



# Особенности организации практической деятельности по разработке мобильных приложений дидактического назначения для развития коммуникативной толерантности будущих педагогов

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## АННОТАЦИЯ

**Проблема и цель.** Модернизация высшего образования открывает перспективы использования мобильных технологий для повышения качества обучения студентов-педагогов. Кроме того, приоритетными задачами программ подготовки являются: стимулирование культурного обмена, формирование убеждений и мировоззренческих позиций, развитие коммуникативных и цифровых компетентностей. Цель исследования – выявить особенности организации практической деятельности будущих педагогов по разработке мобильных приложений для формирования их коммуникативной толерантности.

**Методы исследования.** Мобильное приложение дидактического назначения – программа, спроектированная в среде разработки и обладающая определённым образовательным потенциалом. В эксперименте задействовано 68 студентов Вятского государственного университета (Российская Федерация). Программа подготовки: 44.04.01 Педагогическое образование (уровень – магистратура). Деятельность по разработке мобильных приложений реализована на занятиях по дисциплинам: "Интерактивные образовательные технологии", "Разработка и применение компьютерных игр в обучении", "Профессии будущего". Среда разработки – платформа MIT App Inventor. Для оценки сформированности коммуникативной толерантности применяется тест В. В. Бойко. Метод статистической обработки – критерий  $\chi^2$  (хи-квадрат) Пирсона.

**Результаты.** Описана система работы обучающихся экспериментальной группы по применению мобильных приложений для поддержки толерантности и мультиязычной коммуникации; формирования уважения к культурной самобытности других людей; развития эмоционального интеллекта. Особенность предлагаемого информационного взаимодействия – адаптация контента мобильных приложений под специфику направления подготовки. Выявлены статистически достоверные различия в качественных изменениях, произошедших в педагогической системе ( $\chi^2 = 6.547$ ;  $p < 0.05$ ).

**Заключение.** Сформулированы особенности деятельности по проектированию приложений, которые обеспечивают дополнительные условия для развития коммуникативной толерантности: добровольный характер общения всех участников информационного взаимодействия; применение цифровых технологий для поддержки диалога в рамках профессионального общения; наличие обратной связи через компоненты среды разработки.

## КЛЮЧЕВЫЕ СЛОВА

мультиязычность, информационное взаимодействие, цифровая технология, среда разработки, образовательное приложение, платформа MIT App Inventor

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# Peculiarities of organizing practical activities for designing didactic mobile applications to develop future teachers' communicative tolerance

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## ABSTRACT

**The problem and the purpose.** Modernization of higher education opens up prospects to use mobile technologies for improving the quality of teaching students. In addition, the priority tasks of the training programs are: stimulating cultural exchange, forming beliefs and worldview positions, developing communicative and digital competencies. The purpose of the research is to identify the peculiarities of organizing practical activities of future teachers in developing mobile applications to form their communicative tolerance.

**Research methods.** A didactic mobile application is a program designed within a development environment and has a certain educational potential. 68 students of the Vyatka State University (Russian Federation) were involved in the experiment, educational program: 04.04.01 Pedagogical education (Master's degree level). Mobile application development activities were implemented in classes in the following subjects: "Interactive educational technologies", "Developing and applying computer games in education", "Professions of the future". The development environment is the MIT App Inventor platform. V. V. Boyko's test is used to assess the formed communicative tolerance. Statistical processing method is Pearson's  $\chi^2$  (chi-squared) criterion.

**Results.** There is described the system of work of students of the experimental group on the use of mobile applications to support tolerance and multilingual communication; the formation of respect for other people's cultural features; the development of emotional intelligence. The peculiarity of the proposed information interaction is adaptation of the content of mobile applications to the specifics of the training area. Statistically significant differences were revealed in the qualitative changes that occurred in the pedagogical system ( $\chi^2 = 6.547$ ;  $p < 0.05$ ).

**Conclusion.** Formulates the peculiarities of design activities that provide additional conditions for developing communicative tolerance: the voluntary nature of communication between all participants in information interaction; the use of digital technologies to support dialogue within professional communication; feedback through the components of the development framework.

## KEYWORDS

multilingualism, information interaction, digital technology, development framework, educational application, MIT App Inventor platform

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## INTRODUCTION

In the world of different cultures, a modern person should have multilingual communication skills and be capable of continuous learning in an information environment through different forms of communication [1]. S. Kopp and N. Krämer emphasize that learning through communication is based on two key factors: the ability to perceive others' point of view; the ability to comprehend the mental states, emotions and behavior of people we interact with [2]. In other words, learning through communication, according to V. V. Boyko's conclusions, determines the importance of forming communicative tolerance [3].

Creating an appropriate educational environment involves fostering honesty, openness, encouragement, guidance, consent, and trust among students. P. G. Labzina, S. G. Menshenina, E. V. Kosharskaya highlight that teachers, acting as mentors, play a crucial role in establishing and maintaining the conducive atmosphere for student development [4].

UNESCO operates with the goal of promoting mutual understanding among people. Key tasks undertaken by UNESCO include fostering and facilitating intercultural communication, promoting solidarity in combating intolerance, stereotypes, discrimination, and violence [5].

V. Chernikova and et al. detect that the rapid advancements in information technology have challenged traditional beliefs regarding values, the purpose of life, and the role of culture. This has led to the process of dehumanization within our culture. Now culture has become increasingly rationalized and intellectualized, it loses emotional and intuitive essence. Individuals are required to engage with culture solely through their intellect, rather than their soul [6].

The problem of preserving culture nowadays can be equal to the problem survival of humanity as a biological species [7]. Implementing inclusive education, as one of the priorities in Russia's state educational policy, emphasizes the relevance of the idea of the individual value. The most important element in this process is fulfilling provisions of the federal program for the development of education up to 2030 [8].

Y. Zhao et al. point out that using computers and smartphones has become commonplace for millions of people, providing them with an opportunity to create, receive, store and distribute information around the world [9].

O. G. Smolyaninova, N. A. Ivanov, N. S. Podusova suggest that the contemporary world is being significantly impacted by the process of informatization across production methods, consumer behavior, creative expressions, and the political arena [10]. The combination of different information technologies has made creative experiences more accessible to the ordinary people, thereby helping the spread of cultural models and values within the realm of information and communication. These transformations have imbued diverse cultural forms and values with social significance [11].

S. P. Aschena in his work claims that the shift to mobile online learning can have several positive changes [12]: inspiring active participation and communication among individuals from diverse cultures through online conferences or through an interactive application; promoting high-quality inclusive education; making appropriate and adaptive content, and reaching equality in the field of mobile digital technologies.

E. V. Soboleva considers mobile learning as an innovative approach that extends beyond the confines of traditional educational settings and pedagogical processes [13]. Mobile technologies offer significant didactic potential by enhancing motivation, facilitating communication, and fostering cross-cultural exchange. Currently, the integration of mobile applications and software tools to improve learning and cognitive processes is being actively developed and methodically refined to optimize its effectiveness.

*The purpose of the work* is to explore and validate the effectiveness of practical activities in the development of didactic mobile applications aimed at fostering communicative tolerance among future educators.

*Research objectives:*

- 1) to clarify the content and identify the levels of the developed communicative tolerance;
- 2) to identify the potential for mobile technologies to create additional resources for shaping the communicative resilience of future teachers;
- 3) to identify and justify pedagogical conditions that facilitate to the most effective development of students' communicative tolerance through creation of didactic mobile applications;
- 4) experimentally validate the effectiveness of the projected work system.

## MATERIALS AND METHODS

The presented research considers communicative tolerance as an integrative personality quality that is formed in the process of socialization. It regulates inner harmony with oneself and outer harmony with the world around.

A mobile application is a software, functional web product that is specially developed based on the opportunities of modern gadgets. The didactic mobile application differs in that it is a software product, the functions and appearance of which are originally designed to work on mobile platforms in order to achieve socially significant educational goals.

The practice of developing and using didactic mobile applications to form communicative tolerance has been implemented among students of the field of study: 44.04.01 Pedagogical education (master's degree level), Pedagogy of giftedness. Experimental activities were implemented in classes in the following subjects: "Interactive educational technologies", "Developing and applying computer games in education", "Professions of the future". The base of the experiment is the Vyatka State University. 68 second year graduates were involved. The average age is 22. There are 64% female and 36% male participants. This feature of the sample is due to the specifics of the pedagogical profile of training.

To develop mobile applications for didactic purposes, future teachers used the tools of the MIT App Inventor cloud environment. The selection process included evaluating at different stages of the study the potential of the following software products: iBuildApp, Dvadeshki, MS Visual Studio, Eclipse, Thinkable, MIT App Inventor, Android Studio, Kodular, etc. Selection criteria: target audience; design functionality; multilingualism; complexity to use and develop a software solution; the use of different technologies for storing information.

Advantages MIT App Inventor: visual designer, Drag-and-Drop interface support. Users can drag and drop interface elements such as buttons, text boxes, images, and more from the toolbar directly onto the development screen. MIT App Inventor contains programming blocks: the application logic is created by connecting blocks, which resembles puzzles. This makes the programming process easier, especially for beginners.

V. V. Boyko's test was used to assess the formed communicative tolerance. Its advantages: it allows the mentor to see weak points of the interviewee; to understand which behavioral reactions, strategies and attitudes in interpersonal communication should be adjusted to make the communication process effective. The test includes 45 questions divided into 9 blocks. Each of the blocks reflects the peculiarities of behavior in certain communication conditions. The rating scale contains integer values from 0 to 3 points. They are used by the respondent to express how applicable the judgments given in the test are to him. The mechanism of value placement: 0 points – not applicable; 1 point – sometimes applied in a minor manifestation; 2 points – applied significantly; 3 points – applied in maximum expression.

Next, the sum of the points received for all nine criteria is calculated. The maximum number of points is 135, for each block — 15. Since all the participants in the experiment are second-year students of the master's degree in education and pedagogy, it was decided to introduce three levels

of formed communicative tolerance: high (from 1 to 45 points), medium (45-85 points), low (85-135 points). That is, the level of "total rejection" was combined with the "low" level. The level, according to the methodology of V.V. Boyko, is an integral indicator for all blocks.

The  $\chi^2$ -Pearson criterion was used for statistical verification.

## LITERATURE REVIEW

The initiatives of UNESCO are implemented in the unity of education, culture, science, mass media and technical means of communication [5]. In other words, all achievements of the human mind and scientific and technological progress are attracted and actively used to meet these key tasks [14].

This range of effects is defined by M. Ott, F. Pozzi, as a complex mechanism called "manipulation". An important component of a person's life position, tolerance, in this situation can mitigate a potential contradiction. After all, every person has their own values and interests [15].

S. V. Mareeva, E. D. Slobodenyuk, V. A. Anikin note that tolerance is recognized as one of the fundamental values in the modern world [16]. According to them, education is one of the key areas where forming and maintaining the value of tolerance becomes a state task. Consequently, one of the most important areas for improving the didactic process may be integration of oriental physical education practices into academic programs. According to the authors' conclusions, this will contribute to the activation of motor abilities and favorably affect the formation of students' ethnic tolerance, their respect for representatives of other cultures.

A. V. Ponomarev and E. V. Reimer also substantiate that the interaction of students in joint activities can be based on both feelings of fellowship and comradery, and on the basis of competition and isolation on various grounds [17].

A. G. Asmolov considers communicative tolerance "as the art of living in a world of completely unlike people and ideas" [18]. G. D. Dmitriev identifies the following stages in developing tolerance: teaching tolerance (developing tolerance among students with respect to the cultural features of other ethnic groups); communication with representatives of another culture in order to study its features and better understand; forming respect for the discovered cultural differences; understanding and expressing an active social position in communicative activity [19]. M. Verkuyten and R. Kollar emphasize that the use of the concept "tolerance" is quite possible and effective from the perspective of designing education management [20]. N. Goncharevich et al. hypothesize that the problem of educating a tolerant personality is relevant for modern society, which is characterized by pluralism, lack of uniformity in opinions, assessments, attitudes, and forms of behavior [21].

O. G. Smolyaninova, N. A. Ivanov, N. S. Podusova explore the features of organizing the information and educational environment at the university, the basis of which is mediation technology [10]. Mediation is considered in the context of conflict resolution and formation of a psychologically comfortable educational environment, ensuring social and emotional security of the individual.

L. Popovic, D. Čosić, S. Popov show that contrasting points of view and ideas brought by diverse staff are a valuable resource that promotes creativity and innovation in the modern information society [22]. The combination of different perspectives and experiences, supported by ICT tools, enhances the ability of an individual or organization to generate original ideas and expand creativity.

According to the conclusions of S. P. Aschena, during the COVID-19 pandemic, the education system faced the need for significant changes, much more than just ensuring the availability and access to modern digital resources, such as mobile applications, especially in South Africa, a country that seeks to overcome the injustices and inequalities inherent to the pre-democratic period [12]. One of the key aspects of the didactic potential of mobile application development is the ability to create interactive learning applications for users of different countries and cultures. Students can participate in the design of applications that allow them to actively interact with educational material, conduct experiments, solve problems and receive instant feedback.

S. Sakulwichitsintu describes the experience of research that assesses the impact of mobile technology on human consciousness and subconsciousness [23]. The author notes that the content of mobile applications supports various forms of communication (interpersonal, group) through a naturally formed prism of perception of the information received. There is an integration of visual, auditory, and graphic images of words.

D. Kumar and B. Pande conclude that researchers' interest to studying the role and impact of mobile learning in higher education has increased rapidly since 2010, especially after the introduction of affordable smartphones on the market. Many studies report that higher education institutions have made efforts to integrate mobile devices into training highly qualified mentors [24].

A. Hinze et al. note that there is an active integration of mobile technologies (applications, services) into the higher education system [1]. Authors revealed that teachers and students mainly use mobile applications for: storage and exchange of documents (data); communication (including intercultural). They are forced to come up with original ideas, find non-standard solutions and bring them to life through the creation of programs. This process contributes to the development of innovative thinking and entrepreneurial skills.

E. V. Soboleva et al. present a classification of mobile applications used in teaching based on meaningful and functional features [13]. The main selection criterion is the didactic purpose of the designed application (motivation, actualization, control, study of new material, development/self-development or education/self-education).

The analysis of modern mobile learning technologies allowed us to identify the following main advantages of their implementation in the educational process: the availability of feedback and the possibility of evaluating learning outcomes [25]; the ability to independently choose the place and time of study [26]; the possibility of personifying the educational program [27]; changing the forms of classroom work due to the widespread use of practice-oriented technologies; expansion of social interaction based on the educational process and others [28]. Moreover, as noted by S. Jarutkamolpong et al., the didactic opportunities of mobile technologies are often aimed at creating the most comfortable conditions for implementing the educational process outside the educational institution by providing access to information resources [29]. Employers increasingly value the practical experience and skills gained in the process of creating real projects, which makes such graduates more in demand.

O. V. L'ova points out that the search for ways and means to solve the problem of tolerance is now extremely relevant for the world community [30]. The experience of using ICT tools indicates an increase in students' motivation by involving them in active work in the media they are familiar with, in particular in social networks.

So, mobile devices become increasingly popular among educators and methodologists as a learning tool in both online and offline formats. However, it is important to realize that the potential of mobile technologies is not limited to educational purposes only. They are also able to stimulate research activities, improve cognitive functions and promote the development of personal qualities.

## RESEARCH PROGRAM

The main purpose of the experiment is to verify that practical activities on designing and applying didactic mobile applications will provide additional pedagogical conditions for forming future teachers' communicative tolerance.

The first stage analyzed the significance of the problem of forming communicative tolerance in a modern multicultural society. Here, software tools (platforms, programming systems, web services) with resources to implement the research tasks were evaluated. It was revealed and substantiated that MIT App Inventor is the optimal development framework for beginners in programming. Others advantages: quick implementation of the "draft" version of the project: instant preview (the ability to quickly view and test changes in the application on a real device or emulator); development speed (a

visual approach and ready-made components can significantly reduce development time compared to traditional programming); cloud storage and teamwork; online access (projects are saved in the cloud, which allows you to work on them from any device and share with other users; disadvantages. Limited flexibility: while visual programming is convenient for simple applications, it can be limited for more complex tasks that require fine tuning and optimization; some functions may not be available or limited depending on the capabilities of MIT App. Applications created on the platform may be less optimized compared to manually written code in programming languages such as Java or Kotlin.

Further, the content of various psychological solutions for assessing communicative tolerance was studied: the methods of "Tolerance Index" (G. Soldatova, O. Kravtsova, O. Khukhlaeva, L. Shaigerova) and determining tolerance to uncertainty (S. Badner); the test of communicative tolerance (V. V. Boyko), etc. As a methodology for the present research, it was decided to use the V. V. Boyko test. The reasons for this choice: the test allows you to diagnose tolerant and intolerant personal attitudes that become obvious in the process of various types of communication (including professional); nine blocks of test questions allow you to reflect the peculiarities of human behavior in certain communication situations.

Using the test, all respondents included in the general sample were divided into an experimental and a control group. There were 34 graduates in each of them. The general sample included all second-year students studying in the field of training 44.04.01 Pedagogical education. The principles of scientific ethics were taken into account:

- the graduates were aware of the experiment being conducted;
- all classes were held in the same classrooms of the university buildings (Internet access, unified software);
- subjects involving the study of pedagogy and psychology, philosophy of education were studied by graduates earlier. Therefore, all participants in the experiment had an idea of the principle of tolerance, the essence of communicative tolerance;
- the master's degree program is designed in such a way that all these disciplines ("Interactive educational technologies", "Developing and applying computer games in education", "Professions of the future") follow each other. This makes it possible to use the existing students' experience in the development of didactic applications. No more subjects involving the practice of mobile development and the study of the problems of a multicultural society were conducted during the experiment.

It was decided that within the framework of classes in the subject "Interactive Educational Technologies", 1 hour of lectures and 2 hours of practice would be given to form an initial students' understanding of the functionality and design stages of mobile applications. Within the framework of the subject "Developing and applying computer games in education", future teachers would consider the stages of designing didactic mobile applications in more detail. This would take 1 hour of lectures, 4 hours of laboratory work. And finally, in the classes of the subject "Professions of the future" (2 hours of laboratory work) they would be able to develop and put into practice mobile applications that contribute to forming multicultural communication.

All the students were aware of the experiment. Their participation was voluntary. All classes were conducted by one tutor – E.V. Soboleva. The teacher's mobile phone was used to check the functionality of the applications. Unsupervised work was also designed: studying additional tools, selecting material for filling the application, testing and debugging, checking the functionality of the program and its purpose during information interaction with students of the city's schools.

At the second stage, graduates studied the materials of the subjects according to the academic work programs approved at the university.

At the third stage of the study, pedagogical conditions were identified that contribute to the effective formation of future teachers' communicative tolerance in the course of practical activities to design and apply didactic mobile applications.

## RESEARCH RESULTS

A didactic mobile application to support the formation of future teachers' communicative tolerance is a software designed specifically to: improve and simplify the learning process; providing additional opportunities for information interaction between users, including in a foreign language. Didactic opportunities of mobile applications include motivating and stimulating; activating cognition, developing creativity; supporting information communication. The peculiarities of work with mobile applications are specific types of activities contributing to the development of communicative tolerance.

In this research, didactic mobile applications are used for teaching and developing tolerance; communicating with representatives of another culture (social group, nation); forming respect for cultural and intellectual-emotional features; expressing an active position. Earlier it was noted that there are a sufficient number of tools and programming environments for mobile solutions (iBuildApp, MS Visual Studio, Eclipse, Thunkable, MIT App Inventor, Android Studio, Kodular, Dvadeshki, etc.).

Examples, Kodular is an online Android application development platform designed for users without deep programming knowledge. It allows you to create applications using a visual designer, where interface elements and functionality are programmed using blocks. The main features, advantages and disadvantages of Kodular were considered. Advantages: visual designer, Drag-and-Drop interface support.

Users can drag and drop interface elements such as buttons, text boxes, images, and more from the toolbar directly onto the development screen. Kodular contains programming blocks: the application logic is created by connecting blocks, which resembles puzzles. This makes the programming process easier, especially for beginners. Kodular offers a rich set of components.

For example, for the interface, including lists, media elements, maps, and forms. Advantages: accessibility for beginners. Kodular is specifically designed for users with no programming experience, making it an ideal tool for novice developers. Also, extensive documentation and training: the platform offers a variety of training materials, including manuals, video tutorials and sample projects. Limited flexibility: the work is available only in English, there is no support for Russian.

We will indicate the reasons for choosing MIT App Inventor: the opportunity to work in the environment even for beginners, since the construction of programs is carried out in a visual mode using blocks of program code; support for Android OS, which does not require knowledge of Java programming language and the Android SDK, knowledge of the elementary basics of algorithmization is enough; after creating a project, you can immediately install it on a mobile device and launch it using a QR code. The latter is easy to scan using a phone.

Other the reasons for choosing MIT App Inventor:

- media and animation: the ability to integrate multimedia elements such as images, videos and sounds, as well as create animations;
- sensors and equipment: support for working with various device sensors (e. g. accelerometer, gyroscope) and equipment (camera, GPS);
- MIT App Inventor integration and extensibility: databases and API (support for working with external databases and API, which allows you to create more complex and functional applications);
- plugins and extensions: addition of third-party extensions to enhance the functionality of their application;
- payments: support for the integration of payment systems to create commercial applications.

Topics studied previously: "New information technologies", "Classification of information technologies", "Cloud technologies". Let's describe the content of the practical lesson "Getting to know the App Inventor environment. Creating a new project".

1. Click on the link to the main page of the App Inventor website. To start creating a mobile application, click on the "Create Apps" button. After that, the site will ask you to register with a Google account. The basis of this service is creating a mobile application using the tools of two desktops. Let's analyze them further. Don't forget to switch the interface language to Russian to make it easier to navigate.

4. The desktop of the App Inventor service "Designer". This is the designer space that is responsible for the design of the application. Here you form the interface components, which you use further to create an application. And here, each component is configured for more precise tasks.

An example of a designed application is the "Crystal Ball". The finished solution will be a virtual construction in the form of a ball. There is a dark liquid inside the ball, where an icosahedron floats, with various answers. There are 20 possible answers in total. The user asks a question by shaking the ball and gets an answer.

The last 2 components are invisible. Components in a vertical arrangement should be placed in the center. Add a balloon image and a music file to the Media section. Attach the "m8ball.png" file to the "Image 1" component so that the program can turn on the image of the ball at startup. In Label 1, write the phrase "Ask a question to the magic ball". Next, the application code is written. To do this, go to the "Blocks" menu.

Set the main action, which will look like this: when we give the command to execute a component, it performs certain actions associated with it. Then the actions for the accelerometer are arranged sequentially. Next, we check the program using an emulator (Connect – Emulator) or a smartphone (by downloading the APK file). Save the project. Within the framework of the subject "Developing and applying computer games in education", practice with mobile applications was preceded by the study of the topics: "Gamification of learning: history, problems and prospects", "Educational games with digital components", "Interactive online services".

An example of a project implemented by students is "How are you feeling today?". This mobile application provides checking mood changes throughout the day in a game mode. Methodological recommendation: the student writes the name of the application and phrases for the dialogue in a preferred language. This research presents a variant of the game application, where English is used for inscriptions, labels, phrases

To begin with, the application design is developed. In the Designer block, add FeelingLabel (size 20 pt., color to choose from) to Screen1. Write the phrase "How are you feeling today?" into it. Next, place 3 horizontal locations "Happy\_Bar", "Angry\_Bar", "Sad\_Bar". Then place a button and two labels in each of them. Via the Media menu add three emoticons and assign to each button. Write in the inscriptions "Happy", "Angry", "Sad", in the remaining ones write "0". Next, insert the image of the hero (via the Media menu), the inscription "Oww, cute Hero", and the button to launch. Methodological recommendation: future teachers also determine the name for the hero themselves.

As a result, after all the manipulations, the program interface is ready. Next, go to the "Blocks" menu, i.e. start the development phase of the application code. Set the buttons "HappyButton", "AngryButton", "SadButton" as working ones. Configure their properties and actions. Next, design the action – phrases to cheer up the user with warm words of support. For example, we add three text blocks with the phrases "You are the best!", "I believe in you!", "You can do it!".

Within the framework of the subject "Professions of the future", the following topics were studied previously: "Atlas of professions of the future: changes in graduate training", "In-demand supra-professional skills and competencies", "Game expert", "Tutor", "Mediator of social conflicts", "Mobile application developer". It was while studying the specifics of the latter profession that future teachers were asked to design mobile applications for didactic purposes. Sample versions of the projects are "Indigenous peoples ...", "Tastes differ", "Masterpieces of music".

Let's present a variant of one of the projects. Methodological recommendation: graduates could come up with their own topic for research. The name for the hero was also determined by themselves. The situation "After studying the issues of chronology and time calculation at the lessons

(history, literature, mathematics), Fyodor became interested in what calendars in China or India are like. He turned to mentor with this question after the lesson. Having received an answer to his question, Fyodor wanted to share his knowledge with all his classmates. To this end, he decided to create a pocket hint in the form of a mobile application containing information on this topic.

Help Fyodor realize his idea by creating a mobile application with a home screen and buttons, which, when clicked, display the definition of "Oriental (Chinese) calendar and its types". On the first development screen, you should figure out what is necessary to design the application (images, labels and buttons). To add images to the application, use the "Image" component in the "User Interface" section and drag it to the screen model of the mobile device. Set in the properties: align horizontally and align vertically – center. This will mean that all the used components of the application will be located in the center.

In order for the image to match the screen size, select "Fill parent" in the image properties in the height and width items. Next, also from the "User Interface" section, add the "Label" component by dragging it to the top of the screen. After that, from the same section, drag the "Button" component to the bottom of the screen. In the properties, change its text to "Definition". Add another button and change the text to "Examples". Under each button, add an inscription for the component. The text for these components was also thought out by the graduates themselves.

To prevent the label text from being visible initially, and it would appear only at a button click, remove the check mark from the "Visible" parameter in the properties of the "Label" component. Upload the images. To do this, use the "Upload Media" button at the bottom of the "Components" panel (on the right). For example, select "Image1" from the "Application" folder. Next, we will set the sources for the images. To do this, in the properties of the component "Image1" in the column "Image", select the name of the file that is necessary from the drop-down list (in our case "1.jpg"). We switch to the constructor mode (blocks) Here you should specify the values of the buttons used. Save the application.

The first development of the situation: "Fyodor, before sharing the application with classmates, demonstrated his development to the mentor. The teacher praised the student for his enthusiasm. But he noticed that there was not enough information in this application, so it would be extremely difficult for others to understand what Fyodor was trying to convey. Help Fyodor improve the application, e.g. to create an additional screen that would contain information about the calendars given in the examples".

The second development of the situation: "After the work done, Fyodor decided that he was still missing something. He thought about it and wanted to add examples of converting dates from the European calendar to the Eastern one to his application. Help Fyodor to finalize the application so that each calendar has a separate picture with information about the rules of translation. Also add a jump button to the home screen". Example to check: 1959, this was the year of the Ground (yellow) Pig.

Problematic task: "Fyodor noticed that significant distortions appear on his smartphone while recording in the Dictaphone. He decided to create a Dictaphone application for himself. Help Fyodor realize his idea". The task of the student is to develop an application that will record sound at the moment, and then play it back. The initial step is to start working with the service (it consists in creating a project).

We call the application "Recording". After creating the project, the application design window opens. In the window you should customize the appearance of the components. For the initial setup, you need to align the screen. To further develop the application, it is necessary to add interface components. Methodological recommendation: repeat that the interface components are a variety of tools for implementing your idea (buttons, sounds, images, etc.). Let's add two buttons from the components. We call them "Record" and "Play". We also add the "Sound" and "Voice recorder" elements. The addition is carried out by transferring the component to the "Phone" screen. Now you need to switch to the "Blocks" programming mode. This is where the programming of the design elements will take place. In the "Blocks" mode, all possible commands with the components are present. First, you need to assign an audio track to the "Sound" component. Methodological

recommendation: the track should be pre-recorded and saved. Next, we program the buttons so that they fulfill their purpose.

The first development of the task: "Fyodor liked his application. He wanted to refine the design, make the interface aesthetic and understandable to the user." Fyodor wanted to add a microphone icon to the screen and change the background color. Explanation of the solution: it is necessary to add the "Image" component and change the background color (at the discretion of the user). In the first case, add the "Image" component. And then download the microphone image from the Internet. Or create it using a graphical editor.

The second development of the task: "Fyodor decided to further improve the application for friends. He wanted to add an inscription element and another image from the radio".

The graduates of the experimental group could use the developed applications as part of their predegree practice to support information interaction. The students of the control group also studied all the topics of these disciplines, according to the syllabus. However, they were not involved in the purposeful and organized work on the design of didactic mobile applications according to the logic described above. Examples of questions and assignments that undergraduates completed: Which website builders do you know?

Example, "Create a video telling about the problems of foreign students at overseas universities". The creation tool is Powtoon (<https://www.powtoon.com>). After getting to the project page, the students had to choose the type of the first scene. To do this, use the background library, go to the "EDU" tab and select the background you like. There are already ready-made objects on the stage. In the title, the students entered the inscription "The problem of adaptation among foreign students". Next, the choice of color, font, location. The problem situations under consideration: differences in social norms, values and behavior; difficulties in understanding and using the language of instruction; different educational systems and curricula; difficulties in establishing contacts with local students and teachers; expenses for education, housing and other living expenses.

At the fixing stage of the experiment, testing was carried out again according to the method of V. V. Boyko [3].

High level of communicative tolerance: students understand and accept the importance of active creative activity in a modern multicultural and multinational society, intensively mastering and applying the means of new information technologies in interaction. In accordance with the principle of tolerance, they are able to independently select material for filling a didactic electronic resource, form the resource in digital form without errors. They actively use the resulting information product to preserve their socio-cultural identity, support peace and harmony with representatives of different nationalities, races and beliefs.

Average level of communicative tolerance: in most cases, students understand and accept the importance of active creative activity in a modern information multicultural society. In accordance with the principle of tolerance, they are able, with little help from a mentor, to select material for filling a didactic electronic resource, form it digitally without gross technical and substantive errors. They strive to apply the developed information solution for forming and supporting intercultural communication, in the fight against intolerance, stereotypes, discrimination.

Low level of communicative tolerance: in rare cases, students understand and accept the importance of active creative activity in a modern information multicultural society. In accordance with the principle of tolerance, they are able only with the substantial methodological assistance of a mentor to select material for filling a didactic electronic resource, form it digitally with some technical and substantive errors.

Table 1 shows the results of measuring the level of future teachers' communicative tolerance according to the methodology of V. V. Boyko before and after the practice of developing mobile applications.

**Table 1**

The results of the influence of students' involvement in the practice on developing applications on the level of their communicative tolerance

| Level   | Groups                              |                      |                                |                      |
|---------|-------------------------------------|----------------------|--------------------------------|----------------------|
|         | Experimental (34 master's students) |                      | Control (34 master's students) |                      |
|         | Before the experiment               | After the experiment | Before the experiment          | After the experiment |
| High    | 3 (9%)                              | 12 (35%)             | 3 (9%)                         | 5 (15%)              |
| Average | 13 (38%)                            | 15 (44%)             | 14 (41%)                       | 13 (38%)             |
| Low     | 18 (53%)                            | 7 (21%)              | 17 (50%)                       | 16 (47%)             |

For  $\alpha = 0.05$ ,  $\chi^2_{\text{crit}}$  is 5.991. It is determined that  $\chi^2_{\text{obs.1}} < \chi^2_{\text{crit}}$  ( $0.066 < 5.991$ ), and  $\chi^2_{\text{obs.2}} > \chi^2_{\text{crit}}$  ( $6.547 > 5.991$ ). Therefore, the difference in the levels of communicative tolerance for the experimental and control groups can be considered non-random. Let's analyze the changes in the levels of training:

1. The control group showed the highest dynamics in the "High" level. The corresponding value increased by 6% (2 graduates). In the experimental one, the increase in this level is much higher (26% or 9 people).
2. In the experimental group, the number of respondents with "Average" level changed by 6% (3 people). In the control group: decreased by 3% (1 student).
3. "Low" level in both groups decreased: in the experimental group – by 32% (9 graduates), in the control group – by 3% (1 graduate).

## DISCUSSION

The distribution presented in the previous paragraph and the subsequent change in the levels of developed communicative tolerance, in our opinion, are caused by the following factors: increased students' interest in practical work with mobile services; independence in the choice of content for filling didactic electronic materials; active communication in a multilingual environment and intensive feedback; the initial level of tolerance of teachers towards students, the ability to understand and forgive the imperfections of others.

However, in general, the results obtained can be considered as measures to support UNESCO initiatives in terms of promoting mutual understanding between people, supporting intercultural communication, combating intolerance, stereotypes, discrimination and violence [5]. The authors confirm conclusions of V. Chernikova et al., that new information technologies have a significant impact on the formation of ideas about traditional values, the meaning of life, the role and place of culture in them [6]. However, in the presented study, these effects are positive: showing respect for a partner (virtual or real); striving to comprehend the value and diversity of other cultures; the significance of one's own actions and their impact on other people.

In other words, there is agreement with the position of L. Popovic, D. Čosić, S. Popov that modern information technologies are a valuable resource contributing to creativity and innovation [22]. This research is a logical extension of the earlier work of E. V. Soboleva et al. regarding identifying the didactic potential of mobile technologies [13]. The previous conclusions on the activated cognition, increased motivation and intensified feedback are complemented by conclusions on the support of intercultural communication, professional communication.

As directions for continuing the research, there are two options: to use a more complex software and technical development framework; to conduct research on students of non-pedagogical specialties (for example, engineers).

## CONCLUSION

Forming communicative tolerance, built along the chain from learning tolerance through communication and interaction to active social activities, takes place in the process of developing didactic mobile applications. It has been revealed that in order to create one's own mobile application, the developer needs to know the functionality. And for this, he must understand the basic principles of programming. App Inventor will help the future mentor of the digital school in this. A didactic program is created there using blocks. This helps to understand how to create a mobile application independently. And at the same time, you do not write a single line of code yourself.

The MIT App Inventor tools (design and code construction blocks) allow you to create mobile applications quickly enough. Moreover, appropriately organized practical activities (i.e., the design process itself) support future teachers in developing their own abilities and skills that constitute the essence of communicative tolerance. At the same time, the resulting software solution will contain educational content with the potential to form such personality qualities as tolerance, respect, peacefulness, love, goodwill, etc. Exactly those that make up the essence of communicative tolerance.

In the research, mobile applications of didactic purpose are used to teach tolerance; multilingual interaction; to form respect for the cultural features of other people (ethnic groups, peoples); to develop emotional intelligence.

The participants of the experiment noted the practical application of the acquired knowledge in the following areas:

1. Mobile programming can be used in interactive learning.
2. The invention of mobile applications contributes to the development of creative thinking among students.
3. This type of activity helps to develop and improve the skills of cooperation and teamwork of students in an intercultural space.
4. Students learn to interact effectively, share ideas, assign tasks and resolve conflicts in the process of teamwork. It develops communication, leadership and group work skills.
5. Working on mobile applications contributes to the development of skills in working with graphics, sound, video and other multimedia elements.
6. Programming skills can prepare students for the labor market. The experience of developing mobile applications significantly increases the competitiveness of pupils.

So, let's highlight which features of working with mobile applications provide additional conditions to develop future teachers' communicative tolerance:

- the voluntary nature of communication of all participants of information interaction;
- the use of innovative information technologies to support constructive dialogue within the framework of professional communication: to respect the diversity of opinions, ethnic and cultural aspects; to understand the point of view of other people, to show interest in their thoughts and feelings; in the fight against intolerance, stereotypes, discrimination;
- the feedback through the tools and components of the development framework (buttons, labels, images);
- independent selection of the plot and content for filling didactic mobile applications;
- active use of mobile solutions in professional communication to understand the mental state, quality and actions of interaction partners.

The research results obtained are planned to be used to improve the forms and methods of teaching for the previously mentioned disciplines and also for implementing elements of work on designing educational mobile applications in the programs of additional professional education taught on the basis of the university.

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