“Cultures in negotiation”: teachers’ acceptance/resistance attitudes considering the infusion of technology into schools

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"Cultures in Negotiation": Teachers' Acceptance/Resistance Attitudes Considering the Infusion of Technology into Schools

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Abstract. A teachers' training project, employing teacher-mentored in-school training approach, has been recently initiated in Greek secondary education for the introduction of Information and Communication Technology (ICT) into the classroom. Data resulting from this project indicate that although teachers express considerable interest in learning how to use technology they need consistent support and extensive training in order to consider themselves able for integrating it into their instructional practice. Teachers are interested in using ICT (a) to attain a better professional profile, and (b) to take advantage of any possible learning benefits offered by ICT but always in the context of the school culture. They are willing to explore open and communicative modes of ICT based teaching whenever school objectives permit, otherwise they appear to cautiously adapt the use of ICT to the traditional teacher-centered mode of teaching (strongly connected to the established student examination system). Teachers' attitude to adapt ICT mode of use is supported by research evidence that emphasize the situational character of knowledge and expertise. Authors employ a model premised on Perceptual Control Theory to interpret available data and discuss the view that introducing ICT into schools can be understood as a "negotiation" process between cultures.

Keywords: Media in education; country-specific developments; secondary education; improving classroom teaching; learning communities.

In many countries the introduction of Information and Communication Technology (ICT) into schools has been praised as the necessary (although not without problems) course of action for the qualitative improvement of teaching and learning methodology (OECD, 2001; OECD, 1999, Sinko & Lehtinen, 1999; Pedretti, Mayer-Smith, & Woodrow, 1999). Introduction of ICT in school is considered a necessity premised on economic, social and pedagogical rationales (OECD, 2001) and many governments have launched major programs and invest substantial capitals to support ICT-in-Education projects (Pelgrum, 2001). According to OECD (1999) this was estimated at an annual figure of US$16 billion for OECD countries across primary, secondary and tertiary education, which could well have grown significantly since. These efforts are expected to foster the important educational reform that ICT based teaching can hopefully support by transforming students into active knowledge constructors, a more appropriate profile for the citizens of the Information Society. It is expected that "an educated citizen in the year 2020 will be more valuable as an employee because he or she will be able to produce more builders of theory, synthesizers, and inventors of strategy than valuable as an employee who manages facts" (Di Sessa, 1998 cited by Hamza & Alhalabi, 1999).

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At the same time though a dissatisfying phenomenon is recorded: teachers in schools do not appear to make effective use of information technology for teaching (Zhao & Cziko, 2001; Stetson & Bagwell, 1999; Pedretti, Mayer-Smith, & Woodrow., 1999; Ely, 1993; OECD, 2001). It seems that teachers' attitudes regarding ICT use in schools not only pose difficulties in the use of technology per se but also cancel the learning benefits expected to spring from the instructional reform. Teachers are characterized as being 'technophobic' about using ICT (Rosen & Weil, 1995; Brosnan, 1997 cited in Selwyn, Dawes & Mercer, 2001). They are also blamed of resisting instructional reform being rooted in improper pedagogical beliefs (Gillman, 1989; Finlayson & Perry, 1995 cited in Selwyn, Dawes & Mercer, 2001), which leads to a considerable variation of the supposed uniformly designed instructional reform efforts. The overall picture seems to be that introduction of ICT in schools, although long awaited and strongly supported, encounters significant problems related to the attitudes of the people who are responsible for its use in the classroom.

In this paper we present and discuss our experiences from the effort to train teachers in the Greek secondary schools to use ICT as a means for teaching broader subjects of the curriculum. In the Greek context this program is innovative in two aspects. First, it is the first time ever that teachers are offered training regarding the use of specific educational software, thus advancing the use of ICT in the curriculum. Second, teachers' training is being delivered in school by teacher-mentors, i.e. their colleagues who, after attending a postgraduate specialization course, administer training sessions in schools appropriately equipped with computer laboratories.

Our work focuses on the acceptance and/or resistance attitudes that teachers develop regarding the training efforts and their initial attitudes towards incorporating ICT in their teaching practice. In the following we first outline the general picture concerning the use of ICT in schools worldwide as documented in the literature. We then present our recorded data and try to reach a deeper understanding by connecting to a consistent theoretical framework emerging primarily from the application of a model premised on Perceptual Control Theory. This framework also comprises our supported view that the infusion of ICT into school can be conceptualized as initializing a negotiation process between cultures.

ICT in schools

How is ICT used in schools?

Research data indicate that the introductory step for computers in school is using them in administrative tasks and not as part of the learning process (McCannon & Crews, 2000, p. 111). There is also indication that teachers proceed to adopt ICT in stages. Wells & Anderson (1995) (cited in Myhre, 1998) report that teachers initially focus on their own interaction with the new medium and as they gradually become comfortable with the technology they start deliberating upon potential learning benefits that would result from the use of the computer. Myhre (1998) concludes that this increased familiarity with computers allows teachers to turn their interest in the pedagogical use of technology (rather than its operational issues) but also emphasizes that such change processes do not occur rapidly and are not easily achieved.

Two important questions are relevant at this point: (a) "Under what conditions are teachers motivated to use technology in classroom?" and (b) "What kind of instructional methodology do teachers employ after deciding to use technology?".

Zhao & Cziko (2001) formulate an answer to the first question, employing a Perceptual Control Theory (PCT) based perspective. According to PCT (Powers, 1973; McClelland, 1998) the activation of purposeful agents (such as human beings) towards success of their objectives occurs when a discrepancy is detected between what is perceived and what is internally established as a standard of reference. Discrepancies could emerge either as a result of changing perceptions about conditions of external environment or as an alteration of internal reference condition. As a result the individual begins to vary his/her behavior trying to minimize the discrepancy and its consequences. These internal reference conditions should be conceptualised as parts of a hierarchy where higher-level conditions (goals) are the most important to maintain. Many times people accept to alter lower level goals in order to succeed stability in higher levels. An interesting element of the PCT approach is that human perception about environmental conditions (and not human behaviour) is considered as the independent variable that defines further human actions which have as objective to minimize detected discrepancies. Following this perspective three conditions are identified as necessary for teachers to use technology (Zhao & Cziko, 2001, p. 27):

1. Teachers must believe that technology can more effectively achieve or maintain a higher-level goal than what has been used ("effectiveness").
2. Teachers must believe that using technology will not cause disturbances to other higher-level goals that they evaluate as more important than the one being maintained ("disturbances")
3. Teachers must believe that they have the ability and resources to use technology ("control").

It is therefore supposed that if these conditions are met, teachers will introduce ICT in the classroom. But how do they actually teach when using ICT? Available data are rather disappointing. Overall there is evidence that ICT is assimilated into the established way of teaching without teachers making effective use of the new medium to create innovative learning experiences. "Technology use reflects traditional classroom methodology, though affording some increased attention to the individual learner. It still depends too much on highly motivated pioneering principals and teachers" (OECD 2001, p. 67). Also "information technology in the classroom is used in an ineffective way and it has been proved difficult to integrate within traditional curriculum settings" (Jules Van Belle & Soetaert, 2001, p. 38).

What are the obstacles for using ICT in schools?

There are many elements identified as obstacles in the way of introducing ICT in schools. Pelgrum (2001) presents a list of ten such issues that educational practitioners perceive as serious impediments for realizing their ICT related goals. From this group of ten we isolate the three major ones: (1) insufficient number of computers, (2) teachers' lack of knowledge/skills, and (3) difficult to integrate in instruction. Ely (1993) similarly distinguishes as major conditions, relevant to ICT

implementation, the following: (1) dissatisfaction with the status quo, (2) existence of knowledge and skills, and (3) availability of resources.

The two taxonomies identify, more or less, the same issues: Ely's "existence of knowledge and skills" relates to Pelgrum's "teachers lack knowledge/skills". Also Ely's "availability of resources" is relative to Pelgrum's "insufficient number of computers". Finally Ely's "dissatisfaction with the status quo" is directly related to what Zhao & Cziko (2001) describe as "discrepancies that activate individual". The issue of teachers' confidence in their ICT competence as a major factor for integrating technology in teaching is reported in other studies as well. Mooij & Smeets (2001) state that "if teachers are not confident in their ability or competence to handle computers this may hamper their willingness to introduce technology in their classroom". In an international study (Smeets et al., 1999 cited in Mooij & Smeets, 2001) it is also reported that the most important reason teachers mention for not using ICT is that they are not familiar with ICT or they feel unsure about it. This ICT competence factor is the same that Zhao & Cziko (2001) refer to as "Control Principle".

Some other important factors are also recorded as significantly influencing ICT use in schools. Teachers claiming to follow more innovative educational practices (use of inquiry, project-oriented work, hands-on activities) are more likely to use new technologies than those who stick to the more traditional instructional approaches. (Honey & Moeller, 1990 cited in Myhre, 1998). According to Mooij & Smeets (2001) school manager's policy and budgetary decisions and in general the attitude of the school manager (their commitment and decisions) are expected to be relevant to the ICT innovation process.

As a conclusion, there are three major issues repeatedly identified by research as important for introducing ICT into the classroom. Namely:

1. "Control" (possessing working knowledge of ICT, being confident, having control over technology) as an enabling and psychologically reassuring factor.
2. "Resources" (number of available computers) as an enabling factor.
3. "Inner dissatisfaction" (dissatisfaction with the current status) as a motivating - activating factor.

Introduction of technology into Greek secondary schools

Greek secondary education comprises three categories of schools: Gymnasiums (lower secondary, ages 13-15), Lyceums (upper secondary, ages 16-18) and Technical Vocational Institutions (ages 16-18). Students in the two upper classes of Lyceum have to participate in centrally administered examinations (by the Ministry of Education and Religious Affairs), which in great degree determine whether they enter tertiary education institutions. Currently in Greek secondary schools there is not any systematic use of ICT for teaching broader subjects of the curriculum. The existing computer laboratories are in great part used for teaching technology related lessons (informatics, graphics art, etc.) in the vocational schools. However there are several other computer laboratories installed (or being installed) by the "Odyssey" project (see below) already used for teachers' training and instructional use of ICT.

ICT introduction to the curriculum is in great part also centrally administered (see Greece-OECD Country Note, 2000). The Ministry of Education has launched an EC funded project for the extended use of ICT in the curriculum. Head manager of this project (most appropriately called "Odyssey", http://odysseia.cti.gr) is the Computer Technology Institute (CTI) (http://www.cti.gr). Within the "Odyssey" project, a series of subprojects have been initiated which include (among others) installation of computer laboratories, connecting to Internet, development of educational software and teacher training. Such a subproject has been recently initiated for the training of in-service teachers on the educational use of ICT. The project employs a teacher-mentored in-school training scheme and its objective is to provide both basic ICT knowledge along with advanced training regarding the instructional use of specific educational software. Teacher-mentors are selected teachers of various specialties who initially attend a yearlong course of postgraduate specialization on the educational use of ICT. These courses are administered and delivered by cooperating University departments. Subsequently teacher-mentors are allocated to selected schools, which are already equipped with appropriate infrastructure (i.e. "Odyssey" project computer laboratories), and work as facilitators transferring and sharing their experience with colleagues.

Preparing teacher-mentors; The ICT Post-Graduate Specialization Course

In Aristotle University of Thessaloniki, twenty (20) selected in-service teachers (10 physicists and 10 literature teachers) attended this yearlong postgraduate specialization course (PGS course). The course was administered cooperatively by the Computer Science Department and the Pedagogical Department for Elementary Education. PGS course comprised three distinct training phases. Initially it provided 300 hours (about 4 months) of lessons organized in two complementary series: technology studies and pedagogical studies. In these lessons teachers attended lectures and participated in laboratory sessions, group discussions and team project works. Academics and other highly specialized educators delivered these lessons emphasizing ICT supported didactic approaches (interactive learning environments, project based learning, collaborative learning). Didactic phase was followed by an apprenticeship phase. Teacher-mentors visited selected schools in the area of Thessaloniki and, supervised by their course tutors, delivered initial training sessions to the school teachers. This phase lasted 4 weeks and teacher-mentors worked in small groups of mixed specialties. So they were introduced to the practical aspects of their mission and gained hands-on experience. During next semester (spring semester) teachers-mentors were assigned practice work. Each one of them was responsible for three of four selected schools (in various places of Northern Greece) and administered in-school training sessions for the respective school teachers. Their main objective was twofold: (a) training of teachers of the same specialization (e.g. Physicists) to the use of domain specific educational software including off-line and on-line resources (we call these sessions "vertical training" since it addresses the needs of teachers in specific domain), and (b) the training of every interested teacher to general ICT tools (i.e. word processors, electronic presentations, Internet communication, etc.) ("horizontal" training sessions). During their practice teacher-mentors were supported by their PGS course tutors using Web based communication facilities (discussion forum and email). Teacher-mentors were regularly reporting to their tutors on the progress of their training efforts and discussed (both with tutors and

other colleague mentors) the problems encountered and any possible solutions. Teacher-mentors are currently being involved into supporting in-school training projects and transmitting their ICT experience to their colleagues.

This model of peer to peer training has been reported to be followed in other cases as well resulting to positive outcomes (Trushell, Slater, Sneddon, & Mitchell, 1998; OECD, 2001). It is worth noticing that a question related to this model is whether teacher-mentors will be removed from their school didactical duties in part or completely. In countries such as Canada and Norway mentors are assigned a reduced teaching load while they go on supporting their colleagues (OECD, 2001). Contact with classroom offers them the chance to increase their experience, deepen their understanding and develop new methodologies. At the moment teacher-mentors in Greece are only assigned to offer training to their colleagues. However they still get the chance of using ICT in classroom teaching in cooperation with their trainees.

Research Data

Selection of Schools and their characteristics

Data presented in this study come from the schools where teacher-mentors delivered training sessions in their apprenticeship and practice work. Schools were selected depending on their infrastructure availability. Apprenticeship took place in 5 Gymnasiums in the area of Thessaloniki, which were selected by PGS course administration. Practice lasted three months and schools were selected by the Ministry and the CTI. Overall 39 Gymnasiums (including those in apprenticeship), 17 Lyceums, and 4 Technical Institutions participated and accepted teacher-mentors. Some of these schools were also in the area of Thessaloniki but many others were located in other municipalities of Northern Greece as well.

All training took place in school computer laboratories. Such a typical laboratory includes a number (12) of personal computers connected in local network with educational software preinstalled. The local network is connected to the Internet by means of a router and a proxy server. Printer and a video projector are also available.

The voluntary basis of the whole project should be emphasized. Teacher-mentors were volunteers and so were their trainees in the schools. Teachers who attended training sessions had no further obligation to include ICT in classroom and apply any proposed methodologies. Only voluntarily (and experimenting) some of them brought their students into the laboratory and (in cooperation with teacher-mentors) delivered ICT supported lessons.

Data collection methodology

Data were collected employing a threefold methodological approach: (a) naturalistic inquiry, (b) teacher-mentors' reports, and (c) teacher-mentors' interviews. In detail:

a) Naturalistic inquiry: While in apprenticeship teacher-mentors visited the selected schools and organized initial training sessions, supervised by their PGS course tutors. Supervisors recorded and processed data that emerged from this early training experience.

b) Reporting: During their practice teacher-mentors were regularly reporting to supervisors about their on-going training efforts in the schools of their responsibility. These reports were analyzed and offered substantial data for the overall picture of teachers' acceptance/resistance attitudes.
c) Interviewing: After completing their practice work teacher-mentors were interviewed to record available information regarding their experiences in schools. Many of these interviews were videotaped and in depth processed (i.e. categorizing experiences and interpretations thus resulting in the identification of common themes). These data being correlated to previously recorded data offered opportunity for confirmation and fine-tuning of resulting conclusions.

Recorded Data[2]

- Teachers' participation and training schedules

Table 1 presents the number of teachers who attended "horizontal" training sessions (addressing every interested teacher).

{insert Table 1 here}

Table 2 presents the number of Physics and/or Literature teachers who attended "vertical" training sessions (domain related educational software presented to teachers of these two specialties).

{insert Table 2 here}

Table 3 presents the weekly mean workload per teacher-mentor.

{insert Table 3 here}

In the last column "ICT in classroom" denotes ICT supported teaching sessions for students, administered cooperatively by teacher-mentor and teacher-trainee. There were totally 73 such sessions delivered by 10 teacher-mentors and trainees within a time interval of 9 weeks.

An important task for teacher-mentors was to find the necessary time in schools to organize training sessions. Here are the solutions they followed:
a) In 25 schools: Teachers attended in groups whenever their lesson timetable permitted, one day per week or two days every second week.
b) In 14 schools: Teachers attended in groups, in the afternoons, after school was over.
c) In 9 schools: Teachers attended in groups in three-hour shift (after rearranging the lesson timetable), one or two days per week.

[2] Elements of data are presented accompanied by a code in Italics, e.g. "*E4*". These codes are used later in the "Discussion" section for reference to each specific element.

d) Finally in 12 schools training sessions were organized in some other way (e.g.: individual training whenever teacher was available or after school was over).

- School headmasters' attitudes

Perhaps the major problem that teacher-mentors encountered was to be accepted by regular members of school life and find necessary resources for their training efforts (taking into account that the whole training project was on a voluntary basis). Teacher-mentors unequivocally agreed that the role of school principal had been very important to this aspect. There are however both positive and negative attitudes recorded regarding their behavior. Positively acting headmasters intervened and offered solutions to problems or newly encountered situations (e.g. allocated appropriate time for training sessions, encouraged school teachers to attend, enhanced perceived importance of the project) *(E1)*. On the other hand some of them exhibited a bureaucratic (and even possessive) attitude in the management of school resources, especially in relation to the availability of computer laboratory and they were generally unwilling to help and facilitate teacher-mentors *(E2)*.

One could identify three distinct attitudes in school headmasters' behavior *(E3)*: (a) Supporting (mainly in Gymnasiums and in Lyceums with former experience in innovative programs), (b) reluctant to support (mainly in Lyceums for the reason of not disturbing school timetable and students' preparation for their examinations) (c) initially negative turning afterwards to positive (mainly in Gymnasiums).

- Teachers' interest

Many teachers did care to learn how to use computers (especially in schools with experience in innovative projects) and were very positive towards training *(E4)*. As documented in Table 1 more than half of the teachers working in selected schools attended the training sessions. In some cases teachers from neighboring schools (initially not included in the training program) asked the teacher-mentor to accept them for training as well. According to teacher-mentors the great majority of teachers were completely novices and their interest focused primarily on the use of commonly used software tools *(E5)* (word processor, spreadsheet, Web browsers, search machines). A great part of the training sessions addressed these initial needs as shown in Table 3 ("horizontal" sessions). Comparatively less teachers attended the "vertical" sessions (see percentages in 'total' rows of Tables 1 & 2) where the use of domain specific educational software was presented (e.g. "Interactive Physics" for Physicists). *(E6)*

However some teachers (usually carrying negative experience from previous rather unsuccessful training efforts) tended to perceive this new training as just another Informatics seminar or computer use workshop *(E7)*. According to teacher-mentors it had been necessary to better inform teachers about the objectives of such a training program aiming to introduce ICT in the curriculum.

Teachers were sometimes reluctant to participate in seminars outside of their timetable, as this would be a significant additional workload for them *(E8)*. Some (including those who were about to get retired) were not interested and did not feel

that ICT had anything to do with them *(E9)*. In cases it was recorded that teachers were gradually losing their initial interest and withdrew from training sessions, somehow developing a "that's all" feeling about ICT and believing that they had mastered everything there was to *(E10)*.

It is characteristic that many teachers asked for an official acknowledgment of their learning efforts, some kind of a certificate for their personal files. Teacher-mentors also expressed the opinion that a more official program profile could greatly enhance perceived importance of the training, participation and commitment *(E11)*.

What should not go without noticing is that there was no ideological opposition to ICT school introduction. Teachers seem to have totally accepted the necessity of ICT use in teaching (only some of them expressed worries about possible Internet misuse by students). This thesis though is a tentative one since many other teachers did not attend training sessions and they might have expressed different opinions if given the chance *(E12)*.

Finally it is worth mentioning the role of Informatics teachers. They often offered technical support *(E13)* but sometimes problems arose in the sharing of resources (e.g. timetable of computer laboratories).

- Lower vs. Upper Secondary Schools

Teachers in Lyceums (upper secondary) appear to be higher motivated than their Gymnasium colleagues, to explore instructional benefits that ICT could offer. Students' examinations for entering tertiary education is an important objective in Lyceums and imposes greater teaching demands which in turn activate teachers to explore ICT based teaching. In Gymnasiums teachers' interest in ICT seems to depend much more on personal motivation. However Lyceum teachers in several occasions expressed their doubtfulness as to the extent and the mode of ICT use that could better support their teaching objective. Overall there seems to be a selective and adaptive process in action, i.e. teachers trying to identify modes of ICT use compatible to the established teaching and learning methodologies (which are valued as better accommodating the already set instructional target) *(E14)* (we extensively comment on this point at the "Discussion" section of this paper).

Moreover Lyceum teachers are assessed by teacher-mentors as hard workers provided they are convinced for the necessity and the benefits of ICT based teaching, exactly because they are accustomed to higher teaching demands and greater workloads *(E15)*.

- Lack of ICT competence – Mode of use

Teachers in many cases expressed their lack of confidence when confronting the new teaching demands imposed by ICT. They avoided implementing by themselves pilot ICT teaching but several tried and delivered lessons in cooperation with their teacher-mentors *(E16)*. We briefly present and comment on two representative cases.

In a most interesting case *(E17)* a Lyceum literature teacher along with her teacher-mentor delivered an ICT supported lesson where students located literature texts in Web sites, processed them and emailed authors their questions and opinions (one of the authors was invited and joined the classroom in a later session). The whole event was evaluated as innovative, significant and satisfying by teachers and students and was even supervised by the literature school advisor of the prefecture. The teacher-mentor expressed the opinion that interweaving of medium and content helps novice users develop more easily ICT competences while working in the context of specific problems. She also noticed that her objective was to create a kind of "literature workshop" that would engage students into various activities using ICT as a communication and information processing tool. What should also be emphasized is that ICT was used to support the already established school objectives (i.e. engaging students into literature text processing and production of their own original text).

In another case *(E18)* the rather restrained use of ICT was demonstrated in the teaching of Gymnasium Physics. The teacher had his students seated in groups in front of the computers and presented "Interactive Physics" software using a video projector. He asked students to follow instructions in their worksheets to set up a simple motion experiment. Students were not given the time to discuss in their group, experiment and formulate their own explanations. Whenever a question came up they turned to the teacher to receive explanations and answers. It was a kind of ICT supported teacher-centered teaching; an adaptation of ICT tools to the traditional mode of school teaching directly connected to established teacher's conceptions of how students should learn.

- Technical support

The project initially employed a technical support scheme provided by independent cooperating vendors. However there was no technical support whenever needed. This caused significant problems to teacher-mentors *(E19)*. A teacher-mentor's statement: "technical problems made me follow another route" indicates flexibility but also possible disorientation of training objectives. Teacher-mentors proposed that trained informatics teachers could possibly offer technical support.

- Acceptance - Adaptation

Schools where apprenticeship took place were more easily and efficiently adapted to the needs of the practice phase. Teacher's prior experience helped developing a positive attitude towards the further acceptance of the training program. This "acceptance - adaptation" effect had been observed in another instance as well: in schools (Gymnasiums and/or Lyceums) having participated in other innovative educational projects teachers were reportedly more open to accept and participate in their in-school training programs *(E20)*.

Teachers also consistently tried to identify (by asking teacher-mentors or searching in software tutorials) in what degree the presented educational software was compatible to the existing curriculum. This seems to have been their first attempt to accept and adapt software usage in terms of the school culture *(E21)*.

- Support

Teacher-mentors expressed in many cases their need for continuous and multifaceted support (continuous training on various issues of educational technology, information about new software, communication, meetings and conference attending, accessibility to data bases of didactic proposals and successful approaches sorted according to curriculum contents) *(E22)*.

Another proposal by teacher-mentors was that their job would have been more effective if they could become members of a specific school community, being responsible for ICT training and support for this specific school instead of many (something that worn them out by imposing on them too many time consuming tasks) *(E23)*. This exclusive connection between teacher-mentor and school has been supported in many cases by the strategy followed in various countries, which "encourage the designation of one teacher within the school as ICT coordinator, to act as the central reference point for ICT issues and support colleagues on technical and pedagogical issues" (OECD, 2001, p. 94)"

- Flexibility

Teacher-mentors acknowledged that a considerable degree of flexibility was necessary for dealing with various problems resulting from the more rigid form of traditional school structure as well as other unexpected situations that eventually came up. Adapting the training schedule, forming teacher groups, addressing the needs of each specific trainee, even dealing with hardware failures, were few of the resource management issues that teacher-mentors found themselves deeply involved in *(E24)*.

Discussion

Theme I: "Necessary Conditions for using ICT"

To better understand teachers' behavior we refer to the conditions set by the model by Zhao & Cziko (2001). The model is premised on the notion of a perceived reality dynamically evolving due to actions of purposeful human agents who aim to satisfy their need for balance between perceptions of outside world and inner hierarchy of goals. In order for teachers to introduce ICT in classroom they must feel that:

a) Using ICT maximizes effectiveness for achievement of higher level goals,
b) Using ICT does not cause disturbances to other higher order goals, and
c) They have the ability to control technology.

a) "Effectiveness": What are the goals that teachers do care to achieve when using ICT?

An important higher order goal for all professionals is competence in their job. Teachers seem to have totally accepted the rationale for using ICT in school (see E12), realizing that technology slowly but steadily finds its way into the educational setting. They are interested therefore in attending training programs (E4) for attaining a more competent level for themselves and they wish to certify this knowledge (E11) in order to present a better professional image in any future teacher assessment. In

case this competence factor was valued insignificant (E9, E10) their interest in training was minimized. Enhancing, therefore, their professional status is an important motivation for teachers to learn about ICT. It is worth noticing that many more teachers expressed initial interest to receive introductory training on general ICT tools as opposed to domain specific training on the use of educational software (E5, E6). This and other recorded facts (E7, E8) indicate that for many teachers "ICT competency" means primarily to know the basics about the computer. Since for the moment it remains unclear how exactly ICT is going to be used for teaching and what kind of skills and knowledge will be necessary, many teachers set accordingly as main objective what is already clearly identifiable (i.e. technology knowledge and skills at a basic level) and leave the rest for when they feel as more appropriate. It should also be noticed how teachers' willingness to receive training was influenced (positively or negatively) by in-school factors, such as headmasters' attitude (E1, E2, E3) or other introduced disturbances (E7, E8).

Of course another important goal that teachers are interested to achieve when using ICT is enhancing the quality of their teaching. This is more clear in the case of Lyceum teachers where teaching demands are higher (E14, E15). However "quality of teaching" is something evaluated in relation to the established school objectives. Teachers' effort, in principle, focuses on producing the kind of learning compatible to these objectives. This eventually results to an effort of adapting ICT to the traditional teacher-centered methodology which is perceived as successful at producing the expected learning outcomes. This brings us to the second condition of the model, namely teachers' efforts to minimize any "disturbances" resulting from the use of ICT.

b) "Side effects": What are the ICT caused disturbances that teachers do care to minimize?

Higher secondary teachers appear to be more explorative and selective, compared to their lower secondary colleagues, as to how they are going to use ICT in classroom (E14). These efforts aim at identifying those qualities and modes of use of educational software that would enhance students' learning according to school perspective. So, teachers being strongly oriented to fulfilling the already established school instructional targets tend to ignore any innovative learning activities (e.g. collaborative learning, team project work) that would seem to "disturb" this course of action. Is this attitude simply a teachers' false judgment or is it justified by research evidence? We try in the following to formulate an answer.

Students' examination system is a socially constructed assessment methodology for evaluating students' learning acquisition and expertise development. In Greek school system it is students' performance at written examinations which determines in a great degree their studying at tertiary education institutions. Is expertise something developing out of the context of the learning setting or does it incorporate situational characteristics? If expertise is a decontextualized form of knowledge then its practice (i.e. students' performance in examinations) would be successful no matter what the situational characteristics of the learning environment might be. If the opposite is true and expertise is modified by contextual characteristics then performance varies according to environmental conditions and it is valid to suppose that a learning

environment exhibiting the same situational characteristics as the practicing environment, would better accommodate successful performance.

Billet (2001) offers significant evidence that strongly support the latter option. He states that

> "…the conception of expertise founded in mainstream American cognitive psychology based on individual acquisition and organization of domain-specific knowledge in memory sits uneasily with emerging views that include, emphasize or give primacy to the social and cultural contributions and their relationships to thinking, acting and knowing" (Billet, 2001, p. 432).

Billet underlines the fact that the specific socially imposed requirements of a particular vocational practice influence the way that the abstracted knowledge of the occupation is manifested in practice. Situational characteristics of expertise are illustrated in the research results of a study by Voss, Tyler & Yengo (1983, cited in Billet, 2001) where college students and their workplace-prepared colleagues participated in different constructed tests. The college students performed better when answering questions about economics, but failed when faced with real work tasks. The workplace-prepared subjects outperformed the first team in these latter tasks.

Although Billet refers to "vocational training" we believe that these considerations apply to school learning as well, e.g. in a traditional curriculum subject like Physics. Learning Physics in the school perspective means that students should become experts able to manifest their expertise under specific circumstances (mode of testing). Teachers traditionally follow a teaching methodology utilizing problem situations similar to those expected to be encountered in the final test. When ICT enters the learning setting they try to adapt its use in order to serve the established target. The core of their deliberation is that the situational characteristics of any innovative learning methodology employing ICT tools (e.g. higher degree of interaction, experimenting, students working in teams and cooperating) might hinder the development of the kind of expertise that would be useful for dealing with the specific mode of testing (individual ability to solve problems of specific type). One could say that the "language" to be learnt (abstract principles of Physics) may be the same in both cases of learning but the "dialect" to be mastered (way of applying this knowledge) is different since the situational characteristics vary. In the light of the aforementioned research evidence teachers' choice is justified.

Such incompatibilities between ICT supported modes of learning and traditional assessment methodologies have been recorded as a significant obstacle when introducing ICT into schools (OECD, 2001, p. 15). Situational nature of expertise is an impediment to teachers following innovative learning methods as long as assessment methodologies continue to focus on students' isolated skills and knowledge.

c) "Control" of technology

Most teachers are far from being ICT competent. Naturally they worry about their ability to overcome possible technical problems and to handle educational software effectively which, in turn, makes them feel insecure and reluctant to implement by themselves ICT supported teaching (E16). Technical support is crucial to overcome these initial drawbacks. Any lack of it may significantly decrease teachers' motivation to work with computers. Technical support may be well be offered by

insiders (e.g. school teachers properly trained (E13)) and it should always be on time, for otherwise it results to redesigning (E19) which may be interpreted as evidence of flexibility but it is also a possible failure indication, in case the redesign eventually canceled the initially set training objectives.

Theme II: "When school met ICT: cultures in negotiation"

People in an educational setting are agents participating in the act of meaning development and sharing, in the perspective of culture continuation. Technology by permeating through every important aspect of contemporary social and economic life is not simply a medium for processing and transmitting information but a prominent cultural characteristic. Users of ICT belong to ICT culture, i.e. they experience a world where ICT multiplies interaction, mediates human communication, is incorporated in procedures of knowledge production and management (OECD, 2000, p. 56). However using ICT is not a trait of the school culture. "ICT has arisen outside the world of education, but with an irresistible case for adoption within schools" (OECD, 2001) and when ICT enters the school culture inconveniences arise. Many teachers find themselves in the difficult position of using technology products without being members of the technology culture. Using a computer is out of their everyday routine, many of them lack even the introductory technological knowledge (E5). School traditional mode of function hinders instead of facilitating the needs of effective ICT use (E2, E3b, E24). Being familiar with other innovative programs enhances acceptance (E20) but consistent support and extensive training (E22, E23, E19) is crucial for the productive use of technology. Teachers accept ICT (E12) but they initially conceptualize the use of ICT within the understandings they have developed in school culture (E17, E18, E21). They seem to be in doubt on how to proceed with the use of ICT tools and what exactly might be what ICT has to offer to school. Pelgrum (2001) underlines this point: "there are notions that students should trained to learn more autonomously and to get access to and digest information more independently than has been the case so far. However what this means for the educational process is still rather unclear".

These evidence along with what has already been discussed (Theme I-b, I-c) support the view that school and ICT are cultures initially in tension. How could we describe the way things evolve at the meeting point? Salomon (2000) points out that there is "a consistent tendency of the educational system to preserve itself and its practices by the assimilation of new technologies into existing instructional practices". Papert (1997) also emphasizes that "school reform is impossible", meaning that any centrally administered effort to change a complex system is bound to fail. "ICT assimilation" and "school reform" (or "non-reform") are two commonly used concepts relative to this process. One might describe this school transformation process as a "paradigm shift". A paradigm is understood as "the basic way of perceiving, thinking, valuing, and doing associated with a particular vision of reality" (Harmon, 1970). So a paradigm shift can be conceptualized as an evolutionary process that affects the fundamental beliefs, principles and practices of a community, leading gradually to a new collective understanding, which better accommodates its needs. In the core of a paradigm shift lies the cognitive conflict that the members of the community experience when the existing paradigm fails to explain newly encountered

phenomena. These difficulties give rise to a state of crisis and a new paradigm is gradually formulated to offer new insights and resolve the conflict.

However, in the case of ICT entering school community it is rather an externally originated demand for change rather than an internally generated state of crisis and a seek for a new paradigm. School, if seen as an isolated learning community, can continue employ traditional teaching methodologies and produce "satisfactory" (within the established assessment paradigm) learning outcomes. The inconvenience arises when the different knowledge production and management skills that broader society demands are taken into account. So, unlikely the paradigm shift process where the affected community experiences the old paradigm inadequacy and strives for a better understanding, in this process the added problem exists that the essence of the necessity for change is still to be understood and accepted by practitioners within the school community. Teachers are asked to adapt their teaching to the needs of another culture, the cognitive traits of which they experience mainly in a theoretical way. We propose that this complex sociocognitive process can be described as a negotiation process between the two cultures. The "negotiation" concept implies that when ICT enters school a "give and take" process is initiated for the establishment of an accepted mode of use of the innovation by accepting and/or adapting and/or rejecting the various possibilities offered. The "invaded" culture (school) has to redefine its boundaries, meaning that its members have to decide what changes and to what extend they are going to implement considering the new practices and relationships that these changes are going to introduce. The dynamics of this process are outlined by the model we use: teachers accept to alter their practices at lower level aiming (a) to better accommodate higher order goals and (b) to minimize detected disturbances. This negotiation takes place not only between teachers and external agents supporting ICT introduction (e.g. governmental services) but also within teachers themselves, forcing them to decisions that accept/adapt/reject modes of ICT based teaching. Our data reveal how teachers welcome training to attain a higher professional and teaching status, support a communicative mode of ICT-use when a "consonance" exists with the established school learning objectives (E17) and assimilate the use of ICT into a mode of teaching compatible to these objectives (E18), to avoid any possible "dissonance". We see all these as evidence of the negotiation process.

Within this framework of understanding it seems reasonable to hypothesize that the implementation of innovative teaching methodologies would be facilitated by emphasizing to teachers the "higher – lower" level dualism of conceptualizing about their teaching: "teaching for success in testing" is a lower level dispensable goal, a minor case resulting from the higher level goal "teaching for the development of socially useful skills and knowledge" that should be preserved. In this perspective, teaching and learning are not procedures divorced from socially imposed requirements and using ICT to support innovative modes of learning is not solely a cognitive matter. What is characterized as innovative, constructive and open use of ICT and the respective learning quality has to be reflected in the socially accepted instructional objectives, in teachers' epistemological assumptions and of course in assessment methodologies.

We feel that at this point the following two research questions emerge: (a) to identify and describe the dynamics of this negotiated use of ICT in schools, and (b) to propose and implement appropriate course of action that would enhance the adoption of

teaching methodologies which, tailored to ICT tools, can foster the desired learning qualities of students in the information society. What we described in the previous paragraph as "emphasizing the higher – lower level dualism" might be a possible candidate.

Conclusions

In this paper we presented and discussed our first observations regarding Greek secondary school teachers' attitudes towards the introduction of ICT in the curriculum. Training efforts are generally welcomed by teachers but consistent support and extensive training is necessary in order to consider themselves able for integrating ICT in their teaching methodologies. Teachers are interested in using ICT (a) to attain a better professional profile, and (b) to take advantage of any possible learning benefits offered by ICT but always within the context of the school culture. So we experienced some open and communicative modes of ICT based teaching where school objectives encouraged, but also the assimilation of ICT tools into a traditional teacher-centered mode of teaching. Teachers' attitude to adapt ICT mode of use is justified by research evidence that emphasize the situational character of knowledge and expertise. Introducing ICT into schools is seen as initiating a "negotiation" process where lower level goals may be altered to preserve what are perceived as goals of higher order. These higher order goals however are socially constructed and established. While we agree with Norum, Grabinger, & Duffield (1999) who, emphasizing the role of the individual in this process, state that "healing the universe is an inside job", we would like to add that "healing" prescriptions are negotiated and formulated by interacting social agents as a whole.

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Tables

	Teachers who attended	Total number of teachers in participating schools (100%)
Gymnasiums	430 (51,9%)	828
Lyceums	260 (63,1%)	412
Technical	110 (62,5%)	176
Total	800 (56,5%)	1416

Table 1. Attendance of "horizontal" training sessions

	Teachers who attended	Number of Physics & Literature teachers in participating schools (100%)
Gymnasiums	70 (19.7%)	356
Lyceums	24 (12.8%)	188
Technical	3 (8.2%)	37
Total	97 (16.7%)	581

Table 2. Attendance of "vertical" training sessions
(offered only to Physics and Literature teachers)

	Training sessions per week (total: 9 weeks)		
	"Horizontal"	"Vertical"	ICT in classroom
Number	3.2	1.2	0.6
Hours	9.3	2.4	not available
Teacher-trainees	25.7	5.0	
Teacher-trainees per training session	8.0	4.3	

Table 3. Weekly mean workload per teacher-mentor.