

Mobile-oriented Learning: Developing and Using Infoword Application «Informatics Dictionary»

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Abstract--- In the article authors presented the working-out and use of the application «Informatics Dictionary» to improve the quality of future teachers' training. Based on the analysis of scientific pedagogical and special literature, researchers have come to the conclusion that during the global technological progress, the use of mobile applications is the requirement for a modern educational process, and the educational process becomes simply impossible without the use of innovative information and communication technologies. Thus, mobile oriented learning is replaced by a traditional education system. In the process of scientific research, the researchers analyzed three of the most popular graphic constructors for creating mobile applications: Alstrapp, Appsgeyser, Appsmakerstore. In a detailed analysis of these constructors, their advantages and disadvantages were determined. The authors of the article assigned the following disadvantages: problems with downloading APK files, free use of these constructors only for administrator defined terms; hidden fees for using certain app tabs; purchase of a license (from 90 \$ and above); the lack of interconnection with the customer support service, and the lack or imperfection of an interface for creating educational applications, etc. Scientists have proposed an algorithm for developing their own mobile application by writing it in the Java programming language. The advantages for the author of the application are revealed, the constructive thinking, creativity and professional skills develop, programming skills are improved during the working-out of this application. The researchers are presented in detail the experience of using the author's application «Informatics Dictionary» to improve the quality of future teachers' training. There was a research from 2017 to 2019, during which the results of control tests were analyzed, and a poll of students about the use of mobile applications in the learning process was conducted. Taking into account the results of the work, the authors conclude that the use of mobile oriented learning is a requirement of the present day, because today every student uses mobile devices in daily life and during educational process. Prospects for further research are to conduct seminars for students about the working-out of mobile applications.

Keywords--- Mobile Applications, Android, Google Play, Future Teachers, Mobile-oriented Learning.

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I. INTRODUCTION

Setting the issue

Today, it's impossible to imagine a person who does not use gadgets (smartphones, tablets, laptops, etc.) in everyday life and the educational process is no exception. When training future specialists, innovative information-communication technologies play an important role.

«The issue of education comes to the fore in connection with the emergence of a new type of social relations – the information society Today, in Ukraine there is a controversial situation between the requirements of the society to the specialist, on the one hand, and the real level of training at higher education institutions – on the other» [[9]].

The education system in each country is linked to its socio-cultural environment, production and technological base with a large number of complex functional dependencies and relationships. Today, when the problem of universal secondary education has practically been solved in the developing countries and the higher education has become more necessary, these relations and dependencies have rightly occupied one of the leading places in the public and state priorities. This is especially true for systems of highly qualified specialists training capable to develop and use information and communication technologies in their activity [[10]].

In the process of conducting these seminars for future teachers of computer science and other specialties (optional), we consider it necessary to take into account the following theoretical foundations of professional training of future computer science teachers, namely principles and functions.

The principles of professional training of future teachers of computer science include:

- The principle of clarity - increases the assimilation of the material, because all channels of perception of students such as visual, mechanical, auditory and emotional are involved;
- The principle of visualization - follows from the principle of clarity: the technology of visualization of educational information is being developed. Visualization refers to the process of forming mental images;
- The principle of consciousness and activity - the implementation of the principles of clarity and visualization simultaneously allows to apply this principle, because in the construction of the educational process using mobile-oriented learning, students better perceive, understand the nature of the material under study, increase their mental activity.
- The principle of professional development – it is aimed at improving the methodological system of education of future specialists in higher education institutions and should strengthen the professional orientation of all its components of their training, taking into account the growing requirements for the level of professional competence.

The functions of vocational training of future computer science teachers are:

- Organizational and informational – it provides fast mastering of the job with educational and communicative web-technologies; continuous receipt of objective information to all subjects of the educational process; promotes the informational web-management;

- Motivational -it promotes activity and interest increasing in new methods of teaching professional disciplines (theoretical foundations of informatics, information systems, school course of informatics and teaching methods, use of ICT in the educational process, methods of using computer technology in elementary and high school, etc.) new IT-technologies, cloud-based web-services, remote platforms (studying their specificity and use in their own activities), which are aimed at improving the professional competence of future computer science teachers);
- Development and communication – it is aimed at comprehensive harmonious development, self-development of future computer science teachers with the help of modern visual information and technical resources, cloud technologies, computer simulation tools, computer graphics, multimedia means of modern professional application software;
- Analytical and research – it helps to organize the acquired knowledge, skills and theoretical knowledge (computer architecture, programming languages, computer networks, the basics of artificial intelligence) as a means of solving practical problems based on the use of ICT and feedback between participants in the educational process, development of educational sites, blogs, forums and platforms for research).

A. Kharkivska notes that the improvement of the content of the future teacher's professional training and the use of scientific and information technologies for teaching should take place in the following priority areas:

1. Creation of the common educational information technologies for different educational disciplines, focused on information support of different forms of educational activity.
2. The introduction of new information technologies, the development of new components of teaching methods, the creation of information-learning environment in specific disciplines, will allow to take into account the possible changes in the state of the system of children's education and make adjustments in the educational process.
3. Creating the subject-oriented information and educational learning environments that allow the use of integrated presentation technology and quality of knowledge using hypermedia, multimedia systems, e-books and more. Such environments allow to integrate all known pedagogical software tools and realize the idea of an innovative approach when creating and using new information technologies in teaching.
4. Using of computer network technologies to exchange various information between users, to access databases, library holdings, resources of large scientific centers and more. With the development of computer technologies and the creation of global information networks, the need for the formation of students' knowledge, skills and navigation abilities in the information-educational space is increasingly becoming more active in order to increase the efficiency of their cognitive and practical activity in the conditions of becoming an information society [[9]].

We believe that the development of mobile development-oriented applications on Google Play for Android [[7]] requires the creation or support of a developer's personality through the developing environment, inventive, creative interaction and personality development of teachers and students, based on a variety of engaging communication activities where their mutual enrichment takes place.

In this context, the teacher acts as a carrier of the pedagogical purpose and organizer of the development process, acting as if in two planes: first, as a manager of a certain professional environment, a carrier of a certain socio-pedagogical role; secondly, as a specific creative person, which directly influences the process of qualitative professional training of the future teacher of computer science or other specialty.

Hence, lecturers of higher education institutions need to respond quickly to the changes that take place in all spheres of human life and to train future specialists taking into account these requirements and to directly take an active part in informatization of the educational environment.

At the time of the large-scale implementation of ICT in the educational process of future teacher training [[2]; [3]; [8]; [11]; [14]], there arises a necessity to increase their computer awareness – not only the foundations of using computers at computer science classes, but also using them for self-education, during practical training, in extra-curricular activities etc.

After analyzing the curricula for training future teachers of different specialties, it has been established that when getting the bachelor's degree future teachers of physical education or music art have 26 classroom hours for studying computer sciences, and 66 / 64 hours are given to the students' independent work; for future teachers of primary school with an additional specialization - 130 classroom hours and 120 hours – independent work, for future teachers of computer sciences, according to training specifics, the number of hours is much larger. However, it should be noted that although the number of hours is designed for full ICT acquiring and their application for self-educational future professional activities, today the curricula of computer science disciplines don't take into account developing aspects and innovative ICT use, such as educational mobile applications, which are becoming an inseparable part of informatization and global computerization of the Ukrainian school.

The task of the modern high school is to train specialists with fundamental knowledge and skills of developing and using ICT in professional and self-education activities, who can respond quickly to transient changes and new trends in education, since the use of mobile devices not only at higher education institutions, but also at institutions of general secondary education is no longer a requirement of time, but an everyday normal practice. Thus, the promising use of mobile applications aimed at supporting the educational process proves relevance of the research.

II. MATERIALS AND METHODS

The phenomena of ICT in the educational process was in the scientific focus of A. Kharkivska. In the article «Managing the quality of training future teachers of informatics in the context of education modernization», the researcher highlights the main aspects of quality management of future computer science teachers training in the conditions of education modernization and the system of additional requirements to the level of professional competence of future computer science teachers, as well as analyzes the components of the professional competence of future computer science teachers [9]. V. Andrievska and L. Bilousova study the specifics of introducing STEM education in Ukraine, demonstrate BYOD concept effectiveness and describe its benefits, namely: free access to electronic resources, instrumental-cognitive support for cognitive activities for those who study outside educational institutions, convenient use of QR codes, etc. [[1]]. In the article «Features of using the system geogebra when studying the course «Mathematical Foundations of Informatics», O. Hrybyuk and V. Iunchyk demonstrate the

peculiarities of studying the course «Mathematical Foundations of Informatics» when training future mathematics teachers, provide examples of applying the rule guidelines to solve situational problems using the GeoGebra Dynamic Mathematics System [[6]]. In the article «Mobile educational applications in modern education»«, V. Bilous defines the role of mobile educational applications in the educational process, characterizes the notion of «mobile education», as well as presents the advantages and disadvantages of portable devices [[4]]. In the article «Using Android mobile devices and tablets in the educational process», V. Kosyk, T. Khomych and Iu. Khomych suggest variants of using mobile devices in the educational process, consider the factors that cause the system-wide integration of mobile learning, which should be an integral part of the state reforms in the system of education [[12]].

In the article «Applying mobile technology Plickers in the process of studying physics», O. Liashenko and S. Tereshchuk analyze the possibilities of introducing mobile technology education in school practice as a means of forming information and digital competence of students; characterize the methodical features of applying mobile technology in the educational process, in particular during the frontal questioning of students using the mobile application Plickers [[13]].

Despite the fact that the above listed researches substantially enhance the theoretical and methodological basis of using ICT when training and improving the education quality for future teachers and specialists in different fields, the issue of developing and using Google Play apps in the educational process has not been studied by any of the researchers.

The aim of the article is to develop, demonstrate and analyze the results of implementing the infoword application «Informatics Dictionary» when improving the quality of future teachers' training using mobile-oriented learning.

III. THE RESEARCH RESULTS

Modern technical and technological progress and the results of the analysis of scientific-pedagogical and special literature give grounds to assert that efficiency and quality of the educational process also depend on the use of gadgets. After all, smartphones, tablets, smart-watches make the subjects of the educational process mobile, who can freely master the virtual educational environment without facing any difficulty.

With the introduction of the technologies in education, one of the main trends is mobile-oriented learning.

According to Z. Seidametova and S. Seytvelieva, mobile-oriented learning is a new stage in the development of e-learning [[17]], which involves the use of mobile devices and wireless access to learning resources as a means of training.

E. Narozny notes that any training that occurs when a student is not in a fixed, predefined place, or studying, when a student benefits from educational potential of mobile technology is mobile-oriented learning [[15]].

Agreeing with the researcher, we believe that the use of mobile applications is a need of a modern educational process. When developing an application, it is necessary to determine how the product will be made.

There are two ways: program code is developed independently (for example, in Java programming language) or with the help of the already developed and available in the Internet graphic designers.

Let's consider some of the most popular graphic designers:

- Alstrapp (<https://alstrapp.com/>) [[5]] – A complete CMS for creating and managing applications for Android and iOS. No supplementary payments are required, but there is a need to purchase a license that costs approximately \$90.
- Appsgeyser (<https://www.appsgeyser.com/>) [[18]] – one of the fastest graphical designers of the applications, the main advantage of which is the placement of own advertisements (university, site, specialty, etc.) in Android applications. This program interface is designed in English, which causes some difficulties. When we tried to develop an application using this graphical constructor, we even uploaded the APK file, but it was not possible to place it on Google Play, because the file was downloaded either with a virus or corrupted.
- Appsmakerstore (https://appsmakerstore.com/pricing_plan) [[16]] – a designer for creating a variety of mobile applications ranging from business to charity organizations. However, having worked in the environment of this graphic designer, we identified a number of shortcomings: when choosing a program interface our application name was not changed; it was not always possible to upload the information (text or graphic); changes in the course of work were not saved in most cases; if you developed an application, you had to fill it in and upload immediately, but there appeared another problem – APK uploading was not possible, the support service did not respond when being addressed as for the problems that arose, in our opinion, this application is payable, although the price policy of the designer is not displayed on the site.

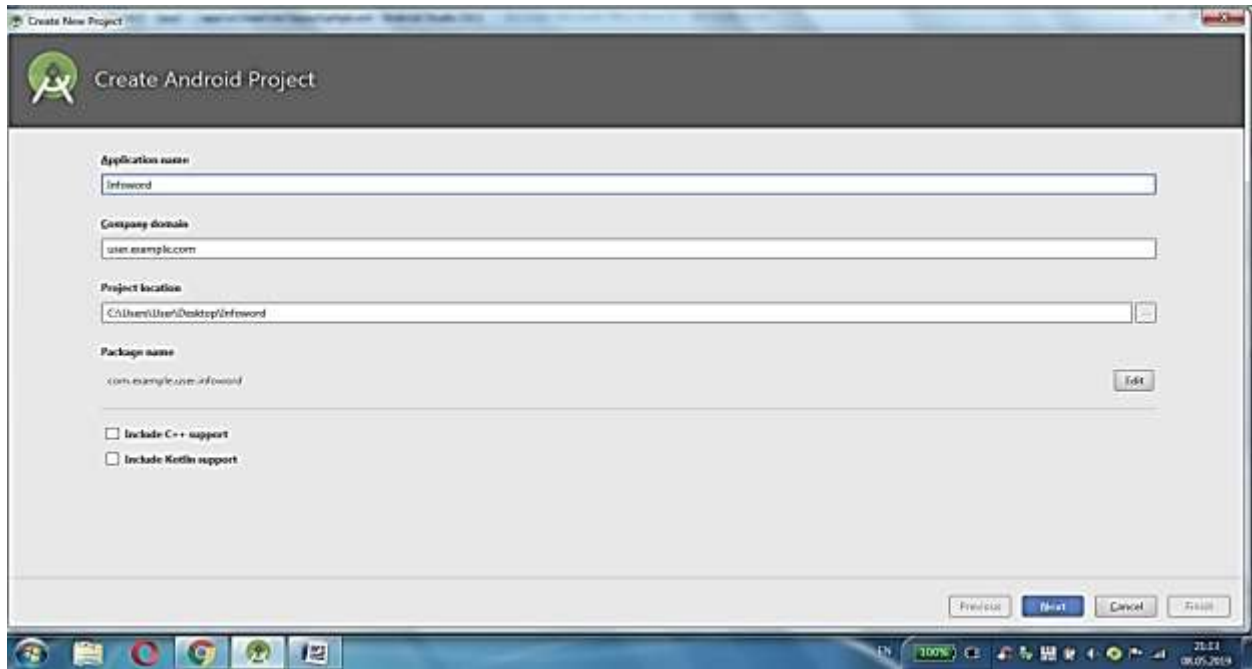
Having analyzed the most popular graphic designers, we should note that there are significant disadvantages in using ready-made products, such as: APK uploading fails; hidden fees for using certain app tabs; license purchase (90 \$ and more); impossibility to get in touch with customer support service, unavailability of interface for creating educational applications, etc.

Therefore, we think it worthwhile to develop own mobile application, although it takes some time and requires programming skills, the developer gets invaluable personal experience, saves money and takes into account own desires and vision of the application when writing it. When developers create their own applications, they develop logical and critical thinking, creativity, cognitive activity; and, most importantly, mobile applications are relevant and user-friendly for students in the process of studying in higher education institutions.

Let's examine the algorithm for creating and posting the infoword app «*Informatics Dictionary*» on Google Play for Android.

The first step is to download Android Studio (<https://developer.android.com/studio> – hyperlink for downloading), then we download and install the Java Development Kit (JDK) from [http://www.oracle.com/technetwork/java/javase/downloads/inde ...](http://www.oracle.com/technetwork/java/javase/downloads/inde...), after that we download Android SDK libraries and API plugins for different versions of Android on Android Studio.

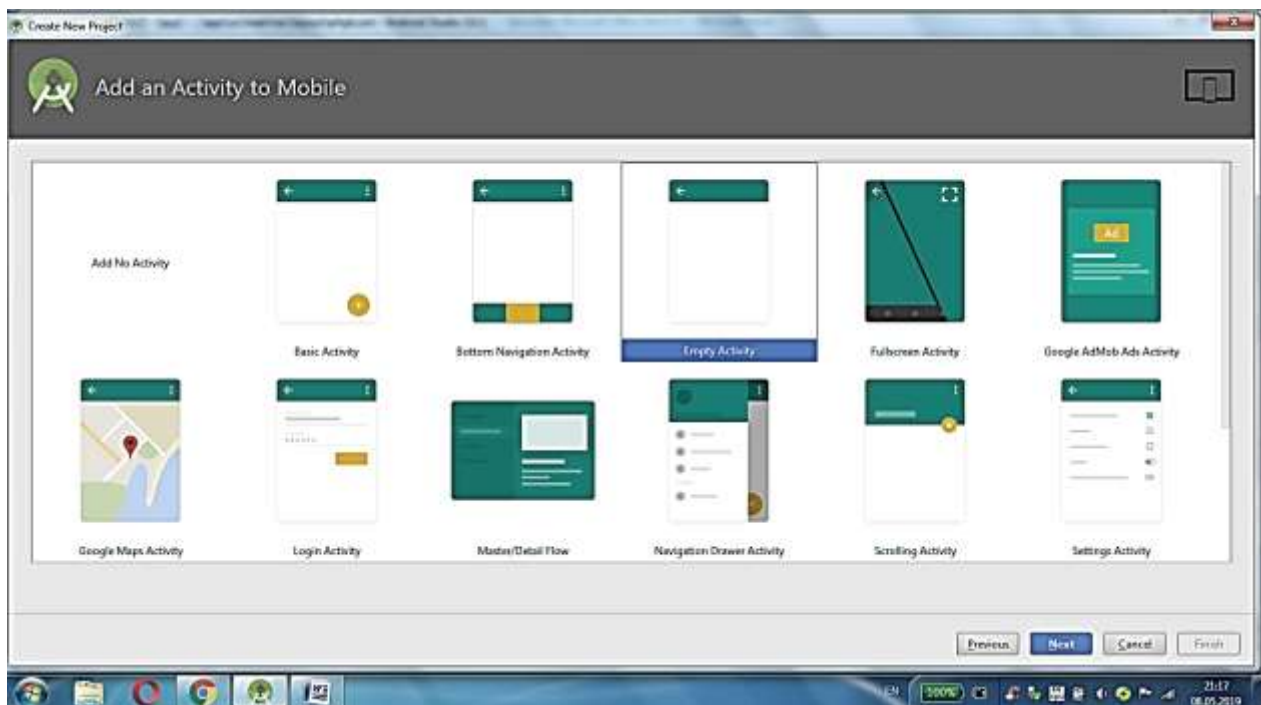
The next step is to create a new project and rename it corresponding to the name of our program – «Infoword» (the program code was written in the Java programming language) (Pict. 1).

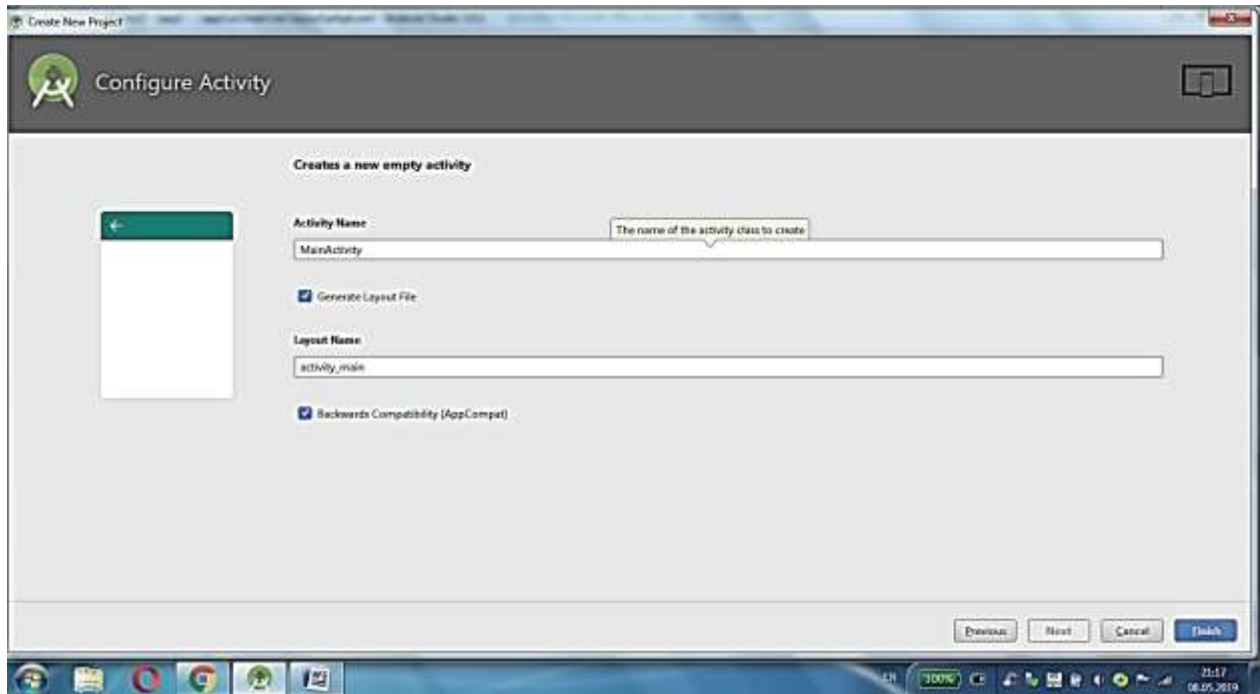


Pict. 1: Screenshot When Creating a New Project

The minimum supported Android version has been selected 4.04 with a minimum API 15 for this version supported by up to 9 Android.

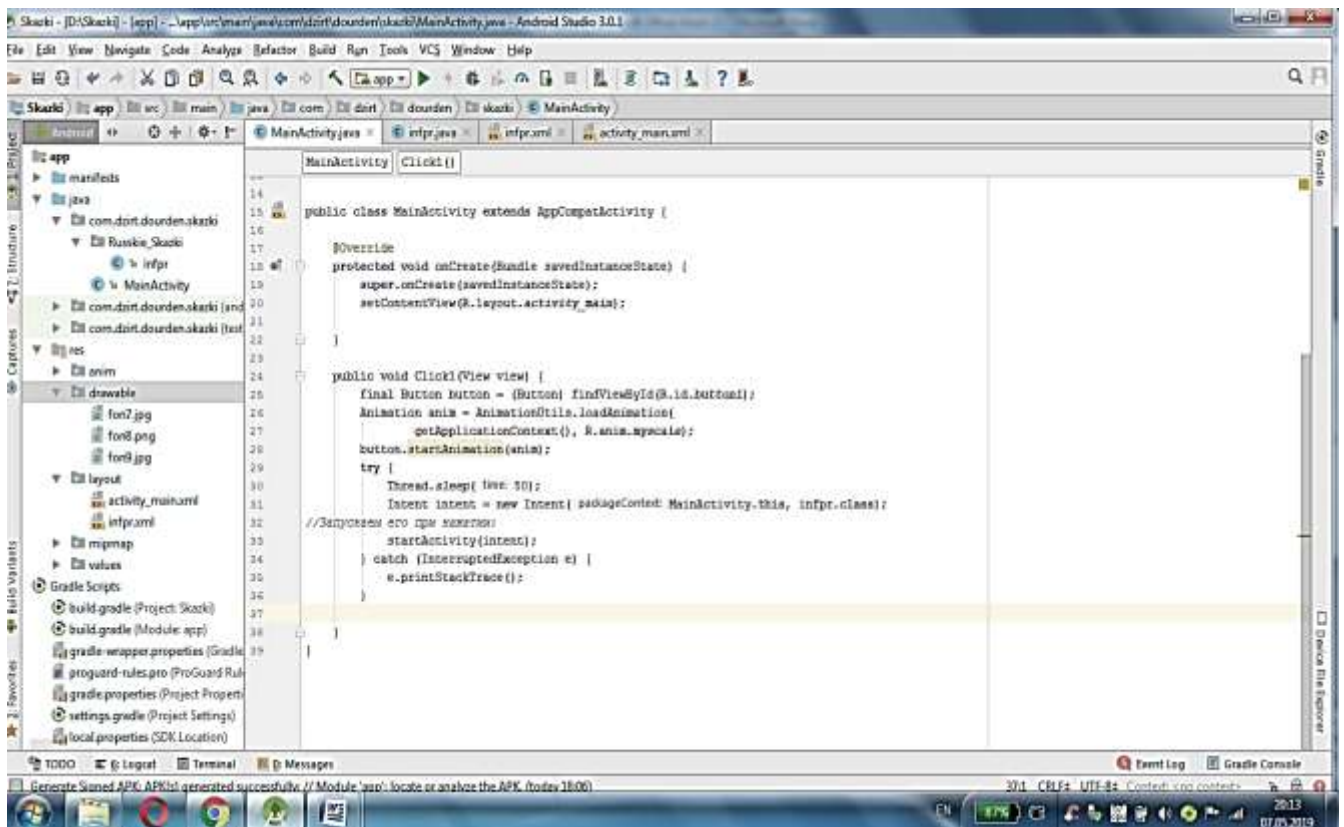
Here's an algorithm for developing the Infoword application «*Informatics Dictionary*» for Android using screenshots.



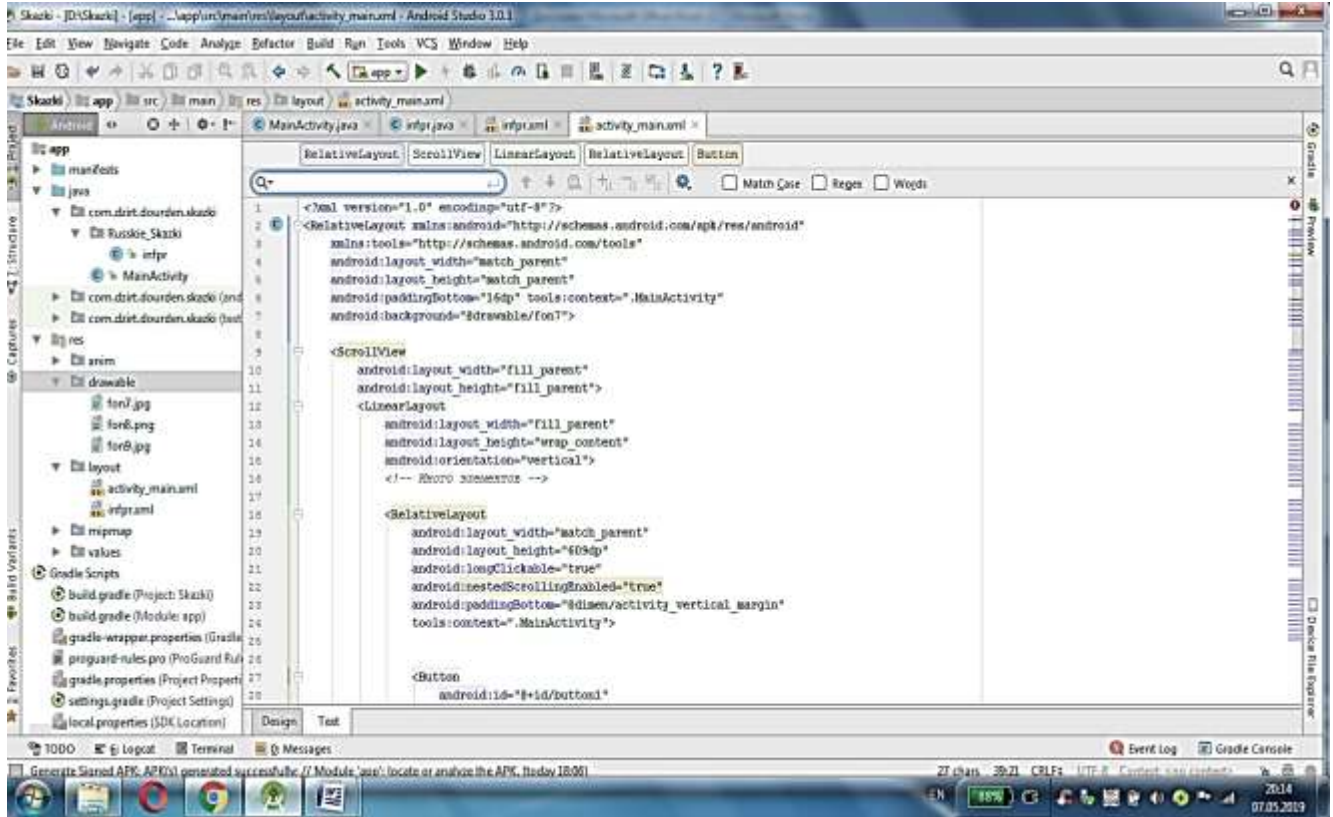


Pict. 2: The Algorithm of the Screenshots During the Development of the Application

The next step is demonstrating the code of the main menu and submenu of the program written in the programming language Java (Pict. 3 and 4).

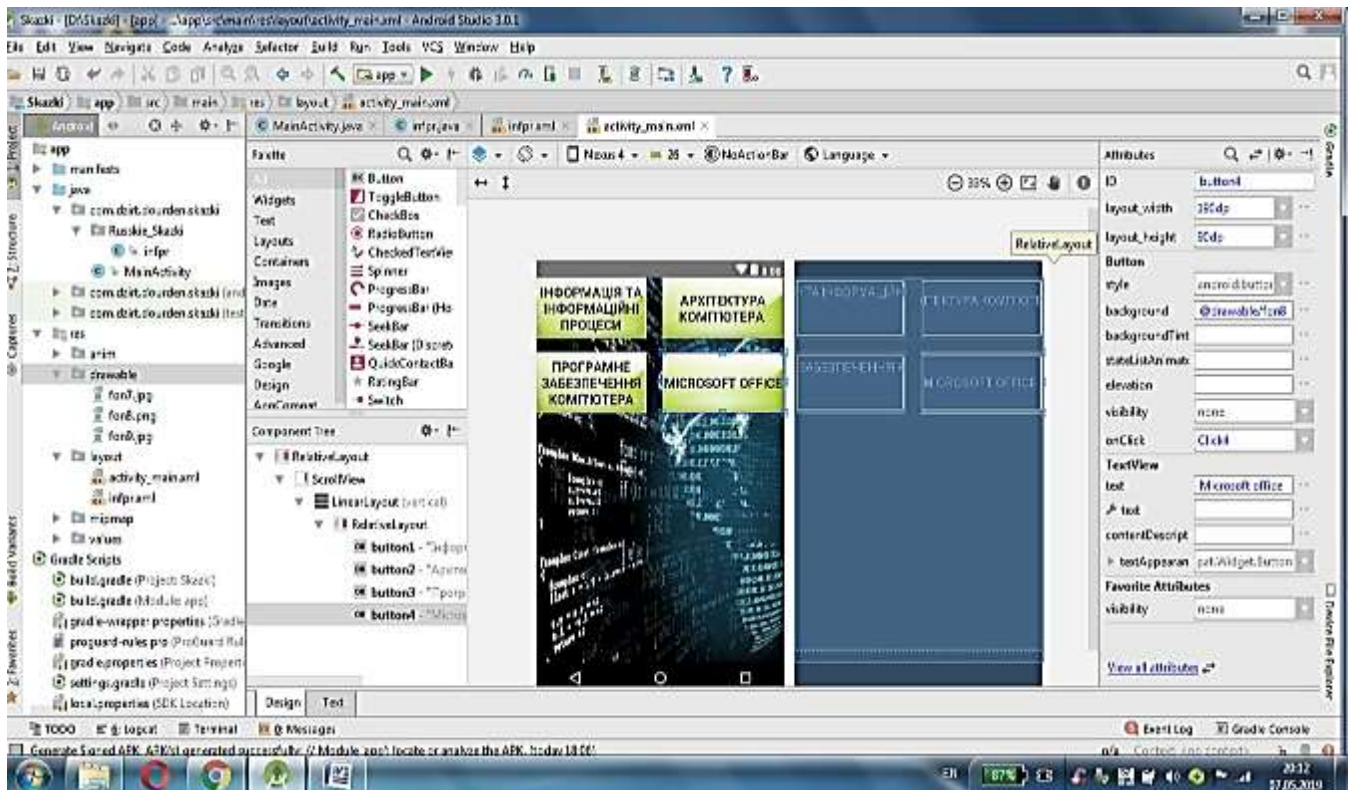


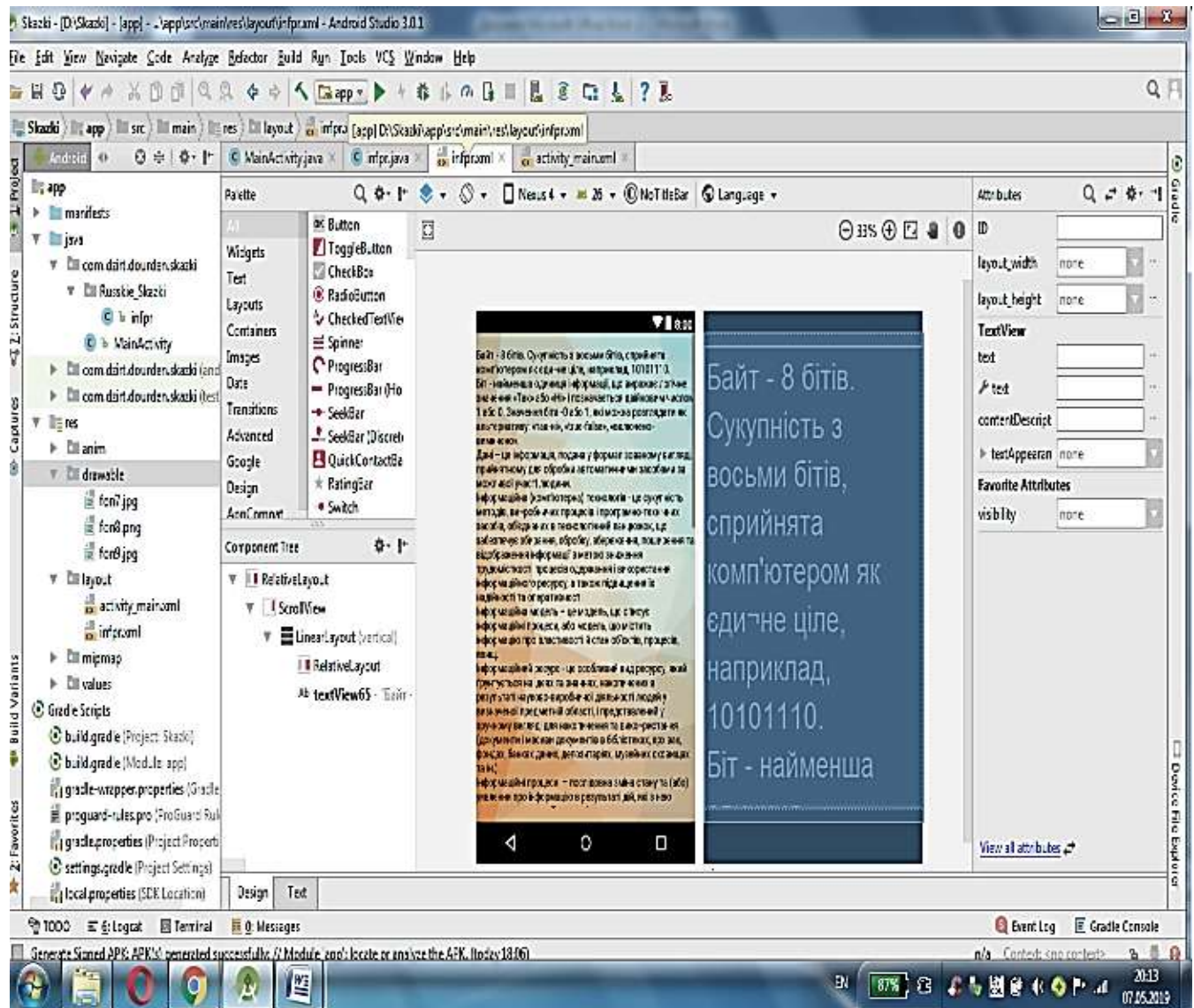
Pict. 3: Screenshot of the Main Menu Code When Writing a Program



Pict. 4: Screenshot of the Submenu Code When Writing a Program

Here is an example of screenshots showing how the release version of the application will look (Pict.5).



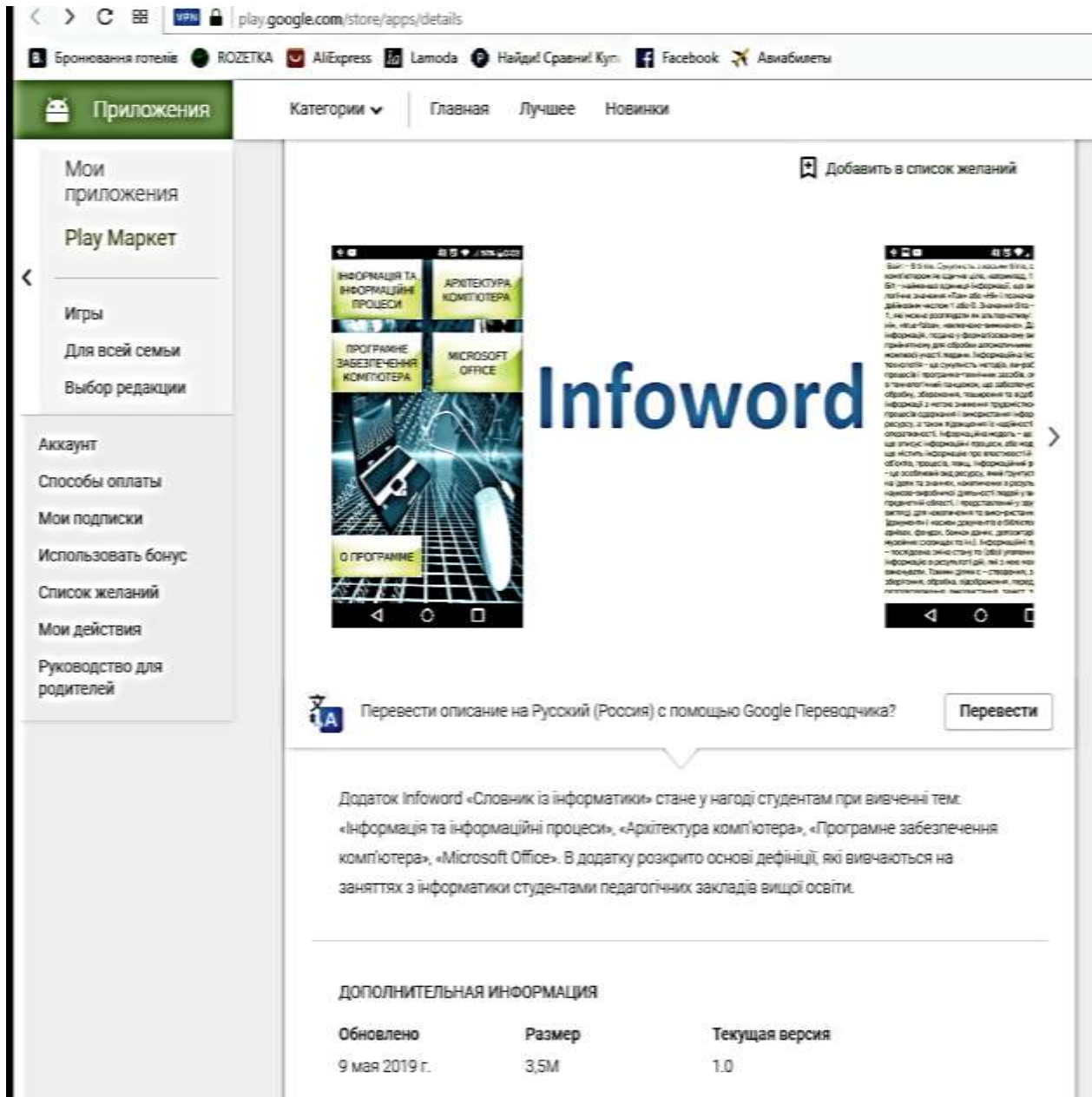


Pict. 5: Screenshots for the Release Version of the Infoword Application «Informatics Dictionary»

Then the fully-fledged project is compiled for the release version: ready-made screenshots of the Infoword application «*Informatics Dictionary*», pictures, icons are uploaded to Google Play. After that, site moderators check this app and it becomes active on Google Play.

It is worth mentioning that for placing anything in Play Market for you must have an account that costs \$ 25, this fee is paid once, and only by the application developer, all others can download it free of charge. After paying the fee and creating an account, the developer has the right to upload apps to the Google Play without limitation on quantity.

Here is a screenshot of this app on Google Play.



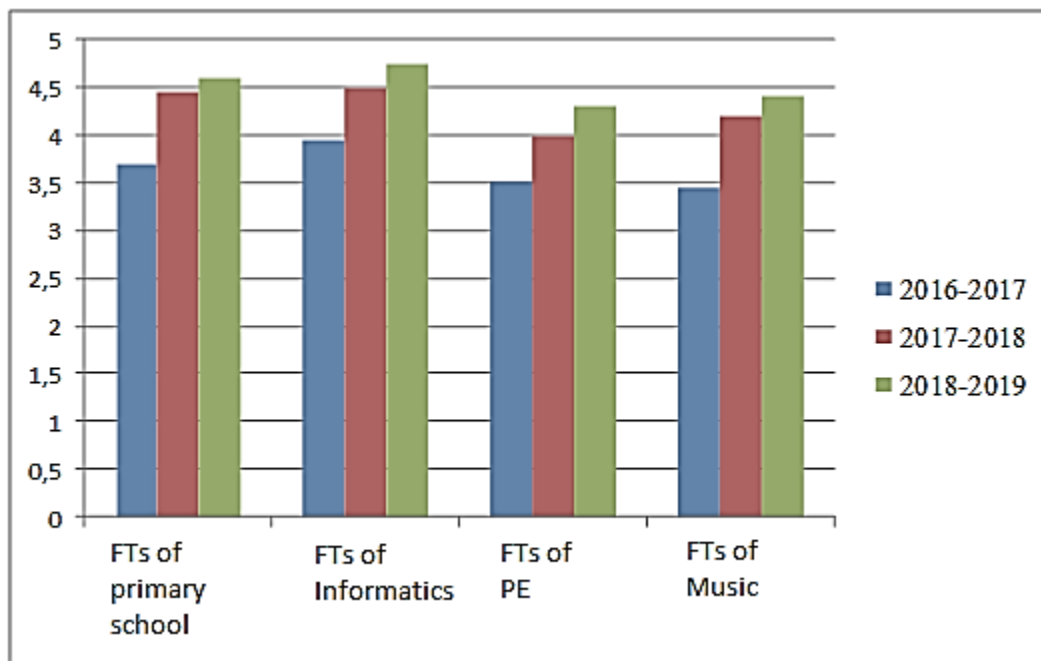
Pict. 6: The Screenshot of the Infoword Application «Informatics Dictionary» on Google Play

This dictionary covers the topics of the courses «Informatics», «Informatics and Computer Engineering», «Information Technologies» developed for pedagogical specialties, namely: «Information and Information Processes», «Computer Architecture», «Computer Software», «Microsoft Office».

Students can download the app from the Play Market to their smartphones and use it during computer science courses learning such topics as: information, information processes, computer architecture, input and output devices, software, multimedia systems, means of communication, Microsoft Word, Microsoft Excel, Microsoft Publisher, etc.

In the course of the pedagogical experiment, prior to the work on the application there was a survey conducted among the students. The question was «Do you use mobile applications in the learning process?» and in the 2016-2017 academic year 45% of students answered «yes», which allowed us to come to the conclusion about expediency of work in this direction. After the implementation of the test version of the Infoword application «*Informatics Dictionary*» in the 2017-2018 academic year, this survey was carried once more and 57% of the respondents (future teachers) gave a positive answer. In the 2018-2019 academic year, only 3% of students did not use mobile applications in the learning process, stating that they were more comfortable with their notes and books.

Also, the results of the module tests on the disciplines of the informatics cycle were analyzed (Pict.7).



Pict. 7: Results of Assessing the Quality of Future Teachers' Knowledge of Computer Sciences

Comparative analysis of the results shows that the quality of future teachers' knowledge of Computer Sciences significantly increased through the use of Infoword application «*Informatics Dictionary*». The level of knowledge of students – future primary school teachers increased from 3.7 to 4.6; future informatics teachers – from 3.95 to 4.75; future physical education teachers – from 3.5 to 4.3, future music teachers – from 3.45 to 4.4. The average increase in the quality of knowledge for future teachers of different specialties is 0.8625.

The practice proves that using a mobile application Infoword «*Informatics Dictionary*» is effective for enhancing cognitive activity, future teachers' self education, reflection, improving their professional and information competency.

IV. DISCUSSION

Having analyzed the scientific achievements of the domestic and foreign researchers, we found that the main aspects of the development and use of mobile applications to improve the quality of the future computer science

teachers training have not been the subject of separate studies. Having studied the most popular graphic designers, it was found that they do not meet the requirements put forward into the planning process of a mobile application developing. In the course of scientific search, it is appropriate to develop the author's infoword "Dictionary of Informatics" application in the Java programming language. In the process of creating a mobile application it was found that the developers increase their imagination, formative and constructive thinking, creativity and more. After the introduction of the authoring infoword "Dictionary of Informatics" application it was found that the quality of training of future teachers in computer science has increased significantly.

V. CONCLUSIONS AND PROSPECTS FOR FURTHER RESEARCHES

Summarizing the results of the research, we note that improving the quality of training future teachers of various specialties in Computer Sciences, in modern conditions, is possible through the introduction of mobile-oriented learning, which is convenient for educators (teachers, students) and aimed at mastering innovative ICT, both in self-education and in professional activities. This training provides students with enormous flexibility when choosing a gadget they want to study with, the time when it is convenient for them to carry out self-education activities, because in the process of mobile-oriented learning they are not limited to an educational institution, a library, a laboratory, a classroom, students can view mobile application materials, wherever they want, with the pace of learning that is comfortable for them.

We believe that the application we developed is a trendy one and represents an extraordinary innovative way of implementing self-educational activities of the educational process participants.

As prospects for further research we suggest conducting seminars for future teachers of computer science and other specialties (if desired) on the development of educational mobile applications that will promote the development of personal qualities, flexibility of thinking, creativity, independence, raising the level of professional competence, etc.

Therefore, only with the introduction of mobile-based learning, namely, mobile applications in the educational process, without doubt, one can count on the training of highly qualified and competent future professionals.

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