Использование чат-ботов на основе больших языковых моделей для повышения качества подготовки педагогов в области информатизации образования

Н. И. ИСУПОВА, Д. А. ШАБАЛИНА, З. В. ШИЛОВА, Н. Н. ШАДРИНА

АННОТАЦИЯ

Проблема и цель. Модернизация высшего образования предполагает активное использование виртуальных помощников и диалоговых агентов в подготовке наставников цифровой школы. Однако, применение больших языковых моделей (LLM), представляющих сложные системы для генерирования текста, проведения диалога с пользователями требует учета их преимуществ и ограничений. *Цель исследования* – выявить возможности применения чат-ботов на основе LLM для повышения качества подготовки педагогов в области информатизации образования.

Методы исследования. LLM – это модель глубокого обучения, которая использует и обучает массовые наборы данных, чтобы преуспеть в задачах обработки языка. Магистрантами применяется ресурс – LMSYS Chatbot Arena, краудсорсинговая открытая платформа для оценки LLM. Эксперимент проведён на базе Вятского государственного университета (Российская Федерация). В нём задействовано 58 магистрантов по направлению подготовки 44.04.01. Педагогическое образование, профиль «Информатизация образования». Интеграция чат-ботов на основе LLM в дидактический процесс выполнена в рамках дисциплины «Информационные технологии в педагогической деятельности». Согласно структуре соответствующей рабочей программы, разработано авторское тестирование из 5 разделов. При статистической обработке данных использован критерий χ^2-Пирсона.

Результаты. Описана деятельность магистрантов с чат-ботами на основе LLM: определение понятий, разбор примеров; изучение интерфейса и возможностей платформы; отработка навыков и понимание принципов формулирования промптов на простых примерах; применение сервиса для научного исследования; формулирование методических рекомендаций для начинающего пользователя. Особенность информационного взаимодействия – участники самостоятельно (с учётом специфики подготовки) определяют сущности в тексте, формулируют промпты, выбирают модели. Выявлены статистически достоверные различия в качественных изменениях, произошедших в педагогической системе ($\chi^2 = 6{,}820$; $p < 0{,}05$).

Заключение. Определены дидактические возможности применения чат-ботов на основе LLM: генерация персонализированного контента, мультиязычность, активация познавательной деятельности, интенсификация обратной связи. Выделены и трудности: настороженное отношение к новым технологическим решениям и необходимость дополнительных ресурсов на понимание их принципов работы; этические проблемы.

КЛЮЧЕВЫЕ СЛОВА

искусственный интеллект, цифровая технология, генерация персонализированного контента, информатизация образования, промпт, Chatbot Arena

Для цитирования: Исупова Н. И., Шабалина Д. А., Шилова З. В., Шадрина Н. Н. Использование чат-ботов на основе больших языковых моделей для повышения качества подготовки педагогов в области информатизации образования // Перспективы науки и образования. 2025. № 4. С. 538–550. https://doi.org/10.32744/pse.2025.4.35

Поступила: 22.02.2024 | Одобрена: 15.04.2025 | Опубликована: 31.08.2025

PERSPECTIVES OF SCIENCE AND EDUCATION
PSEJOURNAL.WORDPRESS.COM
SCIENTIFIC ARTICLE |

Using chatbots based on large language models to improve the quality of teacher training in the field of informatization of education

N. I. ISUPOVA, D. A. SHABALINA, Z. V. SHILOVA, N. N. SHADRINA

ABSTRACT

Problem and aim. Modernization of higher education involves the active use of virtual assistants and dialog agents in the training of digital school mentors. However, the use of large language models (LLM), which are complex systems for generating text and conducting a dialogue with users, requires taking into account their advantages and limitations. The aim of the study is to identify the possibilities of using chatbots based on LLM to improve the quality of training teachers in the field of informatization of education.

Research methods. LLM is a deep learning model that uses and trains massive data sets to excel at language processing tasks. Master's degree students use the resource LMSYS Chatbot Arena, a crowdsourcing open platform for LLM assessment. The experiment was conducted at Vyatka State University (the Russian Federation). It involved 58 master's degree students of the training program 44.04.01. Pedagogical education, training program specialization “Informatization of education”. The integration of LLM-based chatbots into the didactic process was carried out within the framework of the discipline "Information technology in pedagogical activities". According to the structure of the corresponding work program, the author's testing consisting of 5 sections was developed. In statistical data processing, the Pearson's chi-squared test was used.

Results. The article describes what master's degree students used LLM-based chatbots for: defining concepts, analyzing examples; studying the interface and capabilities of the platform; practicing skills and understanding the principles of formulating prompts using simple examples; using the service for scientific research; formulating methodological recommendations for a novice user. The peculiarity of information interaction is that participants independently (taking into account the specifics of training) define entities in the text, formulate prompts, and select models. Statistically significant differences in the qualitative changes that occurred in the pedagogical system were revealed ($\chi^2 = 6.820$, $p < 0.05$).

Conclusion. The didactic possibilities of using chatbots based on LLM are defined: generation of personalized content, multilingualism, activation of cognitive activities, intensification of feedback. Difficulties are also highlighted: a wary attitude towards new technological solutions and the need for additional resources to understand their operating principles; ethical issues.

KEYWORDS

artificial intelligence, digital technology, personalized content generation, informatization of education, prompt, Chatbot Arena

For Citation: Isupova, N. I., Shabalina, D. A., Shilova, Z. V., & Shadrina, N. N. (2025). Using chatbots based on large language models to improve the quality of teacher training in the field of informatization of education. *Perspektivy nauki i obrazovania = Perspectives of Science and Education*, (4), 538–550. https://doi.org/10.32744/pse.2025.4.35

Received: 22 February 2025 | Approved: 15 April 2025 | Published: 31 August 2025

INTRODUCTION

1. The result of UNESCO's work, which has been dealing with the use of AI technologies in education for almost a decade, was the recommendations on the ethics of using artificial intelligence in education and scientific research approved in November 2021. The outcomes of this research were the guidelines for the use of generative AI in educational and scientific practice created in 2023. UNESCO experts note that some countries at the state level still hinder the use of devices that provide access to AI technologies in the educational process [1]. Nevertheless, V. Ratten and P. Jones emphasize, the rapid development of AI-based technologies inevitably leads to the emergence of various difficulties and concerns that cannot yet be overcome because of shortcomings in the public policies of a number of countries and the lack of necessary laws and regulations [2].

2. After analyzing the situation in Russia, it can be noted that experts from the AIRI Institute of Artificial Intelligence determine the following facts [3]: understanding and using AI chatbots can significantly affect various aspects of educational, cognitive and work activities. The national project "Digital Economy" offers several initiatives which are being implemented and influence the emergence of trends in the field of education, which are also fair for IT teachers: training of personnel for the digital economy; an increase in the number of developments in the field of artificial intelligence, as well as its integration into various social processes; discussion of the difficulties of legal regulation of issues of ethics, cybersecurity and intellectual property rights [4].

3. P. V. Sysoev, E. M. Filatov, D. O. Sorokin argue that the very limited number of conducted empirical studies does not allow us to talk about the systematicity and complexity of the identification of all challenges for the use of AI-based tools in education [5]. In this regard, as E. A. Mamaeva et. al. substantiate, there is a need to train specialists capable of research and training with the support of AI [6]. The authors consider the option of organizing project work for teachers specializing in the problems of informatization of education. In this case, the key didactic tool is a chatbot for educational purposes.

4. The content of the master's degree program "Informatization of Education" includes disciplines within which it is possible to effectively prepare future specialists of the digital society to use large language models (LLM) to support analytical, research, and communication activities, in particular, to understand and use the resources of "smart chatbots". Using recommendations and answers received by users as a result of communication with a virtual assistant, as O. Bourkoukou and E. E.Bachari substantiate, causes significant difficulties for most participants in information didactic interaction [7]. Thus, there is an objective need for additional research into the use of LLM-based chatbots in the implementation of the master's degree program "Informatization of Education" to improve the quality of professional training of students.

Research hypothesis – the use of LLM-based chatbots in training specialists in informatization and digitalization of education will provide additional resources to improve the quality of their training in the master's degree program. The purpose of the work is to identify the possibilities of using LLM-based chatbots to improve the quality of training of master's students-teachers in the field of informatization of education. Research objectives:

- to clarify the problems and possibilities of using LLM-based chatbots in training specialists in informatisation of education;
- to describe the options for using LLM-based chatbots to support various types of students' educational and professional activities, taking into account the specifics of their training;
- to identify the factors influencing the quality of using LLM-based chatbots to enhance information interaction;
- to experimentally test the effectiveness of the proposed integration of LLM-based chatbots in training master's degree students.

MATERIALS AND METHODS

A master's student – a teacher in informatization of education – is a professional who is able to develop information and methodological support for educational activities based on knowledge of the cognitive characteristics of the digital generation and the communication advantages of new media, social networks and computer games. Graduates of the program will be able to apply the acquired competences in the field of informatization, taking into account the challenges of the future. In the study, we will use the LMSYS Chatbot Arena resource (https://chat.lmsys.org/). This is a crowdsourcing open platform for assessing LLM (Large Language Model). Its advantage is that at the initial stage of work, the user is immediately warned that the service is a preliminary study. It provides only limited security measures. The platform should not be used for any illegal, harmful, violent purposes. The developers warn: do not upload any personal information. The service collects data on user dialogues, including both text and images, and reserves the right to distribute them under the license. LLM is a deep learning model that uses and trains massive datasets to excel at language processing tasks. It creates new text combinations that mimic natural language based on its training data.

A prompt is a request to the neural network to get the desired image or text. The clearer and more correct the prompt is, the more relevant the result will be.

The experiment is based at Vyatka State University (hereinafter referred to as VyatSU). The experiment involved 58 master's degree students of the training program 44.04.01. Pedagogical education, training program specialization "Informatization of education". The average age of students is 24 years (55% – female, 45% – male). Involvement of master's degree students in information interaction with chatbots based on LLM is implemented when studying the discipline "Information technologies in pedagogical activities". The materials of the assessment tool fund, compiled by the authors, according to the requirements of the university and the content of the work program of the discipline, are the basis for determining the control and experimental groups. The test has 50 questions (25 open and 25 closed questions). The number of questions was determined according to the indicators (developed professional competences in the discipline). The essence of each of the indicators is deciphered in the research program.

The correct answer to an open question was estimated at 2 points; to a closed question – 1 point. Examples of questions are given in the Research program. Thus, according to the results of the control test, master's degree students could score from 0 to 75 points. Levels of professional training: "low" (from 0 to 29 points), "average" (from 30 to 64 points), "high" (from 65 to 75 points). The methodology for determining and interpreting the levels is in the program and results of the study. The control (29 teachers of information technology and education) and the experimental (29 teachers of education) group were formed. Statistical data processing was performed using Pearson's χ^2 (chi-square) test.

LITERATURE REVIEW

In 2024, two works were published with the support of UNESCO, they presented a list of artificial intelligence capabilities and a list of skills that should be focused on, firstly, by digital school mentors, and, secondly, by students [1]. The presented materials serve as guidelines in terms of how to ethically and effectively use AI in the didactic process. Zh. Zhang, X. Huang point out that the significant attention paid to the integration of AI and machine learning in the educational process is justified at least by the condition that new technologies support automation and personalization in learning. Digital tools make it possible to adapt teaching methods to those significant problems (for example, replenishing vocabulary and memorizing words) that some students face. Based on this condition, the authors conclude stating the need to prepare the teachers themselves for the skillful use of "smart chatbots" [8].

X. Zhang et al. determine that the significant interest of the scientific and pedagogical community in generative artificial intelligence is justified by the following circumstance: it has human-like

abilities to interpret, generalize, create and predict information of various kinds. However, the existing volume of theoretical and empirical data, according to the author's conclusions, is still not sufficient for a deep understanding of the application of GenAI in education [9]. B. Alsafari et al. explore how chatbot technology is undergoing a transformation over time [10]. The authors track the integration of advanced AI models and indicate that AI is becoming a key factor in changing dialog agents in the field of education. The research team presents its educational assistant for efficient processing of various requests. In their opinion, the capabilities of this educational assistant correspond to a new paradigm in the capabilities of educational chatbots.

In the work of S. V. Titova, K. T. Temuryan it is concluded that the use of artificial intelligence in education supports the implementation of the following tasks: generation of natural language, personalization of learning and control [11]. One of the methodological tasks for the teacher is to correctly organize the educational process, to create appropriate educational materials, and to implement the didactic advantages of intelligent agents in practice. The authors conclude that at present, the solution to these problems is noticeably simplified for a number of reasons. For example, the development of tools of intelligent agents (in particular, chatbots) does not require such training from the teacher as it did before.

S. Balaskas et. al determine that the current stage of development of society determines new trends in the education system, one of which is the introduction of technologies, programs and services created on the basis of AI [12]. In the research of P. V. Sysoev, E. M. Filatov, D. O. Sorokin it is indicated that chatbots and voice assistants should be considered as a class of programs that: operate on the basis of artificial intelligence; organize special interaction with a person to solve communication problems [13]. N. Rane et al. describe trends and tendencies in the field of improving chatbots, which is for example, generating personalized responses [14]. LLM are able to adapt to the style and manner of communication of each specific user, which makes interaction with the chatbot more individual. Models can "adapt" to the user's habits, offer personalized recommendations or solutions based on previous interactions.

Y. Yin, H. Peng, H. Liu stress the fact that a new era in innovation is coming, requiring "smart" personalized training of specialists of various profiles [15]. L. K. Yuki et al. identify the relationship between e-learning, culture and traditions [16]. The phrase "AI-based chatbot" is a logical continuation of this chain. J. Rajik analyzes rural teachers’ views on the integration of Large Language Models (LLM) into the teaching and learning process [17]. He identifies key challenges teachers in the Philippines face. The author shows that teachers have significant concerns due to unequal access to technology and quality teaching. Teachers doubt the reliability and effectiveness of LLM. In addition, they experience difficulties in aligning the results of LLM with the curriculum and pedagogical goals. A special point is highlighted by significant concerns of mentors about data privacy and security. J. Rajik argues that teachers recognize the potential benefits of LLM. However, their concerns point to the need to add courses to teacher education programs that explore how to incorporate large language models into the teaching and learning process. Such changes will allow them to gain skills that support their professional development and improvement for the responsible and ethical implementation of new technology in rural schools. The study emphasizes the importance of solving these problems for the successful implementation of LLM in education and the introduction of relevant disciplines in teacher training. E. V. Soboleva et. al consider the option of improving the program for training teachers in the field of informatization of education at the bachelor's degree level. The authors propose using gamification services as a basis for information interaction [18].

P. Ghimire, B. Neupane, N. Dahal note that large language models radically change the approach to the development of chatbots and virtual assistants. These models are able not only to understand the context of the conversation, but also to generate meaningful responses, which makes interaction with users more natural and flexible [19]. C. Zhou et. al point out that conversational agents (or chatbots) are largely based on data used to train large language models (LLM) and are used to obtain new content (knowledge) in response to user queries [20]. In conclusion, they formulated prospects for increasing their efficiency and reliability in various areas of application. For example, the correction of the limitation when chatbots based on LLM generate incorrect answers. That is, what should users do if LLM has formulated an answer that sounds plausible, but is incorrect or inaccurate.

D. M. Nazarov, S. V. Begicheva perform a brief historical review of the emergence of LLM models, formulate principles for constructing good and bad queries in the GigaChat and Yandex GPT services. They also provide practical examples [21]. W. Gan et al. prove that the use of LLM in the field of digital/ intelligent education has broad prospects [22]. Research on large educational models is constantly evolving, offering new methods and approaches to achieve personalized learning, virtual tutoring, and automated feedback. F. Zeng et al. analyze the problems of using LLM-based chatbots in master's degree education [23]. For example, the authors note that despite all the advantages, the use of LLM in chatbots and virtual assistants faces a number of challenges. At a minimum, this is data bias. That is, models can reproduce the bias of the data on which they were trained, which can lead to incorrect answers. More seriously, when privacy issues arise, since the processing of users' personal data requires strict security measures. B. Luo et al. stress that LLMs support many languages, which makes them ideal for companies working with an international audience [24]. They provide guidance to practitioners to help realize the commercial value of chatbots; support informed decision-making related to the development and implementation of chatbots in various business contexts.

A. Abidi et al. indicate that there is a growing interest in supporting self-reflection and self-development of teachers using generative artificial intelligence (GenAI) technologies [25]. The authors consider the use of LLM, such as GPT-4, to automate the analysis of the pedagogical practice of secondary school teachers in Singapore. I. Ndukwe, B. Daniel rightly note that teachers themselves need to be taught to use information technology and digital technologies to apply them in analytics (both their own activities and those of students) [26]. These ideas are continued in the study by E. V. Soboleva et. al. The authors propose the use of interactive personalized portfolios [27]. In the authors' understanding, the proposed tools dynamically reflect the individual performance results of each teacher. And they provide material for analysis and self-improvement. O. Chinedu, A. Ade-Ibijola, based on serious analytical work (after studying 53 sources), note that chatbot resources can ensure fast and personalized interaction of all participants in the didactic process, including employees of educational institutions [28]. M. Idris, X. Feng, V. Dyo assess the transformative potential of large language models (LLM) in the field of higher education and emphasize their ability to change the academic environment [29]. L. Na explores the possibilities of chatbots to improve the efficiency of university employees involved in the management and support of the educational process [30].

The analysis revealed that: the introduction of LLM-based chatbots is an important area of informatization of education and the achievement of Sustainable Development Goals; LLM-based chatbots have didactic and methodological potential for their use in the training of specialists in the informatization of education; there are regulatory, technical, methodological and organizational difficulties in using LLM-based chatbots in the training of master's students.

RESEARCH PROGRAM

At the first stage, the analysis of literature and experience of using LLM-based chatbots in teaching master's degree students was conducted. It was revealed that despite all the advantages, using LLM in chatbots and virtual assistants faces a number of challenges: data bias, confidentiality, and sometimes incorrect answers are generated. The provisions of the federal standard for the training area were analyzed. Indicators for assessing the level of professional training were identified according to the working program of the discipline. And 50 questions were compiled for control (before and after the experiment): 10 questions for each indicator:

1 indicator: applies the norms of professional ethics in the informatization of education. Example question: "The main threats to the educational environment on the Internet do not include: disinformation, equipment failure, computer crime, spam".

2 indicator: demonstrates the ability to optimize professional activities. Example question: "Which of the following aspects is important for ensuring the security of information technology? Answer options: data clarity, data confidentiality, ease of use, data processing speed".

3 indicator: is able to design programs of academic disciplines. Example question: "What is a curriculum? Answer options: a document defining the content and structure of the educational

process; a set of educational materials; a document that describes the teaching methods; a program for automating the educational process".

4 indicator: demonstrates skills in designing educational results of academic disciplines and ways to achieve them. Example question: "Using GOST R 52872-2012 "Internet resources. Accessibility requirements for the visually impaired", develop a presentation illustrating the main requirements for a website version for the visually impaired".

5 indicator: is able to critically analyze problematic situations based on the systems approach. Example question: "How can I set up a corporate mailbox so that I can quickly separate letters from parents (legal representatives) of students from other senders' letters? Answer options: schedule automatic sending of letters; set up a blind copy of letters; set up filtering of letters; set up an automatic signature for the letter".

There are 25 open and 25 closed questions in total. The correct answer to an open question was equal to 2 points, to a closed question – 1 point. Next, the place of work with LLM-based chatbots in the discipline structure was specified. And the procedure for quality control of training was determined – questions for the assessment tool fund. Based on the results of the author's test, the levels of training of master's degree students were determined. Control and experimental groups were formed.

At the second stage of the study, master's degree students studied the materials of the discipline according to the plan described above. At the third stage of the study, factors influencing the quality of using LLM-based chatbots to activate information interaction were determined.

RESEARCH RESULTS

As it was established during the literature review, the use of LLM for the development of chatbots and virtual assistants opens up new horizons in the field of automation of communication with users. These models improve the naturalness of interaction, personalize responses and provide real-time support. Education is one of the areas where LLM are already playing an important role. Virtual assistants can act as mentors, help students solve problems, answer questions and explain complex topics. For example, a virtual tutor based on LLM, integrated into an educational platform, helps students understand, theoretical material, solve problems in mathematics or languages, providing detailed explanations and examples. It can also adapt to the student's level, offering tasks based on student's progress. As a result, students' engagement in learning increases, information search processes are optimized and their creative research is stimulated. During the lectures, the master's degree students of both groups studied the main terms related to chatbots and AI: artificial intelligence, API, neural networks, attributes, data tags, chatbot constructor, chatbot types, communication channel, entities, prompt, etc.

Then the master's degree students considered practical examples of using chatbots, for example, YandexGPT by Yandex, GigaChat by Sber, etc. The participants identified the advantages and limitations of including chatbots in pedagogical activities. An example situation for the analysis: "A virtual tutor based on LLM, integrated into an educational platform, helps students understand the educational material, solve problems in mathematics or languages, giving detailed explanations and examples. It can also adapt to the student's level, offering tasks based on student's progress". Then the problems of ethics, maintaining confidentiality, and assessing the reliability of information received by the user upon request from the chatbot are discussed. Participants of the experimental group worked with a chatbot based on LLM. It is important to note: master's degree students can be primary school teachers, additional education teachers, etc. For example, a foreign language teacher at the International full-day primary school "Sova". Therefore, the information interaction option includes tasks from "simple" (not requiring knowledge of education informatization) to "complex" (taking into account the specifics of training). The purpose of the proposed option for the master's degree students in the experimental group is: to gain knowledge about working with "smart" chatbots; to acquire the skill of formulating "correct" prompts to obtain "correct" information; to gain experience in writing scientific and project work. Next, we will describe the logic of working in the LMSYS Chatbot Arena resource environment step by step (https://chat.lmsys.org/).

Step 1. When you open the page, read the warning about working with the resource. By clicking the "Close" button, you agree to the following conditions:

– firstly, you are aware that this service is a preliminary research version. It provides only limited security measures and may create offensive content. It cannot be used for any illegal, harmful, violent, racist or sexual purposes;

– secondly, you have been warned that the service collects user dialogue data, including text and images, and reserves the right to distribute them under a Creative Commons Attribution (CC-BY) license or a similar license. The resource page contains the following tabs: Arena (battle), Arena (side-by-side), Direct Chat, Leaderboard and About Us. On the Arena (battle) tab, the user can anonymously chat with any two models out of 48 offered. The user can vote for the model that gave the most suitable answer in your opinion. It is not necessary to rate after answering the first remark. The user can continue the dialogue and draw a conclusion based on several answers. On the Arena (side-by-side) tab, it is possible to select interlocutors (two specific models out of 48 offered). Here it is possible to vote for the model you like. On the Direct Chat tab, the user can chat with one selected network. Don't forget about the rating. The Leaderboard tab shows the rating of models, the user can find out more about the service on the About Us tab.

If the user has not yet decided on a model, he /she can select the first tab to work with two models at the same time. It is very easy to communicate with models: ir is required to type a prompt in the text input window and press Enter, wait for a response from the interlocutor (or two interlocutors at once). The dialogue can be continued until the user understands that the answer suits. After the first answer, the first and second tabs will show the opportunity to evaluate the work of the models. If the user wishes, it is possible to give own rating to the models. If the user does not like the answer, he/she can regenerate it. If the user wants to change the models, he/she starts a new round, on the second tab the user can select the model manually. The same request (prompt) can be asked to different models. And then the user has many assistants.

Step 2. Completing tasks, during which the master's degree students of the experimental group study the principles of the service and learn to formulate props.

Task 1. Formulate a prompt to explain concepts, names, specific phrases. Methodological recommendation: their selection is carried out by each master's degree student, taking into account personal needs and interests.

1.1. For example, "artificial neuron". The prompt can be formulated as follows: "Please explain the concept of an artificial neuron". Continue the dialogue and ask the next question, for example: "What is neural network training? How does this training happen"? Vote for the model whose explanation is liked the most.

1.2. The name of the salad. One of the master’s degree students made a request for "Russian dressed herring". The prompt was formulated as follows: "What is Russian dressed herring? What is the connection between it and Russian people"? Continuing the dialogue, the mentor advised asking the next question, for example: "What other nations cook Russian dressed herring"? Next: "Please tell me what can replace Russian dressed herring"? Next: "I don't eat mayonnaise. What should I use to dress this salad"? The graduate student then independently continued this dialogue.

Task 2. Identify the entities in a famous work of art. 2.1. Entity "The author's main ideas in the work". The prompt for one of the master's degree students was formulated as follows: "Identify three main ideas in the novel "Brave New World" by Aldous Huxley. The answer must be at least 100 words".

2.2. Entity "The course of events in the work". The prompt for one of the master’’s degree students was formulated as follows: "List the main events that occur in the novel "Brave New World" by Aldous Huxley, in chronological order. The answer must be at least 100 words".

2.3. The essence "The main characters and their relationships in the work”. The prompt for one of the master’s degree students was formulated as follows: "Tell us about the main characters of the novel "Brave New World" by Aldous Huxley and their characters. Describe the relationships between the characters in the novel. The answer must be at least 100 words".

2.4. The entity "Review of a work". The prompt for one of the master's degree students was formulated as follows: "As a literary critic, please write a negative review of the novel "Brave New World" by Aldous Huxley. The answer must be at least 100 words ".

2.5. The entity “Quotes from the work". The prompt for one of the master’s degree students was formulated as follows: "Give 7 famous quotes from the novel "Brave New World" by Aldous Huxley". Insert a screenshot of the dialogue liked most into the report.

Step 3. Independent selection of entities for interaction, taking into account the specifics of training. For example, digital technology, electronic educational resource, curriculum, database. That is, many of the terms studied are concepts from the control testing questions.

Step 4. Understanding the acquired skills of information interaction with the service.

Ask the participants to write own essays on the topic "Address to a first-year student" about the discipline "Information technologies in pedagogical activities", their attitude to it, their impressions of its teaching, advice and recommendations for studying this discipline (minimum – 1000 characters). it is recommended to use in the essay at least 10 out of the proposed phrases: scientific research, publication, bibliography, careless use, reasonable approach, numerous problems, and this is great, to the amazement, a big ship, a real adventure, the role is huge, significant changes, efficiency, what kind of miracles are these, wide opportunities. Next version of the work: to write an essay using LMSYS Chatbot Arena. Material for discussion: which essays did you like more? Answers of which neural network did you like more?

Step 5. Using the LMSYS Chatbot Arena service (https://chat.lmsys.org/) when writing the master’s degree thesis. Let’s see if language models can be useful for designing scientific research. When completing the tasks, rely on the topic of master’s degree thesis (or area of scientific research).

Task 1. Formulate the aim and objectives, and justify the relevance of the master’s degree thesis.

1.1. Ask the neural network to formulate the goal and objectives for the area of your research within the framework of the master's degree thesis. The prompt can be formulated as follows: "I am writing a master’s thesis on the topic "Title of the topic". Formulate the aim and objectives of the work in a scientific style". Then you can clarify some points in the list of tasks.

1.2. Ask the neural network to justify the relevance of your scientific work. Formulate the prompt yourself. To do this, describe in detail why relevance is needed. What should be written in it. You can make several attempts using different neural networks to achieve a more suitable result. Remember: what is formulated be the model must be questioned, analyzed, criticized and reformulated, and the resulting text must be checked for originality. The chatbot will not do all the work for you.

Task 2. Let’s say you need to compare several objects. To do this, you need to define the comparison criteria and describe this information in detail in the prompt.

2.1. Compare clouds by color. The prompt can be formulated as follows: "Topic "Types of clouds’. Compare them by color". Next: "Form a comparison of clouds in a table". This way, you will get two answer options: as a list and as a table. If you only need a table, the type of answer in the first request can be specified.

2.2. Use neural networks to compare objects required in your master's degree thesis (for example, compare different programming environments for developing a mobile application or compare platforms for creating e-learning courses). Insert a screenshot of the resulting comparison table into the report.

Task 3. Key words. 3.1. Find out how much text can be written in the prompt. Is it possible, for example, to send five A4 pages?

3.2. Send a small piece of text (start with one page) and ask to highlight several key words in the text. If the request is successful, then increase the text volume. Otherwise, try to "cheat the system" by adding text sequentially. In this case, ask the model to add a new portion of information to the previous one.

Task 4. Conclusions. Similarly, send a small piece of text on the topic of your research (start with one page) and ask the neural network to draw conclusions and write a conclusion. Insert a screenshot of the completed task result into the report. The master's degree students in the control group were not involved in the targeted use of the LMSYS Chatbot Arena service resources. For example, they worked with the Boris Bot designer. An example task: "tell fourth-grade students about the computer and the structure of the computer". A possible work plan: compose a text for a message, think over a list of questions and answers, design different options for developing a

conversation, select illustrations. It should be notes that the Boris Bot activity is pre-programmed by the mentor, i.e. the user virtually talks with the developer.

Step 6. Write 2-3 recommendations for a friend/colleague who is just starting to study and use a chatbot based on LLM (for example, Chatbot Arena) and prepare a report in digital form. After the information interaction with LLM-based chatbots, control testing was conducted again and the levels of professional training of master's degree students were determined again.

High level – master's degree students are fully prepared for the activities of using LLM-based chatbots to solve educational and professional problems in accordance with the challenges of the digital school. They accurately use digital technology resources when collecting and analyzing information facts, interpreting results, and designing educational events. Teachers introduce an element of creativity when completing assignments.

Average level – master's degree students are stable in their preparedness for independent activities of using LLM-based chatbots to solve educational and professional problems in accordance with the challenges of the digital school. In standard situations, they successfully use digital technology resources to collect and analyze information facts, interpret query results, and develop educational projects.

Low level – master's degree students are poorly prepared for independent activities when using LLM-based chatbots to solve educational and professional problems in accordance with the challenges of the digital school. They very often need the support of a mentor (manager) at the stage of using digital technology resources to collect and analyze information facts, interpret query results, and think through scenarios for educational projects.

Table 1 presents the results of training master's degree students-teachers in informatization of education.

Table 1

The level of preparation of master's degree students before and after the use of chatbots based on LLM

Level	Groups			
	Control (29 master's degree students)		Experimental (29 master's degree students)	
	Before the experiment	After the experiment	Before the experiment	After the experiment
High	6 (21%)	6 (21%)	6 (21%)	15 (52%)
Average	12 (41%)	13 (45%)	11 (38%)	10 (34%)
Low	11 (38%)	10 (34%)	12 (41%)	4 (14%)

The following hypotheses were accepted: H0: the level of training in the experimental group is statistically equal to the level in the control group; H1: the level in the experimental group is higher than the level of the control group. For $\alpha = 0.05$, χ^2_{crit} is equal to 5.991. It was determined that $\chi^2_{obs.1} < \chi^2_{crit}$ (0.087 < 5.991), and $\chi^2_{obs.2} > \chi^2$ (6.820>5.991). Therefore, changes in the level of professional training are not random. Comparison of the results shows that training using LLM-based chatbots provides a personalized and effective experience of information interaction, contributing to the improvement of the quality of students' professional training. Unlike simple algorithms that rely on pre-defined scenarios, LLM can analyze complex user requests, take into account the tone and even previous messages in the dialogue.

DISCUSSION

The presented study is an option for implementing the benefits that AI-based chatbots provide when included in education. The logic of information interaction was designed in the light of the recommendations presented in the UNESCO materials. Training highly qualified teachers in the field of informatization, taking into account the didactic capabilities of large language data models, is an important condition for self-realization and success of graduates, having consideration for the areas of the Digital Economy program and the challenges of the future.

The described option of the activity is aimed at helping participants in information interaction in resolving those objective contradictions that are partially formulated by O. Bourkoukou, E. E. Bachari [7]. The materials of the work complement the conclusions of E. A. Mamaeva et al. on the need to make changes in the training of specialists capable of analytical, research, and creative activities using AI technology. The conclusions of A. Abidi et al. are considered, when it is stated that generative artificial intelligence technologies can be effectively used to support self-reflection and self-development of teachers. Moreover, the obtained results confirm the statements presented in the work of W. Gan et al. about the directions and prospects for using LLM in the field of digital education.

As directions for the development and clarification of the results formulated in this work, we can propose: adding an alternative software solution for working with chatbots based on LLM; at the level of discipline content – making changes to the assessment of the level of professional training, formulation of the tasks for manipulating chatbots based on LLM, taking into account the use of information resources for interaction and users with special educational needs.

CONCLUSION

Thus, the use of LLM-based chatbots in training IT and digitalization specialists can be considered as an additional resource for improving the quality of their training. The latter circumstance is a priority in the context of implementing UNESCO activity areas (in general) and the Digital Economy program (in particular). The study describes the activities of master's degree students with LLM-based chatbots, carried out according to the following plan: studying basic concepts, practical examples from reputable software developers; studying the interface and capabilities of LMSYS Chatbot Arena. Understanding the rights to use the service; practicing skills and understanding the principles of formulating prompts using simple (everyday) examples; using LLM-based chatbots to write a master's degree thesis; formulating rules/methodological recommendations for another user who is starting to study the capabilities of Chatbot Arena.

The participants of the interaction highlighted the following didactic capabilities of LLM-based chatbots: their ability to understand the context more deeply; generation of personalized responses, i.e. adaptation to the style and manner of communication of each specific user; support for multilingualism, i.e. multiple languages, which makes it possible to create multilingual chatbots and virtual assistants; activation of students' cognitive activity; diversity of teaching aids; intensification of feedback. Personalization in learning and cognition is supported in the presented information interaction as follows: when students formulate prompts (or select an image for a request); when selecting a model from the rating on the About Us tab; when selecting an answer suggested by the platform models; when writing an essay.

Difficulties (problems) of organizing dialogues with chatbots based on LLM: problems of access to the Internet and inequality in digital literacy of participants in information interaction; ethical issues; wary attitude of mentors to new technological solutions; need for time to understand the principles of the service; insufficient understanding of the practical opportunities that didactic chatbots provide to the teacher. The obtained results can be used to improve: training of specialists in educational informatization as part of training master's degree students.

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Авторы

Исупова Наталья Ивановна
(Россия, Киров)
Кандидат педагогических наук, доцент кафедры цифровых технологий в образовании
Вятский государственный университет
E-mail: natalyisupova@mail.ru
ORCID ID: 0000-0001-9889-445X

Шабалина Дарья Александровна
(Россия, Киров)
Кандидат педагогических наук, доцент кафедры цифровых технологий в образовании
Вятский государственный университет
E-mail: darya.expo@yandex.ru
ORCID ID: 0000-0002-5156-3036

Шилова Зоя Вениаминовна
(Россия, Москва)
Кандидат педагогических наук,
доцент кафедры высшей математики
МИРЭА – Российский технологический университет
Доцент кафедры математики
Московский политехнический университет
Доцент кафедры ФН-12
Московский государственный технический университет имени Н.Э. Баумана (национальный исследовательский университет)
E-mail: zoya@soi.su
ORCID ID: 0000-0003-1715-2513

Шадрина Наталья Николаевна
(Россия, Москва)
Кандидат физико-математических наук, доцент кафедры высшей математики
МИРЭА – Российский технологический университет
E-mail: shadrinann8@yandex.ru
Scopus Author ID: 47061974600
ORCID ID: 0000-0002-3923-6497

Authors

Natalya I. Isupova
(Russia, Kirov)
Cand. Sci. (Educ.), Associate Professor of the Department of Digital Technologies in Education
Vyatka State University
E-mail: natalyisupova@mail.ru
ORCID ID: 0000-0001-9889-445X

Darya A. Shabalina
(Russia, Kirov)
Cand. Sci. (Educ.), Associate Professor at the Department of Digital Technologies in Education
Vyatka State University
E-mail: darya.expo@yandex.ru
ORCID ID: 0000-0002-5156-3036

Zoia V. Shilova
(Russia, Moscow)
Cand. Sci. (Educ.), Associate Professor,
Department of Higher Mathematics
MIREA – Russian Technological University
Associate Professor, Department of Mathematics
Moscow Polytechnic University
Associate Professor, Department of FN-12
Bauman Moscow State Technical University (BMSTU)
E-mail: zoya@soi.su
ORCID ID: 0000-0003-1715-2513

Natalia N. Shadrina
(Russia, Moscow)
Cand. Sci. (Phys.-Math.), Associate Professor,
Department of Higher Mathematics
MIREA – Russian Technological University
E-mail: shadrinann8@yandex.ru
Scopus Author ID: 47061974600
ORCID ID: 0000-0002-3923-6497

Вклад авторов

Исупова Н. И.: концептуализация, методология, создание рукописи и ее редактирование, руководство исследованием, администрирование проекта
Шабалина Д. А.: верификация данных, проведение исследования, создание черновика рукописи
Шилова З. В.: формальный анализ, проведение исследования, визуализация
Шадрина Н. Н.: ресурсы, программное обеспечение, проведение исследования

Author's contribution

Natalya I. Isupova: Conceptualization, Methodology, Writing - Review & Editing, Supervision, Project administration
Darya A. Shabalina: Validation, Investigation, Writing - Original Draft
Zoia V. Shilova: Formal analysis, Investigation, Writing - Original Draft
Natalia N. Shadrina: Resources, Software, Investigation

Авторы заявляют об отсутствии конфликта интересов

The author's declared no conficts of interest