

Educating teachers in a technology rich environment – Does it make a difference?

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The current study accompanies a four-year project offering an integrative program for teacher education, emphasizing interdisciplinary learning in technology rich environments, as part of lifelong professional development. The theoretical framework of our study is based on three interrelated ideas: constructivism, activity-based learning and distributed cognition. The aim of the study is to investigate the impact of a constructivist teacher education curriculum, including e-learning and exposure to ICT environments, on the student-teachers both as learners and as teachers. A mixed method comprised of qualitative and quantitative tools was used to achieve both a broad coverage and an in-depth inquiry of the research aim. Analysis of the data indicates that learning in a constructivist technology rich environment promotes teaching in such environments, although a long term experience time is needed for that.

Context of the Study

The context of this study is a four-year project offering an alternative program for teacher education. This program emphasizes interdisciplinary learning in technology rich environments, as part of a professional development process beginning in the teacher training stage and continuing throughout the professional teachers' career. Its aim was to design and activate an alternative innovative learning environment for teacher education based on five main components: A lifelong professional development, an inter-disciplinary orientation to curriculum, an inter-trajectory orientation, inquiry as part of the program and learning in technology rich environments. The aims of the study were: 1. to investigate the impact of a constructivist teacher education curriculum, including e-learning and exposure to ICT environments, on the students both as learners and as teachers 2. to check whether learning in a technology rich environment promotes teaching in a technology rich environment.

Theoretical framework

Recent studies of ICT environments in teacher education focus mainly on the difficulties in establishing such environments (Wedman & Diggs, 2001; Schaffer & Richardson, 2004). Our study is based on theoretical analyses of learning within ICT supported environments focusing on three interrelated ideas: constructivism, activity-based learning and distributed cognition.

Constructivism in technology rich learning environments emphasizes active learning of constructing knowledge focused on thinking skills and social negotiation. (Savery & Duffy, 1995; Mor, 1999; Heilweil, 2002 ; Zeller Mayer et al, 2004).

Inspired by activity theory (Engeström, 1999) Jonassen (2000) believes in engaged learning processes in technology-based environments and recommends using "computer applications as cognitive tools" because they are "developed to function as intellectual partners with the learner" (p.45).

The contribution of the distributed cognition approach focuses on the distributed nature of cognitive phenomena across individuals, artefacts and social structures. Wilson and Ryder (1998) describe technology-based environments as Dynamic Learning Communities (DLCs), characterized by distributed control and autonomy of community members, who share new knowledge through dialogue, interaction, collaboration and flexible learning activities.

The above conceptual framework has been applied to e-learning curricula by designers of e-learning environments (e.g., Wilson, 2001a, b), who take advantage of internet tools to incorporate a number of supports for community and social cohesion into academic courses. Jones (2003) notes that, to a large extent, the tools, educational theories and pedagogic constructs already exist. However, as a whole, teachers are as yet insufficiently trained to construct such environments in their classrooms or to lead the necessary curricular change in their schools. In order to achieve this, teacher education programs have been encouraged to include technology as a pervasive part of teaching (e.g., Queitzsch, 1997; Mor, 2001). The present study examines the extent and the quality of the impact of those environments on 48 student teachers.

Research Design and Procedures

A mixed method comprising qualitative and quantitative tools was used to achieve both a broad coverage and an in-depth inquiry of the research aim. Creswell's sequential explanatory design strategy was used (Creswell, 2003 p.112).

Quantitative data was collected from questionnaires filled in by students (n=48) on four different occasions during the course of the program: beginning of first year, end of first year, end of second year and end of fourth and last year. The questionnaire was constructed for the purpose of the present study and measured the students' beliefs about integrating technology in the program for teacher education. The data collected in the first questionnaire underwent a free varimax factor analysis with orthogonal rotation to identify the main clusters of beliefs and to characterize types of students with regard to the effect of ICT; a one way ANOVA analysis with post hoc comparisons was administered to examine the developmental changes throughout the four years of the program.

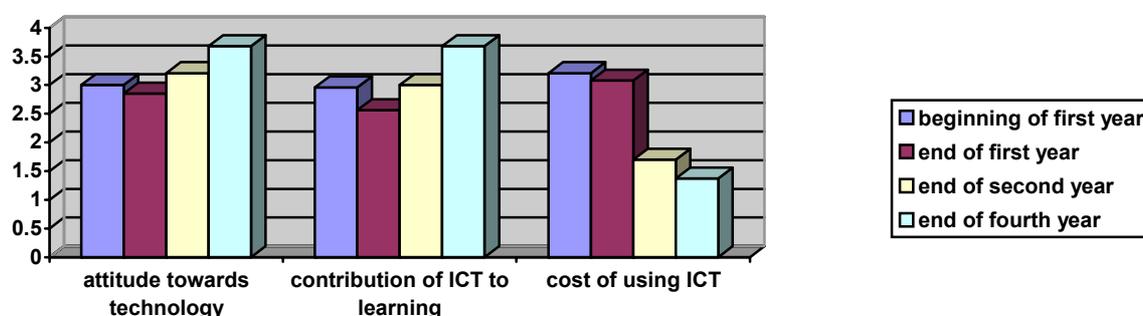
Qualitative data which was collected from texts, log diaries, lesson plans, observations and interviews underwent a content analysis in the grounded theory method (Titscher, et al, 2000). The categories found were compared with the categories found in the factor analysis of the questionnaire. This analysis enabled a deeper understanding of the student teachers' concepts of and attitudes towards ICT in learning and teaching, the extent and expertise of their use of ICT and their abilities to use ICT for both learning and teaching. In addition four case studies were administered, based on types of learners characterized by the first questionnaire.

The validation of the findings included the triangulation of the various data sources and the reciprocal relationship between data and theory.

Results

Analysis of the questionnaires using a free varimax factor analysis with orthogonal rotation yielded three factors accounting for 61% of the total variance: attitudes towards technology (e.g., I feel upset when asked to work with a computer), pedagogical benefits of ICT (e.g., I believe computer technology promotes learning), and perceived cost of using ICT (e.g. Using computer technology is time consuming). Interesting changes in the three factors occurred throughout the four years of the program, as seen in figure 1.

Figure 1: Average measurements of the factors in four measurements



The means of the four measurements revealed U shape pattern of change with regard to the first two factors: attitudes towards technology and pedagogical benefits of ICT and a constant decrease throughout the four measurements with regard to the third factor, perceived cost of using ICT. Student teachers do not find technology contributing to their learning and teaching during the first year of the program; only after a year of using ICT and getting acquainted with digital tools do students begin to appreciate computer contribution, and consequently, their attitudes towards technology change again. The U shape pattern of the factors “attitudes towards technology” and “pedagogical benefits of ICT” indicate a decrease during the first year and a gradual increase between the end of the first year and the fourth year. The cost of ICT decreases significantly between the first and fourth year of their studies.

Qualitative findings support the quantitative ones: Student-teachers reported on a change in their attitudes towards ICT; the massive presence of technology in their personal and professional life from the very beginning of the program aroused rejection to digital environment; only after a semester the rejection decreased. In addition Student-teachers reported about including digital components in their lesson plans and even about experiencing computer supported teaching. Content analysis of the qualitative data revealed four factors: attitudes towards technology, pedagogical benefits of ICT and its contribution to learning and teaching, perceived cost of using ICT and applications of ICT in

personal and professional life. The three first categories are parallel to those found via the factor analysis of the questionnaire, and the fourth one focuses on actual usage of ICT in real personal and professional life. The analysis of the qualitative data indicates a growing belief in computer supported collaborative learning and teaching, accompanied by a clear shift towards a more positive attitude towards computer technology, a wider and deeper understanding of the pedagogical affordances of ICT, a mixed view of the cost of using technology and an increase in the use of ICT for personal and professional needs.

Discussion

The findings of the current study indicate a two-stage change in student-teachers attitudes towards technology and in their use of ICT. Phase 1: First year - deterioration of beliefs in ICT. Phase 2: Years 2-4 - increase of beliefs in ICT. During the first year of the program there was a shift of participants' belief in technology towards the negative direction. This can be explained in various ways:

- an overriding impact of technology, the new component in the learning environment,
- incubation time needed
- absence of technology in the "real" education-system surrounding participants, which neither supports nor reinforces the new model practiced,
- resistance to change

During the second, third and fourth years of the program there was a gradual shift in student-teachers' attitudes and beliefs towards the positive direction; they used digital tools more intensively in both learning and teaching.

The findings of the current study show that:

- studying in a constructivist technology rich teacher education program has an impact on the participants (aim 1)
- learning in a technology rich environment promotes teaching in such environments (aim 2)
- Long term is needed for incubation of and penetrating into the digital environment; thus it's important not to stop using technology in teaching and learning after a short while, even if it seems difficult and not contributing in the beginning.

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