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THE SIGNIFICANCE OF TEACHING KNOWLEDGE OF HOMOGENEOUS MAGNETIC FIELD THROUGH THE ANDROID PROGRAM IN A SCHOOL PHYSICS COURSE

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Abstract. *This article describes the methodology and importance of teaching the "Magnetic field" section of physics for schoolchildren through the Android program, focusing on topics such as magnetic field flow and finding the torque of a current frame in a homogeneous magnetic field. . Also, the structure, functions and animations of the program, its positive effect on student activity and understanding of the subject, compatibility with modern teaching methodologies and the advantages of introducing new technology into education are revealed.*

Keywords: *android app, physics education, teaching methodology, magnetic field, torque, teaching tool, students, learning resource, interactive learning, magnetic field flow, torque, current frame, visual learning, student engagement, conceptual understanding, hands-on learning.*

Introduction. In many countries of the world, the effective use of modern educational methods in the interdisciplinary teaching of physics, first of all, the development of the teacher's knowledge of the physics course and related subjects and the improvement of the educational process, is considered as one of the main issues. Plab research works have been carried out. To teach the physics course by using innovative methods and to constantly apply it to the educational process, to form (create) didactic support and ways to develop the physical worldview (thinking) of students, and to improve teaching technologies through its development special attention is paid [1].

This paper presents an innovative Android application specifically designed to enhance the teaching and learning experience of the magnetic field section in physics education.

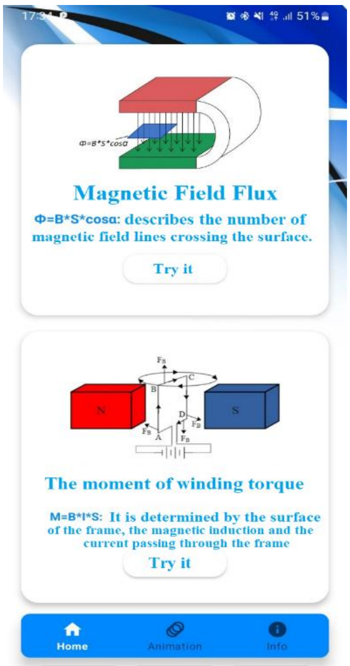

Fig 1. The appearance of "Home" window.

Methods. An Android program consists of individual and interconnected components, each of which contributes to a holistic learning experience. The "Home" section is the central function of the program and provides easy operation of two important sections: "Magnetic field flux" and "Current frame torque" (Fig. 1).

The "Magnetic Field Flux" window allows users to perform calculations using the formula PH=BScosa, where they enter certain values to obtain the desired quantities [6]. To do this, click on the row with the indicated size. Then the cursor and numbers for input are automatically created and the necessary numbers are filled. One section, i.e., the required quantity to be calculated, is left blank and the "Calculate" button is pressed, the program calculates the missing value (Fig. 2). This function of the program allows you to save time spent on calculations. For example, the following problem can be given as an example.

A magnetic flux passing through a wire frame with a surface area of 250 cm^2 located in a uniform magnetic field with a magnetic induction of 4 T is equal to 87 mWb. At what angle are the magnetic field induction lines falling on the surface? (Answer: 30°)

Given:	Formula:	Solution:
B=4 T S=250 sm^2=0,025 m^2 Φ=87 mWb=0,087 Wb	$\Phi = B \cdot S \cdot \text{Cos}\alpha;$ $\text{Cos}\alpha = \frac{\Phi}{B \cdot S};$ $\alpha = \text{arcCos}\frac{\Phi}{B \cdot S}$	$\alpha = \text{arcCos}\frac{0{,}087\,Wb}{4\,T \cdot 0{,}025\,m^2} = \text{arcCos}0{,}87$ $\alpha \approx 30^0$
α-?	Answer: 30^0	

Now let's consider how to work on this issue through the Android program: first, we look at the "info" window of the program to learn the information (Fig. 5). In this window, we get an understanding of the magnetic field flow and a preliminary idea of the placement of the current frame in the magnetic field. In the 2nd turn, we go to the "Animation" window of the program and observe how the vine frame moves under the influence of the field (Fig. 4). It allows you to enrich the imagination and better retain concepts in memory by seeing the information about the influence of the field and how the vine frame moves under this influence. In turn 3, we put the values of the quantities given in the "Magnetic field flow" (Fig. 2) window of the program and it looks like in Fig. 1a. In the last step, the "submit" button in the program is clicked. At this stage, the program does its job, that is, it calculates the most accurate possible value of the answer to the problem (Fig. 1b).

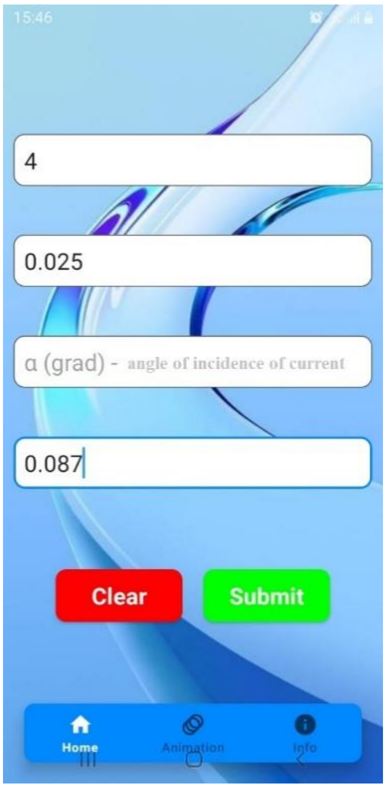

Fig 1.a.

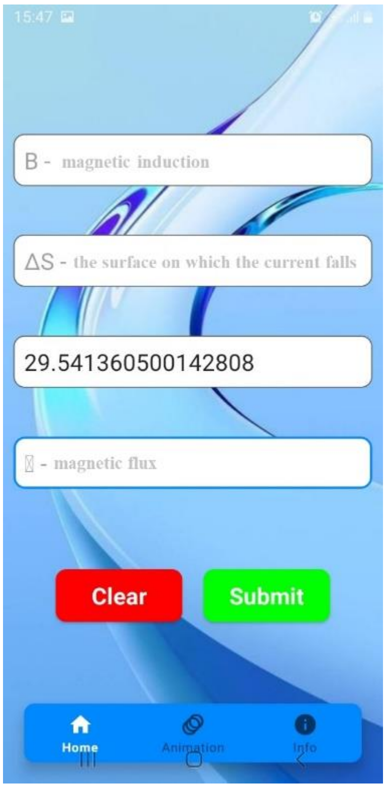

Fig 1.b.

Calculations are made using the M=BIS formula in the "Torque frame torque" window. Similar to the previous window, users enter certain values to calculate the desired quantity [5], which gives them the torque acting on the current frame in the magnetic field, the magnetic induction vector, the current strength in the frame, and the hypothetical surface of the area bounded by the current frame. allows to study the relationship between (Fig. 3).

Below are the "Magnetic field flux" and "Current frame torque" windows:

Fig 2. The appearance of "Magnetic field flux " window

Fig 3. The appearance of “Rotate the frame” window

The Animation window takes visual learning to new heights and offers attractive animations for Magnetic Field Flux and Torsion Frame Torque. These animations provide dynamic images, help students understand complex concepts, and reinforce their understanding through visual engagement (Fig 4). That is, it allows to study by seeing the rotational movement of the current frame under the influence of the field and magnetic field on the current frame, which is explained by continuous drawings.

The program's "Info" window serves as a comprehensive knowledge bank that provides detailed theoretical information about magnetic field flux and current frame torque. Students can access this window to deepen their understanding, reinforce concepts, and explore additional resources related to the magnetic field section (Figure 5). The information in this window of the program is taken from the physics textbook of the 11th grade of the school course, and does not overload the student's mind [10].

The “Animation” and “Info” windows are shown below:

Combining these components, the use of software focuses on creating an immersive and interactive learning environment that encourages student engagement, critical thinking, and hands-on inquiry. It helps to eliminate the gap between theoretical knowledge and their practical application, to effectively master physical phenomena and processes for schoolchildren [2].

Results. The use of Android applications serves to provide a continuous learning experience for students and a thorough understanding of subjects. The convenient interface of the program allows easy transition between different windows, provides availability and convenience.

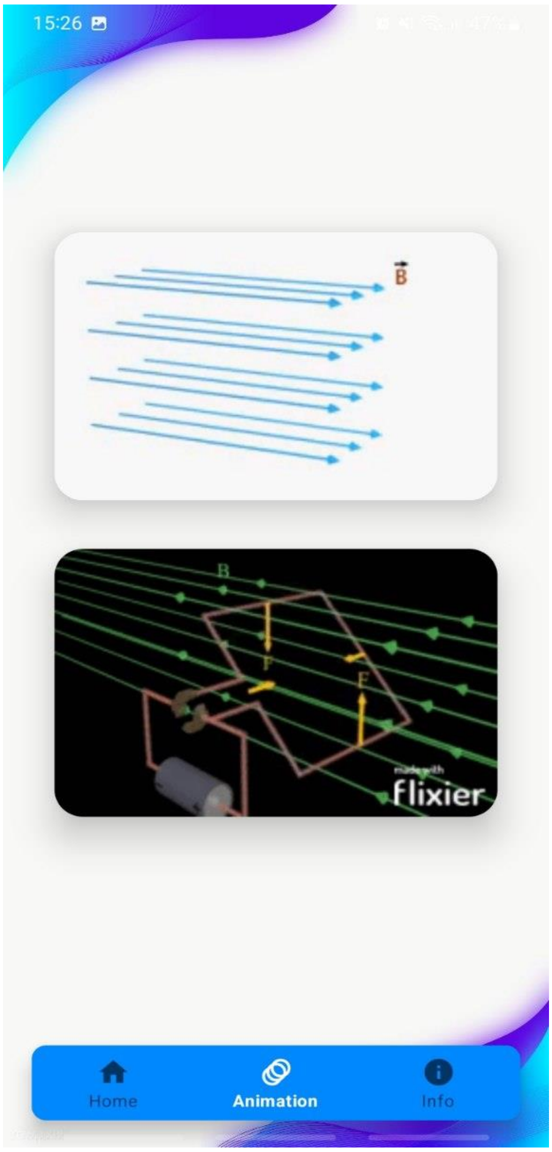

Fig 4. Appearance of “Animation” window.

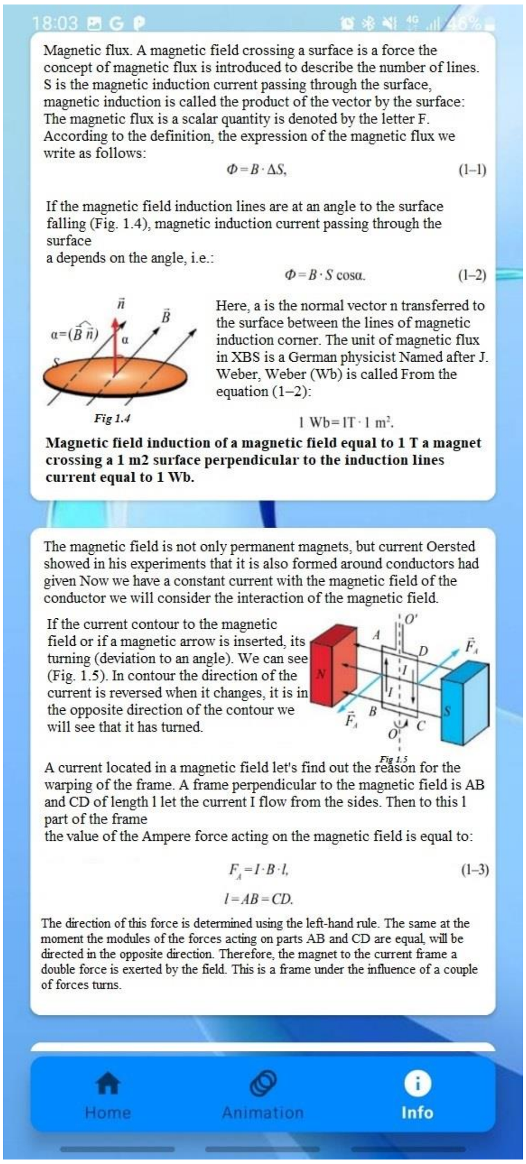

Fig 5. Appearance of “Info” window.

In the "Magnetic Field Flow" window, students do calculations using the formula PH=BScosa. By entering certain m values, the program calculates the required quantity, helps solve active problems, and reinforces the relationship between magnetic field strength, surface area, and angle [6].

The Torsion Frame Torque window uses the formula M = BIS, where students enter values to calculate the desired result. This window deepens the understanding of torque generation in a magnetic field and the effects of parameters such as magnetic field strength, flux, and surface area.

The Animation window provides attractive visuals of Magnetic Field Flux and Current Frame Torque. These animations bring abstract concepts to life, enhancing understanding through dynamic and engaging visuals.

The program's Info window serves as a comprehensive theoretical resource, providing in-depth explanations and background information on the concepts of magnetic field flux and torque. It complements the interactive components and allows students to strengthen their basic knowledge [4].

Through its structured design and interactive features, this Android app enables students to actively learn and understand the magnetic field section of the physics curriculum, promoting engagement, conceptual clarity and key practical application. The use of this type of software creates a number of conveniences for the student.

Significance and Benefits: Designed to teach the magnetic field section in physics education, this program provides many opportunities to students. By incorporating technology and interactive learning, the program enhances the overall learning experience and promotes a deeper understanding of magnetic field concepts.

Another important advantage of the program is its convenience and flexibility. Being an Android application, it is easily accessible on mobile devices, allowing students to use it anytime and anywhere [6]. This flexibility allows students to learn at their own pace and revise program content as needed, strengthening their understanding and supporting individual learning preferences.

Visual images of the program, in particular, animations, help to improve the visualization of magnetic field phenomena and the observation of its network. The dynamic nature of animations helps students understand abstract concepts more easily, allowing them to develop a clear visual model of magnetic field flux and torque [8]. The shape component of this imagination enhances students' spatial thinking skills and deepens their understanding of complex electromagnetic interactions.

An Android application for teaching the magnetic field section provides important benefits such as increased student engagement, usability, and improved visual representation of concepts. Using technology and interactive learning, this program is an effective tool for educators to facilitate a comprehensive and engaging learning experience, resulting in improved student achievement in the study of magnetic fields. Because we all know that the magnetic field cannot be felt, seen or held in normal conditions [8].

Developing an Android application for teaching magnetic field is a thorough process aimed at creating an effective and engaging learning tool, with a thorough analysis of learning objectives and specific content related to magnetic field. helped define key concepts, formulas, and calculations to be included in the program.

School teachers mastering Android programs in sync with the times, developing their use in the course of the lesson, developing new didactic tools and popularizing the methods and methods of the teaching methodology will bring the physics teaching methodology to higher heights. we believe that it will come out and corresponds to the knowledge needs of schoolchildren studying magnetic fields [9].

In order to ensure the effectiveness of the program, experiments were conducted with a group of students and teachers. Their feedback will determine areas of improvement and fine-tuning of the program's functions. The collaborative efforts of teachers, developers, and students have played a crucial role in improving the program and adapting it to specific educational needs.

Another important aspect of the work combines user-friendly design and intuitive operation. The program is designed to have a clean and visually appealing interface that is convenient for school students. Usability testing is conducted to ensure that the software is intuitive and accessible to learners with varying levels of technological knowledge [7].

Discussion. Interactive learning is the central part of the program. Through the windows "Magnetic field" and "Rotating torque of a current frame", students actively perform calculations using the formulas provided. By taking certain opportunities, problems and missing forces, students develop their solution and magnitude, critical thinking, and gain a deeper understanding of the relationship between different variables in the interaction of the field [3].

In addition, the convenient interface of the program adds intuitive navigation to the development of learning. Pupils can pass calculations from them, perform calculations, which helps to develop independent learning and independent research [5, 6]. Saving the program on a mobile device allows students to engage with the material in their own program, which facilitates personalized learning.

By directly correcting and zooming in on quantitative data students' knowledge of quantity fields and programming formulas. Visual images, particularly animations, have been shown to be valuable for describing abstract appearances and deepening reproduction [7].

Incorporating technology, interactive learning, and visuals, the program offers a comprehensive and engaging platform for students to explore and visualize magnetic fields [9].

The program was validated through implementation and through analysis, it identified improvements in students' conceptual process and state implementation. The program's interactive nature and visuals, especially the practical application of theoretical knowledge developed by students, contribute to the creation of a distinctive difference, intuitive interface and user-friendly design [7].

In conclusion, the Android application for teaching the magnetic field section offers an innovative approach to physics education. Its structure, interactive features, and pedagogical approach prove to engage students, deepen conceptual understanding, and improve problem-solving skills. Combining technology and interactive learning, this program helps school students understand the subtleties of magnetic field concepts and develop their knowledge of the magnetic field.

At a time when the continuous use of digital knowledge and modern information technologies [11, 12] in educational activities is required to achieve the effectiveness of teaching subjects: how modern the teacher is in collecting, processing and teaching certain educational material it is important to know communication technologies and use them in the educational process. The difference of this program from other programs is that physical concepts, animations and calculation of formulas can be seen in one program itself.

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