

# VOICE ASSISTANTS WITH ARTIFICIAL INTELLIGENCE FOR IMPROVING ACADEMIC ENGLISH

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## **ABSTRACT**

*The article describes applications of using voice recognition technology based on artificial intelligence to the educational process. The author presents a comparative analysis of existing examples artificial intelligence in the educational process. Artificial intelligence uses in specialized software it makes educational process more convenient for both the students and the teachers. There is a description of an application "Academic phrase bank" developed by author. The application consists of two specialising actions for Google assistant. The application allows to increase academic vocabulary, train of creating grammatically correct academic expressions, and memorize templates of academic phrases. In active mode, this application helps to create correct phrases of academic English and improve the abilities of understanding English speech.*

## **KEYWORDS**

*Academic English, Google home, personal assistant, academic publications, applications for learning English.*

## **1. INTRODUCTION**

Active development of artificial intelligence (AI) leads to the fact that AI is widely spread in various fields, including education [1]. We use the term "artificial intelligence" in the narrow meaning as a specialized software system for implementation a natural user interface. AI allows learners to gain some advantages over traditional learning techniques []. An educational platform with AI can be adjusted to meet the needs of students and consider their personal features (initial level of knowledge, speed of learning, current interests) for identifying the most effective way of studying. The interaction students with a smart platform reveal the weaknesses of students and motivate them for additional studying, so it makes possible to create a system of adaptive learning [2].

There are some AI-based technologies popular in the educational process [3]: adaptive knowledge assessment, spaced repetition, virtual assistants, adaptive feedback, formal verification of creative works, etc. Let us briefly consider the features of these technologies and the mechanisms of their implementation with AI.

Computer-aided assessment with AI [4] implies using of specialized applications that allow to test, and automatic check various types of creative work, such as essays, etc. System with computer-aided assessment analyse answers of students, providing feedback, finding factual or

semantic errors. The data gathered from student' answers are using for preparation an individual learning path adapted to the current knowledge of students.

The spaced repetition technique based on the theory that a proper time interval of information representation allows maximizing the rate of learning [5]. AI technology in spaced repetition software applications allows recording and tracking progress, when the information was presented, how effective it was for a particular learner, and then to adapt the time intervals of the information representation when it is most appropriate for the learner.

Traditional educational system uses different types of feedback, such as checking and evaluation of student's work, interaction tests, different teacher's activities. Artificial intelligence makes it possible to create specialized chatbots, which can interact with the student through a dialogue interface, analyse their responses, and provide quality feedback to make easier the teacher's work. In the future, these chatbots will be transformed into virtual assistants and be able to respond to students' requests more accurately and quickly in the natural language [6].

The technology of virtual assistants (VAS) is a perspective variant of the AI implementation [7]. One of the first in the mid-nineties, Microsoft has released the office assistant "Clippie", a specialized virtual assistant, which should help users to effectively use Microsoft Office. This feature got many negative responses from users, so in later versions of Microsoft Office, this assistant was removed because it showed low efficiency and negative attitude of users.

The surge in popularity of virtual assistants has been observed over the last few years, and they are especially widely used in modern smartphones. Many software companies like Amazon, Google, Microsoft have released their own virtual assistants [8]. The growing interest to this topic related to dramatically improvement of natural speech recognition, which allows to implement an effective voice interface [9]. A significant increasing of the usefulness of virtual assistants also correlated with the development of the Internet of things (IoT).

Virtual assistants allow to manage IoT devices, organize and analyse information obtained from both virtual and physical sources. Modern personal assistants use AI extensively for automation tasks of everyday activities, such as creation of reminders, prompting required information in the current context, constructing routes, grammar checking, translating, etc.

There is a particular interest in using AI for adaptive learning [10]. Adaptive learning is an educational method of using modern computer algorithms to teach students in accordance with their individual characteristics. Adaptive learning is considered: the emotional state of a student, his ability to perceive different types of information, the current level of learning skills, gender, etc. Adaptation is that the curriculum customized to the student, try to build an individual learning trajectory.

In many countries, the adaptive learning based on AI is being actively implemented with supporting of the government. There are a number of countries where it is enshrined as a legal framework. In Brazil, for example, the Geekie system. This system allows pupils to prepare for the final examination at school. At the beginning of the training, a student takes some tests and selects the own learning goal, then the system with AI analyses the student's preferences, prepares individual learning trajectories for them, highlights the necessary and suitable content.

In learning, a specialized program captures every student's action and transmits information to the system. Each student can have a personal pace of learning and the system accumulates information about students and adapts the learning process to their abilities. The developer points out that the using of this system has increased results of the final exams for all students [11].

In Russia, some private companies are also trying to create an adaptive platform with AI elements. Stepik created a learning platform which generates educational materials based on the level of user knowledge, which selects the content suitable for a particular stage of learning. At present, this educational platform is positioned as a template for open online courses with adaptive recommendations. The platform allows users to create interactive lessons with feedback and verification of the teacher's tasks.

Thus, there are three main reasons why AI is being intensively embedded into the educational process:

- AI helps to make the educational process more effective and convenient for both students and teachers. In Russia, some large online schools create and implement training courses with AI.
- AI increases the involvement of students in the educational process through gamification. Most training simulators use artificial intelligence to create the effective game mechanics. For example, a language school SkyEng [12] integrated AI into the educational process, it provides adaptive and personalized learning, and performs task verification in real time. AI analyses each lesson, assesses student progress, and evaluates teacher performance. Such learning system allows to change a path of student teaching.
- implementation of AI into educational process provides automation of it. Modern educational resources can effectively function without a human: chatbots answer questions and conduct lessons. This trend is increasing every year.

## 2. VOICE USER INTERFACE

Natural User Interface (NUI) describes interaction between a person and a computer with intuitive actions that do not require special training of users [8]. The purpose of using a user-friendly interface is to hide the complexity of a system as much as possible. Even if the user is inexperienced or requires a rather complicated interaction, it will be able to interact with the system by NUI. Examples of interfaces with NUI include interfaces based on touch, gestures, body movements (Kinect), voice, etc. Neurocomputer interfaces are expected to be created soon.

In recent years, virtual assistants with voice control have become widespread in various fields. Virtual assistants have become commercial products thanks to Apple, which introduced the Siri assistant for iPhone in 2011. Virtual assistants use a Voice User Interface (VUI), which is a human-computer interface with voice input to control computers and devices. The VUI interface has a long history since the 1950s, when the first prototypes of devices with VUI appeared [13]. However, initially these interfaces were not highly effective, a significant breakthrough has been achieved in the last decade, thanks to the developing natural language recognition with AI. VUI have become more convenient and useful, and these technologies have gained wide popularity due to the spread of smart speakers (Amazon Echo, Google Home, Yandex.Station) and other devices with voice recognition.

There are a few significant advantages of voice input in comparison with using keyboard [13]:

- high speed of information input (faster than typing on keyboard).
- voice input can be used simultaneously with other activities (you can react without switching from the current context).
- intuitive interface.
- high level of empathy (voice messages have more empathy than text messages, interaction through voice can be more pleasant and convenient for a person).

VUI is becoming widely used as a communication for many various intelligent devices. For example, all modern smart speakers do not have a graphical display and keyboard, so you can communicate with them only by VUI. A virtual chatbot is a program that imitates the real interaction with a person. Interfaces of modern chatbots based on VUI. These types of interfaces are implemented like text chat in Facebook Messenger or Skype Instant Messaging for dialog with an intelligent device.

There are standard development tools for creation VUI. For example, a script describing the interaction between users and a script of interaction between a user and a computer have a remarkably similar structure. The only exception is that the chat-bot interface can display images and hyperlinks, while the VUI can only play sounds.

Using chat bots for learning a foreign language has the following advantages [14]:

- Gamification. Chatbots use gamification, they have built-in game mechanics to motivate students to continue learning. For example, learners receive points or other achievements for regular training or achieving a certain goal. Gamification turns learning into a hobby, it motivates users to study even during periods of rest.
- Individualization. Personal lessons with a teacher who will correct your grammatical or phonetic errors are quite expensive, and when the classes are in a group, you must wait your turn to work with the teacher. Lessons with a chat-bot removes these restrictions, you can get individual attention at any time and freely.
- Availability. Lessons with a chat-bot can carry out at any time. The chatbot instantly answers any your questions, and you can train for several hours. This significantly increases the intensity of class and involvement in the education process.

No evaluations from the teacher and no fear of errors. For many students, the language barrier is due to an internal fear of making a mistake in dialogues. Chatbot allows to overcome this fear, remove the language barrier, help a learner to start fluently communicating.

Below, there is a description of several chatbots which designed specifically for teaching English. We compared two main categories of chatbots that can be used for self-study of English. The first category is the chat bots, which are specially designed for learning English. The second category is the chat bots for practical tasks, with them we can train English in real situations, which is an effective way of learning a foreign language.

### **3. CHATBOTS FOR LANGUAGE LEARNING**

Modern applications use AI for creating a language environment, assess the current language level, etc. Learning language with chatbots is faster than in traditional ways. With several test dialogues at beginning, the chat-bot identifies the strengths and weaknesses of student, and then configures the scripts of the dialog according to the student's language capabilities. Chatbots are adaptable, then more the learner performs the exercises and the more information collected by a chatbot, then the better it will form tasks for students. The AI allows to create individual tasks for students, make them own educational path, and then teach at a pace that is convenient for them.

Mondly [15] is a specialized program for English learning, which has two versions of the interface: an internet site and a mobile application for smartphones. The user can communicate with the Mondly by keyboard or by VOI through a microphone. The application uses a dialogue mode, when a user answering a question, he should choose the best option to answer or pronounce it aloud (the user also can type his answer in a special dialog box). If the chat-bot does not understand what the user told, it will ask him to repeat the answer. If there is a pause in the

conversation, the chatbot offers several different answers for continuous of the conversation. The user can also choose how to listen of the answers in a male or female voice. Developers carry out some experiments by using a virtual reality to immerse students into the language environment with chatbots. They created Mondly VR, a special application for learning English in virtual reality glasses.

Andy [15] was designed to improve conversation practice in English. This chat-bot is positioned as a virtual teacher and you can talk to it on various topics, play language games, build vocabulary, and learn grammar rules. The user can choose a topic of discussion and get a short explanation for the corresponding grammar rule. The application supports different levels of language skills (from Beginner to Advanced). If the users have questions during the training, they can receive additional information and feedback. At the end of each topic, the user has to test himself. If there were mistakes in the test, the chatbot explains how to amend them and show the correct variant, and for unfamiliar words shows their definitions and examples of using in context. The user can talk to the chatbot on a free topic. Communication can be both written and oral by user's choice, and the chatbot corrects errors.

Virtual assistants help to practice language skills in a real-life situation. Online shops and services (travel industry, catering, etc.) use chatbots for helping customers to shop goods or book a place.

Hipmunk was designed by a company that helps in a travel company. Hipmunk help to find information for travellers about hotels, flights, car rental, etc. The internet site offers a virtual assistant, and the user can get help from him through conversation on natural language. Conversation with the chatbot starts by saying "Hello Hipmunk", then the user can ask a question, for example, "What is the cheapest flight from Moscow to San Francisco in the first week of March?" and get a reasonable answer. The chatbot allows user to practice English questions. If Hipmunk understands your questions and can answer you, it means a sufficient level of your pronunciation.

Mona is a chatbot for helping users to make profitable purchases. Mona uses databases of large online stores and finds products that maximize the customer needs. User can ask the chatbot in a free form about what kind of good he is trying to find, what range of prices, and so on, then the chatbot will pick for user the best option. User can interact with this chat bot through a dialog. In this mode, Mona asks leading questions and provides additional information in reply messages in a form of a menu to select an option. This is a good way to improve your ability quickly reading and answering English questions. This type of communication allows for user to memorize words about household items, products in stores, terms related to fashion and clothing, home appliances, etc.

Android smartphones have Google Assistant as a virtual assistant that can use for daily English conversation practice. Google assistant has a natural user interface and can help to perform different tasks, for example, it can set an alarm clock at a given time by voice request. The user should be able to build different types of English sentences. If the user's pronunciation is wrong, the assistant will not execute the command. This is an effective way to improve pronunciation and train skills of making sentences without context or nonverbal clues.

Google Nest is a line of smart speakers created by Google. It has Google Assistant and allows for users to interact with VUI. By Google Nest users can receive answers from the Google search engine, launch applications, create reminders, etc. The devices enable users to implement of the Internet of things at home, the gadget can turn on and off devices, control lighting and TV, etc. Use Google Assistant for IoT, we can without Google Home device, for this you need to have a

smartphone with parameters (Android 5.0+ / iOS 10.0+). In Table 1, we summarize some applications for Google Assistant and describe their functionality.

Table 1. Applications for Google assistant

Name	Developer	Description
Stories	Google	This app is also known as "Tell the story". The user can listen to several classic and modern stories in English. There are many stories for children. The application improves listening skills, and it is an effective way to get access to a lot of low complexity English texts.
Creative Coach	Google	The application develops a creative potential of users. It can be used in various situations, for example, for generation ideas for photos and drawings. If you are going to improve written English, you can use the command "Ask written prompt". In response, the application will generate a theme and a few lines for a new story. This application is quite universal and suitable both for those who are already fluent in English and want to improve their creative skills, and for those who have just recently started learning the English language.
Dictionary	Google	A dictionary application for finding the meaning of a word. The app lets you ask Google Home "define [word]." or "what does [word] mean?" by voice. The answer will be a description or a translation of the word.
Fun Facts	Google	The application trains listening skills, allows user to listen to texts in English and memorize new words in context. The app tells some fun facts about different things. The fact descriptions are short and use simple language, so it is a good way for training English.
Mr Vocab	Vocab Assistant	The Vocab application is aimed at people who are preparing for the GRE. The application offers a few dictionaries games and allows checking your current vocabulary.
News	Google	Listening to news in English allows you to refill your vocabulary with everyday words, as well as to train your listening skills. This application offers various options, news sources (BBC, Financial Times, etc.).
Spell Check	Google	Sometimes you may find that you know how to say an English word... ..but you do not know how to spell it. The spell checker provided by Google lets you check the spelling of any word: just ask, "How do you spell [word]?" or say Google Home "Spell [word]". While this is no substitute for precise word learning, spell check is a great tool for helping you confidently learn new words.
Vocal Notes	Maildover LLC	User can use voice memos if he wants to dictate rather than write in English. The application can be useful for sending messages in English, or for improving your confidence in using both spoken and written English.

#### 4. ALGORITHM OF APPLICATION CREATING

Academic English proficiency is an essential skill of a modern scientist and requires constant practice. Researchers need continuous language training for improvement their language competencies. To expand opportunities for self-development of academic English skills, we

developed application for Google assistant "Academic phrase bank trivia" and "Academic trivia". The first application helps to train the vocabulary of academic English. The second helps to develop skills of building grammatically correct sentences in academic English, memorize phrases of academic vocabulary, and train the correct pronunciation.

For the developing our application, we use the Google action console, which allows to create an application for Google Assistant. In the console we step by step create an application and make some configurations using a specialising online editor. After completing all steps, we will get a fully working application that can be tested on a computer simulator or on a smartphone and publishing in Google Assistant directory. Figure 1 demonstrates the algorithm of creating the application.

The first step of the algorithm is to collect the exercises that will be used to create our application. The collected information is checking for incorrectness, if some errors are detected, the initial data are correcting, and the first step is repeated. After the final correction, the data is entered into a special Goggle Sheet template. The next step is to configure the voice interface to run the application and build an invocation model. Then a specialized online environment is using for building of an action. This environment is also using for building of logic, responses and intent training phrases. At next step of development, the built application can be tested in a simulator. At the next step of development, the application can be tested on a smartphone. The last step of the algorithm involves create a realise and publishing the application to Google actions directory.

When we were creating the application, we used some rules of development. Questions for the application should be brief and clear. It should be considered that the question is displayed on the smartphone screen, and there is interaction only by voice, so it is difficult for a player to remember a long question, especially in a foreign language. Therefore, questions and answers should be as short as possible. In the guide, Google recommends that the answers contain only one or two words [16].

If there are many correct answers to a question, you can specify them using the "|" separator. Any of these synonyms will be considered a valid answer. The Google guide recommends varying types of questions, which ensures dynamic learning and engagement, and questions should be as compact and clear as possible. It is recommended that the quiz be culturally and gender sensitive so that it is interesting to as many users as possible.

An action creates by the Trivia template, go to the Action console, and create a New Project. Then select the Template command in the Advanced Parameters section at the bottom of the page and specify Trivia Template in the appearing window. Then open the file from templates in Google Sheet editor. Then copy and paste the URL of the sheet in your browser and open the file in the online spreadsheet editor.

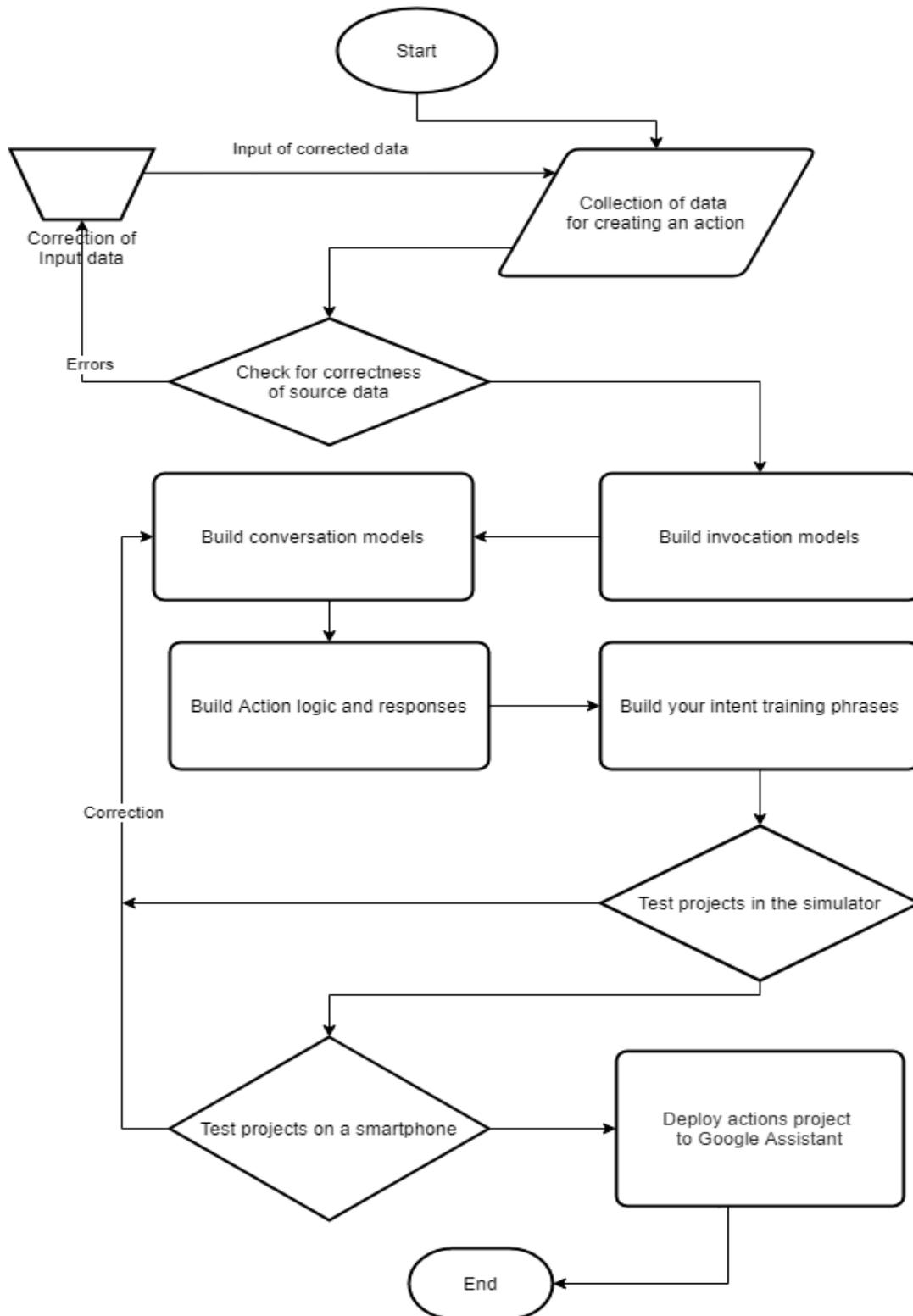


Figure 1. The algorithm of creating the application

You can fine-tune the quiz by specifying the difficulty and category for each question and create your own sound effects or speech files. You can specify difficulty levels for the questions, add a "Difficulty/Grade Level" column on the sheet, then specify a difficulty level or grade level for

each question. You can specify up to three different difficulty levels: "Easy", "Medium" and "Hard". To separate the questions into categories, you will need to add a "Category/Topic" column and then specify a category for each question on the worksheet. You can set up to three custom categories. Before running the quiz, the user will be asked about the desired topic and the level of difficulty for the current round of questions. Additional settings and examples of using them there are in User Guide [16].

Once the action has been created, it can be tested. To do this, it is necessary to select the Test command in the top menu to test the action through the web interface. Figure 2 shows testing application in action console.

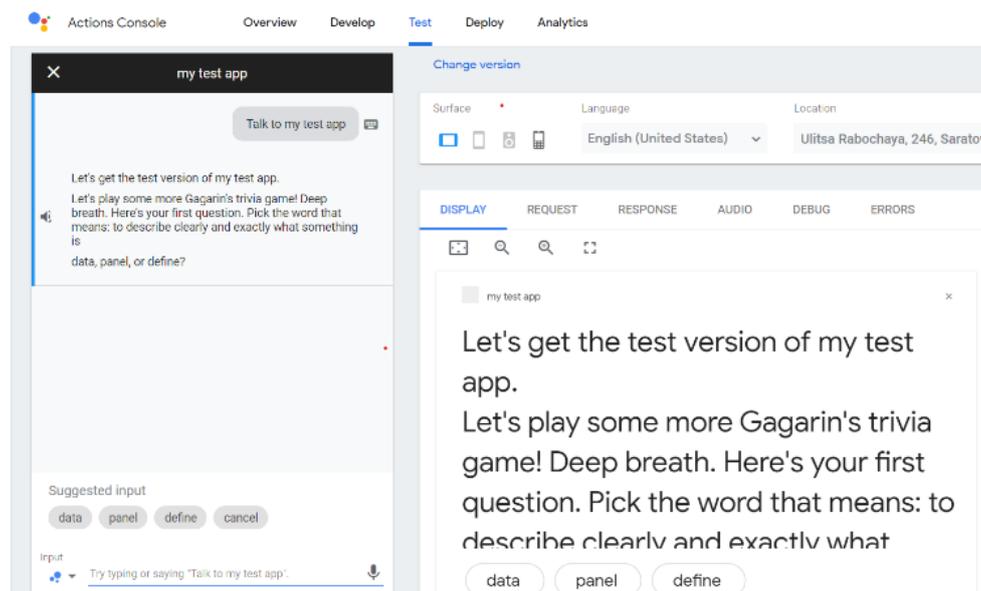


Figure 2. Test application in action console

To test the action in your smartphone, you need to run the Google Assistant and say into the microphone or enter the phrase "Talk to my test app". You can test your action through a Google Home device, the device must be connected to the same developer account. If the action supports more than one language, you should test each language separately.

## 5. VOICE ASSISTANT FOR ACADEMIC ENGLISH TRAINING

A Trivia Action template was used for developing an application, in the order that was described above. This template allows you to create test quizzes, which can be run on mobile devices with Google Assistant, as well as on smart speakers with the Google Home system.

The action "Gagarin Trivia" was developed by us for vocabulary learning and training academic writing. For questions we used terms recommended by the HSE Centre for Academic Writing [17] and other quality sources [18].

To start the action, it needs to say the phrase "Play Gagarin Trivia game" to the Google assistant. Figure 3 shows the launched application, and the assistant tells you the rules of the quiz. You can choose the number of participants and the number of questions in one round. Then the first question will be read out and you will get three choices for answer. You must either say the

answer or the answer number. If the answer is correct, the program will give the approval reaction, if not, you will get the correct answer and some explanations.

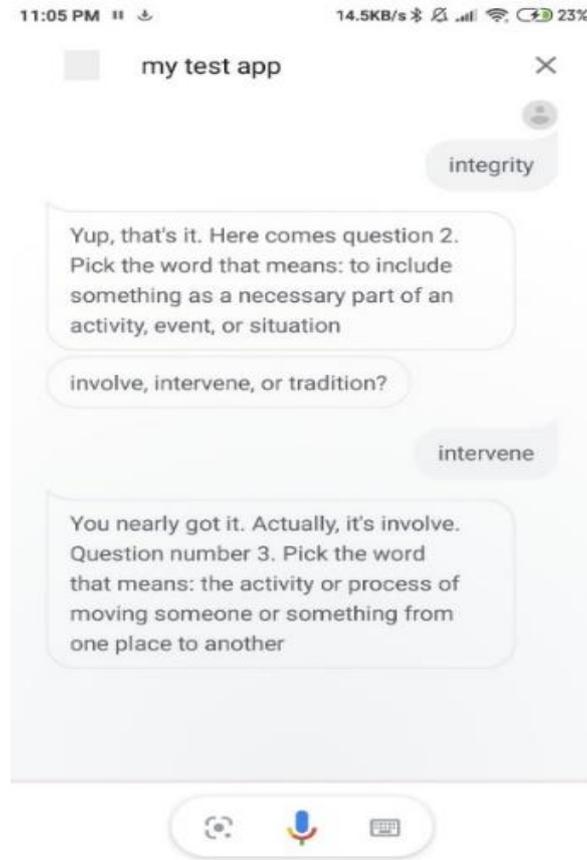


Figure 3. App view on a smartphone

If you do not understand the question, you can ask the assistant to repeat it with the command "Repeat question". If you do not know the correct answer, you can skip the question with the command "Skip question". To finish the game, you should say "Stop". At the end of the round, the assistant will summarize and tell you the number of correct answers. The application is quite fascinating. If you have the high level, you can use it even while walking, communicating with the assistant using headphones.

The second action is "Academic phrase bank Trivia" which allows to improve the knowledge of academic English. The information from English textbooks, specialized websites, and Academic phrase bank was used as a content of the application [19].

As answer to the assistant's question, it is necessary to choose the sentence closest by its meaning to the given phrase in English. As a hint, the assistant gives three options. In order for a phrase to be counted, it is not necessary to pronounce it verbatim, partial correctness is enough.

The exercise allows to improve the skill of scientific English attentive listening, and train pronunciation. In addition, the pronunciation of the templates will help them to memorize well. If you cannot pronounce the suggestions correctly, you can skip the question and proceed to the next one.

## 6. CONCLUSIONS

English proficiency enhances the quality of scientific research. Many modern scientific works published in highly ranked scientific journals are written in English. The ability to communicate confidently in English enables effective communication with other researchers.

Improving language skills is a long-time process that requires considerable time and financial expenditure. The application uses the artificial intelligence of the Google platform and was designed for self-study of academic English and improving academic speaking skills. The application allows to study new words, to carry out the construction of grammatically correct sentences in English, to memorize templates of academic phrases. Users can train the correct pronunciation of phrases and developing skills of scientific texts listening.

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