

Mathematics trainee teachers' attitudes to computers

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This study explores primary mathematics trainee teachers' attitudes to computer in mathematics education with an open-ended question which is a part of a survey. Survey was conducted with a self constructed "Using Computer in Mathematics Education (UCME)" questionnaire. Piloting, reliability ($\alpha=0.88$) and factor analyses have been performed. Sample is a total of 134 trainee primary mathematics teachers. Explorations of the responses to the question revealed different aspects of attitudes and give insights. Results show that the trainee teachers usually enjoy working with computer although they are able to do considerably minor works about mathematics. They stated that they can learn and teach mathematics effectively if they use computer better, even if they do not feel confident studying mathematics with computer.

Keywords: Computer-Based Mathematics Education, Trainee Teachers, Attitude

Introduction

Recently, with the developments and changes in education, primary mathematics teachers begin to receive training in computer, computer based mathematics education and educational technology. Teachers' understandings, explorations, views, attitudes, uses and reflections of the subjects on a new technology are important since it will influence their use of technology in classrooms. Mathematics educationalist express that technology is more influential than traditional approaches in education. It is generally accepted that it has effects on students' learning, achievements and affective dimensions. One of the developments in technology about mathematics education is computer (and educational software) which has to be used in mathematics classrooms. So, determination of trainee teachers' experiences, views and attitudes about computer may have important implications for mathematics education. In this context, teacher training courses have vital influences on students for their future conceptions and uses of computers in the classroom.

Literature review

NCTM (2000) identified the 'Technology Principle' as one of six principles of high quality mathematics education and technology, and considers it as an essential part in teaching and learning mathematics. It is accepted that mathematics teachers, not technological tools, are the key change agents to bring reform in mathematics teaching with technology (Kaput 1992, NCTM 2000). Yet, preparing teachers to use technology appropriately is a complex task for teacher educators. Waits and Demana (2000) argue that adoption of technology by teachers requires professional development that focuses on both conceptual and pedagogical issues, ongoing support in terms of "intensive start-up assistance and regular follow-up activities" and a desire to change from within the profession (p. 53, quoted from Garafola 2000).

The main purpose of using technology in teacher education is to lead to better teacher effectiveness and improved student learning. Thus, training of teachers with appropriate and sufficient proficiency is very important. Trainee teachers not only learn how to use computer (or technology), but also how to incorporate computer into their teaching.

However, earlier literature on technology and preservice teacher education indicates that teacher preparation programs were not adequately preparing their graduates to teach with technology (Strudler and Wetzel 1999, Thurston et.al 1997, Wang et. al. 2003) and they had not yet fully integrated technology into their programs for preparing teachers (Wang, et. al., 2003) all over the world. Similarly, in an attempt to address the current situation of technology and teacher education much of the literature states: most preservice teachers know very little about effective use of technology in education and leaders believe there is a pressing need to increase substantially the amount and quality of instruction teachers receive about technology (Wang et. al, 2003).

Regarding the possible reasons for this situation most of the research studies focus mainly on two factors: faculty of education related factors and preservice teachers related factors.

More recent literature shows that new developments and considerations are highly appreciated all over the world. "Teachers should use technology to enhance their students learning opportunities by selecting or creating mathematical tasks that take advantage of what technology can do efficiently and well—graphing, visualizing, and computing" (NCTM 2000, 25). NCATE (2008) highlights and sets standards very clearly: "Teacher education programs have to prepare candidates who can integrate technology into instruction to enhance student learning and be able to integrate technology into instruction effectively".

These reflections are also echoed in Turkey as well and is seen in the introduction of part of the new primary mathematics curriculum which starts with stressing rapid developments in technology and its effects on teaching, learning and communicating mathematics. It concludes the introduction with the consequence of the technology stressing the importance of estimation and problem solving (MEB 2007, 7). Especially, it mandates effective use of technology and refers to new opportunities that technology serves for mathematics education nowadays; including materials, calculators and computers. It points out the importance of software, Internet and other interactive programs and addresses some of them (ibid, 24 -25).

Method

Purpose of the study

The specific aim of the study was to investigate and explore preservice primary mathematics teachers' attitudes to computers that they have at the end of a preservice teacher education course with an open-ended question.

Survey

A survey was conducted with 'Using Computer in Mathematics Education (UCME)' questionnaire which was constructed by the researcher. The questionnaire was developed, piloted and reliability ($\alpha = 0.88$) and factor analyses were conducted (Dogan 2008). The final version of the questionnaire has three parts. The first part

consists of eleven multiple-choice questions about students' experiences with computers. The second part has thirty-nine Likert Scale type questions about computer use and attitudes of trainee teachers in mathematics education. The third part has a single open-ended question.

Sample

The sample was a total of 134 (75 female, 59 male) fourth year primary mathematics trainee teachers. This was a group-administrated questionnaire, and the researcher explained how to complete the questionnaire, thereby reducing any misunderstandings and ensuring 100% response rate. Subjects were especially encouraged to complete the open-ended question.

Data Analyses (investigations)

This paper reports explorations of responses from the sample for the open-ended question. The responses were analysed using qualitative techniques. The question is "What do you think about computer use in mathematics education? Please, can you explain in the lights of your own experiences?" A total of 61 students from the sample made valuable comments about the question. Thirty-nine students' responses have been investigated qualitatively. All the chosen responses were categorised. The students stated a total of 67 different views about computer use in mathematics education. These different views are about thirty-two different situations. Selected responses have been reported.

Results, explorations and discussions

Qualitative analyses of the responses revealed different aspects of preservice mathematics trainee teachers' attitudes to computers. The responses are especially helpful for observing the students' attitudes accurately. They help to develop an understanding of students' backgrounds which are very important on constructing attitudes to mathematics and computer.

Most shared comments are categorised as follows;

- the use and usefulness of computer in mathematics
- the necessity of computer in mathematics education,
- the department (that students had training) and lectures,
- enjoyment of computer and mathematics,
- misuse (limited use, uselessness) of computer,
- enjoyment and anxiety about computer and mathematics.

Most comments were about the use of, and usefulness of, computer in mathematics education. Several comments highlighted the use and usefulness of computers for learning different mathematics subjects. They usually underlined the importance of understanding mathematics subjects. The most commonly mentioned subject was geometry. Geometry was considered as a subject that the computer is very helpful for visualising and understanding shapes and figures.

..... I strongly think that computer helps to learn mathematics better, especially visualization needed subjects. It makes the learning process faster, effective and gives feedbacks immediately (female).

Several students thought that the computer is an effective tool that makes abstract subjects more concrete and understandable.

Computer makes abstract subjects concrete and helps them to be understood easily (female)

In particular, some students considered computers as a key instrument for uncovering facts in mathematics that may make mathematics more useful.

Logic of mathematics can be understood by using computer (female).

Even more, some of the comments were about the usefulness of computers in mathematics in general. Computers were appreciated as helpful and suitable items for mathematics.

I agree that computer is suitable for mathematics education (male).

I believe that mathematics can be taught better using computer (female).

All the more, some students generalised the subject to whole education and saw it as a necessary part.

Computer has definitely to be used in education. Since being a fascinating machine, it catches the attention of students to subjects (male).

Several students made a comment for a different purpose. For example, one of them distinguished computer-based mathematics according to its effects on different levels of achievement.

For me, computer based mathematics has different effects for different levels. It is important for fast calculations, carrying out operations in effective ways in academic purposes. It is important for visualization, concrete modelling and motivating students in primary schools (female)

Besides, some students found using computers constructive in mathematics lectures.

Taking mathematics lectures with computer is a good idea. I think it is constructive (male).

All of the above comments mostly appreciate the usefulness of computer in mathematics education. These comments may indicate that the students are more favourable to use computer in mathematics with more positive feelings, less anxiety and more self confidence.

While with the above comments, several students agreed that computers can be used successfully in mathematics and mathematics education with appropriate training and professionalism. Some suggested solutions for the problem. Suggestions usually concentrated on teacher training and the lectures.

In short we know mathematics and use of computer but we do not know how to combine them successfully. Teacher education has to have more lectures and real practices (male).

Various students suggested different solutions in the same direction as;

Computer based mathematics lectures could be more successful, if they include independent, individual practices and project works (male).

... computer based mathematics needs proficiency, effort and time... (female).

Several students did not feel themselves confident about their professionalism and ability in using computers. With the above comments, the source of this problem was usually seen to be ineffective and insufficient lectures during the training.

But I do not feel myself fulfilled. It makes me sceptic about effective use of computer in mathematics education (female).

I always have problems about my ability (knowledge) and using computer. That makes me cautious about using computer (female).

Several students were well aware of the fact that content of the lectures have to have constructive activities. They also argued evaluation and marking systems of the lectures.

... People are not interested teaching mathematics with computer. Only important point is pure success and public exams. These make computer useless in mathematics education. This fact forces teachers not to use computer and they concentrate only on exams (female).

On the other hand, a reasonably large amount of students have negative feeling about computer. Some of the students argued that using computers in mathematics and mathematics education is useless or nonsense activities. Some thought that computers have limited use or misuse. Some others saw it as a time consuming activity and not important in mathematics.

Computer based mathematics is just nonsense. We spend lots of time for nothing (female).

It is not necessary to use computer in every mathematics subjects, it can be used for limited purposes. If it is forced, students may not learn mathematics properly (male).

A student compromises different situations like paper and pencil works.

... I do not like computer. I like doing paper and pencil operations in mathematics and thinking logic sides of mathematics. That is why I do not like computer (female).

Some definitely believe that mathematics can be taught better without computer.

I do not think computer has much importance in mathematics education (female).

Computer started to seem as a rescuer in mathematics education. This is not true. I claim that mathematics can be taught and learned without computer (male).

Conclusion and recommendations

Although the preservice primary mathematics teachers were largely positive about computer based mathematics, they were not happy with the education at the department. They argued that the training they have received was not satisfactory for computer based mathematics. They agreed that mathematics lectures involved very few computer based activities. These activities were usually based on basic typing and presentation software. They were well aware of the fact that the activities for computer based mathematics education should be more than the usual computer and mathematics lectures. They have to combine computer and mathematics including special tools, software, activities, practical works, projects etc.

They usually declared that they are enthusiastic about teaching mathematics with computers and will be very happy to get any opportunity to do so. Although the students' appreciation of computers seems to be a good point, explorations also reflect some views that still problematical. Training of the primary mathematics teachers and ways of getting knowledge about computer has to be involved in formal training process with all necessary and supportive activities. Thus, teacher education has to have more effect on construction of the knowledge about computer. Departments have to have facilities not only for common use and basic needs for lectures, and also access, facilities and supportive environments for individual uses of student that are necessary for preparing professional teachers. Thus, teacher education has to have more effect on construction of the knowledge about computer. Different activities, such as Internet use, doing practical works, projects etc. have positive effect on

appreciation and use of computer. Thus, providing purposeful activities may increase students' views, performance and confidence about the context.

However, most of the students feel comfortable working mathematics with computer. Still, they do not feel more comfortable using computer in mathematics. Thus, they may wish to work mathematics with computer, but some of them still resistant to use it in mathematics.

Some of the preservice teachers stated that they are not going to use computer when teaching mathematics. Similarly, several of them see using computer in mathematics as useless, or time consuming activity. This seems to be an obstacle for using computer at teaching. This issue has to be solved during teacher training.

References

- Dogan, M. 2008. Trainee Teachers' Views About Computer In Mathematics Education. 8th International Educational Technology Conference. 6-9 May 2008, Eskişehir, Turkey. <http://www.ietc2008.anadolu.edu.tr> last accessed August 15, 2008.
- Garofalo, J., H. Drier, S. Harper, M.A. Timmerman and T. Shockey. 2000. Promoting appropriate uses of technology in mathematics teacher preparation. *Contemporary Issues in Technology and Teacher Education*, 1(1): 66-88.
- Kaput, J.J. 1992. Technology and mathematics education. In *Handbook of research on mathematics teaching and learning*, ed Grouws, 515-556. New York, Macmillan.
- MEB (Ministry of National Education). 2007. *Primary Mathematics Curriculum*. <http://ttkb.meb.gov.tr> Last accessed March 21, 2008
- NCTM (National Council of Teachers of Mathematics), 2000. *Principles and Standards for School Mathematics*. Reston, VA: Author. www.nctm.org
- NCATE (National Association for Accreditation of Teacher Education), 2008. *Professional standards Accreditation of Teacher Preparation Institutions: The Standard of Excellence in Teacher Preparation*, <http://www.ncate.org/documents/standards/NCATE%20Standards%202008.pdf> Last accessed March 17, 2008
- Strudler, N. B. and K. Wetzel. 1999. Lessons from Exemplary Colleges of Education: Factors Affecting Technology Integration in Preservice Programs. *Educational Technology Research and Development*, 47(4): 63-81.
- Thurston, C.O., E.D. Secaras and J.A. Levin. 1997. Teaching Teleapprenticeships: an Innovative Model for Integrating Technology Into Teacher Education. *Journal of Research on Computing in Education*, 29: 385-391.
- Wang, A., Coleman, A., Coley, R, Phelps. 2003. *Preparing Teachers Around the World*. Princeton, ETS.