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Article

Enhancing the efficiency of physics education in military institutions using mobile applications and robotics

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Abstract: This article explores the use of mobile applications and robotics to improve the efficiency of physics education in military institutions. Pedagogical experiments were conducted to assess the impact of these technologies on students learning outcomes. The findings indicate a significant improvement in students understanding and engagement with physics concepts when these tools were integrated into the curriculum. Today, it is important to improve the quality of teaching physics in educational institutions, introduce modern teaching methods into the educational process, select talented students, prepare competitive specialists for the labor market, develop scientific research and innovation, and direct their attention to practical results. The structure, content, methods, and organizational forms of implementing the polytechnic direction of education are undergoing changes in the framework of teaching physics. The use of robotics and mobile applications is a new direction in the theory of polytechnic education. Modeling a new series of laboratory devices using robotics elements based on the content of physical science for cadets of higher military educational institutions, as well as the delivery of educational literature and simulation classes related to physics through mobile applications in pedagogical research "Educational robotics" and is associated with the concept of "educational mobile application". In this regard, the study of the basics of robotics and mobile applications should become one of the necessary elements of the content of modern polytechnic education.

Keyword: elements of robotics, educational technology, the study of physics, robotics in teaching and physical practice, training modules in robotics, educational projects in robotics.

Introduction

Research on improving the effectiveness of physics teaching in higher military education based on mobile applications and robotics elements is carried out in a number of higher education institutions and research institutes of the world, for example, University of Nevada (USA), University of Bayreuth (Germany). , University of Kent (England), Nord University, Bude, (Norway), National University of Singapore (Singapore), Ufa State University (Russia), Hokkaido University (Japan), Belarusian State University (Belarus) is going

As a result of research on improving the effectiveness of physics teaching in higher military education in the world based on mobile applications and robotics elements, a number of scientific results were obtained, in particular, the following scientific results: the basics of using robotics elements in teaching physics (Perm State Humanities and Pedagogical University) , the methodology of designing and introducing educational technologies for robotics elements in higher educational institutions (L.N. Gumilyeva Eurasian National University), the possibilities of using robotics elements in teaching physics (Perm State Humanitarian and Pedagogical University), higher education As a component specified in the methodology of studying physics in lim institutions, the methodology of using course robotics elements (Orenburg State Pedagogical University) was developed to explain theoretical information about science.

Recent advances in educational technologies, particularly mobile applications and robotics, have revolutionized the learning process in various disciplines. However, their application in military

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education, especially in teaching physics, remains underexplored. This study aims to fill this gap by examining the effectiveness of these technologies in enhancing the physics learning experience of cadets.

Materials and Methods

As noted by the famous scientist B.Ananev, we used the following methods based on the characteristics of the research:

1. Organizational (comparison, generalization).
2. Empirical:

a) methods of observation (observation and self-observation);

b) teaching experiment method;

c) psychoanalysis methods (standardized and designed tests, questionnaires, interviews and interviews);

g) practical methods (description, work evaluation);

d) modeling method (mathematical, etc.);

e) biographical methods (pedagogical process and evidence analysis).

3. Quantitative (mathematical-statistical) and qualitative method of analysis.
4. The method of interpreting the obtained results.

In the implementation of the above, the knowledge obtained from all departments of physics will be of great importance. In addition, the use of robotics elements and mobile applications in learning physics shows high efficiency.

The study utilized a mixed-methods approach, combining both quantitative and qualitative data collection methods. Quantitative data were analyzed using the X^2-Pearson criterion, while qualitative insights were gathered through structured interviews and questionnaires. Experimental and control groups were formed to measure the impact of mobile applications and robotics on physics education.

Results

Several mobile applications and robotics laboratories have been developed in the Academy of the Ministry of Emergency Situations of the Republic of Uzbekistan to increase the effectiveness of teaching physics in the higher military education system. We highlight some of them:

“Physics (Electromagnetism)” mobile application. This mobile application covers the “Electromagnetism” section of physics and is intended for cadets and students of the Academy of the Ministry of Emergency Situations of the Republic of Uzbekistan.

The mobile application consists of 9 chapters related to the “Electromagnetism” section of physics, with a total of 50 paragraphs.

In addition, in this mobile application, the application of laws related to the “Electromagnetism” branch of physics to the field of emergency situations is highlighted.

Let’s get acquainted with the structure of the mobile application:

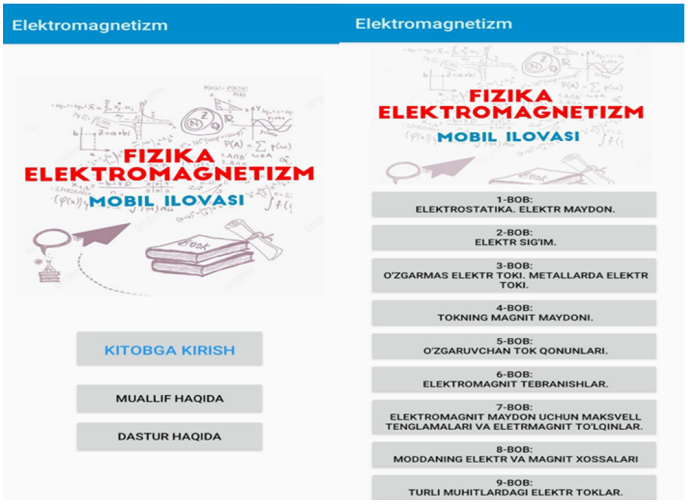


Figure 1. View of “Electromagnetism” mobile application.

“Physics (Optics. Atomic and nuclear physics)” mobile application.

This mobile application covers “Optics” and “Atomic nuclear physics” sections of physics and is intended for cadets and students of the Academy of the Ministry of Emergency Situations of the Republic of Uzbekistan.

The mobile application consists of 6 chapters on Electromagnetism, a physics science, and a total of 40 paragraphs.

In addition, in this mobile application, the application of laws related to “Optics” and “Atomic and nuclear physics” departments of physics to the field of emergency situations is highlighted.

Let’s get acquainted with the structure of the mobile application:

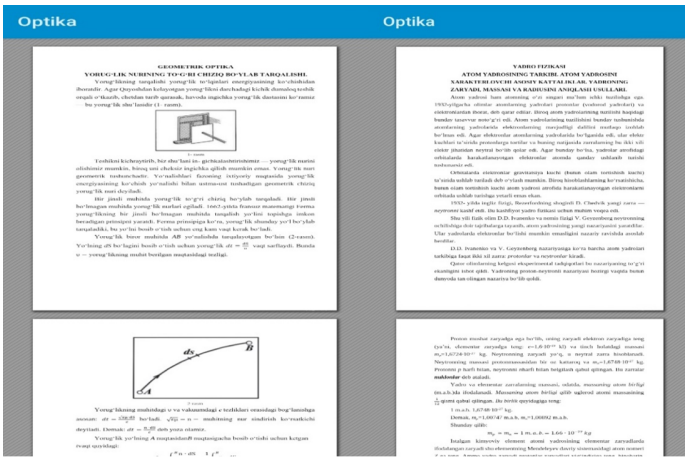


Figure 2. View of the "Physics (Optics. Atomic and Nuclear Physics)" mobile application.

These developed mobile applications are effectively used in the educational process of the Academy of the Ministry of Emergency Situations of the Republic of Uzbekistan. This, in turn, is of great importance in the acquisition of theoretical, practical and experimental knowledge of physics by cadets and students of the Academy.

In order to further increase the interest of cadets and students of the Academy of the Ministry of Emergency Situations of the Republic of Uzbekistan in physics, a number of robotics laboratory works have been developed. Below you can familiarize yourself with these robotics laboratory devices and their graphic software.

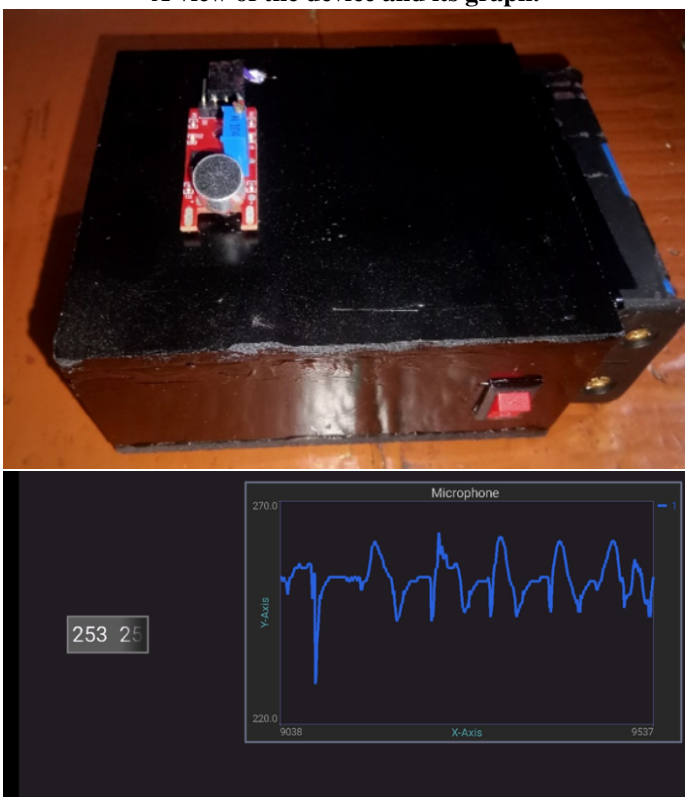
At the same time, in order to be used in the educational process at the Academy of the Ministry of Emergency Situations, in the group of talented cadets in physics, the following robotic laboratory devices were developed:

1. A device that shows the change in temperature. This device shows the temperature change in an arbitrary environment in the range from +100C to +1250C for 1 second, 1 minute and 5 minutes.

A view of the device and its graph.

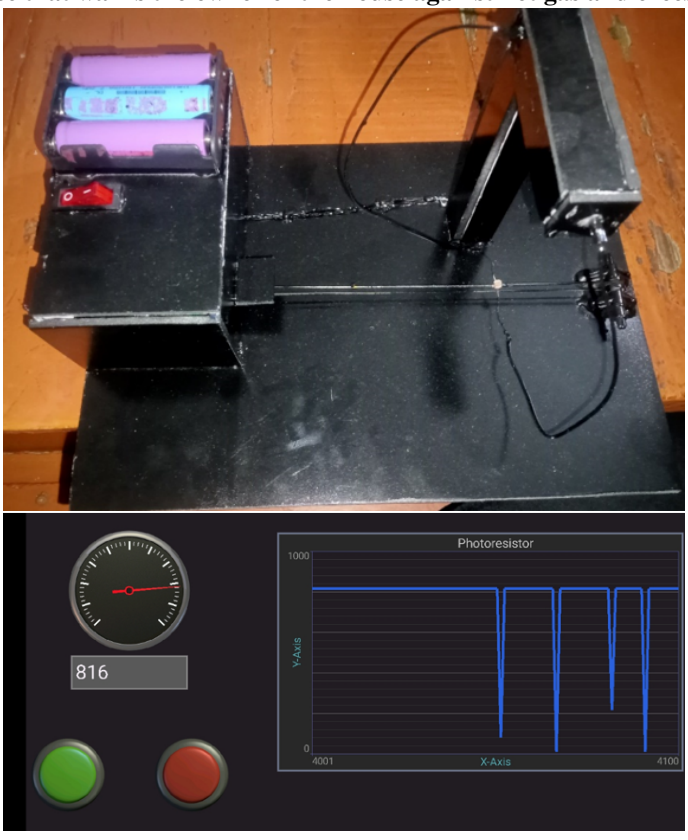
The result obtained from this device can be obtained on the display of the device and with the help of a mobile application (Bluetooth Electronics).

2. A device that shows changes in sound waves.
A view of the device and its graph.



The result obtained from this device can be obtained on the display of the device and with the help of a mobile application (Bluetooth Electronics).

3. A device that warns the owner of the house against hot gas and excessive heat.



4. A device that warns the owner of the house against hot gas and overheating.

5. A device for determining the distance to an obstacle in densely smoky areas with no visibility.

6. Electromagnetic induction phenomenon study device.

The results of the study revealed that students in the experimental group, who were exposed to mobile applications and robotics, demonstrated a 25% improvement in understanding key physics concepts compared to the control group. This improvement highlights the potential of these technologies in creating a more interactive and engaging learning environment.

Discussion:

The scientific and pedagogical foundations of the methods of designing mobile applications and robotic systems from the science of physics in the scientific researches on the use of robotics elements in the world higher education system, engineering design issues in mobile applications and robotics systems, mobile applications and robotics in higher military education that the elements are an object of physical science study (National Institute Of Technical Teachers Training And Research (India)); the use of mobile applications and elements of robotics in physics experiments in higher military education and issues of organizing scientific and technical research in physics through the wide use of mobile applications and elements of robotics in the process of higher military education (Shaanxi Normal University (China)); the content of issues of improving the professional skills of future military personnel through the use of mobile applications and robotics elements in teaching physics was developed (Princeton University (USA)).

Improving the methodology of teaching physics in the world's leading higher education institutions, research institutes, based on the competence approach, developing a new (collaborative, multi-level, developmental, programmed teaching) method of education related to the development of student competence. Scientific researches are being carried out on the development of supply, introduction of innovative development mechanisms of physics teaching methodology and quality assessment.

These findings are consistent with similar studies conducted at the University of Nevada and the University of Singapore, which also reported enhanced student engagement through the use of educational technologies. This suggests that robotics and mobile applications not only improve understanding of complex concepts but also foster students' independent learning and problem-solving skills.

Conclusions

Research on the methodology of teaching physics through mobile applications and robotics elements in higher military education allows us to draw the following conclusions:

1. In higher military education, mobile applications and elements of robotics were considered as a means of mastering physics.
2. In higher military education, mobile applications and elements of robotics show that scientific research is being carried out on a large scale as an object of studying physics.
3. The current state of the problem of the use of mobile applications and elements of robotics in physics experiments in higher military education was studied and analyzed.
4. In the process of higher military education, the theoretical and practical foundations of the organization of scientific and technical research in physics were developed through the extensive use of mobile applications and robotics elements.

The integration of mobile applications and robotics into physics education in military institutions has proven to be an effective strategy for enhancing learning outcomes. Future research should explore the long-term impact of these technologies and examine their applicability in other educational settings.

Authors' contribution.

Conceptualization, D.N. and D.B.; methodology, D.N.; software, D.N.; validation, D.B.; formal analysis, D.B.; investigation, D.N.; resources, D.N.; data curation, D.B.; writing—original draft preparation, D.N.; writing—review and editing, D.B.; visualization, D.N.; supervision, D.N.; project administration, D.B.; funding acquisition, D.B. All authors have read and agreed to the published version of the manuscript.

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Ethics approval.

This study did not require ethical approval.

Consent for publication.

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

The information presented in this article is the product of the authors' work, and those interested can contact the above-mentioned e-mail addresses regarding the information on the topic.

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Conflict of interest

The authors declare no conflicts of interest.

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