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## Organization of Educational and Project Activities of Students to Create Chat Bots as a Condition to Train Future Teachers

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### Abstract

The future teachers training involves the formation of competencies for the development of software for various purposes, design of automated systems for managing real objects. The development of relevant qualities in higher education is complicated by a number of problems of a different nature. The authors propose to organize the project activities of students to create interactive programs (training bots) to improve the training of future specialists.

**Methodology.** Project-based learning is used to form competencies in the field of informatization of education, to obtain in-demand soft skills, and to unite the team. The construction of a chat bot takes place in teamwork. The experiment involved 43 students of the North Caucasian Federal University in area of training 44.03.05 Pedagogical education with two training profiles. The assessment of the quality of educational results was carried out using the author's testing of 10 tasks ("passed"/"not passed"). Fisher's test was used to establish statistically significant differences.

**Research results.** Students study services for creating chat bots, analyze the didactic potential and functionality of the programs received, and apply them to solve problems. The features of the presented variant of the organization of educational activities on the creation of chat bots are described: teamwork, the use of templates and scripts, the choice of project topics.

In conclusion, problematic questions are formulated, the answers to which make it possible to determine the directions of work on the design of chat bots: discussion of the development goal and didactic goal, the use of blocks and actions, modeling interaction scenarios, etc.

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**Keywords:** project-based learning, dialogue program, scripting template, professionally oriented communication, design, BorisBot.

### **1. Introduction**

The UNESCO Recommendations on the ethical aspects of artificial intelligence are a set of principles for the development and application of appropriate systems aimed at maximizing the benefits they provide to society and reducing the risks associated with such technologies ([Proekt Rekomendacii..., 2021](#)). These principles largely coincide with the provisions of the National Strategy for the Development of Artificial Intelligence for the Period until 2030, adopted in Russia in 2019 ([Ukaz Prezidenta..., 2019](#)).

Such systems, according to the indicated international recommendations, include chat bots. S. Sands et al. based on experimental data, they prove that because of automating the process of working with clients, the latter more actively turn to the services of companies through a chat bot or robotic support on the site ([Sands et al., 2021](#)). Y. Saadna, A. Boudhir, M. Ben Ahmed conduct an alternative study to analyze the frequency of students using social media messengers for educational purposes ([Saadna et al., 2022](#)). According to the conclusions of both scientific groups, representatives of the modern generation prefer precisely these methods of contact for obtaining advice, choosing a service, and organizing professionally oriented communication.

Achieving all these goals requires intercultural communication skills and digital skills from the participants in the interaction. R. Barac et al. state that work on the formation of appropriate skills must begin at preschool age and continue at all stages of education ([Barac et al., 2014](#)). Including teaching in the practice of university N. Yemez, K. Dikilitaş conclude that the learning model in the modern multicultural world should involve the formation of a creative personality that will be capable of an independent creative search for solving professional problems, the use of cyber-physical systems at various stages of professional communication ([Yemez, Dikilitaş, 2022](#)).

The level of scientific and technological achievements of recent years allows teachers to use not only social networks, video resources, interactive capabilities of Web 2.0 services, learningapps.org, but also new online technologies in teaching ([Zlobina et al., 2020](#)). Moreover, it is proposed to develop their own mobile applications, video blogs ([Soboleva et al., 2020](#)). A.S. Budnikova, O.S. Babenkova note that chat bots can radically change the nature of human interaction with the digital world: from reading and writing to listening and speaking. the authors point out that chat bots can be considered as "ideal partners" for learning languages, allowing you to learn several languages anywhere, anytime and at your own pace ([Budnikova, Babenkova, 2020](#)).

At the same time there are certain methodological difficulties: what kind of chat bot to use when teaching, how to organize effective educational and cognitive interaction in an automated environment, how to keep the interest of students. B. S. Goryachkin and ed. note that the danger of the effect of novelty and the rapid loss of interest in the study of the subject is one of the main didactic problems of the digitalization of education ([Goryachkin et al., 2021](#)). In the case of chat bots, for example, a celebrity-voiced conversational agent is used as an aid.

So, there is an objective need for additional study of the development and application of chat bots to enhance information interaction between participants in the didactic process in the modern educational environment. The relevance of the proposed direction of improving the training of future specialists is also due to the fact that the orientation of the processes of transformation of higher education involves the formation of a new management model that takes into account globalization processes, both in foreign economic activity and in the technological aspect of the digitalization of society.

The hypothesis of the study is that the participation of future teachers in the activity of designing chat bots will provide additional conditions for the development of popular digital skills (working with data, ability to work with information and make decisions, programming, digital interaction, use of modern means of communication, etc.).

#### **1.2. Goals and objectives of the study**

The purpose of the study was determined from the need to use innovative collaborative learning software tools to improve the quality of teacher training for future professional activities as important soft skills.

Research objectives:

- analyze the experience of using chat bots in the education and training of future teachers;
- to clarify the essence of the concepts of "chat bot for didactic purposes", "project to create a chat bot" in the context of the digitalization of education;
- specify the didactic potential of chat bots for the development of popular digital skills;
- describe the procedures and principles for measuring the formation of students' competencies in the design of chat bots;
- experimentally confirm the effectiveness of the proposed educational and project activities for the formation of the competencies of future teachers, development of demanded soft skills and experience of collaboration.

## **2. Relevance**

### **2.1. literature review**

#### **2.1.1. Analysis of Russian scientific and pedagogical literature**

The profile state program for the introduction of digital transformation technologies is the program "Digital Economy of the Russian Federation" (Lapidus et al., 2020). It provides support for the development of the following key end-to-end technologies: big data; neurotechnologies and artificial intelligence; distributed ledger systems; quantum technologies; new production technologies; industrial internet; robotics and sensor components; wireless communication technologies; technologies of virtual and augmented reality, automated messaging.

Artificial intelligence plays a key role in the implementation of the ideas of personalized learning, organization of project and joint activities. With the help of cyber-physical systems and software, learning, its content and pace are adapted to the specific needs of each student. Communication automation software provides the ability to obtain data from a variety of sources, validate it, and then analyze it using tools such as script template and link building.

According to the research of V.A. Kastornova, many educational institutions use artificial intelligence, including chat bots for teaching and organizing the educational process (Kastornova, 2022).

A chat bot is a special program which give answers to questions of the user.

E.V. Shirinkina, B.Sh. Sobirov describe the capabilities of a chat bot that supports the operation of service stations in Russia and Kazakhstan, which sends daily reports on key indicators, informs about critical situations during interaction (missed call, bad rating, unprocessed application, access violation) (Shirinkina, Sobirov, 2021).

Regarding education, as noted by S.S. Grechikhin, the use of chat bots should be understood as the acquisition by graduates of such knowledge and skills that provide them with awareness of the process of their own education and its real results (Grechikhin, 2020).

In the work of N.M. Chapaev, problems associated with the development of artificial intelligence in the educational and upbringing spheres are noted (Chapaev, 2021). The author considers issues related to the place and role of artificial intelligence and its potential. N.M. Chapaev clarifies the pros and cons of the distance learning process, and specifically artificial intelligence technologies (for example, the Internet of things, avatars and chat bots for consulting, testing and designing individual educational routes, machine learning, big data, blockchain and cloud computing and etc.) in the field of digital education (Chapaev, 2021).

According to the conclusions of L. V. Shevchenko, there is another area in which chat bots can have a huge potential, it is education (Shevchenko, 2022).

A.S. Budnikova, O.S. Babenkova describe the advantages of using chat bots for the formation of foreign language competence in future teachers in detail (Budnikova, Babenkova, 2020). The paper considers the experience of foreign and domestic researchers dealing with the use of chat bots as language partners. The authors provide a list of modern programs of this type, reveal their features.

Education in the modern digital environment, supported by online services and interactive resources, as defined by O. Kalugina, N. Tarasevich, is focused on revealing the identity of the student, maintaining interest in educational and professionally oriented communication activities, developing intellectual, creative abilities in the process of solving any problems (Kalugina, Tarasevich).

I.A. Shcheglova identifies the following characteristics of "soft skills" (including those relevant for the future teachers training): multifunctionality; oversubjectivity and

interdisciplinarity; intellectual development (abstract thinking, reflection, determination of one's own position, self-esteem, critical thinking, etc.); multidimensionality, i.e., they include various mental processes and intellectual skills (Shcheglova, 2019).

V.A. Chernov et al. understand a project as a purposeful activity of a temporary nature, designed to create a unique product or service (Chernov, 2020). O.V. Dubinina, L.D. Hrytsiak highlight the skills that, in their opinion, are the most important for future teachers in terms of participation and creation of their own resources (accounts in social networks, groups, blogs, video services), as well as management of educational projects (Dubinina, Hrytsiak, 2018):

- understanding of the real needs of society and the student himself/herself;
- the ability to plan, decompose and cascade large goals into understandable didactic tasks;
- management of objects (real and virtual) during interaction in the information educational environment.

E.A. Neretina, A.B. Makarets note that with the help of special software, you can easily manage all tasks – both project and personal; control the activities of the team and achieve more with less time and resources (Neretina, Makarets, 2013).

Project-based learning, as defined by E.V. Soboleva et al., is focused on revealing the personality of the student, maintaining interest in learning activities, developing intellectual, creative abilities in the process of solving a problem (Soboleva et al., 2020).

This circumstance is especially important for training and practice of solving future professional problems, reaching the level of professional competence.

So, the use of chat bots in teaching at the university allows to increase the level of digital skills, skills in information technology and artificial intelligence, maintain students' interest in the process of mastering fundamental theory, and contributes to the development of logical and associative thinking (Usoltseva, Usoltsev, 2020).

Analysis of the domestic scientific papers listed above makes it possible to identify a problem associated with the need for additional study of the development of students in the area of training of Pedagogical Education in demanded digital competencies.

### **2.1.2. Analysis of foreign studies**

Under artificial intelligence A. Følstad et al. offer to understand information systems with the following characteristics (Følstad et al., 2021):

- support the ability to process data by methods that are as close as possible to intelligent behavior in terms of algorithms;
- contain aspects such as reasoning, learning, recognition, forecasting, planning and control.

In general, the interaction between a person and a chat bot should be aimed at the implementation of the goals that the UN has identified as priorities for sustainable development (Hong et al., 2021): development of linguistic diversity, support for a healthy lifestyle, quality education, gender equality, access to modern sources energy, rational models of consumption and production, etc.

Also in the work of P. Anki, A. Bustamam, R.A. Buyung, the functions of artificial intelligence technology in education at the present time are highlighted (Anki et al., 2021). They indicate that chat bots combine two important components: they are multitasking, as they allow to automate a number of processes (consulting, conducting control activities and exams, checking test results, conducting surveys of students to identify weaknesses in educational programs), and are convenient for interaction with the user due to a comfortable communication format that imitates a conversation with an interlocutor (Mateos-Sanchez et al., 2022). These qualities of chat bot applications make them an indispensable tool for conducting educational programs and bring the quality of education to a new level.

E. M. Mateos-Sanchez and ed. determine that in the formation of a single digital educational space, an important factor is the automation of information exchange processes (Mateos-Sanchez et al., 2022).

Due to cross-platform, chat bot applications are available on various operating systems, and, sometimes, do not require installation on a computer at all, since most of the functions can be performed on remote servers (Jackson, Latham, 2022).

In addition, chat bots help involve students in professionally oriented communication, interest students in mastering the material through constant communication with the user. With this option of



organizing educational and cognitive activities in the classroom at the university, a chat bot is an important means of obtaining feedback and, as a result, helps improve the quality of training.

C. Tan, I. Huet substantiate that there is an objective need to train highly qualified specialists who are able to control and manage the processes of data exchange between users in a virtual interaction environment (Tan, Huet, 2021). Therefore, automation of processing and recognition of messages is a logical and necessary step in the further digitalization of the work of an educational institution. The work of Y. Saadna, A. Boudhir, M. Ben Ahmed describes a variant of organizing students' project activities to develop an intelligent chat bot to automate the exchange of information in the service sector (Saadna et al., 2022). S. Wollny and ed. present a detailed analysis of online resources to automate the exchange of information between participants in network interaction, creation of dialogue programs (Wollny et al., 2021).

Chat bots, according to E. Vázquez-Cano, S. Mengual-Andrés, E. López-Meneses, are one of the promising areas for the development of information technology (Vázquez-Cano et al., 2021). These interactive programs are capable of processing natural language and offering answers to users' questions. The latter, however, do not always come in the form of text. Sometimes they are specific actions: showing a photo / video at the request of the user, making a purchase, making an appointment, etc.

S. Wollny and ed. explore the development of technology for developing chat bots (Wollny et al., 2021). They conclude that many international companies (such as Facebook) are launching APIs that allow brands to adapt and use bots in their messengers to communicate with customers. D. Jackson and A. Latham study issues related to clarifying the place and role of artificial intelligence, its didactic potential (Jackson, Latham, 2022).

E. Vázquez-Cano, S. Mengual-Andrés, E. López-Meneses note the advantages and disadvantages of using various types of artificial intelligence in e-learning (for example, Internet of things, avatars, chat bots, etc.) (Vázquez-Cano et al., 2021).

At the same time, both Russian and foreign researchers note that the use of chat bots as an assistant in the study of disciplines is often an element of game-based learning. At the same time, its didactic potential is significantly reduced and lost.

Thus, during the analysis of foreign scientific research, the need for research aimed at substantiating the organization of educational and project activities of future teachers when creating chat bots as an important condition for improving the quality of their training was also revealed.

### **3. Materials and methods**

#### **3.1. Theoretical and empirical methods**

In the process of using automated interactive programs for studying an academic discipline, all participants in the didactic process are involved in various types of activities (cognitive, regulatory, innovative, collective, etc.). In the present study, interaction with a chat bot makes it possible to provide the most effective conditions for the formation of professional, general professional competencies of future teachers, development of demanded soft skills and gaining collaboration experience. At the same time the inclusion of chat bots in training is simultaneously considered as a technology for acquiring new knowledge and competencies, as a technology for professional communication.

In the ongoing study, at different stages of the organization of educational and practical activities on the use of the chat bot, the didactic resources of Robochat, BotVK, Eliza, Parry, A.L.I.C.E., Jabberwacky, SmarterChild, Watson, Siri, Alexa and Cortana, Alice were considered. Criteria to compare educational chat bots are: tariffs (paid/free), availability of help/support for self-learning, functionality for constructing a dialogue in various languages, didactic potential.

To design and develop their own dialogue program, the Borisbot service, a constructor of educational chat bots, was used. Its advantages: the ability to create 30 block options ("Clear text", "Buttons" (with one choice/with multiple answers), "Timeout", "Rating", "Predictive Question", "Carousel", etc.). In addition, the designer's YouTube channel has an official video with a detailed overview of the service's functionality. The bot allows to select tasks of different levels of complexity on various topics and in various formats.

But, of course, the most important criterion when choosing this particular constructor is the range of didactic functions: the possibility of independently obtaining new knowledge, application in extracurricular activities, support for gamification, and personalization of learning.

An experimental study was conducted on the basis of the North Caucasian Federal University while studying the course "Information and Communication Technologies in Education". 43 first-year students in the area of training of 44.03.05 Pedagogical education with two profiles (training level – bachelor's degree) were involved in the educational work on the design of chat bots. The average age of the respondents was 18 years (51 % girls and 49 % boys).

According to the results of solving specially designed tasks (tasks and principles of their design are described in clause 4.3.1), all students were divided into control (22 students) and experimental (21 students) groups.

Empirical methods (observation, analysis of the results of teamwork in the chat bot constructor) were used to obtain up-to-date information about real qualitative changes in planning skills; in assessing the degree of trust in each other; in the management of emotions in case of errors; ability to constructive dialogue, information interaction in the team and with the designer; mutual support; reflection in the team and individually, in the use of feedback mechanisms; protection of project results (chat-bot).

To diagnose the formation of competencies in the field of informatization of education, 10 tasks were formulated. For the control work, the student could get from 0 to 100 points. According to the results of measurements, the marks were determined as follows: from 0 (inclusive) to 55 points – “failed” and “passed” in all other cases. To assess the effectiveness of specially organized activities for the design of chat bots in terms of improving the quality of education, the Fisher criterion was applied.

### **3.2. The base of research**

The main goal of the experiment was to test the effectiveness of the use of chat bots in the classroom at the university to improve the quality of future teachers training.

43 first-year students were involved in the area of training of 44.03.05 Pedagogical education with two profiles (training level – bachelor's degree). The average age of the respondents was 18 years (51 % girls and 49 % boys).

The BorisBot service (<https://borisbot.com>) is used as a software tool to support automated data exchange, communication and project work. The tools of this service allow to support a special organization of the learning process in the digital environment of the university. Its essence is expressed in a combination of creative pedagogical influence and a set of optimal pedagogical conditions, which should be based on the integration and interpenetration of modern achievements in pedagogy and psychology.

With the help of the results of the entrance test, it was possible to collect the required initial data on students. The sample was not random. To fulfill the rules of probabilistic selection, the same teacher supervised the practical activities of all students of pedagogical training. He also formulated systems of educational tasks, directed information interaction in the process of solving tasks of automated messaging by means of BorisBot by students. Work with BorisBot resources (with ready-made templates, questionnaires, menus and buttons, tests, sending files, setting a timer, tracking comments, adding files, team introspection and protecting projects) was performed in the same classrooms, on the same equipment and software. The materials for the test were developed by the authors in accordance with the current standard of higher education in the area of training.

### **3.3. Stages of research**

The study was carried out in three stages.

At the preparatory stage of the experiment, various digital services (RoboChat, BotVK, Eliza, etc.) and programming environments (Python, PHP, C#; Java; C++; JavaScript, etc.) for creating chat bots were considered and analyzed. The projects and innovative experience of Telegram, Facebook, WhatsApp, VK were also studied.

The didactic potential of chat bots for interaction in messengers and social networks (Telegram, Viber, Facebook, V Kontakte, WhatsApp and others), on websites, in mobile applications, control systems (Siri), voice assistants (Alisa) was studied.

Further, the didactic capabilities of the BorisBot tools for systematic professionally oriented teaching of students, the formation of digital skills and the establishment of quick contact with students and the transmission of information in a compressed form were specified.

For the control work, the student could get from 0 to 100 points. According to the results of measurements, the marks were determined as follows: from 0 (inclusive) to 55 points – “failed” and “passed” in all other cases.

Thus, it was possible to collect data on 43 first-year students of the North Caucasus Federal University in the area of training of 44.03.05 Pedagogical education with two profiles (training level – bachelor's degree). The average age of the respondents was 18 years (51 % girls and 49 % boys).

The second stage of the study was devoted to determine the course structure in accordance with the purpose of the study. The teacher of the course "Information and communication technologies in education" organized the activities in the experimental group in the following stages: "Studying the theoretical material"; "Breaking the study group into teams, choosing the topic of the project to create a chat bot"; "Students' activities in designing a chat bot"; "Protection of projects and operability of dialogue programs by commands".

The third stage of the study covers experiential teaching and the use of BorisBot tools in learning to develop students in the area of training Pedagogical education of demanded digital competencies.

## **4. Results**

### **4.1. Clarification of the essence of the basic concepts**

During the analysis and generalization of the scientific literature, the author's positions were determined regarding the key concepts of the study: chat-bot, "educational project" and "project activity".

A chat bot is a program which simulates a real conversation with a person.

The concepts of "educational project" and "project activity" are studied in science from various positions (philosophical, psychological, pedagogical). At the same time for university training, various activities of students are described as part of the development of the educational program (workshops, theater reports, design shows, etc.).

Under the educational project we mean the activities of students organized and directed by the teacher:

- subordinate to the solution of a certain practically/theoretically significant problem;
- designed in the form of a final product that can be seen, applied in real future professional activities;
- satisfying the requirements: availability of an order for the result, clarity of didactic tasks, criteria for achieving the result and deadlines, originality and independence of the solution, involvement in professionally oriented communication, taking into account the limited resources (financial, time, etc.).

The draft professional standard of the Ministry of Labor of Russia for teachers determines that the teacher must participate and create his/her own resources (accounts on social networks, groups, blogs, video services, and also work on other educational digital materials). To implement these requirements for the training of future specialists in the Federal State Educational Standard of Higher Education in the area of training of Pedagogical Education, a new competence (OPK-9) has been added. It is expected that the teacher in his/her professional activity will be:

- able to create information products for their subsequent inclusion in a single digital educational space;
- ready to use modern information technologies in solving various problems: in the development of software for didactic purposes, in managing projects and real objects (training bots); for experimenting with computer models; to search for information, its collection, storage, processing and transmission; accompanied by intellectual leisure of students.

So, the modern digital educational environment should: be focused on new realities of didactics; provide opportunities for adaptation to specific conditions; support the interconnected communicative and social and cultural development of students; encourage the participant of the didactic process to be creative; use information technologies (multimedia, electronic resources, software) at all stages of education.

Thus, we note that any educational project includes not only the image of the desired result (in the presented study, the model of the dialogue program), but also the organized activity for its design/modeling (from the inception of an idea to its implementation).

#### **4.2. Educational and project activities of students to create chat bots**

The review of digital services and programming environments made it possible to determine the range of common functions that chat bots can perform: statistics on working with users, dialogue constructor, templates for responses and scripts, etc. Such functions can be provided through the use of online constructors for simulating interactive dialogue programs. The main advantage of which is that they:

- do not require special programming skills. The creation of the bot takes place in the constructor window – the user himself/herself selects the desired steps of the bot and connects them like Lego;
- contain ready-made templates: questionnaires, menu with buttons, test with scores, design customization, subscription to mailing lists;
- determine the automatic reaction of the bot to keywords, requests and certain events: subscription and unsubscription from the community, the first message, sending files, timer;
- support the ability to send media: photos, videos, music, documents;
- load dynamic data from the user profile: name, city, social network ID, gender;
- perform automatic collection of interaction statistics, segmentation of the audience through tags.

Based on the results of the analysis of the supported didactic functions and the range of tasks performed, the BorisBot service (<https://borisbot.com>) was chosen.

The second stage of the experiment was devoted to determine the structure of the course in accordance with the purpose of the study. The teacher of the course "Information and Communication Technologies in Education" organized the activities in the experimental group in the following stages:

I stage. The study of theoretical material (trends in the development of artificial intelligence technology, chat bots based on artificial intelligence, educational bot as a variant of informatization of education (examples, didactic properties and functions), principles for developing interactive programs, ethical standards of application, etc.).

II stage. Dividing the study group into teams, choosing the topic of the project to create a chat bot.

A feature of the proposed option for organizing educational and project activities is that the Wheel of Fortune service (<https://ru.piliapp.com/random/wheel/>) is used to divide the study group into teams. This is an interactive program that allows you to automate the random selection of a participant.

Another feature is that the students of the experimental group could determine the topic for the project themselves, or use the order of a potential employer, or the teacher's options. For example, students developed an educational project for a healthy lifestyle chat bot. The program interactively motivated the participants to bake cakes and sent the recipe; asked to conduct a morning workout and record it on video; reminded of the need to organize a meeting on ZOOM and write about the results; recommended to watch movies or books.

There was an order from a potential employer to make a chat bot for remote interaction of company employees. The main areas of activity that were automated by the chat bot were: personnel management, sales of goods and related accessories, technical support, consultation, etc. For the initial testing of the chat bot, it was necessary to create a scenario for automating the interview for the vacancy "HR specialist". First, the applicant was asked to fill out a questionnaire (name, city, contacts), choose a vacancy. Then the chat bot offered to pass two tests: an assessment of qualifications and personal characteristics. In the first case, the bot asked ten questions about professional competencies (depending on the vacancy). Time for answers is limited – ten minutes. The second case: the bot helps find out the characteristics of the character, inclinations and interests of the individual based on a combination of personal factors.

Project variant from the teacher: implement a chat bot to support the study of the string data type. The logic of the program:

- 1) asks for a username;
- 2) suggests studying the string data type. If the user answers "yes", then the chat bot displays information about the string data type, otherwise it displays a completion message. According to the information studied, the program offers to answer one question and, in accordance with the answer, displays information about its correctness;



3) offers to continue studying and learning about the syntax of the string data type. If the user answers "yes", then the program displays information about the syntax of the string data type, otherwise it displays a completion message.

4) offers to study what operations can be performed on the string data type, etc.

III stage. Student activities for designing a chat bot:

- designing dialogs and their modeling in a graphical user interface;
- customization of the initial design or selection of an existing template;
- use of blocks "Timeout" (time delay for a response), "Channel selection" (transferring a dialogue to a messenger or mail), "Buttons", "Rating", "Geolocation", "Carousel", "Notification", "Repost links" etc.;

- setting up transitions to the block when choosing another answer option, ability to ask again;

- performing actions (create a survey, go to the site, etc.);

- testing, debugging and refinement of dialogue scenarios.

The development of the chat bot was accompanied by the following types of tasks: analysis of the professional field of activity of the future teacher, setting the task (objects and subjects of control, problems of data exchange, areas of interaction, evaluation criteria/efficiency of the programmable system); selection of blocks for the technical implementation of the chat bot; experimental verification of the computer model performance; testing and updating the information model; using the constructor to solve real problems.

IV stage. Protection of projects and operability of dialog programs by commands.

### **4.3. Experimental evaluation**

#### **4.3.1. The ascertaining stage of the experiment**

At the first stage of the experiment, materials specially developed for the test-paper were used to evaluate the input. There are examples of tasks below.

1. The home designer is testing a system to secure entry into the house. Every second the program sends a signal (0 or 1) to the control panel. This signal is an alert about whether there is someone else in the house or not. While the program sends "0", no action is necessary. As soon as a unit appears, the program should signal and report that "Reinforcements are leaving!". Help a specialist develop an appropriate technical system.

2. The curator of collective creativity needs to divide the group (N people) into two parts. But he/she wants to do it in an unusual way. The participant of the experiment must go to the terminal and enter his/her name. The program must determine the appropriate subgroup according to the following rule: if the person's name begins with the letters "A-K", then the student is sent to the first subgroup, otherwise – to the second. Help a specialist develop an appropriate technical system.

3. There are two lists: a list of communication situations (with an employer, manager, colleague, parents, friends, network interlocutors, etc.) and phrases from the appeal ("Would it make it difficult for you to tell me ...", "I'm sorry to bother you, you won't tell me...", "Listen, you know where...", "Dear host, let me...", "Ladies and gentlemen, a moment of attention...", "Dear ladies and gentlemen!", "Welcome aboard!" etc.). The student needs to correlate the situation and phrases of communication.

4. To implement by means of information technology (for example, MS Excel) the project "Choice of the future profession". The program must perform an analysis of professions according to the proposed parameters and determine the most optimal option for the user. Task modification: write down the parameters of the criteria by which you want to compare, in a separate text file.

Approximate criteria columns: demand (in percent), wages (in roubles), tuition fees (in roubles), training costs (in roubles), number of working days. Approximate lines-professions: teacher, process engineer, IT specialist, economist, builder.

For example, an interactive program should select a profession suitable for the user according to the following parameters: salary of at least 100 thousand roubles, training budget should not exceed 150 thousand roubles.

For the test-paper the student could get from 0 to 100 points. According to the results of measurements, the marks were determined as follows: from 0 (inclusive) to 55 points – "failed" and "passed" in all other cases.

#### 4.3.2. Forming stage of the experiment

This stage of the experiment was devoted to determine the directions for including BorisBot tools in online information interaction, project activities of students.

The initiator of the project activity carried out preliminary methodological work with all participants in the didactic process to master the functionality of the designer.

To organize joint work on a chat bot, the following activity algorithms were considered: how to recognize and interpret requests, how to make money transfers, how to book a table in a cafe, how to make an appointment in beauty salons, how to buy a movie ticket, tell the rules of the Russian language (for example, "zhi-shi" – write with the letter "i").

Examples of other tasks using chat bots.

Task 1. Read the text and make a family tree of the Coppola family. What other famous families do you know? Tell the bot about one of them.

Task 2. Make a memo "Rules for safe online communication."

The students of the control group during the project activities were not purposefully involved in the creation of chat bots for educational purposes. With the help of ready-made bots (for example, StepicBot), they completed spell check tasks, search for the meaning of a word, studied concepts from mathematics and programming, and a foreign language.

There is an example of a task in the @ucheba\_bot environment. With the help of a ready-made bot, organize a dialogue that will help you choose a university, college or courses in accordance with your requirements. In addition, the program should send you a selection of educational institutions of the requested subject on a daily basis. The bot should inquire about the search object (university, college or courses), then specify the form of study (full-time or online) and ask what you want to study. If there are no current courses for the requested topic, the bot will offer a new search or subscription. By subscribing, the chat bot will notify you when a course is available.

At the control stage of the experiment, a verification work was also carried out on the course materials.

#### 4.3. 3. Control stage of the experiment

Test-paper was also carried out at the fixing stage of the experiment.

The validity of the experimental results was verified using the Fisher criterion. The control measurement data before and after the experiment are presented in Table 1.

Information about the levels of formed skills in project management before and after the experiment is presented in Table 1.

**Table 1.** Results of the control event

	Before the experiment		After the experiment	
	Control group	Experimental group	Control group	Experimental group
Proportion of students with the mark «not credited»	50 % (11)	52,4 % (11)	45,5 % (10)	14,3 % (3)
Proportion of students with the mark «credited»	50 % (11)	47,6 % (10)	54,5 % (12)	85,7 % (18)

Calculations were made using an online calculator (<https://www.psychol-ok.ru/statistics/fisher/>). The critical value of the Fisher criterion for a significance level of 0.05 ( $\varphi_{crit}$ ) is 1.64.

The following hypotheses were accepted:

$H_0$  – the level of educational results in the experimental group is statistically equal to the level of the control group;

H1 – the level of learning outcomes of students in the experimental group is higher than the level of the control group.

The empirical value of the Fisher criterion before the start of the experiment is 0.157 ( $\varphi_{\text{emp}} = 0.157 < \varphi_{\text{crit}} = 1.64$ ). Therefore, before the start of the experiment, the hypothesis H0 is accepted. The value of the Fisher criterion after the experiment is 2.311 ( $\varphi_{\text{crit}} = 1.64 < \varphi_{\text{emp}} = 2.311$ ), so the hypothesis H0 is rejected and H1 is accepted.

In other words, the participation of future teachers in the activity of designing chat bots made it possible to provide additional conditions for the development of popular digital skills (working with data, ability to work with information and make decisions, programming, digital interaction, use of modern means of communication, etc.). Corresponding changes in the pedagogical system are not accidental, but regular.

### **5. Limitations**

The sample of students was not probabilistic, since the experimental and control groups were formed in such a way as to guarantee the presence in each group of the same skills and personality traits that form the basis of the competencies of future teachers, their identical distribution.

For diagnostics, the results of the input control measure were taken into account. The selection of participants for the experiment and the sample size are justified by the specifics of the investigation: the study of theoretical material on artificial intelligence technologies, design features of chat bots based on artificial intelligence, use of educational bots as an option for informatization of education, dividing the study group into teams, choosing the topic of the project to create a chat bot.

The problem is that the use of chat bots for educational purposes is included in the training program for a limited number of specialties. Throughout the experiment, practical activities to solve the described problems, supported by digital technologies, were carried out by the same teacher, using the same software equipment in special classrooms. During the implementation, the main principles and stages of the development of an educational project, the functionality of the service for modeling a dialogue in the constructor environment were taken into account.

### **6. Discussion**

Performing a quantitative analysis of the data in [Table 1](#), we can conclude that educational results in the experimental group after studying the course "Information and Communication Technologies in Education" in accordance with the proposed structure of the organization of educational and project activities of students to create chat bots increased. The share of students with the mark "passed" increased by 38.1 %. In the control group the increase was only 6.9 %. When discussing the didactic potential of chat bots, it was found that the formation of competencies in the field of informatization of education occurs due to the fact that:

- in the process of developing a training bot secretive, uncommunicative and shy team members become more free in interaction;
- the process of decision-making and choice is supported ("predictable question", "timeout", time delay for an answer);
- the distribution of resources is optimized within the existing restrictions (for example, for asynchronous communication – the possibility of interaction by e-mail; entering text or choosing from available answers);
- there is an acceptance of the need to comply with "virtual" rules, follow patterns and scenarios;
- the fear of making a mistake in the answer is minimized (for example, by choosing the most convenient channel for communication);
- a joint effort to model a dialogue with a chat bot contributes to the formation of professionally oriented communication skills.

In general, the pedagogical experiment allows us to conclude that the simulated educational and cognitive activity contributes to the formation of such sought-after competencies in future teachers as computer and technical literacy, teamwork, communication with people and an automated program, and the willingness to manage several tasks/projects. Activities for the development of chat bots for educational purposes provide additional opportunities for training

specialists for joint creativity, ability to interact and resolve conflicts in a team, ability to empathize and motivate, and adapt to the challenges of society.

The materials of the work confirm the conclusions of E. V. Soboleva et al. (Soboleva et al., 2020) about the didactic possibilities of modern interactive resources in terms of the formation of in-demand skills of future professionals. The data obtained by the authors during the study generalize and develop the conclusions of A.S. Budnikova, O.S. Babenkova (Budnikova, Babenkova, 2020) and E. Vázquez-Cano, S. Mengual-Andrés, E. López-Meneses (Vázquez-Cano et al., 2021) about the didactic possibilities chat bots for learning in the information educational environment. In addition, a variant of solving those problems of using chat bots in education, which are formulated by S. Wollny et al. (Wollny et al., 2021).

## 7. Conclusion

At present artificial intelligence technology is actively used to improve the performance of employees, manage innovation, motivate personal development; support operational interaction with customers; in the field of education. Artificial intelligence provides tools to support decision making, choice, and operational feedback.

A chat bot is one example of the implementation of artificial intelligence technology in the field of communication, information collection and analysis, and decision making. At the same time experiments are conducted in world didactics that prove that chat bots contribute to the intensification of research activities, increase cognitive activity and support professional self-determination.

The inclusion of project activities to create chat bots in the didactic process stimulates the development of students' trans-professional competencies that are mostly in demand by the market and therefore attractive to employers.

Designing a chat bot as a dialogue scenario contributes to the development of professionally oriented communication skills (listen to the alternative opinions of other team members, accept the standards and values of others, follow the rules and regulations).

When creating educational chat bots, reference points were formulated – directions for project work.

1. Consider the well-known educational chat bots:

- What is the purpose of creating such a bot?
- Do the tasks solved by the bot and didactic tasks coincide?
- Are there ready-made templates and dialogue scripts or is there necessity to develop your own projects right away?
- Are programming skills required to write scripts?

2. Consider the impact of the chat bot topic chosen for implementation on the training of a specialist to perform labor functions: monitoring the readiness of teachers to use digital technologies, choosing a teaching method, organizing students' intellectual leisure, etc.

3. Before creating a chat bot, do the preparatory work: compose a text for messages, a list of questions and possible answers, select illustrations and videos.

4. An obligatory stage of the described educational and project activity is the analysis of the result obtained (chat bot) and the didactic purpose of its creation.

As a direction for improving the proposed variant of the organization of students' activities in the design of educational bots, it was proposed: more active involvement of potential employers in formulating the topics of projects; inclusion of programming elements to develop unique scripts and increase the originality of the product; creating chat bots to help with paperwork and resource planning.

The results of the study allow to state the advantages of project activities for the development of chat bots to motivate students for group forms of classes, for collective creativity and professionally oriented communication.

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