

A SURVEY ON USE OF COMPUTERS IN MATHEMATICAL EDUCATION IN SERBIA

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Abstract. This paper examines the issues involved in using computer facilities and educational software GeoGebra in teaching mathematics. It documents them in the light of results of the surveys conducted during a six months period. We have interviewed 43 Serbian teachers during three different seminars about mathematical education. The results suggest that even though computers are present in Serbian schools, the use of computers and mainly the educational software GeoGebra are still not on a satisfying level.

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MSC Subject Classification: 97D40

Key words and phrases: Serbian teachers; teaching mathematics; computers; GeoGebra.

1. Introduction

The technology has been present in the history of mathematics education for a long time. For example, abacus is considered one of the ancient technical tools for mathematical calculations. Nowadays, the civilization has made a major progress in technology. Technology helps teachers to fulfill the expectations of today's education. Technology could never replace mathematics, much less the teacher; yet it should be a great remedy in the teaching and learning of the subject matters (Budinski and Takači [1]). To provide a strategy for the technology supported mathematical education, it is necessary to examine different segments of that process. Let us quote the National Council of Teachers of Mathematics [6], "technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning. Teachers' attitudes play an important role in using technology in teaching and learning mathematics". These words are kind of a guideline for the survey. We put our attention on the Serbian teachers' attitudes toward technology.

2. Goal

Initially, the end goal of the survey was to collect data that describes in which extent teachers in Serbia are using computers in mathematical classrooms. It was desired to investigate if the teachers use a computer only in preparation or in performing lessons. We inquired into the use of school computer facilities, as well. The use of the software GeoGebra was also examined because the use of this educational

tool is increasing worldwide due to its good features. Firstly, it is one of the leading mathematical educational software packages, due to its intuitive and user-friendly interface. Secondly, this open source software has features that combine geometry, algebra and calculus. Thirdly, the software can be used at all levels of mathematics education (Hohenwarter et al. [4]). Also, it is translated to Serbian language.

3. The survey

The survey was conducted at seminars in three mathematical centers: Kragujevac, Belgrade and Novi Sad. Mentioned seminars were dedicated to the mathematical education in general, and use of computers, in particular. They covered didactical innovations in teaching mathematics, professional development of teachers of mathematics in primary and secondary schools, application of computer as a teaching aid, connections between mathematics and other subjects, and mathematical modelling. The surveying began in January 2012 when the author interviewed 17 teachers at the seminar of the Serbian Mathematical Society in Kragujevac. The second part of survey took part in May 2012, in Belgrade, at the seminar that was organized by the Faculty of Mathematics. There were 14 teachers who took part in this survey. The third part was conveyed in Novi Sad, at the international conference CADGME, where 12 teachers were included in the survey.

4. Results and discussion

The length of teaching experience was the first fact that was determined. It is shown that interviewed teachers hold different levels of teaching experience. Numbers of years of their professional experience as teachers are shown in Figure 1.

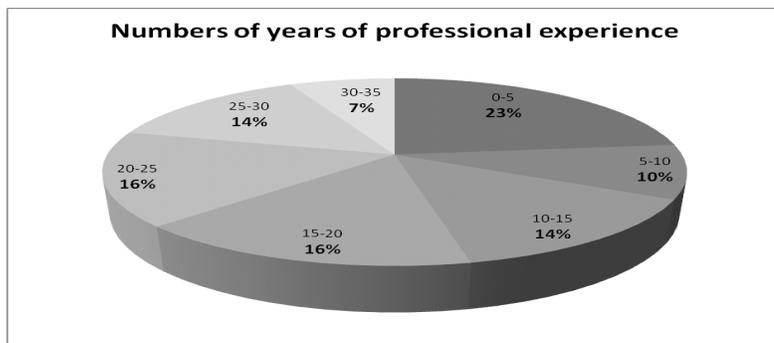


Fig. 1. Numbers of years of professional experience of examined teachers

It can be observed that the teachers with less experience were in majority. On the contrary, teachers with more than 30 years of experience were attending seminars in significantly smaller number. This fact could be explained with the statements of few “beginner teachers” that they felt a need to enrich their teaching skills at the beginning of their careers. One of the statements is presented

below. A teacher from seminar in Belgrade, with two years of experience: “As a result of participation in the mathematical education seminars, mathematics teachers gain different kind of experience, not only in theoretical didactics and methodic, but on how to prepare computer-based lessons and explore for interesting examples. Mathematical education has to be adjusted to the today students, who are computer-literate and require interesting lessons. While I only have two years of experience, seminars of this nature can help me a lot. I have gained rich theoretical knowledge about teaching during my studies, but real life situations require more. I find these seminars as a great remedy for the beginner teachers because of their positive influence to our practice”. Furthermore, the teachers were given a questionnaire with questions about computer usage during their teaching practice. The following questions were asked:

- Q1: Do you use a computer for lesson preparation?
- Q2: Do you use a computer for performing lessons?
- Q3: Do you have computer facilities in the school and do you use them?
- Q4: Do you use GeoGebra when teaching?
- Q5: Do you think that computers should be more present in mathematical education?

The questions were constructed on the basis of TPACK which stands for Technological Pedagogical Content (Mishra and Koehler [5]). We focused our research on technological contents. The teachers’ answers are given in Figures 2a and 2b.

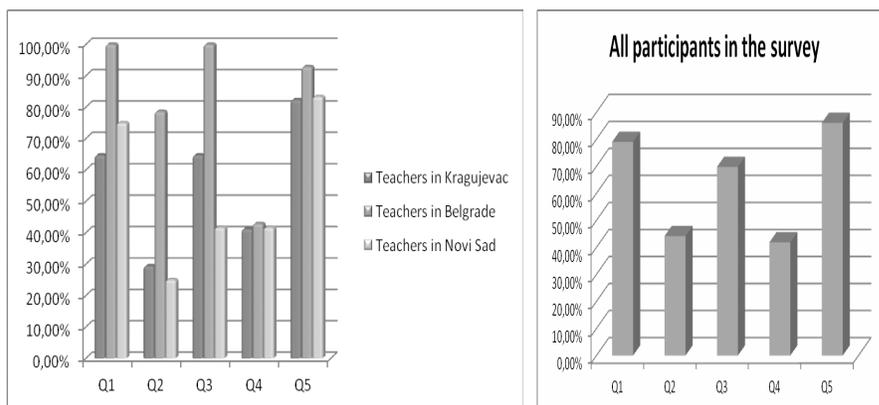


Fig. 2a and Fig. 2b. Survey results of computer usage

As it stands, it appears that teachers use computers more in their lesson preparation, but less in teaching. The final result is 79.07% versus 44.19%. According to teachers’ answers, it could be stated that there is a high percentage of schools in Serbia that have computer facilities. Fortunately, only a small number of 28.13% of teachers do not use it. On the other hand, the results of using of GeoGebra are different. The percentage of GeoGebra users is about 40%, uniform in all three centers: Kragujevac, Belgrade and Novi Sad.

Beside the questionnaire, the author discussed the issue of computer usage with teachers and recorded some of the answers. Because of a smaller ratio of users to non-users of GeoGebra, in the following text, we present some of the answers related to GeoGebra use. A teacher from seminar in Kragujevac: "I came to this seminar in order to experience new teaching ideas. I have downloaded GeoGebra to my computer, but I have not performed lessons with this software. The reasons are various, but I would like to emphasize the lack of didactical practice in using computers in teaching process". A teacher from seminar in Belgrade: "I use computers and especially GeoGebra in teaching on a daily basis. There is a wide range of materials that could be useful to teachers in preparing GeoGebra lessons. There are two GeoGebra institutes in Serbia and they offer different activities in order to increase GeoGebra use in classrooms". A teacher from seminar in Novi Sad: "Occasionally, I use computers in teaching mathematical contents. In my opinion, GeoGebra is very suitable for combining algebra and geometry. Unfortunately, it is not included in the curriculum. It is similar with other software. That is a reason why teachers hesitate to use computers, even though they are part of our everyday life. There is no clear strategy about computer usage".

From survey results, one could see that teachers have positive attitude toward computers, since 86.05% answered that computers should be more involved in mathematical education. Even though classrooms are equipped with technology and there is free educational software such as GeoGebra, teachers are not confident in using computers in performing lessons. Less than 50% perform their lessons with computers. The ratio of 55.81% of teachers who do not perform lessons with computers is about 16% higher than in the study of Dunn and Ridgway [2]. Since there is about two decade time distance from the study, results about teachers from Serbia who use computers while performing lessons are not favorable.

5. Conclusion

The progress in technology is not followed by the innovative technology-supported teaching. The transition to use of technology proved to be the major problem in contemporary mathematical education, as Freudental predicted in 1981 [3]. There might be various reasons. Teachers in the survey emphasized:

- urge for proper didactical training,
- curricula support and
- guidelines to enrich and improve teaching by technology.

Above mentioned seminars is good opportunity to gain didactical knowledge in computer use. It is a good starting point for teachers to share examples and ideas, gain experience and be up-to-date with technology development. Seminars are highlighting advantages of computer use, but also provide help for overcoming the disadvantages. Computer use in mathematical lessons should be officially supported by the curriculum. Otherwise, it is based on personal initiative of the teacher and not used effectively. The results in this paper could help in developing strategy of incorporating computers in mathematical classrooms.

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