



Changes in the System of Pre-Service Computer Science Teachers Training in the Context of Global Digitalization: Mobile Applications both as a Learning Tool for M-learning and a Subject of Study

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Abstract

In the framework of global digitalization, we are forming digital society, digital economy, and digital education. Nevertheless, to enable all the members of our society to become freely oriented in the digital space in a short perspective, we must begin to prepare them since the very childhood. For these purposes it is necessary to rebuild school education, paying special attention to those who provide it – schoolteachers. In this paper, one option to improve the system of pre-service computer science teachers training is proposed (since computer science is the most “digital” subject). The author’s method described consists in expanding the role of mobile technology and is now being used at Moscow Pedagogical State University (MPSU). It is assumed that the ability to use educational mobile applications both as a learning tool (when implementing mobile learning technology) and the subject of study (the ability to develop such mobile applications that would be of high quality from a technical, didactic, methodological and UX design point of view, as well as to teach students to do this) will help computer science teachers be better prepared for the challenges of the digital society.

Keywords: *Digitalization, Pre-Service Computer Science Teachers Training, Mobile Learning, Educational Mobile Applications.*

1. Introduction

For our society to become truly digital, it is necessary to start preparing its members from the very childhood, primarily from school [4], [11]. The content of all school subjects should be reviewed per under the digital society challenges. But first of all, this should be done to computer science as the most “digital” school subject.

As known, one of the most powerful digitization tools is mobile technology. Therefore, the author sees the expansion of its role as one of the most effective ways to improve the educational system in the field of computer science. Digitalization and simplification of access to all information of the world accelerate all processes around. Therefore, all the skills acquired in the learning process should be as applied as possible. This means, for a better understanding, schoolchildren should receive a completed product as one of the learning outcomes. For example, it is good if when learning programming, they not only learn its basic principles, but also put them into practice, by creating application software, such as mobile applications.

Besides, not only the content of educational subjects, but also the teaching technologies do not stand still. For example, mobile learning is becoming an increasingly powerful tool that so successfully complements traditional forms of learning and makes such learning digital.

Thus, today’s schoolchildren should study computer science on the most modern examples and technologies (such as mobile applications development), and this should be done with the most modern educational technologies (such as mobile learning).

Accordingly, computer science teachers should be prepared for the digital society challenges firstly. Which means, according to the author, various aspects of the use of mobile technologies should become one of the directions for improving the system of their training.

2. Objectives

In this research work, the following questions are posed:

1. How to prepare pre-service computer science teachers for the digital society challenges faster?
2. How could mobile technology help to solve this problem?
3. What are the advantages of using mobile technologies both as educational tools and the basis of educational technology (mobile learning), and as a subject of study (mobile applications development)?



Thus, the main goal of this research is to improve the pre-service computer science teachers training system by teaching them not only the principles of mobile learning, but also the development of educational mobile applications as well as using them as learning tools.

3. Theoretical background

Many researchers work is devoted to the modernization of current teacher education system by digital society challenges [1], [2], [3], [9]. British scientists J. Traxler, A. Kukulska-Hulme, D. Laurillard pioneered and actively promote mobile learning [10], [12]. German scientists P. Hubwieser, A. Bollin, I. Diethelm pay great attention to the "restructuring" of the school informatics content in connection with digital society needs, and write about the need to improve teachers' digital competencies [8].

At the same time, none of the researchers currently offers any ways to combine the various aspects of the use of mobile technologies as a system in pre-service teachers training. It allows the author to talk about the novelty and relevance of this research work.

4. Current results

Currently, for 2 years now, a system of academic courses developed by the author for pre-service computer science teachers (students getting their undergraduate degree in Pedagogical Sciences with a Computer science major) has been implementing at the Institute of Mathematics and Computer Science of Moscow Pedagogical State University. The system consists of 3 disciplines:

- "Methods of Teaching Computer science" (where one of the sections is "Mobile Learning");
- "Object-Oriented Programming";
- "Educational Mobile Applications".

"Methods of Teaching Computer science" is a compulsory to study discipline, which forms the basis of the educational program on pre-service computer science teachers training. The section on mobile learning has been part of it before and was expanded by the author.

"Object-Oriented Programming" is also a compulsory discipline, since object-oriented programming is a part of the high school computer science program. In author's system, the discipline is improved by the fact that the basics of object-oriented programming are studied through mobile applications development. This means students not only get acquainted with the concepts and purposes of classes, methods and basic principles of object-oriented programming but also learn how to create a completed application software – mobile applications that can later be used in their professional activities (in teaching). Moreover, such students, becoming in-service teachers, will be able to teach schoolchildren the basics of object-oriented programming through the development of mobile applications, which will certainly increase children's motivation and help in educating new digital society members.

"Educational Mobile Applications" is an elective discipline developed by the author, which combines the two previous disciplines in terms of mobile learning, developing and use of mobile applications in education. Studying this discipline, pre-service teachers learn:

1. How to distinguish between learning mobile applications, educational mobile applications and non-educational mobile applications, as well as understand which of them can be used in the learning process at school.
2. How to search and analyze selected applications according to such criteria as content quality, usability and UX design, data security [7].
3. How to design and develop educational mobile applications that meet all the requirements of the educational system, usability, UX design and data security [6].
4. How to use mobile applications as a learning tool, create class notes and present such lessons to classmates, and then to schoolchildren.

As for the results, despite the fact the research work is still ongoing, at the moment, the following points can be distinguished as the results of described system implementation:

1. To date, 10 educational mobile applications developed by students of Moscow Pedagogical State University completed the course system have been published in Google Play mobile application store. In total, more than 50 mobile applications have been developed during this time, but most students would like to test their developments first with schoolchildren, then finalize them and only after share them.
2. Over the past 2 years, more than 15 bachelor's theses at the Institute of Mathematics and Computer Science of Moscow Pedagogical State University have been written on the topic of mobile learning, development or use of educational mobile applications.
3. The author published a school textbook on the basics of mobile applications development



“Mobile applications development. First steps” [5], which can be used both in computer science lessons at school and in additional education for schoolchildren.

4. Schoolchildren in 4 Russian schools (where students of Moscow Pedagogical State University who have completed the course system now work) now learn the basics of object-oriented programming through the development of mobile applications.
5. Refresher courses for in-service computer science teachers on this topic are being currently prepared at Moscow Pedagogical State University.

5. Conclusion

Thus, the use of mobile technologies as a means of teaching and a subject of study has already been included in pre-service computer science teacher training system at Moscow Pedagogical State University. As a result, it is possible to get more motivated schoolchildren and more prepared for the digital society challenges computer science teachers which is essential in the age of global digitalization.

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