Using Mobile Apps for Physics Teaching and Learning

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Abstract. Technological, Pedagogical Content Knowledge (TPACK) model is used as a conceptual framework to define knowledge domains that are required for teachers to successfully incorporate technology in the classroom. Smartphones represent the most accessible resource among the existing technological tools in Georgian schools, surpassing other gadgets, that are widely used by both teachers and students. Two mobile applications are selected for integration into the training module for physics teachers. The findings of presented study offer an opportunity to integrate modern technologies in teacher training programs. Recommendations will be elaborated to improve the physics curriculum, teacher training, and classroom activities.

Introduction

In recent years, the integration of mobile apps in physics teaching and learning has revolutionized the way students engage with and comprehend complex scientific concepts. These apps serve as dynamic and interactive tools, providing a personalized and accessible learning experience beyond the borders of traditional classrooms. Training module using two mobile applications - "Phyphox" and "Physics Toolbox Suite" is developed at Ilia State University. These applications work on both Android and iOS systems and are free of charge. The use of these applications will make physics experiments more interesting and understandable for the students.

Theoretical framework & research questions

The TPACK model (Technological Pedagogical Content Knowledge) is a conceptual framework that helps define domains of knowledge, which could help teachers integrate successfully to navigate the challenges of the teaching and learning by using technologies. [1]

The research questions are following:

1. What competencies should teachers possess to successfully integrate digital technologies into the teaching and learning process?
2. How do physics educators evaluate their own technological competencies in the teaching process?
3. What factors (internal and external) contribute to the successful development of high technological skills among physics educators?

Methods and findings

From the specificity of the research questions, a particular method - MMR (Mixed Methods Research) is chosen. Training module for Physics teachers "Integration modern technologies in physics teaching" is conducted at Ilia State University in Tbilisi, Georgia. Participant teachers are members of "Georgian Physics Teacher Association". In total, 11 physics teachers from different

regions of Georgia are selected for the trainings. Selection is done based on the motivational letters. Five training sessions are planned in total, three training sessions have already been conducted.

At the initial stage of the training sessions, focus groups and interviews with teachers were conducted. Research instruments were prepared based on the TPACK framework and designed based research [2] is used for the study.

Participant teachers are conducting experiments with the „Phyphox“and „Physics Toolbox Suite“ applications. „Free Fall” and “Rotational Motion of a Cylinder” are discussed and prepared for the physics lessons using Phyphox application by the participant teachers. Experiments in Electromagnetism and Optics are prepared with the use of Physics Toolbox Suite application. All training sessions are structured around discussions among the teachers.

To gather additional evidence for the study, video analyses of physics lessons that implement these applications are planned [3]. This will provide us with the opportunity to observe real-life scenarios and understand how physics teachers utilize technology in their teaching process. At the end of the training module focus group and interviews are planned. Based on the study results a new training module for the physics teachers using mobile applications will be developed. The final analysis of the research findings will be presented on a poster.

For the quantitative data collection, the TPACK questionnaire is utilized, with members of the Georgian Physics Teacher Association participating in this study. The questionnaire has been translated into Georgian and piloted specifically for this research. Quantitative data processing is scheduled for March-April 2024. The findings from the quantitative analysis will also be featured on the poster. Based on the preliminary results of the previous workshops, it can be concluded that the process is progressing successfully. Teachers’ technological competencies are already noticeable.

Conclusion

In the context of education in Georgia, the increasing role of technology in the teaching and learning process is highly significant. Mobile applications have emerged as a valuable resource, providing a user-friendly platform for accessing various tools. It is crucial to acknowledge that current research is not limited to physics, encompassing a broader array of scientific disciplines. This broad focus enriches our understanding across various fields of study.

Use of design-based research method gives us opportunity to create the module of teacher training, which equip physics teachers with the technological competences and PCK for using modern technologies in their teaching. After final analysis of study results, presented in this paper, recommendations can be made to improve the physics curriculum, teacher training, and classroom activities.

References

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