# Impact of mobile apps in higher education: Evidence on learning

## Вплив мобільних додатків на вищу освіту: дані про навчання

Written by:
**Kostiantyn Palshkov[1]**
https://orcid.org/0000-0003-4383-004X
**Natalia Shetelya[2]**
https://orcid.org/0000-0001-8810-4805
**Nataliia Khlus[3]**
https://orcid.org/0000-0001-9860-1047
**Iryna Vakulyk[4]**
https://orcid.org/0000-0002-4812-7719
**Inna Khyzhniak[5]**
https://orcid.org/0000-0002-4227-8268

**Abstract**

The article reveals the main advantages of using mobile applications in the educational process and shows their significance in increasing the level of knowledge and skills of higher education students; elements of the content of mobile learning are revealed; didactic principles are singled out and factors that educational mobile applications must meet are grouped; didactic features of mobile applications are shown in the educational process of a higher school. The methodological basis of the study is the general theoretical and methodological provisions of philosophy regarding the relationship between theory and practice of the Impact of mobile applications on higher education. The results of the conducted research testify to the fact that the use of mobile applications in the educational process to increase the level of knowledge and skills of students has a positive effect on increasing the level of skills and motivation of students to study, significantly facilitates the

**Анотація**

У статті розкрито головні переваги використання мобільних додатків в освітньому процесі та показано їх значущість у підвищенні рівня знань та вмінь здобувачів вищої освіти; розкрито елементи змістового наповнення мобільного навчання; виокремлено дидактичні принципи та згруповано фактори, яким мають відповідати освітні мобільні додатки; в освітньому процесі вищої школи показано дидактичні особливості мобільних додатків. Методологічну основу дослідження становлять загальнотеоретичні й методологічні положення філософії щодо взаємозв'язку теорії та практики впливу мобільних додатків на вищу освіту. Результати проведеного дослідження засвідчують той факт, що використання мобільних додатків в освітньому процесі з метою підвищення рівня знань та вмінь студентів позитивно впливає на підвищення рівня вмінь та вмотивованості студентів до навчання, суттєво полегшує освітній процес на

[1] Candidate of Political Sciences, Associate Professor of the Department of Theory and History of State and Law, Odessa State University of Internal Affairs, Ukraine.  WoS Researcher ID: GOP-3100-2022

[2] Doctor of Pedagogical Sciences, Professor, Rector, Communal Institution of Higher Education "Academy of Culture and Arts" of the Transcarpathian Regional Council, Ukraine.  WoS Researcher ID: JGM-6737-2023

[3] Ph.D. in Physical Education and Sports, Associate Professor, Department of Theory and Methods of Physical Education, Oleksandr Dovzhenko Hlukhiv National Pedagogical University, Ukraine.  WoS Researcher ID: ABH-7748-2022

[4] Ph.D. in Philology, Associate Professor, Department of Journalism and Linguistic Communication, National University of Life and Environmental Sciences of Ukraine, Ukraine.  WoS Researcher ID: AAH-1600-2020

[5] Doctor of Pedagogical Sciences, Professor, Dean of the Faculty of Primary, Technological and Vocational Education, SHEI "Donbas State Pedagogical University", Ukraine.  WoS Researcher ID: D-4454-2018

educational process based on the implementation of a personalized approach outside classroom time, allows you to organize productive independent work in higher education.

**Keywords:** mobile applications, educational process, increasing the level of knowledge and skills of students, institutions of higher education, mobile learning.

основі реалізації персоналізованого підходу у позааудиторний час, дозволяє організувати продуктивно самостійну роботу у вищій школі.

**Ключові слова:** мобільні додатки, освітній процес, підвищення рівня знань та вмінь студентів, заклади вищої освіти, мобільне навчання.

## Introduction

The development of mobile communication technologies and the global Internet (3G, 4G, and 5G) opens up new perspectives for the educational sector. In the organization of the educational sector, in the process of training future specialists, significant changes are taking place, new methods and forms are being added to the traditional methods of education, which are based on the use of mobile Internet, information, and communication technologies, and distance learning.

The widespread use and availability of mobile devices create the possibility of using them for all participants of the educational space as a means of learning in mobile learning.

One of the essential forms of educational space organization for education is mobile learning (m-learning), which is related to distance and electronic learning (e-learning). Its characteristic feature is the use of mobile devices (Plakhotnik et al., 2023).

The use of mobile devices in the educational process contributes to increasing the level of knowledge and skills of higher education students, forming research skills, overcoming the communication barrier, developing thinking, and increasing motivation to master life skills and use them in professional activities.

Mobile technologies in the educational process have firmly entered the lives of all people, and even modern preschool children learn to work with a mobile phone, tablet, and computer with ease, at the level of their own needs. Every student, to increase the level of knowledge and skills in the educational process, is ready to use and uses a mobile phone in education, even if the teacher does not promote the use of new technical means of education. Access to the Internet makes it possible to change the organization of the educational process using a mobile phone.

Taking into account the current trends in the

development of education, the current state of technological progress, and the financial security of higher education students to have a mobile phone at the level of a smartphone, the use of mobile technologies is already mandatory in the process of obtaining an education. Some teachers use them from time to time, and others use them purposefully and constantly, however, in the educational process, the number of participants in mobile learning is constantly increasing to improve the level of knowledge and skills of students (Pudova, 2018). Modern global information and communication networks, modern computer technology, software products, etc. form a new innovative environment for students of higher education and teachers, which increases the overall educational effect and complements the possibilities of digital and traditional learning, allowing using mobile applications in the educational process to increase the level of knowledge and skills. With this approach, the successful organization of the educational process to increase the level of knowledge and skills of students requires the scientific and pedagogical staff to implement and search for methods, new forms, and means of teaching, with the aim of changes in the theory, methodology, and practice of teaching.

Shortly, the role of artificial intelligence will grow in STEM education. And this is not just a fashion trend. By leveraging AI, teachers can tailor curricula to each student's teaching style and learning pace. Moving from a one-size-fits-all approach to a more individualized educational experience improves learning outcomes and allows students to maximize their potential. In addition, AI's ability to analyze vast amounts of educational data means that STEM curricula can be continually improved and optimized. This leads to the creation of flexible and dynamic learning plans that can be adapted in real-time to the needs of students.

It could be mentioned that in the first section, the theoretical framework is presented, in the second section the methodology of the study is

described, in the third section the results are presented and in the fourth section, the conclusions are discussed.

The following aspects are also considered in the article:

1. The importance and main advantages of using mobile applications in the educational process are to improve the level of knowledge and skills of students.
2. Didactic principles and factors that educational mobile applications
3. Didactic features of mobile applications in the educational process of a higher school.
4. The most effective design platforms for creating mobile applications.
5. The importance of using QR codes in the educational process of a higher school.
6. Experimental confirmation of the need to use mobile applications in the educational process to improve the level of knowledge and skills of students.

**Literature review**

Informatization of education, modern global information and communication networks, possibilities of computer technology, software products, and various aspects of the use of computer and telecommunication technologies and tools are being studied by many researchers nowadays. It could be mentioned that there is a growing amount of research on the use of mobile applications in education, but there are still few studies that focus on the context of higher education.

We are interested in researching the possibilities of creating a new innovative environment for students of higher education and teachers, that complements the possibilities of digital and traditional learning, and increases the overall educational effect, allowing using mobile applications in the educational process for quality professional education of each individual. K. Policarpo & J. Bergmann, (2021). In their work, they investigate the problem of aplicativos móveis como recursos didáticos digitais: um mapeamento na educação formal.

In turn, the authors M. Prado Ortega, R. Paucar Córdova, J. Valarezo Castro, M. Acosta Yela & K. Guaicha Soriano (2023) point out that the benefits that the students evidenced from block programming through mobile learning are the ease of use of the application, portability on your mobile device, easy to learn, drag and drop features, connectivity, and storage, tracking in

real-time by executing an educational robot and facility for error detection.

Scientists S. Criollo-C, D. Abad-Vásquez, M. Martic-Nieto, F.Velásquez-G, J. Pérez-Medina & S. Luján-Mora (2021) in their article they emphasize that with the rise of information technology and digitization, education has been faced with the need to adopt new learning models using technology to create innovative educational methodologies. Therefore, this paper focuses on describing the effect of an augmented reality mobile application (NetAR) that was developed for engineering students as a complement to traditional education. The usability results show that users are satisfied with NetAR, and the statistical data from the control group indicate that the application positively affects learning.

Investigating the problem of the relevance of mobile applications in the learning of physical education L. Vega-Ramírez, R.Notario & M. Ávalos-Ramos (2020) emphasize that mobile telephony has developed exponentially, offering a multitude of services that could be optimal for the educational field of physical and sports activity (PSA). With all this, the mobile phone could be an educational tool that awakens interest in teenagers and teachers.

L. Gorbatiuk, N. Kravchenko, H. Alekseeva & T. Rozumna (2019) substantiated the relevance and necessity of using mobile devices and mobile technologies to increase the qualitative level of linguistic competence in the process of foreign language learning of students. Mobile learning is defined as an innovative direction of electronic learning that has a significant advantage over traditional learning methods due to increased cognitive activity and learning motivation, individualization of learning, and intensification of independent activity. An analysis of mobile applications for learning a foreign language was carried out. The theoretical and methodological conditions of the formation of students' foreign language lexical competence were considered using mobile applications; the functionality, design, and structure of a mobile application for learning English were developed. To form English-language linguistic competence, a mobile application for the Android operating system was developed using the integrated Android Studio mobile application development environment. Methodical recommendations were developed by O. Bazeliuk, S. Kravets, L. Maiboroda, et al. (2019), which highlighted the practical and theoretical aspects of using mobile Internet tools in the training of future

specialists, described modern technologies of mobile Internet access, showed the effectiveness of the main trends of mobile learning, perspectives in the context of distance learning, provided practical tips for developing content for mobile learning, using it for distance learning.

The effectiveness of using mobile applications during education was analyzed by O. Dyshko, V. Kovalchuk & N. Tabak (2022). Scientists have proven that mobile applications in the context of the introduction of ICT are an important tool for the educational process of face-to-face and remote forms; described the advantages of mobile applications; examples showed the possibilities of using mobile applications as a means of visualization to increase the effectiveness of training: activation of mutual learning, diversification of classes, increase of productivity, dynamism, etc. The most important mobile technologies for education have been determined, which allow optimization of study time, and are the most effective and in demand for the study of professional disciplines by future specialists.

The question of the use of a mobile phone in the educational process when studying various disciplines was highlighted by S. Pudova (2018); attention is focused on the experience of different countries in using a mobile phone; examples of the use of a mobile learning tool common to all disciplines (working on the Internet, video recording, photography, sound recording, etc.) and software are highlighted; examples of computer programs developed for mobile phones that can be used in the study of various disciplines are given; the possibilities of using mobile phone sensors are shown.

N. Morse et al. (2021) presented the main ways of introducing innovative approaches and digital technologies in the educational process in the conditions of educational transformation. To ensure the quality of education, a high level of digital competence of an educator was identified as a key requirement.

So, we can see that nowadays interest in the integration of mobile applications in education is growing rapidly. Scientists have proven that mobile applications in the context of the introduction of ICT are an important tool for the educational process of face-to-face and distance learning. Therefore, in the educational process of a higher school, such teaching methods are needed that would facilitate and accelerate the transfer of knowledge to students, activate the process of their assimilation of knowledge, and

increase the productivity of educational work and the work of the teacher. Such methods of educational space based on the use of mobile information technologies in education can be implemented.

The use of mobile applications in the educational process to increase the level of knowledge and skills of students can make the learning process more interesting, which meets the requirements of today, providing the right information at the right time.

But despite the availability of mobile phones among students and their use in education, mobile learning is not widespread enough in higher education institutions.

The prospect of a scientific analysis of the process of the impact of mobile applications on higher education in higher education institutions is strengthened by the presence at the current stage of their digital and information-communication development of several contradictions, in particular between:

– the rapid development of the information society and insufficient preparation of future specialists for the performance of professional duties in the conditions of informatization;
– the need to increase the level of digital literacy of future specialists and the level of ICT engagement required to perform their professional tasks;
– standardization of the formation of ICT competence of future specialists and improper development of the methodology of its formation, educational and methodological, and material and technical support.

The necessity of leveling the mentioned contradictions is pedagogical the importance of the problem, as well as its insufficient reflection among scientists and researchers, and the lack of a justified methodical system of its formation in institutions of higher education determined the choice of the topic of the article.

**Goal**. To experimentally confirm the necessity of using mobile applications in the educational process to improve the level of knowledge and skills of students.

**Methodology**

The methodological basis of the study is the general theoretical and methodological

provisions of philosophy regarding the relationship between theory and practice of the Impact of mobile applications on higher education.

Based on the analysis of the positions of scientists regarding the essence of the use of mobile applications in the educational process to improve the level of knowledge and skills of students, we are convinced of their focus on improving the traditional educational process through the use of mobile means of communication, smartphones, and tablets, etc. in the context of a combination with information and communication technologies.

To solve the tasks, by the logic of the research, research methods were used: the analysis of scientific and methodical literature, which made it possible to identify the possibilities of using information technologies in professional training; analysis of regulatory documents, methodical literature, study and generalization of advanced pedagogical experience and others that regulate requirements for the level of assimilation of professional skills, knowledge, and skills of specialists; diagnostic methods (questionnaires, observations, conversations, interviews, self-assessment); experimental methods for identifying and analyzing the obtained results, as well as individual characteristics of the specialist's personality.

The experimental test included two sections: ascertaining and formative. During the experiment, the ascertainment cut revealed approximately the same professional level of both groups, which was determined with the help of input control.

When determining the sample of subjects, the general specificity of the subject of the study was taken into account. The total sample size is 40 subjects. When forming the sample, the criteria of meaningfulness, representativeness, and equivalence were taken into account. The sample was formed by random selection using the technical procedure for calculating the selection step.

The experiment continued during the academic year. The students were divided into two groups: control (CG – 22 people) and experimental (EG – 21 people).

The level of professional skills of the respondents was evaluated according to the following scale: 60-73 points (satisfactory level), 74-82 (average level), 82-89 points (good level), and 100-90 points (excellent level).

The students of the experimental group had the English LioDuo, Lingvaleo, EnglishDom, Lingvist, and Ewa applications downloaded to their mobile phones, which they actively used during the academic year. The students of higher education who were in the control group worked without using such applications. The results of the formative stage of the experiment showed a significant increase in the success level of EG students compared to the control stage.

The scientific novelty of the research: the importance of education of the use of mobile applications to increase the level of knowledge and skills of students, which are used in education with the help of information technologies, was identified and substantiated, and the dynamics of their changes were analyzed. The results of the experimental study confirmed the applicability, optimality, and effectiveness of the proposed pedagogical conditions for the formation of an environmental culture of an ecologist in the process of professional training.
The implementation of the pedagogical experiment was carried out in three stages: preparatory, main, and final.

At the preparatory stage, the purpose and tasks of the research were determined, the experimental plan was developed, methods of measurement and processing of results were selected, control and experimental groups were selected, and their homogeneity was checked.

At the main stage, an experiment was conducted. At the final stage, the results of the experiment were analyzed, their reliability was confirmed, and conclusions were drawn about the pedagogical effect of the experiment.

The reliability and validity of the obtained results, and the objectivity of their assessment were ensured by the methodological soundness of the initial positions and the qualitative mechanism for evaluating the quality under study, the use of a complex of complementary research methods, and the involvement of a group of respondents from a higher educational institution in the analysis of its results.

To assess the homogeneity of experimental and control data, statistical processing was performed using MS Excel and SPSS (Statistical Package for Social Science).

**Results and discussion**

**1. The importance and main advantages of using mobile applications in the educational process to improve the level of knowledge and skills of students.**

To date, the prospects of mobile technologies, which are considered a promising innovative means of implementing educational activities, have been proven (Polishchuk et al., 2022). The emergence of M-learning as one of the forms of E-learning is based on the development of the Internet, the requirements of the information society, and the improvement of digital gadgets. The modern standard of living makes it possible for all students of higher education to have a mobile phone (smartphone); almost all of them have access to mobile Internet.

In recent years, there has been an increased demand for the use of mobile applications in various fields, including education.

The main advantages of using mobile applications in the educational process to increase the level of knowledge and skills of students are small volume, free distribution, fast download process, etc.

Mobile applications are indispensable assistants in the organization of the organization of joint work of students, testing, development of sketches and quick prototypes, the performance of practical tasks, involvement in the discussion of lecture material, etc. (Borysenko, 2018).

Accessibility and flexibility of learning, openness and autonomy for lifelong education, implementation of an individual approach, etc. can be attributed to mobile learning, and its characteristics that determine the implementation of important educational functions (Bazeliuk et al., 2019). Ease of use, modernity, and portability are also among the main advantages of mobile gadgets (Stratan-Artyshkova et al., 2022), the possibility of scanning QR codes, etc.

Various functionalities of mobile applications in the educational process allow students not only to complete the educational task but also to effectively solve social, household, and professional issues and communicate with each other to increase their level of knowledge and skills.

From the point of view of the use of mobile applications in the educational process to increase the level of knowledge and skills of students, it is possible to pay attention to the capabilities of smartphones, such as video and voice communication, which allow students to communicate with each other innovatively. To send messages, students, with the help of mobile applications, can react emotionally through the use of gif animations, and emojis, exchange information, and thus solve many urgent issues that require a quick response (Tereshchuk, 2016). The use of mobile phones by curators of academic groups allows them to be an intermediate chain between management, teachers, and students. S. Sharov developed a mobile application for the curator of the academic group, which stores information about students of higher education, their social status, parents, participation in clubs, etc. (Sharov, 2018). The software tool, developed for the Android mobile OS and installed on a smartphone, has a simple user interface filled with the necessary information and is useful for curators of academic groups who will have instant access to their students (Sharov, 2020). Therefore, mobile technologies, in particular, the use of mobile applications in the educational process is a promising direction to increase the level of knowledge and skills of students, the quality of the educational process, and the development of professional competence of students of higher education.

Content and elements of mobile learning. In the educational process, the term "mobile learning" (mobile learning) refers to the use of mobile and portable IT devices, in particular smartphones, mobile phones, and tablet PCs that support work in mobile networks and Wi-Fi technology and operate under the control of the operating system (Android, iOS) (Bilous, 2018).

With the help of mobile devices, you can create and open multimedia files, get access through the Internet to specialized sites, adapt reference and educational resources that contain practical tasks, and online tests, allow you to exchange information for educational purposes, etc.

The popularity of various mobile applications is growing along with the spread of mobile "devices". A mobile application is an "autonomous software product designed specifically for mobile devices to optimize the solution of some problem or task in the user's life. A mobile application is developed specifically for a given platform (Android or iOS), distributed through special application stores (Apple App Store, Google Play), and installed on the device just like a computer program (Bilous, 2018).

Undoubtedly, the use of mobile applications in the educational process is a promising direction for the development of the educational industry. Scientists define them in different ways. Let's group the main ones.

"A mobile application is an autonomous software product designed specifically for mobile devices to optimize the solution of some problem or task in the user's life" (Bilous, 2017).

"A mobile application is a stand-alone software product designed specifically for mobile devices to optimize the solution of some problem or task in the user's life" (Blazhko et al., 2020a).

"A mobile application is an information technology software artifact specially designed for mobile operating systems installed on portable devices such as smartphones or tablet computers" (Hoehle & Venkatesh, 2015).

Mobile applications are developed specifically for a certain platform (Android, iOS) and are installed on the device in the same way as a computer program. Mobile applications are distributed through application stores: AppleAppStore, GooglePlay, etc.

Today, there are many free or paid mobile applications designed for learning, which provide interactivity with assimilation and verification of the received information, and display of the information itself. A student of higher education can download any program on a modern tablet or smartphone.

It is necessary to consider in which modes they work (interactive (online) when selecting mobile applications and downloading them, or offline, and whether the technical characteristics of the mobile device allow the operation of the downloaded application.

Online:

1. Interactive, dialog mode of working with the system in the network. In this mode, the user sends requests to the system (computer on the network, server, web server) and along the same line receives back fragments of information prepared for him.
2. Network session, including the Internet. Status when connected to the Network, which characterizes two-way data exchange between the user and the corresponding Internet service. It is used as an adjective and describes various activities of users on the Internet, for example, online chat (online

communication on the Internet), online shopping (online purchase of goods), online games (online games), online searching (online search), online communities (online community). etc. Also means the user's mode of connection to a network or system slightly larger than the one he was using before the current connection (Policarpo & Bergmann, 2021).

The main elements of mobile learning were highlighted by Nigel Payne – a member of the International Advisory Board (University of Pennsylvania in Philadelphia). They are:

–   mobile applications must be synchronized with mobile learning tools available on the Internet;
–   mobile applications should be activated from the place where work was interrupted and should be compact;
–   mobile learning provides an opportunity to use free time (Prado Ortega et al., 2023).

**2. Didactic principles and factors that educational mobile applications should meet.**

Mobile applications in the educational process must comply with the following didactic principles to improve the level of knowledge and skills of students:

1) independence and activity (the ability to complete training at a convenient time on your own, in the process of group training to show initiative with other subjects);
2) individual approach (selection of the level of difficulty of tasks taking into account the interests of higher education seekers and the content of education);
3) accessibility (free access to programs and educational information using mobile technologies);
4) systematicity and purposefulness (review of goals after their achievement, setting of short-term positively formulated goals) (Vega-Ramírez, Notario & Ávalos-Ramos, 2020).

Taking into account such didactic principles, the development of the methodological component of the educational mobile application should be carried out in the following directions to study professional disciplines in universities:

–   graphic interpretation of theoretical concepts and estimated models;
–   support for independent work;

– automation of calculations;
– generation of educational tasks (Ichanska, 2019).

For users, an important factor of an attractive and unique mobile product is its functionality:
– availability of hints regarding interaction with functionality;
– intuitive graphic interface;
– personal user profile (statistics display);
– searching for a specific material;
– automatic saving of progress;
– work with multimedia materials (different types of them);
– sending comments and reviews;
– the ability to communicate with friends in the chat, and the invitation to the friends application through social networks (Blazhko et al., 2020b).

**3. Didactic features of mobile applications in the educational process of a higher school.**

To increase the level of students' skills and knowledge, we will highlight the didactic features of mobile applications in the educational process:

– facilitating learning of educational material;
– subject orientation (the content of the mobile application corresponds to the content of individual educational topics, modules, or educational disciplines);
– availability of ready-made applications;
– availability of smartphones on which it is possible to install applications and their wide popularity for every student of higher education;
– the possibility of working with different types of information (graphical, symbolic, textual, or their hybrid forms);
– "speed of entry" (possibility of performing a practical task, ease of mastering based on the experience of studying other programs by the method of intuitive involvement of tools);
– the possibility of using feedback for educational assistance;
– the possibility of evaluating the activity of a higher education applicant using the control module;
– the possibility of aggregation (combining several simple in one application, for example, applications of smart tools that combine, measuring, tools);
– the possibility of a group form of involvement of students of higher education when performing a practical task in the application, etc. (Borysenko, 2018).

Examples of the most popular applications, which are recommended for use in the professional training of specialists in higher education institutions.

Mobile applications can be used in education in general and in the professional training of specialists, in particular: reference books, translators, dictionaries, professional calculators, calculators, applications with professional games, quizzes, etc.

Duolingo is a free app that helps you learn foreign languages. In addition to English, German, French, and Spanish, there are quite rare ones (Irish, Hungarian). The application is available for iOS and Android platforms.

A characteristic feature of the Lingvaleo application is a large selection of modern methods aimed at studying the theoretical foundations of the English language and is free content; personalization (the educational program of English proficiency is formed taking into account the interests of students, language level, and target orientation.

English LioDuo – has about 80 classes of different orientations, combines sound and image, British and American transcriptions, and selection by different meanings of words (selected, complex words, obsolete, etc.).

The smart application Lingvist provides the possibility of taking into account the personal requests of those seeking education, analyzing the way of learning a language, containing a language recognition mode, various thematic areas, and tracking personal successes in the educational space (Krasulia & Shumylo, 2020).

EnglishDom is an application aimed at expanding vocabulary and learning English vocabulary: it provides listening, composing words from individual letters, choosing the correct translation option, printing words; to facilitate memorization, selecting graphic images according to the principle of associative thinking; a translation and the possibility of listening to the correct pronunciation and transcription of each word are provided; monitors the progress of the educational process, evaluates the success of the student of higher education in the study of the English language.

The Ewa application is personalized and the learner can choose the level of training that corresponds to his level of preparation and capabilities, as well as with the involvement of a

choice of methods for learning a foreign language, it provides a wide range of opportunities: listening to his favorite music, reading books, watching videos and films, clips. To create mobile applications today, there are affordable and not complicated programs that do not require programming experience and special knowledge. Having a willingness to spend a small amount of time and money, and the desire to learn, you can use one of the platforms to manage your own mobile site or application.

So, while using these applications for smartphones, students of higher education gained the opportunity to improve their grammatical skills, independently expand their vocabulary, understand and assimilate what they read or heard, etc. When learning a foreign language, this approach aroused interest, reduced emotional tension, and increased the cognitive interest of students of higher education in learning.

**4.    The most effective design platforms for creating mobile applications.**

In our research, we used several builder platforms to create mobile applications (Krol, 2018):

1)    For Android or iOS, there's Appery, a fairly easy-to-use cloud-based mobile app builder that supports Ionic, jQuery Mobile, and Apache Cordova (Phone Gap) with access to their built-in components. The product does not require any additional software downloads, working in the cloud, there is a visual editor that uses drag-and-drop components to create the intended interface. Appery automatically generates code for any components a developer uploads. It is possible to instantly add a server and a cloud database to your application, connect to any REST API, and use it in your application if there is a need to save data. In particular, you can use the Appery plugin catalog or create your own. Real-time team collaboration on the application is easily implemented.

2)    Mobile Roadie is an application designer that allows you to manage and create your Android or iOS application in which the development process takes place in a visual format. All types of media are supported by the platform, automatically importing keywords from Google News or RSS, Twitter, as well as automatically updating the fan wall for real-time communication with users. The function of the appearance of the application through the eyes of the

user and the function of previewing the application are supported. Mobile Roadie checks the quality of the content and carries out the review process in the App Store. This software product allows you to send push notifications from your site or the platform itself. In general, the platform is language-independent and provides data transfer in various formats, including JSON, XML, CSV, PHP, and HTML. The developer is offered, at the very beginning, several options for layouts that can be customized.

3)    TheAppBuilder is a platform that offers a group of apps for different users, supports iPad, iPhone, and Android, creates event apps, and mobile brochures, and integrates YouTube, Twitter, and Facebook videos, calendars, photo galleries, and more. Updating the content of the application and its structure is activated within 60 seconds after making changes, it is easy. You can make changes and publish to multiple mobile platforms even after the application has been published. The designer has two approaches: with the help of an online application creation tool or TheAppBuilder itself to fill the application with content and establish its structure and the platform with which the developer is going to work.

4)    Good Barber provides a platform for creating applications for Android and iPhone, as well as for optimized web applications. Control is supported for every detail of the application for any of the platforms without writing a single line of code. At the beginning, a selection of design templates, access to Google Fonts, and many icons are offered. Data from web applications can replace the current site because they can be optimized for mobile devices, desktop computers, and tablets. The user receives quick visual feedback every time any parameters are adjusted in their application.

5)    Appy Pie is a cloud-based product for creating do-it-yourself mobile applications that allow users without programming skills to create their own mobile applications online. There is no need for any download or installation, just drag and drop the pages. The work is carried out with the ability to send push notifications online, integrate social network channels, track and view location analytics using GPS, websites, blogs, video, audio, etc. When using this platform, there is a meeting scheduling tool, and various topics are offered to the user.

6)    AppMachine – the platform is designed to create professional mobile applications for

Android and iOS and is easy to use. The user can combine different blocks that offer different functions: photo, text, app integration with Facebook, Twitter, video, etc., using a drag-and-drop interface, create your design by choosing a color, navigation, icons, fonts, and layout control and monitoring progress with the Previewer. This platform allows you to scan a website for key content that can be transferred to an Android or iOS app. It is published and promoted after the application is ready and tested for operation, and user data is analyzed. AppMachine takes care of the app to appear on Google Play and the App Store.

## 5. The importance of using QR codes in the educational process of a higher school.

In the educational process, the use of QR codes, which teachers have recently been actively using in the educational process, is of great importance. Translated from English, the abbreviation QR (quick response) means "quick response". This is a matrix code (two-dimensional barcode), which was developed by the Japanese company "Denso Wave" in 1994, which provides 2953 bytes of information in one small square, i.e. 1817 hieroglyphs or 4296 letters or 7089 numbers (1-2 pages of text in A4 format). The advantage of a QR code is that it can be easily recognized by a mobile phone camera or scanning equipment. Today, such codes are relevant in education, they are used in any catalog, and in museums near paintings or exhibits for educational information about the exhibit, its author, etc. The QR code allows you to quickly read, decode, and encode: texts, active links for downloading information, URLs of various sites, etc.; it allows you to go easily and quickly to the website to download files on a mobile device. For educational reading, QR scanners and QR codes are attractive ways to use mobile phones (Bazeliuk et al., 2019).

So, the mobile application in the educational process provides an opportunity to view courses offline and online, to record the progress of a student of higher education, provide the means of simplified interaction with course teachers and authors, etc. to improve the level of knowledge and skills of students.

A smartphone, a tablet, a laptop, and a personal computer allow every student of higher education to get the most out of their studies and always stay in touch with the teacher. To a large extent, mobile technologies facilitate the education process, because, using a tablet or smartphone, every student of higher education

can complete their tasks anywhere and anytime. There are many applications for the development of electronic courses that are available under an open-source license. Every student of higher education has the opportunity to update his application to the latest version without losing the already existing progress from the previous version.

## 6. Experimental confirmation of the need to use mobile applications in the educational process to improve the level of knowledge and skills of students.

Before experimenting, it was assumed that the use of mobile applications in the educational process during the study of professional disciplines by students of higher education would contribute to the formation of professional competence among students.

To confirm the proposed hypothesis, the following tasks were solved during the experiment:

– the initial level of formation of students' professional competence is determined;
– experimental training using mobile applications was conducted;
– an analysis of its results was carried out.

The experimental test included two sections: ascertaining and formative. During the experiment, the ascertainment cut revealed approximately the same professional level of both groups, which was determined with the help of input control.

40 students of higher education who had approximately the same level of knowledge were involved in the pedagogical experiment. The experiment continued during the academic year. The students were divided into two groups: control (CG – 22 people) and experimental (EG – 21 people).

The level of professional skills of the respondents was evaluated according to the following scale: 60-73 points (satisfactory level), 74-82 (average level), 82-89 points (good level), and 100-90 points (excellent level).

The students of the experimental group had the English LioDuo, Lingvaleo, EnglishDom, Lingvist, and Ewa applications downloaded to their mobile phones, which they actively used during the academic year. The students of higher education who were in the control group worked without using such applications. The results of

the formative stage of the experiment showed a significant increase in the success level of EG students compared to the control stage. In addition, EG students, thanks to the self-assessment method, showed an increase in the level of cognitive interest in studying at a higher education institution and in learning English, in particular, at the same time, students preferred the following applications: EnglishDom, Lingvaleo English LioDuo. So, the results of the conducted research confirmed the conclusions about the effectiveness of using mobile applications in the educational process to increase the level of knowledge and skills of students, in particular, in learning English.

At the stage of the formative experiment, the students of the experimental group were offered training using mobile applications. According to the results of the test control of the level of formation of professional competence, the average quality of knowledge of the respondents of the control groups was 62.3%, of the experimental groups – 85.2%. The data of the experiment confirm the effectiveness of using mobile applications for the formation of professional competence.

So, the results of the experimental test proved that the higher education students of the experimental group demonstrated a higher level of professional skills than the students of the control group. This testifies to the effectiveness of using mobile applications in the educational process of a higher school to increase the level of knowledge and skills of students. In particular, the use of applications allows you to independently and more freely improve skills and abilities outside the classroom.

The second part of the experiment aimed to use smartphone applications to identify the impact of the gamification method not only on increasing the level of professional training, and English language proficiency of students, but also on changing the motivation of respondents to study professional disciplines at a higher education institution. The use of applications increases interest in learning thanks to interactive and bright content and gives the opportunity to freely study any discipline at any convenient time.

After completing the experiment, students of higher education were asked to take part in a survey and determine the impact of the used applications on the cognitive interest in studying professional disciplines using a self-assessment method on a 10-point scale. At the same time: the highest score is 10, and the lowest is 0. The

effectiveness of independent work was taken into account according to the criteria of influence on professional communication skills, correct pronunciation, knowledge and compliance with rules, increase in vocabulary, etc.

The results of the survey of respondents were as follows:

English LioDuo – 8 points;
Lingvaleo – 7 points;
EnglishDom – 7 points;
Lingvist – 7 points;
Ewa – 5 points.

Thus, the most effective application for smartphones according to EG students, which not only increases the level of knowledge but also stimulates cognitive interest in learning disciplines through the creation of game content, is the EnglishDom application.

The results of the conducted research testify to the fact that the use of mobile applications in the educational process to increase the level of knowledge and skills of students has a positive effect on increasing the level of skills and motivation of students to study, significantly facilitates the educational process based on the implementation of a personalized approach outside classroom time, allows you to organize productive independent work in higher education.

For a high-quality educational process, to implement the specified innovative technologies and methods, it is advisable to train teachers in the use of mobile applications in the educational process to increase the level of knowledge and skills of students.

For this purpose, the developed questionnaire offered questions related to the assessment of the importance of using mobile applications in professional activities.

The analysis of the research results showed that both students and teachers are interested in the ability to effectively use in the educational process and in the ability to own digital tools, which were grouped by purpose. Respondents had to give each mobile application one of the levels of relevance to increase the level of knowledge and skills of students: low, medium, and high.

So, to identify the effectiveness of using mobile applications in the educational process to improve the level of knowledge and skills of

students, we organized testing among students (25 test questions and 25 visual recognition test tasks). For this, the interviewees were divided into two groups: control (n=31 people) training took place according to the traditional scheme, and experimental (n=30 people), training process involved the introduction of mobile applications. The total number of points determined the level of respondents' mastery of professional knowledge (high, average, low). Having chosen the correct answer, the respondents had to give answers to the test tasks. As a result of the study, it was found that at the beginning of the experiment, there were no significant differences between the respondents of the experimental and control groups regarding the mastery of professional knowledge, which indicates their homogeneity. After the end of the experiment, changes were observed regarding the results of the questions in the tests:

– with a low level of mastery of professional knowledge, the number of respondents decreased – in the control group by 24.4%, in the experimental group – by 33.7%;
– the number of respondents with an average level increased – in the control group by 13.3%, in the experimental group – by 6.8%;
– the number of respondents with a high level increased – in the control group by 10.0%, and in the experimental group – by 24.2%.

At the end of the experiment regarding the use of mobile applications in the educational process to increase the level of knowledge and skills of students, better dynamics were observed in the experimental group. So, the data of the experiment confirm the effectiveness of using mobile applications during the training of future specialists.

The obtained results indicate that students of higher education are more interested in using mobile applications in the educational process than teachers. It is obvious that students of higher education need to use the presented resources in the educational process, in particular, the most relevant for them is the use of mobile applications in the educational process for obtaining digital content, discussion, communication, and evaluation. In turn, teachers are more motivated to master the tools for working with electronic documents, which indicates their readiness to use electronic document management.

**Conclusions**

the development of new teaching methods,

provide a large number of educational multimedia materials and allow you to fully communicate with students and study their cognitive interests. The use of mobile applications for students of higher education contributes to the development of skills: searching for information on a certain topic and purpose, making a comparative analysis, public presentation of work results, grouping of information and monitoring, etc.

The importance and main advantages of using mobile applications in the educational process to increase the level of knowledge and skills of students are shown; the content and elements of mobile learning are disclosed; the didactic principles and factors to which educational mobile applications must comply are singled out; didactic features of mobile applications in the educational process of a higher school are shown. Examples of the most popular applications, which are recommended to be used in the professional training of specialists in higher education institutions, are given, the most effective designer platforms for creating mobile applications are analyzed and the importance of using QR codes in the educational process of higher education is shown. The necessity of using mobile applications in the educational process to increase the level of knowledge and skills of students has been experimentally confirmed.

The results of the conducted research testify to the fact that the use of mobile applications in the educational process to increase the level of knowledge and skills of students has a positive effect on increasing the level of skills and motivation of students to study, significantly facilitates the educational process based on the implementation of a personalized approach outside classroom time, allows you to organize productive independent work in higher education.

To ensure the optimal mode of formation of the Impact of mobile applications on higher education, it is recommended to practice such organizational forms of classes as collective work on the use of mobile applications in the computer class; a subject office with a multimedia board; online classes; virtual tour; Internet project, etc.; pair or group activity of students using mobile applications computer class, subject office; individual activity of students using mobile applications: remote training (for maintaining or organizing the educational process, organization consultations for students); use of online

conferences (forums, chats).

The main contribution of the study to knowledge about the use of mobile applications in education is the identification and substantiation of the importance of teaching the use of mobile applications to increase the level of knowledge and skills of students, which are used in education with the help of information technologies, as well as the dynamics of their changes were analyzed.

Consideration of the readiness of higher school teachers to use electronic document management requires further research.

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