

Pedagogical Aspects Of Improving The Educational Process Based On Mobile Applications In Higher Education Institutions (In The Example Of Solid Physics)

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ABSTRACT

This article presents a theoretical analysis of foreign scientists in the field of improving the educational process in higher education institutions based on mobile applications, mobile education, how and when the use of mobile applications began, the relevance of mobile applications in the education system.

The fact that the 21st century is called the age of information technologies in the world requires the use of information technologies in the educational process on a large scale. This, in turn, is the basis for the introduction of mobile applications and mobile education concepts. Improvement of applications based on mobile devices occupies a special place in higher education institutions in increasing the efficiency of the educational process. Mobile applications are software tools of information technologies, which are more qualitative, compact and easy to use. Such mobile applications do not make it difficult to connect to the Internet on tablets, laptops and computers. Mobile applications play an important role in teaching using mobile technologies. It serves as a software tool in the educational system, on the one hand, and on the other hand, it confirms the relevance of tasks such as increasing the effectiveness of the educational process based on mobile

applications and improving the educational process in higher education institutions.

In the scientific and research works carried out by scientists of foreign countries, the terms like "Mobile Applications", "M-learning" can be seen, which appeared in the literature of English scientists almost 20 years ago. Foreign scientists can see that the perspective of information and communication technologies is inextricably linked with the acceleration of the process of "Mobile Applications", "Mobile Education" ("M-learning"). One of the most important aspects of mobile application and mobile learning is that 4 out of 5 people today have mobile phones and use mobile communication effectively. In addition, there are opportunities to connect wirelessly to the Internet using mobile phones. We can observe the widespread use of mobile communication and mobile internet among the people in the following figures.

In 2010, according to the international research "Mobile Thinking", 5.3 billion people (77% of the world's population) have mobile phones, and about 0.5 billion people in the world have access to the mobile Internet, and it is expected that this figure will increase fourfold in 2022. One in five people using the mobile Internet have access to a high-speed Internet network based on 7G technology. Today, about 300,000 mobile applications have been developed in the last three years, and the most popular mobile applications in the world today are games, news, maps, and social networks.

The use of unlimited Internet for mobile phones was first introduced in Japan, the USA, and later in Europe and the Russian Federation. Today, the weight of mobile communication is higher than the weight of computers in the early 1990s. It should be noted that various features of mobile phones and mobile applications are being used more in developing countries [1]. According to a 2010 study in the USA, mobile phone owners actively use the following functions of their devices: sending messages (88%); photography (85%); listening to music (60%); use of e-mail (49%); watching videos (41%); Creating documents in Word format (23%); communicating in social networks (21%).

It should be noted that using mobile applications is not used in the direction of improving the educational process, but in foreign countries, the direction of integrating mobile tools into the educational process is being developed.

Since 2002, international conferences, roundtable discussions, and seminars have been held in Europe and the United States of America on the role of mobile applications in the educational process. Since 2005, the "M-learning" international conference has been held continuously in Europe. Since 2002, MLearnCon international conference has attracted more than 600 participants by 2011, which is a 55% increase compared to 2010. The international conference "MoLeNET", whose goal is to increase the effectiveness of teaching methods using mobile devices in the educational system, has been held in Great Britain since 2007 [2].

Among the major foreign projects dedicated to the practice and theory of teaching using mobile applications, the following works are noteworthy: "The Mobile Learning Network Project - MoLeNET" (Great Britain), "Mobile Learning Environment (Mobile Learning Environment Project — The MoLE) (USA), "Mobile Technologies in Lifelong Learning: best practices-MOTILL" (European Union), "Mobile Learning Consortium" (MLearning Consortium) (Canada) can be cited [4]. The "Mobile Education System" (MoLeNET) project can be identified as the largest international conference in terms of the number of participants in these conferences. It aims to bring together 115 colleges and 29 schools in the UK to create a single virtual platform for mobile learning. To date, about 10,000 students and 7,000 teachers have been involved in this project. They analyze

various possibilities of mobile applications and conduct scientific research on ways to use them effectively.

In the UNESCO project, when mobile phones were not used, only 28% of girls who were taught literacy received excellent marks in the exam. More than 60% of female students who participated in remote classes using mobile communication received excellent grades in the final exams.

Another research project of the UNESCO organization was conducted in the USA. In North America, part of the training is outside the classrooms, that is, students have created the opportunity to learn lectures and practical lessons using mobile applications in their free time. From these mobile applications, students were recommended to listen and study lectures using their mobile phones, which they carry with them everywhere. This made it possible for students to discuss and apply their knowledge outside the classroom during the lesson. It has been determined that students' mastery of classes conducted in this way has increased by 9-10% compared to traditional classes.

In Canada, in 2002, a "mobile learning consortium" was established, which includes "Seneca College" and the Northern Alberta Institute of Technology, as well as several large companies. The goal of the consortium is to create a new learning environment independent of geographical location and time.

To date, there are several interpretations and definitions of mobile education based on the technological features of mobile devices or didactic opportunities provided by these technologies in foreign pedagogical literature. If we look at mobile education from a technological point of view, using WAP or GPRS technologies of mobile devices, it is possible to post educational information on the Internet, receive materials, answer questions on the platform, prepare tests and perform quizzes.

According to the MoLeNet project, education based on mobile applications is the use of convenient mobile devices to facilitate, support, optimize and extend learning processes for students [6].

Mobile learning is a regular activity conducted through compact, portable mobile devices and technologies that enable students to work more efficiently by accessing or creating information.

J. Draxler in the study "Current State of Mobile Learning" states that mobile learning, mobile applications will completely change the learning process, because mobile devices will not only change the way material is presented and accessed, but it also contributes to the creation of new forms of knowledge and understanding. The teaching process will be just-in-time, just enough, and just-for-me. These characteristics of mobile education differ from the characteristics of mixed and electronic education (e-learning), in which didactic principles such as multimedia, structuring or modularity, interactivity, availability overlap, mobile technologies promote student participation in the educational process, as well as the fact that education based on mobile applications is considered a form of education that differs from distance or mixed education, that characterizes a new type of development in the digitalization of society, and, in this regard, the researchers of the Mobl21 project distinguish two forms of education - mobile and mixed - individual (when, where and at what speed) and informal (presentation of materials, communication) nature of learning.

Many researchers (M. Bransford, J. Douglas, D. Kelly, T. Rekkedal, S. Gedess) emphasize that electronic and mobile education should be distinguished. According to them, the main difference between e-learning and mobile learning is that it does not depend on a specific audience or location. This, in turn, individualizes the educational process. Scientists (S. Hargadon, S. Geddes, J. Douglas,

D. Kelly, M. Bransford, etc.) in the "How People Learn" study noted that teaching based on mobile applications is a promising direction of modern pedagogy.

K. Robinson, a consultant for the development of creative thinking, educational systems and innovations in British international state and public organizations, noted that the development of modern mobile education technology in the improvement of the educational process will lead to the revolutionary development of technical tools for students' learning.

In conclusion, it can be said that the issue of improving the educational process based on mobile applications in higher education institutions in the field of Physics in the field of "Physics of Solids" in the scientific research presented above was not analyzed at all in individual cases and in some studies. Based on the above considerations, it is justified that the improvement of the educational process based on mobile applications in the subject "PHYSICS OF SOLID BODIES" in higher education institutions is an urgent issue. According to the analysis, mobile applications embody video, audio, text, graphics, tests, multimedia, animation, computer simulation models. Therefore, in our research, we have prepared computer simulation models that reveal the essence of the content so that students can better understand physical processes in the subject "Physics of Solids".

Below are the KIMs created on the subject of "Crystal Lattice Vibrations" of "Physics of Solids":

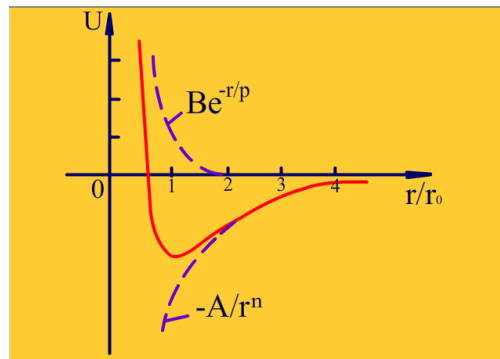


Figure 1. Distance dependence of potential energy of interaction between atoms in the lattice.

Due to the limitation of forces between atoms, they can move and oscillate relative to the equilibrium position at the nodes of the crystal lattice, in the state of equilibrium, the energy of the atom in the lattice is minimal, and its displacement changes the distance between the atoms, which, depending on the direction of displacement, leads to an increase in repulsive or attractive forces, which in turn leads to an increase in the energy of the atom. Since the force acting on the atom is directed against the direction of its displacement, it tries to return to its equilibrium position (Fig. 1). This is the reason for the vibrations of the atoms in the lattice.

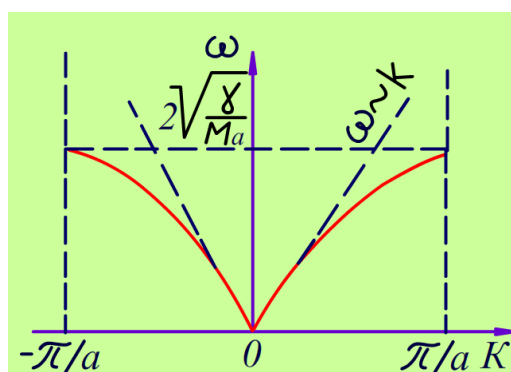


Figure 2. ω is the dependence curve of frequency on k - wavelength.

Imposition of boundary conditions (limiting the length of the chain of atoms to the crystal size) causes the spectrum of permissible values of vibration frequencies to be discrete, and the nature of dispersion bonds is preserved (Fig. 2). Waves propagating in a bounded crystal return from its surfaces, and as a result standing waves are formed in it. A whole number of half-wavelengths are located in the length of the crystal, just like in a string with fixed ends, and therefore the largest wavelength of vibrations should be equal to twice the length of the crystal, and the smallest should be equal to twice the distance between atoms.

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