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# AN OVERVIEW OF TEACHING MATHEMATICS IN SERBIA

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Serbia is a south-eastern developing European country with a population of 7 million. For children between the ages of 6 and 15 years education is free and compulsory, and for children between the ages of 15 and 19 years education is free but not compulsory. The school system consists of preschool (age 6 years), primary (divided in two four year cycles, the first for ages 7–11 and the second for ages 11-15 years), and secondary (ages 15–19 years) schools. This short review covers mathematics teachers in the second cycle of primary school and (all types of) secondary schools.

In the paper (Dimitrijevic S., Popovic B., Stanic M., 2012) the quantity and the quality of the computer usage in mathematics teaching in Serbia in both, primary and secondary schools was analyzed and estimated . It is important to emphasize that the qualifications of mathematics teachers in primary and secondary schools are the same (Master of mathematics).

Results of pupils from Serbia on relevant international tests.

Results that Serbian students achieved at relevant international tests, such as TIMSS (Gasic – Pavisic S., Stankovic D. 2012) and PISA (Pavlovic – Babic D., Baucal A. 2013) are lower than those achieved by their counterparts from developed countries. Lower results are more obvious in senior classes. Concerning mathematics competencies, deficiency was 45 points, which is equivalent to a year long period of schooling in OECD countries.

Factors that can potentially influence such results can be found in the quality of initial education and in-service teacher training, curriculum characteristics, students' motivation etc. Examining mathematics curriculums in the nations with the most successful students (Finnish Board of Education 2003, Finnish Board of Education 2004, Information Services Department, Hong Kong 2013, Ministry of Education – Curriculum Planning and Development Division, Singapore 2012), a common idea comes to the forefront: they all pay special attention to ICT use in knowledge acquisition, as well as in its rehearsal and applications. Therefore, it is crucial to ensure that our teachers have knowledge, skills and are willing to implement ICT in the instruction process.

Experienced and beginner teachers and their use of computer technology.

This work shows that computers are used insufficiently and inadequately in mathematics teaching in Serbia, both in primary and secondary schools. The main reasons for that are lack of knowledge (about appropriate software) and skills related to using computers, as well as lack of positive attitudes towards using ICT technologies in teaching, and, also, modest technical equipment in schools. Also, the teachers who use computers in the teaching process are significantly younger,

have better academic achievements and are readier to attend continuing education classes the once that do not use computers.

The first research of that study included 142 mathematics teachers with a professional license, 68 (47,89 %) from primary and 74 (52,11 %) from secondary schools. Their work experience ranged from 1 to 39 years; with the mean 17,16(±9,92) and the median 16.00 years.

The study in (Dimitrijevic S., Popovic B., Stanic M., 2012) covers teachers who have available computers in their schools. The situation is as follows:

– 94 (66,20 %) participants answered that they had a computer available;

– 32 (22,53 %) answered that they had a computer available, but they shared it with other users, which implies lack of possibility of qualitative usage;

– 16 (11,27 %) examinees answered that they did not have a computer available.

Although there is room for improving the issue of technical equipment, we have to conclude that the current level gives enough support for the use of computers in schools. Teachers mainly use computers as "clever notebook", i.e., only as storage of materials that can be reused or easily modified before some new use. Additionally, we see that 98 (69.01%) participants marked 1 or 4,but only 34 (23,94 %) use computers at an advanced level (which among the others means use of some kind of educational software).

Although CAS – Computer Algebra Systems, IG – Interactive Geometry and DGS – Dynamic Geometry Systems tools are the most effective and most desirable way of using computers in mathematics teaching unfortunately, that usage is quite rare, only 15 (10,56 %) of the 142 participants indicate that they use them. All these just corroborate our observation about inadequate use of computers in the teaching process.

The second study in this paper covered 123 beginner mathematics teachers – applicants for the professional license, 80 (65,00 %) from primary and 43 (35,00 %) from secondary schools. Since there is a single State professional licence Commission, we had examinees that graduated from various state universities (66 graduated from University of Belgrade, 17 from University of Novi Sad, 19 from University of Niš, 16 from University of Kragujevac, and 5 graduated from some other university) and who were working in all regions of Serbia (39 in Belgrade, 23 in Vojvodina, 30 in central and west Serbia, and 31 in south and east Serbia). Thus, the sample effectively represents mathematics teachers from all over the Serbia. The data regarding the age of the applicants: shows that the mean is 34,73(±5,73) and the median is 34,00.

From the data collected, we learned that 8 (6.50%) of the examinees did not use a computer at all (their lesson plans were written by hand). The marks, based on our opinion, for the 115 examinees who used computers for text processing are given in Table 2.

Regarding the connection between the use of computers in the teaching process and the university from which the examinees graduated we obtained the results presented in Table 5. But, according to Table 5, it seems that the university

attended does not play a crucial role in the quality of drawing figures and typing mathematical formulas.

The Chi-Square tests shows that both the quality of text processing and the quality of typing mathematical formulas are independent of the region of Serbia where novice teachers work:

The presented data and the analyses speak in favour of our previously mentioned opinion that the situation is unsatisfactory and overall the same in all schools in Serbia.

The presented data and analyses imply that teachers with higher academic achievements during their studies usually use computers in a more adequate way. This suggests, also, that the studies are the most important part of teachers' education, when a solid foundation for appropriate use of computers in teaching process must be established. We have to keep this in mind when developing curricula and/or university course programmes. Lin (2008) also recommends that mathematics teacher education programmes should be reviewed taking into consideration students' needs and also preparing future teachers for effective use of technology in mathematics teaching.

Another reason for bad situation in teaching mathematics in Serbia is a lack of positive attitude towards using digital technologies in teaching.

The first important result of our research is that the difference between computer use for private and professional purposes is too big, and the level of use for private purposes provides a possibility for a fast increase of computer use in the teaching process. In our opinion, the reasons for such a difference are the following: (1) from the teachers' point of view computer-based teaching is a kind of innovation bringing certain difficulties; (2) the teacher's role should no longer be that of a traditional lecturer. Therefore, teachers do not have a resistance to digital technologies at all, but it is obvious that they are not sure about the ways of implementing them in the teaching processes.

As it was expected, younger teachers are leading the way in using computers in the teaching process. Besides that, our studies show that the main impacts on the use of computers in the teaching process lie in the average marks during the teachers' course of study, as well as their dedication to continuing education. It can be observed that the level and the quality of computer use do not depend on the university from which the teachers had graduated or on the place of work (considering both, type of school or the region's development level).

The results obtained have further convinced us that teacher education is a strategically critical period during which improvements, i.e. effective integration of computers into the curriculum have to be made. Learning to teach mathematics with technology can be best completed when technology is integrated into the teacher education curriculum. Students with positive attitudes towards mathematical computer tools overcame initial difficulties when using such tools and progressed to more effective behaviours. During their education (both basic and continuing) teachers should be encouraged to develop the right attitude and become qualified to use newly developed digital tools for teaching. The term being qualified implies not only to providing teachers with opportunities to learn about

new technologies (knowledge), but also to learn about when and how to use them in teaching (skill).We see a possible solution in providing a wider range of topics directly related to school practice in didactics courses at teaching faculties which would help future teachers deal with multiple problems that they may encounter in their practice. Also, we suggest restructuring of the existing courses in such a way that they encourage the use of digital technologies which can improve the quality of teaching process.

Several years ago at some universities in Serbia a course named Educational Software was included in the mathematics curriculum. That course was intended to increase the interest for software packages, especially for CAS-IG tools, as well as to develop positive attitudes for using contemporary technologies in teaching. Students received examples of those parts of mathematics where the corresponding software packages could be applied in teaching. This decision will mostly influence, in our opinion, those future teachers, students who will graduate in the years to come; they will influence the change of the attitude regarding the use of digital technologies in the teaching process. Serious research which is to follow our graduated students in longer time period, if we talk about their professional work, may give the answers with greater accuracy about the questions being asked.