoyev [32; 33] and M.N. Evstigneev [34] show that the integration of AI in education contributes to the development of students' and learners' learning autonomy and the ability to formulate the purpose of learning independently, to select the means and methods of learning, and to self-control their learning and cognitive work. The participants of the experiment noted that the skills of interaction with PolyBuzz acquired during the training were transferred to the use of other web applications and services to solve other learning tasks.

The third aspect is related to the use of the native language in foreign language classes when discussing the results of students' academic speech practice with AI. Experience has shown that students lacked the language and speech facilities to discuss many professional issues and the results of practice with AI in a foreign language. They were allowed to use their mother tongue to achieve the purpose of the discussion.

The fourth aspect is related to the competence of teaching a professional foreign language course in the field of AI. M.N. Evstigneev, P.V. Sysoyev and I.A. Evstigneeva [35; 36] in their works noted that one of the conditions for the successful integration of AI in education is the competence of teachers in the field of AI. The empirical study conducted by Prof. P.V. Sysoyev [16] showed that modern teachers' competence in the field of AI is much lower than that of students. Our experimental work

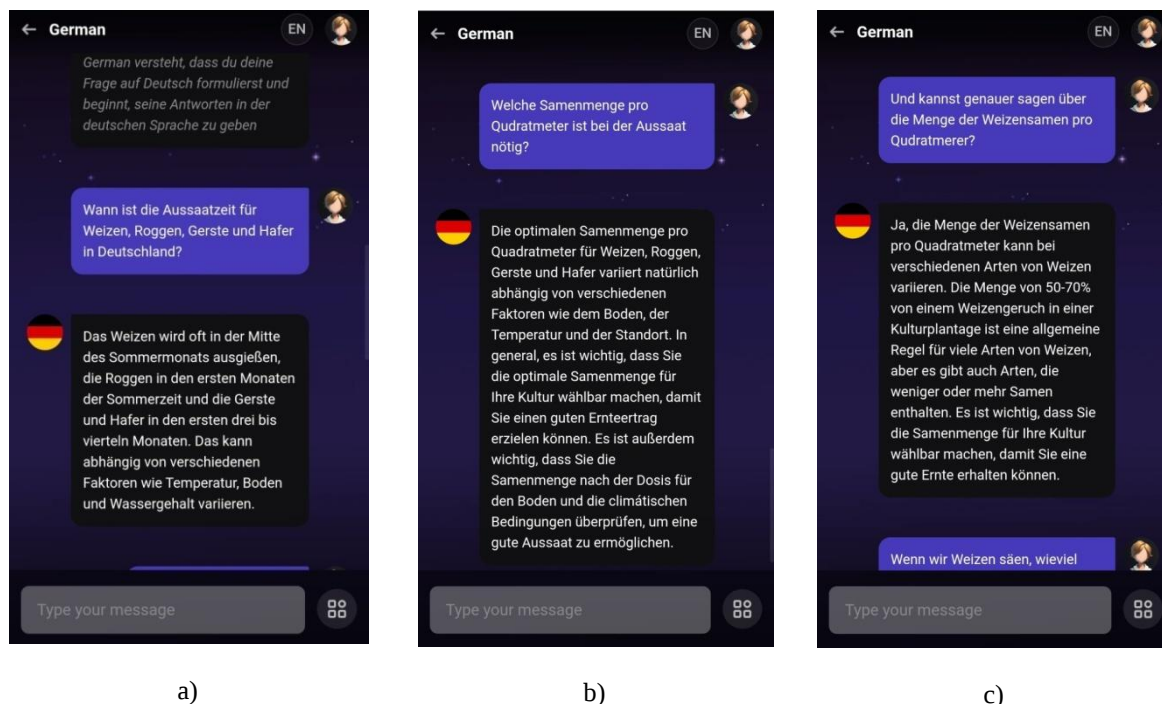


Fig. 1. A fragment of an agricultural university student's discussion with the chatbot of the PolyBuzz mobile application on the professional topic "Seeds"

Source: the screenshot is taken by T.V. Baydikova in the PolyBuzz mobile application.

showed that it is not enough to simply recommend students to participate in foreign-language communication on professional topics with a virtual interlocutor, AI. In the process of communication, there are many issues related to formulating the initial attitude and establishing the context of communication, as well as communicative failures when the responses of the AI tool do not meet the content of the communication. In this regard, the instructor, before assigning the task of interacting with the AI, should engage in this communication himself to alert students to expected and unexpected results. The fifth aspect is related to the validation of the results of the foreign language practice with the AI tool. P.V. Sysoyev and E.M. Filatov [28] quite rightly argue that such confirmation can be

printed versions of the texts of students' communication with the AI. Without such confirmations, students' extracurricular practice with AI can become a formality.

CONCLUSION

The conducted empirical research has proved that the method of integrating the extracurricular foreign language practice of agrarian university students on professional topics with the AI tool contributes to the better formation of their professional thesaurus.

The perspectives of this research are further study of the language didactic and method potential of specific AI tools in the professional training of agricultural university students.

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Information about the author

Tatiana V. Baydikova, Cand. Sci. (Education), Associate Professor of Russian and Foreign Languages Department, Voronezh State Agrarian University named after Emperor Peter the Great, Voronezh, Russian Federation.
<https://orcid.org/0000-0002-2821-8250>
november22@rambler.ru

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Информация об авторе

Байдикова Татьяна Вячеславовна, кандидат педагогических наук, доцент кафедры русского и иностранных языков, Воронежский государственный аграрный университет им. императора Петра I, г. Воронеж, Российская Федерация.
<https://orcid.org/0000-0002-2821-8250>
november22@rambler.ru

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