MATHEMATICS TEACHERS AND NEW TECHNOLOGIES
A CASE STUDY IN DODECANESE ISLAND SCHOOLS

Marinos Andreas* & Avgerinos Evgenios**
Mathematics Education and Multimedia Laboratory
Department of Education
University of Aegean
Dimokratias 1, ave
Rhodes, GREECE
*****marinos@rhodes.aegean.gr, ******eavger@rhodes.aegean.gr

ABSTRACT

This study examined teachers' mathematics interest to achieve educational technology standards (INTEREST) in terms of their computer attitude (ATTITUDE), computer experience (EXPERIENCE) and the professional support to achieve these standards offered to them from their institutions (SUPPORT).

INTRODUCTION

ICT can be used to reinforce teacher-centered practices as well as to facilitate educational change. In fact, even today, many people regard the teacher's role as one of providing pupils with information, controlling the discourse and managing the class. But curriculum documents increasingly advocate the teachers' role as one of creating stimulating learning situations, challenging pupils to think, supporting their work, and encouraging diversification of learning routes. Therefore, pre-service teachers must develop not only various technical competencies but also a sound educational perspective regarding the use of ICT in the mathematics classroom (Ponte, Oliveira Varandas 2002).

Being challenged with the required transition from teacher-centred, lecture-based teaching to student centred, technology-based learning, today's educational reforms call for successful technology-supported teacher education programmes (see, for example, Unesco, 2002).

The work was undertaken exclusively with the opinions of newly appointed mathematics teachers, on if and how they used computers in their work.

Research questions: If mathematics teachers of all ages used computers in their work and if so, what kind of use did they select for them to do.

Hypothesis of the research: We consider that all teachers use computers in their teaching. They also use them to organize their work and to create better conditions for their teaching (data bases, presentations, updating on developments in the science of mathematics and so on).

Limits of the research: The research took place in 8 schools in schools of Dodecanese Islands, and was mostly qualitative. It was an attempt to give an indication of the preferences of New Technology for Mathematics teachers.

THEORETICAL FRAMEWORK

One obstacle relates to prospective teachers' welldocumented resiliency toward changing their views of effective pedagogy (cf., Cooney, Wilson, 1993, Hiebert, 1986; Bower, Doerr 2001, Thompson, 1992). A second difficulty is that, as learners, prospective teachers are often content with what may be superficial understandings of deep mathematical concepts. Once they have formalized a procedure, it is difficult to re-visit the underlying concept for deeper understanding (Bower, Doerr 2001, Hiebert & Carpenter, 1992). As teacher educators, we would like preserve teachers to realize that fragile mathematical understandings are inadequate when teaching mathematics in ways that support more meaningful understanding. Our approach to challenging and perhaps changing prospective teachers' understandings of mathematics and effective pedagogy was to design novel computer based activities that would elicit dissonance between what was expected and what occurred on the computer screen, and then to discuss how this dissonance could promote reflection and learning. The goal of our study was to investigate two questions:

1) How do prospective teachers, acting in the role of *students*, and think about mathematics in the context of their course work?

2) How do prospective teachers, acting in the role of *teachers*, and think about mathematics using an exploratory way during tutoring sessions with young children? (Bower, Doerr 2001)

The Internet may be regarded as a "metatool" where one can find information about new developments in mathematics and mathematics education. Also one can find software, sample tasks for pupils, ideas for the classroom, reports of experiences, and news about meetings and other events. In addition, the Internet allows for the dissemination of personal productions such as texts, images, video sequences, applets, and hypertext documents.

Rendering synchronous and asynchronous communication possible, it is a very useful tool for collaborative work. Facilitating and stimulating personal interactions, the Internet supports human development in the personal, social,

cultural, recreational, civic, and professional dimensions. It is an essential working tool in present days, playing an increasingly important role in education. Pre-service mathematics teachers need to be acquainted with the potential of ICT for mathematics teaching and to develop confidence in using it. (Ponte, Oliveira Varandas 2002)

There is no doubt that it is important to examine the integration of technology in day-to-day teaching/learning with respect to some ET standards (see Barron, Kemker, Harmes, & Lalaydjian, 2003 Kadijevich, Haapasalo 2008), but to understand the extent to which this integration has taken (take) place and improve the matters (if need be), we need to search for critical variables influencing it. Research has evidenced that:

(a) student teacher's intention to use educational technology is in.uenced by perceived usefulness of that technology not by his/her subjective norms concerning it (Ma, Andersson, & Streith, 2005 Kadijevich Dj, Haapasalo Len 2008)

(b) student teacher's interest to achieve ET standards is primarily influenced by his/her computer attitude not by the institutional support concerning this achievement offered during his/her university study (Kadijevich, Haapasalo, & Hvorecky, 2005 Kadijevich, Haapasalo 2008); and to develop student teacher's interest to achieve ET standards, the institutional support concerning this achievement offered during his/her university study should focus on developing his/her computer attitude (Kadijevich, 2006). Bearing in mind that computer attitude and computer experience are related (Kadijevich, 2000 Kadijevich Dj, Haapasalo Len(2008) as well as that, as suggested by Russell, Bebell, O'Dwyer, and O'Connor (2003), computer experience may influence student teacher's interest to achieve ET standards, this study examined this interest in terms of computer experience, computer attitude and the institutional support offered, searching for ways that let us improve the interest.

Wilson (1997) accounts the goals of using New Technologies while teaching Mathematics.

Goal 1. Promote innovative practices in the tool uses of technology in mathematics teaching and learning

- To use technology tools to model and demonstrate standards-referenced mathematics content and pedagogy.
- To enable mathematics teachers to experience and enhance school mathematics using various technology tools for exploring real world applications, engaging in problem solving and problem formulation, and communicating about mathematics investigations.
- To use technology to develop an appreciation of the distinction between demonstration and proof in mathematics and to emphasize the value of each in the understanding of mathematics.
- To use technology tools to engage in mathematics explorations, to form mathematics ideas, and to solve mathematics problems

- To use technology tools to construct new ideas of mathematics for yourself.
- To engage in mathematical investigations using software applications.
- To use general tools such as word processing, paint programs, spreadsheets
- To facilitate investigations and communication about mathematics

Goal 2. Revitalize mathematics teaching and learning by modeling, then applying, innovative technology-enhanced approaches.

- To develop effective mathematics demonstrations using appropriate technology tools.
- To engage in some independent investigations of mathematics topics from the school curriculum or from mathematics appropriate for that level.
- To enable better communication of mathematics ideas that arise from technology enhanced investigations.

Goal 3. Support reform of mathematics teaching and learning mathematics classrooms.

- To enable mathematics teachers to develop and adapt materials and goals from standards based curriculum through the use of technology.
- To model and explore collaborative instructional strategies.
- To develop mechanisms and expectations of sharing instructional ideas, materials, and information among mathematics teachers.
- To disseminate information supporting comprehensive standards-based school mathematics curricula and the implementation of Quality Core Curriculum objectives.
- To realize the use of technology tools in the implementation of alternative assessment strategies.

Goal 4. Establish the human and technological infrastructure needed to sustain meaningful reform of mathematics instruction.

- To develop comfort and confidence in the use of technology by mathematics teachers. as they explore, practice, reflect, and become in technology-enhanced teaching and learning of mathematics
- To enable and encourage mathematics teachers to collaborate by using technology support.
- To support professional development opportunities for mathematics teachers and other key personnel through a network of peer teachers.

Some of the uses of software in the teaching of mathematics are for the presentation of Graphing Tools. Graphics programs of enormous sophistication are available to support middle-grades mathematics programs. We opt for the use of the spreadsheet and the hand-held calculator for part of graphing activities and building connections to data display.. Function graphing environments such as Theorist, Mathematica, Maple, or MatLab are available, but likely too sophisticated for middle grades use. The "graphic calculator" software bundled with PowerPC computers provides useful functions and relation graphers with simple animation.

Dynamic Geometry. Dynamic geometry programs (such as Geometer's Sketchpad, Cabri, or Geometric Supposer) provide exploration tools with rich potential for the middle grades. The can be used to explore relationships of and among geometric objects in a plane. Geometer's Sketchpad (Jackiw, 1992) is our tool of choice, but the problems we develop should be explorable with any software that allows the manipulation of geometric objects depicted on the computer desktop.

Communication Tools. A range of communication tools include word processors, (e.g. Microsoft Word, Clarisworks, etc.), spreadsheets (e.g. Microsoft Excel, Clarisworks, etc.), Internet browsers (e.g. Netscape Navigator, Microsoft Explorer, etc.), web page tools (e.g. Adobe PageMill, Netscape Gold, Clarisworks HTML, etc.), E-mail (e.g. Netscape Mail, Claris Mail, Eudora, etc.), and other utility software. There are also Spreadsheet type programs. Workshop and follow-up activities will not focus on using a spreadsheet per se, but rather doing mathematics problems where the spreadsheet can enable and reinforce investigation, conjecture, and problem solving. Microsoft Excel is widely available, but other general purpose applications, such as Clarisworks, provide good spreadsheet functionality to support middle-grades mathematics. Software Tools :The software tools are of several types. The emphasis is on functionality and recognition of use across computer platforms versus platform-specific applications. Some technology tools will be used primarily for mathematics exploration; others will be for communication and presentation (Wilson J)

Questionnaires were given out to 24 Secondary School teachers, all of whom were in service to the public education service.

They were aged from 25 to 51 years old, and the research took lace in 8 schools, mostly Senior Secondary Schools in an island city.

Teacher age (in years)	25-35	35-45	45-51
Years of using New tehnologies	10	7	7

Table 1:Comprehension of the material used in the questionnaire

The development of its elements took place with the help of Excel Experience was measured by a short questionnaire collecting data about total experience regarding the following six activities: Internet search, text processing, work with spreadsheets, making presentations, work with databases and programming. Attitude was measured computer attitude scale.

Questionnaire

Initially they were given some general elements related to the profile of the respondent. These questions referred to gender, specialty of studies, special studies on computers, and if they used computers in their work. The questions were divided into subject units.

1.If you could probably teach myself most of the things I need to know about computers.

2.If you could probably teach Internet search, Work with text processor (e.g. Microsoft Word or other similar program, Work with spreadsheets (e.g Microsoft

Excel or other similar program, Making presentations (e.g Microsoft Power Point or other similar program) Work with databases (e.g. Microsoft Access or other similar program), Programming

3. If training is needed, and what kind of training is needed in order to better teach mathematics.

4. Lastly we asked them to tell us if they used the computer to collect data or to solve problems.

Results

From the results of the research it emerged that mathematics teachers in general terms have a positive attitude towards New Technology. The majority of teachers use computers. They use them in order to be able to communicate, to write or to calculate. There is differentiation according to age. In the following diagram (figure 1)we observe that the younger teachers all use computers, mostly for Internet search, work with a word processor and work with spreadsheets. They do not use Presentations because they do not know the software. The mathematics teachers who use computers would like to be trained in the use of Mathematica, and Sketchpad to facilitate their work.

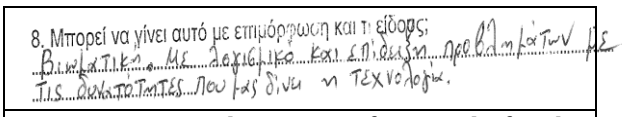

Figure 2. Time plays a significant role for the majority of teachers, so for this reason they propose use of the new Technologies

This need was mostly seen in the 35-45 age groups. The younger teachers did not have this desire, logically enough, since they had been taught the software at university.

There is also an important deficiency in the specific example of the use of presentations PowerPoint, and it is recommended that any teacher training should include the use of New Technology. Teachers consider that there would be improvement in their teaching work if this had more knowledge of computers. They even consider that the applications which there are in Microsoft Office increase their productivity (87%).

Teachers aid in their own learning by a tour of the Internet and the collection of information which has to do with mathematics.

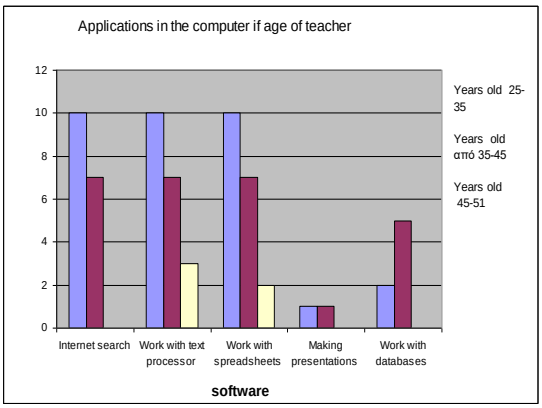

Figure 1

A small number use discussion forums on mathematics on the internet. 17% of mathematics teachers mention that they make use of Wikipedia to get information.

CONCLUSION

The preparation of secondary mathematics teachers who are able to use technology to enhance students' learning of mathematics is not a trivial matter. Computer need to develop technology skills, enhance and extend their knowledge of mathematics with technological tools, and become critical developers and users of technology-enabled pedagogy. The creation of guidelines and materials represents a starting point in our efforts to prepare computer to use technology appropriately. The use however is narrow, focusing mainly on putting content, basic software. Use of computer for teaching of skills such as information literacy, problem solving and critical thinking was infrequent (as were student driven purposes such as peer assessment). These positive dispositions toward computers are important enabling teacher for use. There is consensus about the value of computers. Teacher are overwhelmingly positive about the benefits of computers, both generally and particularly, for teaching and learning. These positive dispositions toward computer are important enabling factors for use. Teachers mathematics were inadequate technology pedagogical issues lack of time to develop or adapt computer materials, and integrating technology into courses and their own small education.

REFERENCES

Barron, A. E., Kemker, K., Harmes, C., & Lalaydjian, K., *Large-scale research study on technology in K-12 schools: technology integration as it relates to the national technology standards,*
Journal of Research on Technology in Education, 35, 489–507, 2003.

Bower, Doerr, A*n analysis of prospective teachers' dual roles in understanding the mathematics of change:Eliciting growth with technology*
Journal of Mathematics Teacher Education Kluwer Academic Publishers 4: 115–137, 2001.

Cooney, T. J. & Wilson, M. R. *Participants' thinking about functions: Historical and research perspectives.* In T. A. Romberg, E. Fennema & T. P. Carpenter (Eds.), *Integrating research on the graphical representation of functions* (131–158). Hillsdale, NJ: Erlbaum 1993.

Hiebert, J. & Carpenter, T. P. *Learning and teaching with understanding.* In D. A. Grouws (Ed.), Handbook of research on mathematics teaching and learning (65–97). New York: Macmillan ,1992.

Hiebert, J. (Ed.) *Conceptual and procedural knowledge: The case of mathematics*. Hillsdale, NJ: Erlbaum 1986.

Jackiw, N. The Geometer's Sketchpad (Version 3) [Computer Software]. Berkeley, CA: Key Curriculum Press, 1991.

Kadijevich Dj, Haapasalo Len, *Factors that influence student teacher's interest to achieve educational technology standards* Computers & Education 50 262–270, 2008

Kadijevich, Dj. Achieving educational technology standards: the relationship between student teacher's interest and institutional support o.ered. Journal of Computer Assisted Learning, 22 (in preparation), 2006.

Kadijevich, Dj., Haapasalo, L., & Hvorecky, J. *Educational technology standards in professional development of mathematics teachers: an international study.* The Teaching of Mathematics, 8, 47–52, Retrieved 31 May 2006 from http://elib.mi.sanu.ac.yu/journals/tm/ ,2005.

Ma, W. W., Andersson, R., & Streith, K.-O. *Examining user acceptance of computer technology: an empirical study of student teachers.* Journal of Computer Assisted Learning, 21, 387–395, 2005.

Ponte J, Oliveira H and Varandas J , *Development of pre-service mathematics teachers' professional knowledge and identity in working with information and communication technology,* Journal of Mathematics Teacher Education Kluwer Academic Publishers. 5: 93–115, 2002.

Russell, M., Bebell, D., O'Dwyer, L., & O'Connor, K. *Examining teacher technology use: implications for preservice and inservice teacher preparation.* Journal of Teacher Education, 54, 297–310, 2003.

Thompson, P. W. *Notations, conventions, and constraints: Contributions to effective uses of concrete materials in elementary mathematics.* Journal for Research in Mathematics Education, 23, 123–147, 1992.

UNESCO Information and communication technologies in teacher education: A planning guide. Paris, 2002.

Wilson, B. G. *"Reflections on Constructivism and Instructional Design."* In C. R. Dills and A. J. Romoszowski (eds.), *Instructional Development Paradigms* (pp. 63–80). Englewood Cliffs, N.J.: Educational Technology Publications, 1997.