

GREEK PRIMARY TEACHERS' EMBEDDING MATHEMATICAL SOFTWARE. SHULMAN'S CATEGORIES AND HABERMASIAN INTERESTS

Chionidou Maria*, Zibidis Dimitrios, Doukakis Spyros*****

University of the Aegean, Department of Education
Mathematics Education and Multimedia Laboratory
Leoforos Demokratias 1, Rhodes 85100, Greece

(*)mchionidou@rhodes.aegean.gr,

(**)dzibidis@rhodes.aegean.gr,

(***)sdoukakis@rhodes.aegean.gr

ABSTRACT

In this paper we present the design and the implementation of a teacher's in-service training programme for embedding Educational Software of Mathematics in primary education. We have planned one years' educational action research, where teachers are training to create Educational Scenarios for using them in their teaching practice. In our research we are examining the effect of this in-service training programme in teacher's knowledge (Shulman's Categories) and level of emancipatory (Habermasian Interests) in relation to curriculum and textbooks.

INTRODUCTION

“The single most important research finding in this field (new technologies in mathematics education) is that the crucial element for teaching and learning is not whether technology is employed, but how” (Noss, 2004).

One of the general principles of the new Greek Cross-Thematic Curriculum for Compulsory Education is: “to prepare pupils to explore new information and communications technologies” (Pedagogical Institute, 2003). Implementing this new educational policy Pedagogical Institute has developed (P.I.E.S.) educational software (Chionidou-Moskofoglou & Zibidis, 2006) for all teaching subjects. The Pedagogical Institute educational software (P.I.E.S.) for Mathematics includes three CD – ROMs. One CD – ROM is developed for the 1st and 2nd grades. One for

the 3rd and 4th and one for 5th and 6th, available on the website: (<http://zeus.pi-schools.gr/logismika1/dimotiko/>).

Although Pedagogical Institute has organised a short and expeditious training program for primary teachers in new textbooks in order to help them to improve their teaching practices, has not included any training on the P.I.E.S.

Researchers as Tearle (2003) and Deaney & Hennessy (2007) have indicated that the training on Information and Communications Technologies has an important role on teachers' professional development and also has helped the improvement of the educational practices.

Our aim is to investigate how teachers develop ways of embedding the P.I.E.S. in their teaching practices. Further we examine the effect of the in-service training programme in teachers' knowledge and the emancipatory level in relation to curriculum and textbooks. The central research questions are as follows:

1. What is the relation among teachers in-service training program and the
 - a) Subject Matter Knowledge
 - b) Pedagogical Content Knowledge
 - c) Curricular Knowledge (Shulman, 1986; Rowland, 2004; Angeli & Valanides, 2005).
2. What is the relation of the evolved in-service teacher's training program and the design of educational scenarios to the instructional practices.
3. What is the relation among teachers' scenarios design, their teaching practice and Habermasian knowledge interests (Habermas, 1987).

A THEORETICAL FRAMEWORK

Shulman's and Rowland's Teachers' Knowledge

Lee Shulman (1986) dealt with the conceptual analysis of teacher knowledge and determined three categories: *subject matter knowledge*, *pedagogical content knowledge* and *curricular knowledge*. Subject matter knowledge (S.M.K.) is knowledge of the content of the discipline per se (Shulman, 1986, p. 9), consisting both of substantive knowledge (the key facts, concepts, principles and explanatory frameworks in a discipline) and syntactic knowledge (the nature of enquiry in the field, and how new knowledge is introduced and accepted in that community). Pedagogical content knowledge (P.C.K.) is particularly difficult to define and characterise, conceptualising both the link and the distinction between knowing something for oneself and being able to enable others to know it. P.C.K. consists of "the ways of representing the subject which makes it comprehensible to others... [it] also includes an understanding of what makes the learning of specific topics easy or difficult..." (Shulman, 1986, p. 9). Curricular knowledge (C.N.) encompasses the scope and sequence of teaching programmes and the materials used in them (Rowland, 2004).

Habermasian Interests

Habermas defines the interest in general “as the pleasure that we connect with the idea of the existence of an object or of an action. Interest aims at existence, because it expresses a relation of the object of interest to our faculty of desire. Either the interest presupposes a need (Bedürfnis) or it produces one”. (Habermas, 1987, p. 198).

As cognitive interests Habermas defines: *the technical interest, the practical interest and the emancipatory one.*

Habermas work has showed that knowledge does not exist independently of us. Scientific knowledge is built up because humans have a desire to exercise control over their world. They attempt to exercise this control by seeing the world as separate objects which can be observed and measured and about which predictions can be made (Bound & Brew, 1995). Such knowledge has, what Habermas terms, a technical knowledge interest, “interest in technical control over objectified processes” (Habermas, 1987, p. 309).

Regarding practical interest, the understanding of meaning is directed in its very structure toward the attainment of possible consensus among actors in the framework of self-understanding derived from tradition. This we shall call the practical interest, in contrast to the technical (Habermas, 1987, σελ. 310).

While, *emancipatory interest,* is about people that do not only either build up objective knowledge or engage in a process of interpretive understanding but they also reflect on the processes in which they are engaged. Knowledge therefore, Habermas suggests, includes a meta-level analysis where reflection is part of the process of building knowledge. This domain of knowledge pursues what Habermas terms as an emancipatory knowledge interest. It is concerned with the pursuit of reflection as such, i.e. self-reflection is part of the process. It is emancipatory in the sense that the meta-level analysis has the capacity to bring into consciousness the very ways in which that knowledge is constructed and therefore to go beyond it (Bound & Brew, 1995).

Where competencies are concerned, such statements are viewed as attempts to make relatively stable statements of learning outcomes which are to be questioned through the practice of self assessment. In the emancipatory conception, skills, knowledge and understanding, competencies and learning outcomes are often difficult to separate.

All logic presupposes the need for emancipation and an originally accomplished act of freedom, in order that man elevates himself to the idealist standpoint of autonomy and responsibility (Mündigkeit). From this standpoint it is possible to gain critical insight into the dogmatism of the natural consciousness and, consequently, into the concealed mechanism of the self-constitution of ego and world (Habermas 1987, p. 205).

We comprehend that emancipatory interest, in contrast to technical and practical interest, deals with the critical apprehension and the reflection’s criticisms, that is emancipatory interest focus on individuals and teams abilities so that they gain the

control of their lives with undertaken of autonomous and collective action for changes in the societies. The emancipatory interest in other words could be defined as follows: “A fundamental interest for the emancipation and the authorisation for the undertaking of autonomous action, which results in valid and critical thoughts for the social layout of human society” (Grundy, 2003, p. 31).

The above Habermans’ interests are well implemented in teachers’ practices concerning curriculum. So, Grundy (2003) and Kostoulas-Makrakis (2006) claim that:

- a. According to technical interest teachers are called to materialise a predetermined curriculum, regardless of their disagreements with the objectives, the content, even with the methods of teaching that are related with this.
- b. According to practical interest teachers try to comprehend or to interpret a situation with purpose to improve it and get self-improved.
- c. According to emancipatory interest teachers adopt authentic training activities, which are incorporated in processes of solving problems taken from the real world (Grundy, 2003, Kostoulas-Makrakis & Makrakis 2006).

Instructional Practices

From Matsagoura’s point of view, (1999), object of instructive methodology is the terms and the processes of materialisation of teaching in the frames of a school institution and for better approach of the phenomenon of teaching that is analyzed in three parts: a) planning, b) materialisation and c) evaluation of teaching.

The instructive methodology can be also reported as followed: a) a course of teaching, b) a method of teaching, c) forms of teaching, d) a strategy of teaching and e) a model of teaching.

With the term strategy of teaching we were quoted to instructive approaches with a determined number of mutual training activities that are constituted, round concrete instructive beginnings and are offered for teaching concrete instructive objectives. The strategies have explicit course and develop one or more teaching methods at the completion of instructive intervention. With this significance, the strategy of teaching is wider than the significances course and method of teaching (Matsagouras, 1999).

Activity Theory

Activity Theory (Engestrom 1987, Nardi 1996, Kuutti 1996) is “a philosophy and cross-disciplinary framework for studying different forms of human practices” and offers a set of concepts, structures and terms which are eminently suited to this type of research. The theory's structure of an activity has been used to identify the items in the domain of this study. An “activity” is undertaken by a human actor motivated towards an object and mediated by tool and community. Activities are

distinguished from each other according to their objects. The word object is used in the sense of the “object of the exercise” and is related to the motive driving the activity; hence the term object-oriented activity is often used. Transforming the object into an outcome motivates the existence of an activity.

Educational Scenario

An educational scenario describes accurately a training activity, while at the same time it refers to digital tools, in the organisation of social structures, and in the chorus chronic of the environment. It is reported in the actions of teacher’s and pupils, it highlights more aspects of training process, which in the past have remained unsaid. The rules and the values that have direct relation with the social environment of training, organisational and cultural surroundings, the ergonomics of space and the distribution of available resources, the social instrumentation related to the participating roles (Kynigos & Theodosopoulou, 2001; Makri et al, 2006). The educational scenario is wider than the traditional lesson planning and the teacher’s role is to create his/her own informal curriculum.

Adults’ Education

Adults’ education constitutes a complex and dynamic field for the modern society and is considered all over the world as necessary in order to be someone an active person in the society.

The importance of Adults’ education is noticed by Organisation for Economic Cooperation and Development (OECD, 1977) and UNESCO, (1975). Alan Rogers (1999) and Sophie Courau (2000) have study in depth the characteristics of adults education.

METHODS

Following the above theoretical principles we have design to study, from a variety of perspectives, the process and analysis of results of the in-service teachers’ training in the educational software of Mathematics and ways of embedding it while teaching in primary schools.

Based on the main aim of our research, in order to examine in depth the possible changes in teachers’ knowledge (Shulman), their instructive methodology (ways of embedding P.I.E.S.) and the degree of emancipatory of textbooks and curriculum (Habermas), we decided to select a qualitative educational action research and not a quantitative research, because we argue that qualitative research will illuminate more efficiently the questions of our research. According to Mason (2003):

1. It is founded in a philosophical thesis which in general is “explanatory”, with the significance that it occupies the way in which the social world is interpreted, becomes comprehensible and is produced.

2. Based on methods of data production that are flexible and sensitive towards the social framework in which they are produced.
3. Grounded on analysis methods and explanatory structures or layouts which presuppose the comprehension of complexity, detail and frame. The qualitative research aims in the production of overall perception, on the basis of rich and detailed elements, as these are presented in their natural social frame. This significance emphasised in given bigger accent in holistic forms of analysis and explanation despite the imprinting of surface models, tendencies and correlations. (Mason2003)

The qualitative research will also function as an exploratory method for comprehending the questions that are being reviewed by using “grounded theory”, that is suggest by the Strauss and Corbin (1991). Also it will be used as method of data analysis, where the questions are not tested but are discovered, developed and verified through systematic collection and data analysis. The explanation and the theory are shaped immediately, through the continuous emerged of data analysis (Glaser and Strauss 1967, in Mason p. 319).

Our research is carrying out in school year 2006-2007 in two schools in Attica and fourteen teachers of all grades are participating. It is framed in a particular school environment in which the research is taking place.

Research Instrument

In our study the main tools for data collections are: a) pre semi-structured interviews (for diagnosis of Shulman’s knowledge), b) written material (at first lesson’s planning and then the design of educational scenarios), c) audio tape recording (during the designing of the educational scenario and the reflection process), d) the second researcher’s notes (as a timetable for all the phases of the research) and e) post semi-structured interviews.

The sorting, organisation, classification and data analysis of the semi-structured interviews, reflection dialogues and written material are shaped through the categorical classification (Mason, 2003, p. 238).

SOME FIRST RESEARCH FINDINGS

We present the educational scenarios that were created by the five teachers of 5th and 6th grade as well as the first findings that emerged from analysis of the semi-structured interviews, their reflection dialogues and their written material that resulted from the data processing.

The three educational scenarios that were created with the “brainstorming” and “lotus blossom” technique (Higgins, 1996) relates with the field of Statistics Mathematics. All the educational scenarios are cross-thematic approaches and have the following titles:

“Pupils council Elections”

“The population’s evolution development of Athens from 1822 until today”

“Temperatures of various cities of Greece”

1. *“Shulman’s and Rowland’s” Teacher Knowledge*

Primary, we are led to assert that the five teachers improved their knowledge for our new cross-thematic national curriculum and they clarify the goals of curriculum. Also the teachers’ enlighten the significance of the particular curriculum’s units while dealing with the process of creating and implementing the educational scenarios and next quotation shows it:

“Until now we didn’t pay enough attention to the unit of Statistics because it was near the end of the textbook, but now we are aware of the importance of that specific chapter of Mathematics”.

They learn to handle that specific P.I.E.S. of Mathematics and raised their initial reserves for the use of that educational software material:

“Now I am not stressed out over the new Technologies, because my pupils have learned to use them quickly”.

“Pupils that had smaller attendance to the lesson were much more careful and they functioned with greater self-confidence than earlier”.

2. *Instructive Practices and Strategies*

During planning and materialization of the educational scenarios all five teachers and their pupils collected information from educational sources such as the textbook, internet, magazines, etc. After that, they continue using the P.I.E.S. of Mathematics for the organisation and the recording of these information, in order to present their statistical findings by graphs and finally discuss the critical analysis and conclusions. It appears that they follow an inductive approach.

They applied student-centered and cooperative teaching methods. The discussion between the teacher and the pupils included open type questions, which might offer to pupil the opportunity to develop critical thought. However, we observed that teachers finally in most of cases followed their well know “teacher-center” approach addressing questions to each pupil individually so the pupils were not given the opportunity for dynamic dialog.

3. *Critical reflecting thought and emancipation towards to the school textbooks and the curriculum*

All five teachers proposed cross-thematic activities for the educational scenarios which are not included in the new textbooks. Moreover, they mentioned that their activities were worthwhile (engaging, educative, authentic) and could relate to pupils’ real word and interests. So, teachers seemed to acquire relatively autonomy from textbooks’ proposed ones.

They changed the proposed by the curriculum chapter's sequence when they found it essential and also they modified the duration of teaching time that is proposed by the curriculum.

On the other hand, they applied without deviation the goals from curriculum because they claim that:

"The curriculum constitutes a law of the Greek state and we do not have the right to change it".

The above described research project is running until June 2008 and we are involved in data collection and data analysis about Greek Primary Teachers' Embedding Mathematical Software in their Teaching Practices.

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