ANALYSIS OF APPLIED MOBILE TECHNOLOGIES IN UNIVERSITY MATH EDUCATION

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Abstract

In the frame of higher education, mobile technologies can be considered as a significant and essential part of the lives of nowadays students. According to theories in sociology, people born after 2000 can be classified as members of the so-called “Generation Z”. Authors Joanne G. Sujansky and Jan Ferri-Reed claim in their book entitled “Keeping the Millennials”, that the current generation of young people is able to do multiple things at the same time, e.g. watch television while working on a laptop, listen to an iPod while chatting or texting messages etc. The young of today do not strictly differentiate between virtual and real experience and often want to have fun alongside work or learning. Today there is a wide range of mobile applications which can be used by students to learn math, and which offer the opportunity to use e-learning support through LMS, alongside with learning materials available as e-books, provided by many Universities. In the conducted research we were interested in finding answers to what forms of e-learning and mobile learning students use, how often do they use them, and what is their opinion on learning through mobile technologies. We have focused on the possibilities that mobile technologies offer to current undergraduates in learning mathematics. The research conducted in form of a questionnaire lasted for over two years and provides data from a sample of 782 undergraduates from the Czech Republic, Slovakia, Hungary and Romania.

Keywords: mobile learning, mathematics education, GeoGebra, mobile applications for education, quantitative methodology.

1 INTRODUCTION

In the frame of higher education, mobile technologies can be considered as a significant and essential part of the lives of nowadays students. According to theories in sociology, people born after 2000 can be classified as members of the so-called “Generation Z”. Authors Joanne G. Sujansky and Jan Ferri-Reed claim in their book entitled “Keeping the Millennials”, that the current generation of young people is able to do multiple things at the same time, e.g. watch television while working on a laptop, listen to an iPod while chatting or texting messages etc. The young of today do not strictly differentiate between virtual and real experience and often want to have fun alongside work or learning. Today there is a wide range of mobile applications which can be used by students to learn math, and which offer the opportunity to use e-learning support through LMS, alongside with learning materials available as e-books, provided by many Universities.

The Neumann Galaxy has been lived together with the Gutenberg Galaxy. These printed books and mobile devices has been frequently appeared in the applied version. One of the important proportion is based on assumption of a utilization by teachers and by students. The learner-centred pedagogy is one of the possible approaches; however, approaches of students can be advantageously analyzed. Focusing on types of mobile learning and talking, can be appropriate in a context of changes in the math classes. The balance between mobile learning and learning activities designed by a teacher should be found. The students of Neumann Galaxy are in a difficult situation. Students refers to university level students in considered cases. [1]

In the conducted research, finding the answers is analyzed with regards to the forms of e-learning and mobile learning by students. Further a frequency of its utilization sand opinions of its implementation should be more detailed analyzed. In this paper, research is focused on analysis of the possibilities that mobile technologies offer to current undergraduates in learning mathematics. The research
conducted in form of a questionnaire lasted for over two years and provides data from a sample of 782 undergraduates from the Czech Republic, Slovakia, Hungary and Romania.

2 THEORETICAL BACKGROUND

“If we want students to become smarter than a smartphone, we need to think harder about the pedagogies we are using to teach them. Technology can amplify great teaching but great technology cannot replace poor teaching” [2].

Today’s students’ needs were identified in six areas. The followings needs can be classified into 6 categories: Sharism, Shifting identities, Border-crossing, Literacies beyond print, A culture of gaming and A culture of bricoleurs.

“Particularly, it is not necessary to hide information. You do not have to stay in one place. You do not have to learn the tools; it is enough to use them. There is no need to be motivated, only to give room for learning. There is no need for a rigid curriculum, but rather a tangible experience” [3].

Mathematics is frequently being hated for its considered opinions about a difficulty and an incomprehensible. However, suitable changes to the right direction and mobile devices get a little gamification in the math learning, this subject will become likeable. Everyone, with the right teaching and messages, can be successful in math. According to researchers, there are a few children who have very particular educational needs, but the vast majority of them – about 95% - any levels of school math are within their reach. [4]

During mathematics courses, student can make use of digital technology in various ways:

- during numerical calculations so they can concentrate on the solution of the problem itself;
- for visualization, modelling and simulation of problems and thus to obtain such a graphical representation of the problem which pushes them towards a solution;
- as a source of educational materials e.g. e-books or videos, interactive educational materials;
- drilling exercises, a student can make use of electronic working sheets or e-tests to evaluate himself;
- they can use applications, such as: GeoGebra, GeoMatech, 3D Geometry, Wolfram Alpha, PhotoMath etc.
- teaching videos about problem solving [5].

Moreover, the Augmented Reality technology enables us to develop new learning methods for mathematics learning. We are talking about augmented reality when with the aid of an application on a mobile device virtual objects can be displayed in the space we can see in front of us. Thus, we create a bridge between reality and virtual reality with the help of which we can reach great influence on every generation and achieve extraordinary results. The term Augmented Reality (AR) was created by Tom Caudell, in 1990, while he was working at Boing, and it translates the integration of virtual images in the real world, i.e. the reality is augmented of virtual elements. The integration of such images is made by the use of Information and Communication Technologies (ICT), through a mobile device with a camera (computer, tablet, mobile phone with android or iOS operating systems) which allows the access to the available contents with AR. [6]

Currently, there are various online math learning possibilities. In this context, platforms and math applications frequently used for teaching and learning are researched in this paper too. These tools are used by a significant part of the respondents of the questionnaire. This problematic focused on mobile and used digital technologies in education, can be seen in [7]−[20].

3 RESEARCH AND ITS STATISTICAL ANALYSIS

Key questions of research:

In our research, we looked for the following research questions:

Do students use mobile devices for learning? If so, what exactly? Are you using math for learning? Is there a difference in the purpose of using the tools for students from the Slovakia, the Czech Republic, Hungary and Romania? What are the students’ opinions about mobile learning, about the inclusion of
mobile devices in mathematics learning, and how much do their teachers involve these tools in the teaching process? Do students say their teachers are encouraging the use of mobiles in the classroom?

*Implementing the research:*

We wanted to measure and analyse the use of mobile devices in mathematics learning for purposes of proving our assumptions, evaluation of possible surprises or achievement of conclusions. Across 4 countries, the most appropriate solutions were analysed using the online questionnaire methods.

*Process of research:*

In an online questionnaire research, we searched for answers from university students when using their mobile devices (smartphones and tablets). The questionnaire was available in two languages in Czech, in Slovak and Hungary language. In Romania, only respondents, which understood Hungary language at state borders, were asked.

*Evaluation of responses:*

For purposes of assumed analysis of applied mobile technologies in university math education, the quantitative research methods were applied on collected data from 782 respondents from the Czech Republic, Slovakia, Hungary and Romania.

The number of 94.6% respondents were females. Fields of a study were based on education in case of 91.6%. The following study fields were appeared as informatics, economics and technical fields in general. A form of a study was identified as 65% of full-time students, 30% of external students. 95% of respondents had own smartphone device. Possibilities of the utilization of smartphones or tablets were obtained as 89% for purposes of the online communication, 86% for email communication, 84% for a taking photos, 81% for communication using the social networks, 74% for a time-management of own work activities, 69% for the searching information, 62% for navigation, 45% for calculations and 49% for recording data during sport activities. 85.5% students used smartphone for learning purposes, 97.7% for the searching information during the learning, 67.9% for read purposes of study materials and 56.3% for the solving the math problems.

According to the research aims, following hypotheses were declared, as can be seen in Table 1.

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>Zero resp. Alternative Hypotheses Definition</th>
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| 1H         | $H_0$: "There are not statistical significant important dependences between the frequency of using the smartphone or tablet in education and a field of study."  
             | $H_1$: "There are statistical significant important dependences between the frequency of using the smartphone or tablet in education and a field of study."  |
| 2H         | $H_0$: "There are not statistical significant important dependences between the possibility of using the smartphone or tablet in education by teacher and a field of study."  
             | $H_1$: "There are statistical significant important dependences between the possibility of using the smartphone or tablet in education by teacher and a field of study."  |
| 3H         | $H_0$: "There are not statistical significant important dependences between the knowledge of using the GeoGebra system in education and a field of study."  
             | $H_1$: "There are statistical significant important dependences between the knowledge of using the GeoGebra system in education and a field of study."  |
| 4H         | $H_0$: "There are not statistical significant important dependences between the teacher’s approach of using the smartphone or tablet in education and a frequency of a utilization of wi-fi connection in school."  
             | $H_1$: "There are statistical significant important dependences between the teacher’s approach of using the smartphone or tablet in education and a frequency of a utilization of wi-fi connection in school."  |
| 5H         | $H_0$: "There are not statistical significant important dependences between the teacher’s approach of using the smartphone or tablet in education and a country of respondents."  
             | $H_1$: "There are statistical significant important dependences between the teacher’s approach of using the smartphone or tablet in education and a country of respondents."  |
Particular selected tests for purposes of testing the hypotheses [21] 3H-5H were dependent on the primary testing the normality of data [22]. If data fulfil the normality-data property, then method of Kruskal-Wallis should be used due to more than 2 items in a categorical variable. In the opposite case, ANOVA test should be used. In case of testing hypotheses 1H-2H, statistical methods were Chi-Squared tests, because both considered statistical variables had a categorical type [21]. In Table 2, obtained results of testing the considered hypotheses can be seen in the form of p-values. The significance value was determined as 0.05 belong to educational generally based research realizations. Whether achieved p-value is greater than or equal to this significance level, than the zero hypothesis is failed to reject. In the opposite case, the zero hypothesis is rejected in favour of the alternative hypothesis.

\[
\begin{array}{|c|c|c|}
\hline
\text{Hypothesis} & \text{Analyzed Items in Questionnaire} & \text{p-value} & \text{Conclusion} \\
\hline
1H & Categorical No. 4, Categorical No. 16, Using Chi-Squared Test & 2E-10 & \text{Zero hypothesis } H_0 \text{ is rejected in favour of } H_1 \text{ on } \alpha = 0.05 \\
\hline
2H & Categorical No. 4, Categorical No. 22, Using Chi-Squared Test & 7.5E-9 & \text{Zero hypothesis } H_0 \text{ is rejected in favour of } H_1 \text{ on } \alpha = 0.05 \\
\hline
3H & Categorical No. 4, Numbered No. 23g, Using Kruskal-Wallis Test & 2.3E-6 & \text{Zero hypothesis } H_0 \text{ is rejected in favour of } H_1 \text{ on } \alpha = 0.05 \\
\hline
4H & Categorical No. 14, Numbered No. 29, Using Kruskal-Wallis Test & 0.67 & \text{Zero hypothesis } H_0 \text{ is failed to rejected on } \alpha = 0.05 \\
\hline
5H & Categorical No. 3, Numbered No. 29, Using Kruskal-Wallis Test & 0.09 & \text{Zero hypothesis } H_0 \text{ is failed to rejected on } \alpha = 0.05 \\
\hline
\end{array}
\]

4 CONCLUSION

In the realized quantitative research, the utilization of own smartphones and tablets was proved according to the considered research questions. It was confirmed that students frequently use mobile devices; however, in other form as was assumed. Prediction of a number of respondents, which should significantly often use smartphones in mathematical education, was achieved in lower number. There were not identified any significant important differences across all considered countries. Using the statistical methods for the testing the hypotheses, hypotheses 4H and 5H were failed to reject on the significance level 5%. In the testing, whether there were statistical significant important dependences between the teacher’s approach of using the smartphone or tablet in education and a frequency of a utilization of Wi-Fi connection in school – similarities were identified. In the testing, whether there were statistical significant important dependences between the teacher’s approach of using the smartphone or tablet in education and a country of respondents – similarities were identified. Statistical significant important dependences were achieved between a field of study and: the frequency of using the smartphone or tablet in education, the possibility of using the smartphone or tablet in education by teacher and the knowledge of using the GeoGebra system in education.

REFERENCES


