

**INTRODUCING COMPUTERS INTO EDUCATION:
A CASE STUDY OF THE GREEK SITUATION**

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ABSTRACT

The study explores the process of the introduction of computers into education as an educational innovation.

The thesis distinguishes two fundamental categories of computer use in schools (IT and ITE), and identifies the different rationales for their initiation at a national level, and the different objectives they reflect at the school level. It also provides a conceptual framework to explore the process of the innovation. It identifies the value that the computer use represents and the complexity it involves as the main factors that influence its initiation into education. Moreover, it explores the ways in which the meaning of the computer use as well as the context of its implementation influence the computer use. The cases of England and Germany illustrate the theoretical considerations of the thesis.

The case study of the introduction of computers into Greek general education attempts to capture the complexity of the process as shaped by the characteristics of computer use and by the specific Greek context. The Greek case study confirms that the value and the complexity of computer use influence its initiation. However, it shows that their codification depends on the specific characteristics of an educational system, the priorities of a country, and its infrastructure. It indicates that the interrelations of these factors at particular points in time, is more important than the factors themselves. It stresses the high levels of technical complexity of the particular innovation. It indicates, however, that a highly centralised bureaucratic educational system can not easily cope with this issue, while more flexible schemata are needed to combine local initiatives with centralised support.

Next, it shows that the meaning of computer use is perceived differently by participants and is shaped in the transition from policy to implementation. It demonstrates how policy documents are often contradictory to each other, creating a lack of clarity about the meaning of the attempted computer use. Additionally, the study illustrates that the proposed computer use is not always implemented the way its initiators envisaged it. It suggests that the reasons for discrepancies may differ among educational systems. In the Greek case study discrepancies were due to a lack of clarity in meaning, as well as to a lack of resources. Moreover, the infrastructure provided by the Greek prescriptive educational system to support the implementation of IT did not encourage initiatives on behalf of the teachers.

Finally, the case study points that although the fast evolution of technology requires flexible procedures to keep up with change, it also stresses the importance of continuity. Therefore, flexible management structures need to co-exist with long term plans.

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Once, I was asked to write about my experience from my PhD. I wrote that it was not only the destination that was important, but also the trip. I still believe so. My trip was difficult but I came out stronger, more knowledgeable about my topic and about research, about myself and about the people who surround me.

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To my son Yiannis

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Chapter 1

Introduction

“... it (the introduction of computers into education) is both a policy phenomenon (in the sense that school districts and states/provinces advocate/require the use of new technologies) and an innovation problem (in the sense that various groups are genuinely attempting to implement more effective uses of microcomputers)”
(Fullan 1989: p.28).

Over the last three decades, the introduction of computers into education has received considerable attention internationally. The role of computers and of new technologies in education has been strengthened, providing the means not only for economic development but also for educational improvement.

Indeed, the use of computers in education may improve curriculum content. The familiarisation of students with computer applications and Information Technology needs to be a part of schooling, since modern institutions require technology-literate citizens, who will be able to participate dynamically in the digital world. In parallel, computer use may also improve the methods for the realisation of existing educational objectives. It may enhance the teaching and learning of school subjects, providing teachers and students with multi-dynamic tools. Finally, computer use may alter education, proposing new educational aims and practices.

Nations all over the world have already made large investments in hardware, software development and services in order to introduce computers into their educational systems through large-scale initiatives. As discussed in Chapter Three, national policies, during early efforts, focused on the introduction of Information Technology as a curriculum subject, while in the early nineties international interest shifted towards introducing computers into educational practice as media of teaching and learning within existing subjects.

Research findings, though, clearly indicate that expectations have not yet been fulfilled. The most common use of computers in secondary education world-wide is simply as an add-on to the curriculum. Most primary schools have introduced computers so that students can play games and work on drill and practice software. Most secondary schools use computers to teach about information technology and its applications, while only a relatively small number of schools use computers within the teaching of existing subjects. In general, only a relatively small number of schools use computers regularly to promote educational objectives. Great disappointment

over the slow progress in achieving these goals has been expressed. (Becker 1986, Duguet 1990, Pelgrum & Plomp 1993, Plomp 1994, Plomp et al 1996)

As a result, pessimistic reports have argued that what computers have to offer is not worth the cost, since they offer nothing exceptional or different to the present educational practices. On the other hand, reports and studies by computer enthusiasts have argued that it was not the computer that had nothing to offer to education. It was those who used it who did not know how to exploit the potential of the computer in the interests of improving their practice and their students' learning. Many examples have been described of students interacting with computers to alter their own learning and meta-cognition. The problem is that these have been isolated cases, which have not been widely diffused.

1.1 The introduction of computers into education

Many reasons have been cited for the failure of the diffusion of computer use in schools. Discrepancies were found between policy and practice in relation to computer use in schools. Different reasons have been cited from different countries, accounting for these discrepancies including the following: A lack of equipment; insufficient quality of software; a lack of funding; location of computers in computer labs, which inhibited their use in classroom teaching; entrance examinations to upper secondary schools; a lack of interest, motivation and computer competence in teachers; the slow pace at which teaching methods adapt; the brain-drain in education, in the sense that qualified persons were employed outside the educational sector (Plomp et al 1996).

In parallel, it was argued that computers come to support different school, classroom and teacher cultures. This way, intended philosophy of software by initiators or designers is many times distorted when it is used in a classroom (Olson 1982, Watson 1992, Hoyles 1992). The teachers' subjective meanings and philosophies about computer use, the resources available and the support provided have influenced computer use in schools and classrooms.

Research focusing on policies related to the introduction of computers in schools, showed that these policies succeeded, either in cases where computers were introduced within a compulsory subject, or in cases where computer use as a tool within existing subjects had become a part of an examination program (Plomp et al 1996, Brummelhuis 1995). Moreover, policies introducing computers in education succeeded when, external support (financial support, training, hardware and software provision) was combined with bottom-up approaches (accepted relevance of computer use by teachers, positive school policy, monitoring and problem-solving approach) (Brummelhuis 1995).

It was recognised that the issues related to the introduction of computers into education were not only technical but also educational. Growing experience in the introduction and use of computers in schools strengthened this argument. Thus, interest shifted towards ways of diffusing successful paradigms, and towards studies on educational innovation. However, much

more research is needed to understand the process of the introduction of computers into education.

1.2 The study

The aim of the research is to explore the process of the introduction of computers into education considered in a framework of educational innovation.

1.2.1 The introduction of computers into education as an educational innovation

Studies on educational innovation (Chapter Two) have pointed out that education is a system comprising many parts, which cannot be isolated from each other. Schools are socially but also locally constructed. Educational innovations are -or, at least, should be - a means to an end. This end is shaped by moral, social, educational, pedagogical, political and economic trends and priorities at the national level, as well as by beliefs of individuals, and schools at the local level. In parallel, they have pointed out that the implementation of an educational innovation is a complex process, involving many interrelated factors at the initiation and implementation levels. Innovations are rarely, if ever, implemented exactly as envisaged by their initiators, since they are influenced by the beliefs of participants in the innovation, as well as by the context of implementation. Considering the above, in order to understand the process of the introduction of computers into education, it becomes necessary to explore the process of initiation of computer use into education, as well as its implementation. Thus, the main research question of the thesis is:

- ◆ What are the implications for the initiation and implementation of computers into education as an educational innovation?

This main research question is broken into three main questions that guide the literature review as well as the empirical research as follows.

1. In what way can the introduction of computer use into education be conceptualised as an educational innovation?

In order to conceptualise the introduction of computers into education as an educational innovation, the study draws on general issues of educational innovation, as well as on the specific characteristics of computer use and of its introduction into schools. Studies on educational innovations have pointed out that the characteristics of an innovation are an important factor that influences the process of the innovation. That is the value the innovation presents and the complexity its introduction into schools involves (Chapter Two). Thus, the thesis conceptualises computer use in schools in terms of the value it presents and the complexity its introduction into schools involves, by pulling together the literature on computer use and its introduction into schools. As will be discussed in Chapter Three, similarly to other innovations, specific values and expectations influence the introduction of computers into education. Additionally, similarly to other innovations, the introduction of computers into education involves an educational complexity, in terms of the compatibility between the proposed innovation and existing educational objectives and structure. The introduction of

computers into schools, however, presents specific characteristics due to its technical complexity. The introduction of computers requires a massive investment in hardware provision, software development and teacher training. This investment has to be sustained over time and teachers' in-service training becomes an issue of great importance, since the field is continuously evolving.

The value that the computer use presents and the complexity its introduction into schools involves are influenced by the nature of computer use. Thus, the thesis distinguishes two broad categories of computer use (IT and ITE). It presents the different values that these categories reflect, and discusses how their promotion fits (or not) the context of the innovation with respect to a country's priorities. Moreover, it discusses the level of complexity their introduction into schools involves, as influenced by the nature of the category of computer use, and the context of the innovation - the technical and human resources at hand and their compatibility with existing educational objectives and structures.

2. In what way are the two categories of computer use (IT and ITE), as well as the process of their introduction into education, illustrated in the international experience?

The study draws on international experience and discusses approaches, policy rationales as well as implementation strategies for the introduction of computers in education. The cases of the early efforts in England and Germany to introduce computers into education, serve to illustrate these different categories of computer use, the different policy rationales for their initiation, and the way these policy rationales were influenced by the characteristics of the computer use and by the context of the country. The cases of the two countries (Chapter Three) indicate that many interrelated factors at the policy and the school levels, throughout the initiation and implementation phases of an innovation, influence this process. Moreover, the importance of these factors differs according not only to the characteristics of the computer use, but also to the context within which the innovation is introduced. The latter accounts for differences between a country's needs and priorities, their educational aims and objectives, as well as their innovation policies. The above indications are further explored and analysed in an empirical in depth study of the effort of one country to introduce computers into education. The empirical study focuses on the introduction of computers into general education in Greece, and the final research question was phrased as follows:

3. What was the process of the initiation and implementation of computers into Greek gymnasiums?

It has to be mentioned that the empirical study did set out to investigate how a proposed computer use in schools was successfully implemented, in terms of faithful replication of the proposed model. By contrast, it was set out to explore the reasons why a specific computer use was proposed at the policy level, as well as to explore how and why it was implemented in a specific way at the school level. This third research question was divided into two sub-questions.

a. What category of computer use was introduced into Greek gymnasiums over time and for what reasons?

In order to answer this question, the thesis explores the factors that influenced the initiation of computer use into Greek schools. It focuses on the policy level, and investigates the way the value of computer use, as accorded in relation to the country's priorities, influenced its initiation. Moreover, it investigates the way the complexity that the computer use presented for its introduction into schools, in relation to the particular educational system, available infrastructure and innovation policy, also influenced its initiation. Specifically, it investigates the following:

- In what way did the proposed objectives for computer use in general education change over time?
- In what way did the policy rationale for the introduction of computers in general education change over time?

b. In what way was the initiated computer use implemented in schools and what influenced this implementation?

In order to answer the above question, the thesis focuses on a specific phase of the innovation (1994-97), and explores the way a specific computer use (IT) was shaped in the transition from policy to implementation level. It investigates the way IT as a subject was perceived by initiators and by IT teachers. Specifically, it investigates:

- In what way did policy makers perceive the objectives of the IT curriculum in gymnasiums?
- In what way were the objectives of the IT curriculum reflected in policy documents?
- In what way did IT teachers perceive the objectives of the IT curriculum?
- In what way did IT teachers perceive the implementation of the IT curriculum?
- What was the context of implementation of the IT curriculum?

Greece was not chosen to stand as a representative case. By contrast, its specificity was acknowledged. It was expected though to promote an understanding of the process, empowering the reader to identify common or uncommon issues and relate it to his/her situation. Chapter Four presents the case study of Greece and describes the context for the introduction of computers into schools. It identifies the educational paradigm that the innovation follows, the main actors at the initiation stage and at the implementation stage. It also presents the educational context of the country in terms of the prevailing pedagogical orientation and structures that might influence decisions about the initiation of the innovation.

The methodology of the empirical research is presented in Chapter Five.

1.2.2 The results of the empirical research and the implications drawn from the study

The results of the empirical research are presented in chapters six, seven and eight. Chapter Six focuses on the initiation of computers into the Greek general education system over a period of ten years. It looks in particular at the introduction of computers into gymnasiums and

Chapter 1: Introduction

discusses policy rationales and implementation strategies over this time based on the theoretical framework developed in Chapter Three. The discussion in the chapter focuses on the way the value of the computer use as accorded in relation to country's priorities and needs, in combination with the complexity that the computer use presented in relation to the Greek context influenced the policy approaches taken. Moreover, the way external factors, such as funding from the European Community, influenced the policy approaches taken at specific times is also discussed.

Chapters Seven and Eight focus on the introduction of IT into Greek schools at a specific time and explore the way IT was shaped in the transition from policy to implementation levels. Chapter Seven discusses the way IT was perceived by policy makers and how these views shaped implementation strategies. It identifies different perceptions of IT among the policy makers and discusses the way these differences were reflected in policy documents, either in terms of generalities or even contradictions between the documents or within the documents themselves. The role of the Ministry of Education and the chosen implementation approach for the introduction of computers into education are discussed, and infrastructure put in place to support the implementation of IT is presented.

Chapter Eight discusses the implementation of IT as perceived by IT teachers. The way IT teachers perceived their role in the implementation of IT and the way they perceived its objectives and implementation are discussed. Finally, the context that the Ministry had put in place to support the implementation of IT, as perceived by IT teachers is presented.

Chapter Nine attempts to pull together all the issues discussed in the earlier chapters concerning the introduction of computers into education as an educational innovation. First it revisits the theoretical considerations of the thesis. Further, it discusses the findings of the empirical research documented earlier (chapters Six, Seven and Eight), concerning the introduction of computers into Greek general education, in the light of the theoretical considerations.

Following the discussion elaborated in this chapter, Chapter Ten presents the conclusions of the thesis, which are based on the theoretical considerations of the study, reports of empirical work on the German and UK experiences as well as on the findings of the Greek case study. In the final part of the chapter implications for the introduction of computers as an educational innovation are presented, as well as the contribution but also the limitations of the present study are cited and further research in this area is suggested.

Chapter 2

Educational Innovation

In this chapter I discuss educational innovation. I review the literature on educational innovation to stand as a base from which the introduction of computers in schools is explored.

In the first section, the chapter briefly presents different paradigms of studies on educational innovation and the shift of their focus from the *innovation* towards the *context* of the innovation and to the *process* of the innovation. The second section of the chapter explores the initiation phase of an innovation. Discussion is based on the issues of *who* decides for *what* innovation based on *which* criteria. It also discusses the way the decisions of the policy makers may influence the accommodation of the innovation by teachers. The third and final section of the chapter discusses the way that teachers may perceive an innovation proposed by policy makers and the way they may react to it.

2.1 Studies on educational Innovation: the shift of focus from “product” towards “process”.

Educational innovations flourished in the 60s and 70s. Their failure to bring about fundamental changes and improvement in schools created the need to study innovation and its process. As discussed below, studies on educational innovation changed their focus of interest over time, under three main perspectives: the technological, the political and the cultural (House 1979).

Earlier studies under the *technological* perspective focus on the innovation itself. They view the innovation process separated into functions and components, based on rational analysis and empirical research. The most dominant model of innovation within the technological perspective was Research, Development and Diffusion (R, D & D) paradigm. According to the RD&D model, first, knowledge is advanced in the research stage, which is the first stage of the innovation. Next, a solution is invented and built during the developmental stage, which presents the second stage of innovation. Third, the innovation is introduced to practitioners in the diffusion stage, and finally, it is incorporated into school systems in the adoption stage. This approach assumes a rational sequence of activities, massive planning, a division of labour, high development costs and a passive consumer at the end of the chain (House 1979). After failure of many innovations, the inadequacy of the “Research, Development and Diffusion” model of innovation was highlighted. As stated by Hurst (1983), “... *planned change is a myth*” (Hurst 1983: p.55). The model was criticised because it was seen as linear

and one-way oriented, since adopters had just to accept “the” innovation made for them. It treated practitioners as passive elements, and also, it created a large-scale hierarchical division of labour (House 1974). Moreover, it assumed considerable consensus between developers and users. It suggested that curriculum users accept and implement change without objection, provided that they fully understand this change. It also assumed that schools are objective structures, rational organisations organised to achieve certain goals. “*The more ‘rational’ the organisation, the more effective it becomes*” (Elliot 2000 p.204). In this sense, teachers needed to be convinced of the rationality of the program, irrespective of their subjective preferences and desires. Diverse practices and conflict would be interpreted as a failure of communication or bad techniques of persuasion (Elliot 2000).

The *political* perspective offered an alternative explanation to the problem of educational innovation, focusing on the *innovation in context*. It focused on conflicts and compromises between participants of innovation, assuming that an innovation is not perceived the same way by all participants (House 1979, Hurst 1983). It was pointed out, that teachers and policy makers have differential access to the rewards of an innovation and thus, different incentives. It was argued that the higher the position of someone in the hierarchy, the higher their benefits and the lower their costs (House 1974).

MacDonald and Walker (1976) proposed another way to understand the issue of conflict and compromise between participants; this was the negotiation of the meaning of innovation. They argued that basic conflicts in values are camouflaged by a common rhetoric to which all subscribe. The gap between project intent and classroom practice is the consequence of a trade-off in meaning, that is negotiated between developers and teachers and also between developers and academic critics. Developers negotiate an idealised product image with academics. Hence the gap between practitioners and critics is not the result of miscommunication but of negotiations that the developers must conduct in order to survive.

However, the political perspective assumes that compromise and consensus may be achieved (House 1979). The issue of “advocacy groups” was raised as a major factor in the success of the innovation. Advocacy groups were important to negotiate meaning and secure resources and rewards with the participants in an innovation. Fullan (1991), discussing the role of the participants of an innovation argues that as innovation becomes more complex, the role of change facilitator becomes crucial. Effective internal and external consultants must facilitate the development of individual and organisational meaning of a particular change, interacting with school and district personnel. Hall, Putnam and Hord (1985)¹, however, pointed out that the role of local change facilitators varies between districts in terms of authority they have, time spent in schools, and activities they are involved with². They also argued that facilitators often do not have specialised training for their role, while it is very difficult to describe what they do.

¹ Quoted in Fullan (1991), p.216

² In the case of the introduction of computers into Greek education, PLINETs were appointed in order to help teachers and support the diffusion of IT. Their role is discussed in detail in chapter seven, section 7.3.4.1.

Moreover, they argued that their role is not always clear between the participants of the innovation. Facilitators often have little clarity about the scope and primary purposes of their role, while there is little congruency between what they say they do and what others perceive they do. Additionally, teachers view them as being remote from the classroom, and they have little understanding of what facilitators really do. Finally, they argued that although facilitators provide the impetus for many innovations, they are in crossfire of demands and expectations.

While, however, little is known about their role, more is known about effective and ineffective facilitators. As Fullan (1991) argues, if facilitators work on a one-to-one basis they will have limited impact because they will reach only a small percentage of teachers. If they work without a co-ordinated plan for managing change, it will be extremely difficult for them to set up activities involving assistance to support the change. Effective facilitators have to access and balance expertise in both the content of change and the process of change, while they must take into account each school and each classroom context with which they wish to work. Finally, they must develop working relationships with other change leaders.

In parallel with the political perspective, another perspective began to emerge; the *cultural* perspective. This emphasised the importance of the school culture (Smith 1968, Sarason 1971). The school was viewed as a set of structured interacting roles in a tradition-dominated social setting. These roles shaped the behaviour of the participants, creating conflict. According to the cultural perspective, conflict is a clash between two distinct cultures: the researchers and the teachers.

Recent studies in the cultural perspective emphasise the importance of the culture of the school and point out that innovation is a process and not an outcome. As Fullan (1993) argues, "...change is a journey and not a blueprint." (p.24) It is non-linear and loaded with uncertainty. However, anxiety comes along with the creativity that is viewed as valuable for educational change (Fullan 1999). Hargreaves and Evans (1997) also argue that educational change in our post-industrial age must be viewed as shared journeys and not destinations, always open to revision and review.

Within this process, new aspects of educational change have been highlighted. First, the meaning of innovation as perceived by developers and teachers becomes a key issue. Sarason (1982, 1996), gives emphasis to the *culture of the school*, and how *teachers*, who are going to use the innovation, view the innovation. He raises the issue of *resources* in the process of innovation, relating them to the innovation's objectives. Although resources have been studied many times in the literature, what is interesting here, is his broad definition of resources, not only as material, but also, and mainly, as human. As Sarason argues, human resources have two aspects: society's impersonal and conventional definition and people's subjective perceptions. When these two aspects are not in conflict, innovation has a chance to succeed. Hence, the more resources there are related to the objectives of the innovation, the greater the possibility for the objectives to be realised. Similarly, Rudduck (1991) and Hargreaves and Evans (1997) point out that personally founded motivation is the essential factor leading to successful change. It is necessary, not only for the participants to agree and understand the

innovation, but also to develop a problem solving approach, which means that they would feel the need for the change.

It has been extensively argued that teachers need to be involved in the process of educational change. This last aspect would allow for the development of commitment, which is a strong motive for change. (Rudduck 1991; Hargreaves 1994; Sarason 1996; Hargreaves & Evans 1997; Fullan & Hargreaves 1998; Sarason 1998; Fullan 1999). In this line of argument, empowerment of the school and of the teacher is needed. Schools within "low structured situations" (Posch 2000) should take the responsibility of the curriculum as best matched to the diverse needs of students.

Within this process, a learning attitude and a structure of problem solving needs also to be developed. Effective responses to complex situations can not be developed, unless problems are seen as things to be solved, and not as occasions for blame. Moreover, conflict needs to be seen as collaborative diversity, a necessary part of change (Fullan 1993; Hargreaves & Evans 1997; Fullan & Hargreaves 1998; Fullan 1999). These kinds of interactions within and across schools flourish within collaborative structures of help and support, *"where teachers work together, become less autonomous and isolated, more open at risk taking, better skilled through continuous development, and ultimately empowered in accomplishing what they set to do"* (Fullan & Hargreaves 1998).

Hargreaves (1994) argues that a meaningful and realistic analysis of educational change requires us to examine the purpose and context of its development. This requires us to look at the interrelationships between the different parts of the context as a whole. By dealing only with issues of knowledge, skill and compliance in trying to make teachers more effective, we fail to deal with other vital influences on the nature and quality of teachers' work. As asserted by Hargreaves: *"These are the teacher's purpose, which drives what the teacher does; the kind of person the teacher is, in their life as well as their work, and how this affects their teaching; the context in which teachers work, which limits or liberates them in terms of what they can achieve; and the culture of the teaching community and how teachers' relationships (or lack of them) with their colleagues can support or subvert them in their efforts to improve the quality of what they offer to their students."* (Hargreaves 1994: p. xiv)

At this point it is necessary to highlight that in spite of the shift in the focus of educational studies to the school context and collaborative models of innovation, many governments and planners have been reluctant to give up the technological paradigm of innovation. That is because on the one hand, massive planning, co-ordinating of speciality roles and control of large-scale development, appeal to governmental officials. The division of labour becomes a hierarchical one, in which the central planners control the flow of new ideas and products (House 1979). In parallel, as Ball (1993) argues, in post-industrial times, progressivism is under attack. An international perspective on education tends to look back at a golden age of basics, enhancing students outcomes in employment-related skills and competencies (Ball 1998, Schostack 2000), while the globalisation of the economy leads to standards-driven reforms, attaining more direct control over curriculum content and assessment (Ball 1998,

Sarason 1998; Brennan & Noffke 2000). Ball (1993), looking at the role of the teacher in English educational system, argues that after the educational reform in the late eighties, the teacher becomes absent in the discourse of educational policy. At the same time, elements of control shift from the teacher to the parents via open enrolments, parental choice and per-capita funding (Ball 1993, Maguire & Ball 1994). Within this framework, which Kickert (1991)³ calls "steering at a distance", constraints are replaced by incentives, while prescription is replaced by ex-post accountability based upon quality or outcome assessments. Teachers become resources. They are visible as the focus of appraisal, accountability, comparison and review. However, they are invisible as expert professional actors and decision-makers. They are to be managed. The key points of control are over the discourse and over the indicators of performance, rather than on practice. (Ball 1993)

Turning to the case of Greece, as will be presented in chapter four, the initiation of an innovation is the responsibility of the Ministry of Education. The Ministry of Education is at the top of administration and control of education. It is responsible for the development of the National Curriculum and its implementation by means of providing the necessary resources, the employment of necessary teaching staff, and provision of in-service training. Although the need for participation at all levels of decision-making was recognised in the mid-eighties, the different advisory bodies that had been established to consult the Ministry of Education, are not allowed to take decisions and to exercise power over the administration. Within this framework, school directors and intermediaries such as school advisors are not influential, since they only monitor and support the implementation of the authorised National Curriculum. In parallel, teachers are not involved in decision-making, while they are called to implement the authorised curriculum. There is little autonomy at the level of schools, while teachers' practice is ruled by the "single" textbook and controlled by school advisors appointed by the Ministry of Education (see also chapter four).

The next section focuses on the initiation of an innovation as can be seen within a centralised educational system.

2.2 The initiation of an innovation: a matter for policy makers

"...what we are striving for is the actual implementation of a good quality program that we value" (Fullan 1991: p.18)

A very important issue that has come up in the recent literature about educational innovation, is the issue of *value*. As argued by Fullan (1991), the meaning of the process of an innovation is to implement a "good" innovation, to bring into the school a new and "good" idea and put it into practice. He points out though, that different innovations and changes "exist" expressing a wide range of values. The main point that arises, as a question rather than an argument is, *"Who judges the quality of an innovation, based on which criteria?"*

³ Quoted in Ball (1993), P.111

Fullan (1991), suggests that advocacy from the central administrator presents an influential factor for the promotion of an innovation. That is because the central administrator can combine access to information, internal authority and resources to support the initiation of the innovation. In parallel, teachers can be very influential through teachers associations, as well as working together and disseminating the innovation. It has to be considered here that the power and influence they may have on the decision phase of a certain educational system is dependent on the innovation policy. Bowe and Ball (1992) as well as Sarason (1990) rightly emphasised that schools remain mostly marginal to the policy-making process; the voices of heads, classroom teachers and students are either excluded or underrepresented, i.e. via teachers' unions. Shaeffer (1991) pointed out that centralised top-down systems do not allow local-level action.

Within centralised educational systems, it is the *policy-makers* in high levels of the hierarchy of education that decide for or against an innovation. This is true in the case of Greece. As briefly presented before (p.11) and will be presented in chapter four, in the case of Greece, school administrators, school advisors and teachers may report their views, although, they do not participate in decision making.

Interestingly, Sarason (1990) made the point that many of those who participate in the commissions set up for deciding on educational reform, have been chosen to a great extent, "*for the clout their names and status lend to [reform] reports*".

It was pointed out that a basic feature of these external reformers is that they have *no first hand experience* of school systems, apart from having worked there or having been students, several or many years ago, that is - given the great speed of change - in a very different context. Lack of familiarity with something one wants to change usually results in a misconception of it and the handling of it in ways that do not suit it and may also harm it. To provide an example, in Silberman's ⁴ review of education in 1970, it was concluded that the failure of the reform movement to bring about change was due to the fact that "*its prime movers were distinguished university scholars*". He argued that these people, despite their good intentions and intelligence, came up with abstract theories and ideas not related or relatable to real school practice.

Turning to the criteria on which an innovation may be promoted or not, Fullan (1991) argues that the innovations that are considered needed, and thus chosen for promotion, are innovations that their *values* and their *objectives* are congruent with what is perceived as the priority *needs for education*. It is argued that education reform all over the world nowadays, although justified by educational need, indirectly or even directly, stems from current economic, political and social demands. More specifically, the new international economy is affecting more than business. The competition of economic forces, the fear of economic depression as well as the reality of it, demand, across national boundaries, the reshaping of schooling according to

4 Silberman (1970) Crisis in the classroom quoted in Fullan, M. (1994), p. 22-23.

the economic needs (House 2000). The preparation of students for the future society becomes an issue of great importance and their education receives a great deal of attention. In addition, education is blamed to a great extent for many crises such as economic, social and moral (Guthrie & Pierce 1990).

In this context, politicians and administrators often claim that something *drastic* has to be done in order to improve the education offered. This has become very common in the 1980s and the 1990s, in the context of the post-modern world, where educational change has become frenetic, being marked by "*recurring waves of reform*" that are developed in short-term patterns. As change accelerates the sense of overload and fatigue among teachers becomes stronger. Teachers feel very tired of the system itself and, possibly, are less willing to co-operate with the multiple reform efforts imposed on them. In addition, the waves of reform are often found to be incoherent and inconsistent with each other (Stronach & Morris 1994). This results in confusion and high levels of resistance by teachers. It is not to say that innovations cannot be introduced in parallel, but they need to fit in the broader context of the school and the education system's objectives. As stated by Hargreaves, "*in education, as in other walks of life, things go together*" (Hargreaves 1994: p.8).

Innovations have to be a means to an end, and not an end by themselves (Hurst 1983; Fullan 1999). Fullan, in his earlier writing (1991), talks about 'opportunistic innovations', that turn out to be meaningless. He argues that the community often influences decisions. The more highly educated communities create more pressure for the adoption of desired innovations or react strongly to unwanted innovations. Yet, an indirect way that a community can influence the promotion of an innovation is the political desire of governments to satisfy their voters, which leads to opportunistic approaches to innovation with no clear educational objectives. The combination of social-economic reasons and desire to ease community pressure often leads top-down changes to become *symbolic in nature*; namely, they are prescribed for reasons other than educational. As discussed, such reasons are to offer a political response, to appease community pressure, to gain more resources, to appear innovative and to impress rather than to offer real solutions to educational problems. Politicians need to be seen to do something for the good of education (Fullan 1991). Given that policy makers have poor knowledge and are distant from the complex school systems (as discussed next), they offer simplistic and unrealistic versions both of the problems they address and the "solutions" they propose.

In addition, in the effort of policy makers to offer an innovation that would have a strong and visible impact, often little *time* is given to teachers (and any other groups affected by change) to assimilate and adapt the meaning of change to their own framework of theory and practice. Fullan (1991, 1993, 1999) pointed out that the psychological process of understanding, learning and implementing something new "*does not happen in a flash*" or "*in several flashes*". Failure of mandated changes is often related to the fact that the reformers expect teachers to comply with the reform directives, before their natural impulse to reject it, is expressed and dealt with. This way, teachers are often asked to implement multiple innovations within short periods of time, before being able to understand and evaluate the substance and the effect of each of

those efforts. Thus the reformers impose an impossible task on teachers, especially when they are distinguished by an urge to bring about a “quick fix”. The issue of time has been widely discussed (Sarason 1996; Rudduck 1991; Hargreaves 1994) and it is discussed more extensively in the next section, in terms of the way it is seen from the perspective of the teacher.

Another aspect of the symbolic nature of top-down changes, is that when they lose their political “glamour”, after the first problems of implementation appear, they become supplemented or replaced by new (usually optimistic and impressionistic) reform directives. These new additional features may not fit in with them, or even more, they may propose a totally new perspective. This inconsistency must become more evident in circumstances of political turnover, where politicians do not need only to be seen to do something for education but also to be seen to do something better than the opposite political group (House 1974).

Additionally, external reformers inadequate knowledge of the system, as was detected by Sarason (1990; 1998), concerns the lack of a *holistic* vision of and approach to the education system, namely, the way the groups and the problems in the system are interrelated. As he explained, the partial view results to conceiving problems and attacking them separately, while the stance “*who is the villain*” is often adopted. Hargreaves (1994) provided a distinctive example of it by referring to the common assertion that educational standards are low and the young are failing because the practices of many teachers, or the teachers themselves, are deficient and misdirected. However, as Sarason (1998), argues “*there are no villains. There is a system*” (p.141), made up of the practices and attitudes of colleges, universities, boards of education, school administrators, political leaders.

Indeed, fragmented approaches may be convenient, but they are also simplistic and misguided and fail to bring about change, because problems and groups in the education system do not exist and develop in isolation from the others. Moreover, we could not say that in education there are villains in the sense that a group has deliberately sought to create problems. Thus, although some partial changes may appear to be beneficial, they are unsuccessful because they do not fit in well with the whole context.

Moreover, it is argued that successful paradigms have not been diffused into the system (Sarason 1998). The issue of transferability of successful paradigms was highlighted (Fullan 1999) and system’s *diversity* was highlighted. Another problem that has been found in centrally imposed innovations, and especially within broad scale implementation, is that they overlook the system’s *diversity*, the fact that the education system of a country includes thousands or hundreds of schools that happen to differ “*widely and wildly*” in many respects.

Indeed, each school is not only different but also unique, because the people in it are unique, their biographies, their experiences, their problems and how all these are interrelated in the given school context. In this way, objectives that are important for a school, a teacher or a group of teachers may be seen as incidental in others. Interestingly, it has also been noticed that there are a number of possible responses to reform directives, even among apparently “similar” teachers in the same school (Acker 1997). As a result, prescribed changes are construed and treated in ways that are quite variable.

What is more, as Bowe and Ball (1992) emphasised, schools are *not* equally *able* and *prepared* to respond to the reform directives. Firstly, the school staff might lack the *capacity*, namely the experience and skills, to respond satisfactorily to change. Secondly, there are *contingencies* such as staffing (recruitment, experience, innovative spirit, quality of collaboration), student recruitment and existent facilities/resources that may advance or inhibit significantly the possibilities of change. Finally, they said, the *history* of the school, especially in attempting innovations, as well as its *commitment* to pedagogical principles also influence the treatment of any top-down changes.

Similarly, Finnan & Levin (2000) talked about basic beliefs and assumptions that underpin school cultures, that are locally constructed. These include beliefs about a school's expectations for students, students' expectations for school experience, expectations for adult members of school communities, acceptable educational practice, as well as desirability for educational change. At this point, we should add that the wider socio-economic context of the school must play a very important role, because it influences the above four dimensions.

Planning and prescribing changes for a great variety of schools requires the belief that one can create educational "products" that can be easily diffused and used in many different educational settings. As House (1978) argued, it requires a "*doctrine of transferability*", while the great diversity makes such transitions infeasible and utopian. Thus, transferability must be conceived as not just dissemination, but also as figuring out how to replicate the conditions that resulted in successful change in the first place (Fullan 1999).

Countries with comparatively high standards of student achievement (i.e. Japan, Korea and Taiwan) have powerful, centralised national programs and policies (Sarason 1990). Their devices include, usually at a nation-wide level, the introduction and imposition of teacher-proof curriculum guidelines, official textbooks, standardised testing (to monitor teaching) and new teaching methods that are said to have proven their effectiveness (Hargreaves 1994).

However, the *policy texts* that accompany and represent them usually have meanings that are *neither fixed nor clear*, which makes the "carry over" of meanings from policy level to education practice subject to personal interpretation, contention and distortion (Bowe & Ball 1992).

At this point, it is helpful to refer to Roland Barthes's classification of texts into "readerly" and "writerly" ones.⁵ He suggested that in readerly texts there is the minimum of opportunity for creative interpretation of the content by the reader, who has either to accept it or to reject it. By contrast, he claimed, in writerly texts there is a great deal of such opportunity and readers can "translate" the text, give critical responses to it, go beyond it and transform its meanings in a progressive or radical way. With regard to the official policy texts and their commentaries (that usually accompany them to make them more accessible), it has been found that they can be very often characterised as "writerly" texts. Moreover, it has been found that the series of texts

⁵ Hawkes, T. (1977) *Structuralism and Semiotics* in Bowe & Ball (1992) op. cit., pp. 10-12.

that correspond to a prescribed piece of reform may be not only unclear but also incoherent or contradictory to each other (Bowe & Ball 1992).

Both points mean that there is a lot of space for personal interpretation and manoeuvre on behalf of the teachers. This space must be enlarged when teachers know how to view the policy texts critically and from different perspectives. Teachers, as readers of educational reform texts, are neither uncritical nor naïve. The fact that they have their biographies, their values, their aspirations and their vested interests in policy, impacts seriously on how they interpret and treat the given mandates for change. In this way, there are a great number of interpretations and in turn various responses in practice to what appears to be the same prescription for all teachers and all schools. Consequently, new cycles of policy-making begin at the level of each school and classroom. These cycles must be unique, because unique are the persons who form and implement them in accordance with their needs, problems, desires and aspirations. What is more, the various outcomes of the reform directives may well be very different from those that the policy-makers have planned and expect.

At this point, the issue of “painful unclarity” that Fullan (1991) introduced needs to be pointed out. In this situation, teachers experience a lot of *discomfort, loss and anxiety* when faced with an innovation the terms of which are abstract, ambiguous and confusing. This, results in anxiety on behalf of the teachers, which increases when teachers are under pressure by mandates, especially in highly controlled, “strict” systems. Within this context, openness of policy texts may result in confusion and uncertainty.

Whatever the innovation means for policy makers, and whatever approach they follow to put forward to schools, it is impossible for any external reformers and inspectors to “*have total surveillance of every teacher in every classroom*”, namely to “*every classroom every minute of the day*” (Acker 1997). Thus it seems that teachers have the possibility of doing quite a lot in their own classroom and school in order to divert or subvert the mandated changes. Their resistance can become more powerful and effective when they support one another. It is really very interesting that the “silent” and seemingly “powerless” voices of teachers during the policy-making process can become heard and powerful when the time for implementation comes. As a result, although the state has power, since it can prescribe changes, these changes are not so much implemented as they are reshaped. The filtering, stronger or weaker, of the mandated changes means that, as was previously discussed, they are not followed by the anticipated and desirable results. That is accounts for the policy-makers’ well-known contention that “what we want is results, what we get is consequences”. In other words, as Bowe and Ball (1992) suggested, it is more appropriate to talk of policies having “effects” rather than having “outcomes”.

2.3. The implementation of an innovation: a matter for teachers

"It is what teachers think, what teachers believe and what teachers do in the level of the classroom that ultimately shapes the kind of learning that young people get" (Hargreaves 1994, p. ix)

What has been highlighted in recent literature on educational innovation is that the teacher is the ultimate key to the implementation of any innovation. Many teachers are not passive to the prescribed changes and provide *creative or resistant responses* to change, shaping them in accordance with their own realities. As discussed before, policy makers often overlook the school context. First, they may overlook the diversity between schools and uniqueness of situation in each school, in terms of existed contingencies (Bow and Ball 1992). Secondly, they may underestimate or overlook schools as "political institutions" in the sense that they present complex interrelations and subjective teacher values and beliefs (Sarason 1982).

Much has been written on the issue of stronger or weaker versions of teachers' reactions to imposed changes. It is significant to note that no matter how weak or strong the filtering of the policy by teachers is, the fact is that this filtering seems to be almost always present. Interestingly, research evidence has shown that the filtering and shaping of mandated changes is a feature of teachers' work that is met in different countries and cultures, even in rigid and highly controlled education systems. (Osborn 1997)

A first issue of consideration is the issue of the *practicality* of innovation, especially in the case of the centrally imposed changes. Judging changes on the basis of their practicality is for most teachers at the heart of educational change; as Hargreaves tellingly put it, teachers have an "ethic of practicality". When a reform is presented or imposed on them, what they firstly do is to examine the extent to which it fits in with their reality. Huberman and Miles (1984) investigating twelve efforts to improve schools in USA, reported that target users seemed to view innovations as complex, unclear, and hard to do. They felt that innovations would demand substantial changes. On the other hand, administrators viewed the practice as relatively simple, straightforward and manageable, and they tended to put more weight on the merits and to minimise the drawbacks. The problem that has been detected in the case of many top-down reforms is that they often appear with timetables and expectations that are so impressive and high that their failure is easily predicted (Sarason 1990, Hargreaves 1994).

Fullan (1991) suggested that the rational assumptions and descriptions of proposed changes may appear irrational and nonsensical in the eyes of teachers because they do not address the serious issues of *boundedness, psychic rewards and time and efforts management* on behalf of them.

Indeed, this must very often be the case for centrally mandated reforms, that usually come up with texts whose language is official, abstract and "rational". Lack of clarity of texts can present another burden to the teacher who has to spend time and energy trying to understand or even make sense of abstract general policy mandates. Particularly in terms of time and energy, the personal costs of trying something new in the teaching profession requires a great

investment by them. This is by no means easy because, as it is widely accepted, teachers feel overloaded, tired and pressed for time, which certainly discourages them from attempting to innovate.

Sarason (1996) highlights the issue of time as of great importance, in the sense that time is needed to allow for internalisation of and reflection to the innovation. When an individual or a small group are asked to implement an innovation, they need *time to locate and develop resources consistent with goals*. As he explains, “*Any attempt to change regularities in the classroom places the teacher in an unlearning and learning process, a fact that has obvious implications for the time perspective of those seeking the change*”(Sarason, 1982: 286).

Huberman and Miles (1984) also found that innovations needed time to be implemented and institutionalised. More time was needed for complex projects (eighteen months), while down-sized projects needed much less time (around six months). Teachers worked their way through to a more differentiated and integrated understanding of the innovation by making it behave consistently. The most common path was through “technical mastery” of the practice. When the assistance was either less frequent, or not sustained, or of a single type, there were markedly lower levels of commitment and “practice mastery”. They reported that enforcing fidelity for substantial, good quality innovations really paid off, provided it was *supported with effective assistance*.

This issue turns the discussion to the issue of support, which has been pointed out to present another influential factor for the implementation of innovation in schools. Support was strongly underlined, especially in relation to large-scale innovations. “*Large-scale change-bearing innovations lived or died by the amount and quality of assistance that their users received once the change process was under way*” (Huberman and Miles, 1984: p. 273). The forms of assistance provided were various: conferences, in-service training, committee structures, team meetings (high-assistance), peer consultation, materials, external consultants, access to central office personnel. Moreover, although strong assistance did not smooth the implementation, it did increase the level of commitment and practice mastery.

Similarly, Fullan (1991) argued that teachers may modify the innovation in their classroom because of lack of understanding of its basic features and objectives. Specifically, teachers may twist the central prescriptions for reform into familiar conceptual frameworks and practices. Possibly, this attitude is also related to people’s general tendency to keep as much as possible from their established patterns of thinking and working, which they feel to be threatened by changes, especially when these are imposed from above. In this case they think that they innovate while they do so only very superficially.

As can be seen, Huberman and Miles and Fullan at one level, focus more on providing teachers with the kind of support that they need to “understand” and “master” the innovation and implement “it”. Hargreaves (1994), and Fullan (1999) however, view the issue of support more as a process of *teacher development*, which needs collaborative structures to flourish. As they argue, teachers need to develop what they call “interactive professionalism”, where they can be involved in a learning community, they can reflect on their practice, deal with problems,

exchange ideas, and be empowered (Hargreaves 1994; Fullan & Hargreaves 1998; Fullan 1999).

Hargreaves (1994) pointed out that trying new things always means that an additional burden of work has to be undertaken. Teachers must feel this burden to be heavier and more disagreeable when they are *directed* to implement change and have not been given any voice during the policy-making process. In this way, they are alienated from the reform enterprise and are, in turn, less willing to spare the time and energy required for its success. Thus, the introduction of top-down changes fail if teacher development strategies do not accompany them. In parallel though, he warned about controlled collaborative models that make “*safe simulations of co-operation and collaboration from which the dangers of spontaneity, sensuality and creativity have been removed*” (Hargreaves 1994: p.13).

In addition to the supportive context or not within which the innovation takes place, the way teachers perceive the value of the innovation influences its shaping in the classroom. Teachers may resist the innovation, and be unwilling to abandon familiar and existing practices that have been proven to be effective in the eyes of teachers. As Marris⁶ explained, teachers want to preserve their “*occupational identity*”, that is, the wisdom they have accumulated through their own experience and that of their colleagues. Both Marris and Schon⁷ rightly related the occupational identity of teachers to the context to which they belong. As they explained, this context provides teachers with a framework of theory, values and practices, gradually shaped and shared, through which they make sense of their lives and their context. They discussed this phenomenon, which is both individual and social, as “*dynamic conservatism*”. Clearly, it forms a serious obstacle to the success of top-down changes, which must become more serious and powerful when the teachers are unified and act not simply in common but also in collective ways.

In the same line of argument, Osborn *et al* (1997) who studied educational change in the context of English primary education argued that many teachers assimilate a change in ways that suit their beliefs and allow them to preserve what they consider to be good for their practice and their children. Thus, despite working within a framework of prescribed changes, teachers can become very creative and alter the direction of the top-down changes⁸.

⁶ Marris, P. (1975) *Loss and Change* quoted in Fullan, M. (1993) *op. cit.*, p. 36.

⁷ *Ibid.*, p. 32.

⁸ Specifically, Osborn *et al* (1997) called that kind of response “creative mediation” and referred to its “protective”, “innovative”, “collaborative” and “conspirational” strategies. In protective mediation, teachers are particularly concerned with protecting their pupils from those effects of the external reform directives that they consider as worse for children. In innovative mediation, teachers find creative and innovative ways to work within the prescribed reform framework as well as to go outside it, when they feel it appropriate, and to do something different. In this way, it becomes evident that they have not been reduced to being technicians but they own a professional, responsible and creative approach to their work. In collaborative mediation, teachers make informal arrangements with each other so as to face the effects of the directives with which they cannot cope alone. In conspirational mediation, the collaboration of teachers becomes more subversive of the mandated changes; teachers work together against those aspects of them that they disapprove of.

Similarly, Hargreaves (1994) who emphasises the teachers' values and aspirations, suggested that teachers are not only technical and passive learners but "social" learners too. He pointed out that teachers have their own desires to learn and incorporate new things in their practice, as well as to conserve or modify some aspects of it that they have their own reasons to value. As he explained, a serious weakness of centrally mandated reforms is that they do not take into account or overrule or misunderstand the teachers' desires or non-desires for change.

Indeed, teachers are not "rationalist" adopters who implement prescriptions for reform without any objection, provided that adequate explanations are given to them. The fact that their own desires are not taken into account by the external directives must make teachers feel that they are not respected and it also explains to a great extent why they often resent and resist the centrally mandated changes. We should also note that the meaningful involvement of teachers must be more crucial when the prescribed change is more complex and long-term. As Fullan (1991) argues, the more complex the change, the less it can be forced.

Thus, the task of innovation is to penetrate the existing culture of the group and to create a new culture, a shared meaning and commitment among them. The meaning of the innovation in the minds of the designers must be transparently real to the target users. Teachers who blend education and change, periodically discuss the meaning of activities with students, work on skills students need to participate in new educational reforms, and consider the relationship between old and new (Fullan 1991).

This way, this shared meaning, evolves *from within*. As Rudduck argues: "*I view the ownership of change as a motivation towards change that is personally founded, and I see it as being about meaning that is explored in relation to the self as well as in relation to the professional context.*" (Rudduck, 1991: p.97)

Teachers not only need to understand what they want to achieve and why, but most importantly the way in which this matches *their* needs. They must feel as individuals as well as members of a working group, which owns and is in control of the problem of change. And this is difficult, especially in top down policies, due to the lack of both time and chances for discussion between teachers and between teachers and policy makers.

As Rudduck puts it, "*if we are interested in substantial curriculum change, we may need to find structures and resources to help teachers to re-examine their purposes, as these teachers did, slough off the skin of socialisation, and feel more in control of their own professional purposes and direction.*" (Rudduck 1991: p.94)

At this point it needs to be noted that although teachers play a crucial role in the implementation of an innovation, all participants of the innovation influence the shaping of the innovation in the school and in the classroom. Schools in parallel with the "culture of schooling" which is shared with all schools, have a specific school culture involving artefacts, processes and basic beliefs and assumptions that influence the acceptance of an innovation. Finnán and Levin (2000) identify five critical components of the basic beliefs and assumptions that shape school culture: school's expectation for children, children's expectations for their school

experience, expectations for teachers and parents, opinions about acceptable educational practices and assumptions about the desirability of change.

In the same line of argument, Rudduck (1991) argues that school culture is a social accomplishment; it is learned and shared, and its power is that it can sustain a complex pattern of norms. Change, on the other hand, involves abandonment of familiar practices, which are comfortable for the participants in education. In this sense, students may also present a powerful conservative force, a significant feature of the innovation process.

Similarly, Fullan (1991) points out that change in schools involves just as much cognitive and behavioural change on the part of the students as it does for anyone else. The more complex the change, the more that student involvement is required. Student motivation and understanding regarding a change are directly related to whether and how they engage in the proposed implementation activities, which are the means to achieving the implementation of the proposed innovation. Thus, students' reactions to the introduction of the innovation need to be considered by those responsible for innovations.

2.4 Summary

Studies on educational innovation changed their focus of interest under three main perspectives: technological, political and cultural. Within the technological perspective of innovation, experts plan an innovation and expect teachers to implement the proposed innovation, at least as it concerns its most important aims and features. In this case, implementation strategies would focus on developing clarity of the innovation meaning and the teachers' mastery. An innovation within the political paradigm of innovation targets to the implementation of an innovation to which all participants conform. In this case, implementation strategies would focus on finding ways of achieving consensus among the participants about the meaning of innovation, through negotiation. Finally, an innovation within the cultural perspective allows variation in its implementation, since it acknowledges that teachers and schools may not be in complete agreement, as they represent different sub-cultures.

Technological perspective on educational innovation and respective studies not only failed to provide fundamental change, but also to explain the process of educational innovation. Recent studies highlighted that innovation is a process and not an event. They acknowledged the importance of the school context that the technological perspective had ignored, and highlighted that education is a system that comprises by many interrelated parts that influence each other. They gave emphasis to the value and meaning of the innovation, as perceived both by decision-makers and teachers.

However, although the cultural perspective dominates in recent research on educational innovation studies, technological perspective still survives and dominates in many - governmental policies, such as in Greece, which supports centralised top-down innovation policies. In such innovation policies, policy makers initiate the innovation, while teachers are distant from the decision making process. These policy makers chose to promote innovations

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that promote objectives that are congruent with what they perceive as the priority needs for education. However, their choices are often driven from social, political, or economic demands, especially in the post-industrial societies. This way proposed innovations might become of symbolic nature, proposing superficial solutions to educational problems trying to bring a quick fix and a visible impact. Additionally, policy makers being distant from school may overlook diversity of schools in terms of school interrelations and culture, but also of contingencies, and thus, propose innovations that are not addressed to real needs.

The implementation strategies of these policy makers in the educational hierarchy focus mainly on the communication of the proposed innovation to teachers. They develop and circulate policy texts and documents that explain the aims of the innovation. However, these documents have rarely fixed or clear meaning, often contradicting to each other or even more, including contradictory parts. The later overloads teachers with the responsibility to make sense of the innovation, or even worse confuses them.

In parallel, educational innovation studies have pointed out that teachers rarely implement the innovation the way envisaged by policy makers, even in centralised educational systems. The implementation context of the innovation in terms of practicality -and support, influence its implementation. The way teachers perceive innovation also influences their practice. Teachers may creatively mediate or resist to an imposed innovation influenced by the way they perceive it. They can find creative and innovative ways to work with the imposed change, or may preserve their occupational identity, adjusting to the nearer occasion of change. Indeed teachers may shape the change according to their context; personal values and school context.

The next chapter discusses the introduction of computers into education as an educational innovation, within national directed initiatives of different countries.

Chapter 3

The Introduction of computers into education

In this chapter I discuss the introduction of computers into education and I present the conceptual framework used in the thesis to analyse the introduction of computers into Greek gymnasiums.

As argued in the previous chapter, different innovations exist presenting a wide range of values and objectives (Fullan 1993). That is definitely the case for the introduction of computers into schools (Hawkrige 1996; Underwood & Underwood 1990; Pelgrum, Anderson, Polydorides 1996; Pelgrum 1994; McKinsey & Company 1997). As Mc Kinsey & Company argue, *"whatever educational philosophy one espouses, IT can have an impact"* (McKinsey & Company 1997, p. 34) Thus, before discussing the introduction of computers into education, there is a need to define different uses of computers in schools.

The first section of the chapter focuses on the innovation itself. It opens the discussion by classifying the use of computers in schools, and discusses expectations at the national level, as well as at the school level. The second section focuses on the initiation phase of the innovation, and discusses educational policies related to the introduction of computers into schools. It presents policy approaches that countries may follow to introduce computers into schools and explores policy rationales for their promotion. The third, and final section, focuses on the implementation phase. It presents implementation strategies that countries may follow to promote the introduction of computers into education, and explores implications for the implementation of the innovation.

3.1 The use of computers in schools: expectations and implications

Since the 1960s introduction of computers into education has received a lot of attention. The role of computers into school curriculum and the potential impact on learning has been widely discussed. Computer use in schools is considered nowadays necessary for the familiarisation of students with technology and its applications, as well as for the improvement of provided education. Students are familiarised with computer applications being prepared to participate in a modern technical oriented society. Moreover, they use computers as multidynamic tools enhancing the learning process by handling vast amounts of data at higher speeds of access, communicate with peers, cultivating higher level thinking, interpretation and creative expression.

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However, these changes will increase pressure on the management role of teachers, who will be expected to manage independent learning pathways of their students. This way, in parallel with the developments of IT as learning tools, IT comes to support educational management too. Within this framework, computerised systems can be used for institutional or classroom management, improving the efficiency and effectiveness of schools (Visscher 1997).

Teachers created the first amateurish school administrative programmes for their own schools in the 1960s, while in the 70s and 80s many countries produced new clerical and administrative applications that were used in schools. By the mid-nineties, the value of management information was recognised for the first time. Nowadays the importance of Information Technology in educational management has increased, shown by the enormous sums of money invested so that schools may benefit from computerised information systems to support clerical work and management activities, and ultimately improve the quality of teaching and learning. (Visscher 1996)

Fung and Visscher (1996) distinguish three levels of computerised systems objectives applying in educational management: school administration, management and pedagogical support. The first mainly supports administrative functions of the school. School information systems enables the computation of alternative solutions for complex but structured problems providing a limited number of solutions. For example, school information systems provide a limited number of alternative solutions to the construction of the timetable, from which the staff can choose the most appropriate, increasing this way their motivation. Moreover, school information systems, as they can contain specific standards with respect to truancy, student achievements and other students' records, they can warn school staff that action is needed in case of violation of these standards, contributing to better school organisation and operation (Visscher and Wild 1997). The second level of school systems objectives relates to management, and supports decision making of the school manager. At this level, computerised systems can be the agents behind the new role of the manager. In this case, the manager carries out his local action according to a broad perception of the entire system, and with reference to global development. Computer use can contribute in the field of socio-cultural communication, the promotion of shared values, the access and dissemination of good examples of educational practice, the continuous development of leadership and systems management. (Slenning 2000). The third level of school systems objectives is pedagogical, and supports teaching and learning. At this level, computer systems can help the teacher to prepare his work for example through better worksheet production, or to support him to create lesson plans. Moreover, they can support the teacher's decision-making relevance to pupil support, through the transfer of the analysis of data on pupil progress. Finally, computers can support the teacher more directly through the management of the learning process itself. (Visscher & Wild 1997) Shifting from the first to the third level is a move from improving efficiency towards effectiveness of the school. The fact that computers enable efficiency improvements implies that the saved staff time and input can be used for other activities that may help schools to set and

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accomplish their pupil and learning related goals which supports them in becoming more effective (Visscher and Wild 1997). The use however, of computers for educational management internationally is still very limited (Visscher 1996, Visscher and Wild 1997).

The section that follows, presents two broad categories of computer use in schools: "Education in Information Technology" (IT) and "Information Technology in Education" (ITE). It does not include the use of computers in educational management, not because the issue is not of importance. By contrast, it acknowledges the important role of IT in educational management. However, it focuses on the role of computers within the curriculum and their role in teaching and learning. In doing so, it suggests different rationales that IT and ITE realise, and the way these may be reflected in a National Curriculum in its specific objectives. It also explores a country's needs that are satisfied by the introduction of IT and ITE, as well as the level of complexity the introduction of IT and ITE into schools presents.

3.1.1 "Education in Information Technology" (IT) and "Information Technology in Education" (ITE)

The term "Education in Information Technology" (IT) is used throughout the present thesis to represent the first broad category of computer use in schools. In general, IT aims to provide students with knowledge about technology and the use of computers (Pelgrum & Plomp 1993), by satisfying two rationales: Social and Vocational (Hawkridge 1996; Underwood & Underwood 1990). In the first case (Social rationale) it is assumed that computer knowledge and competence constitute personal skills that all young people should acquire if they are to enter modern society as informed citizens. In the second case (Vocational rationale), IT aims to provide young people with the personal skills to make them skilled employees or professionals in adult society.

Looking at the level of a national curriculum, even in cases that IT does not constitute a separate curriculum subject, it presents new teaching content that does not influence or relate to other curriculum subjects' content. In order to promote the above rationales, it is suggested that the IT Curriculum should have one or more of the following objectives: Computer Awareness, Computer Competence or Computer Science.

First, the "Computer Awareness" (CA) objective¹ aims to demystify the computer and to seek familiarisation of students with its basic uses. It has been argued that in order for students to be able to cope as future adults in a technologically oriented society, students must be familiarised with topics related to computer use and operation, or with topics related to the social implications of the use of computers (Hawkridge 1996; Underwood and Underwood 1990). Students learn to use the computer through simple applications, useful for their current

1 The term was chosen based on the definition of the word "awareness" which stands for not being ignorant. **aware** /predic.adj. 1 (often foll. by of, or that + clause) conscious; not ignorant; having knowledge. 2 well informed (often in comb.: politically aware). awareness n. [Old English gewær, from West Germanic]Usage

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interests or future adult life. For example, they become familiar with the Windows environment, the keyboard and the mouse, and they can perform basic activities, such as managing files, basic word processing, and printing.

Next, the "Computer Competence"² objective aims at a high level of computer competence. It may be considered to be a next step after the Computer Awareness objective. In order to realise the Computer Competence objective, students are first familiarised with computers, and then they deepen their knowledge and skills, focusing more on computer applications. This way, they become sufficiently competent to use effectively computer applications in their personal lives, or they may even become skilled enough to enter the job market later on (Hawkridge 1996, McKinsey & Company (1997), Underwood and Underwood 1990). For example they are able to write their CV using a professional layout, or they are skilled to fill back office posts.

Although the Computer Awareness and the Computer Competence objectives are defined separately, it does not mean that they are isolated to each other. As in other aspects of education, boundaries between the concepts are not always measurable and clearly defined. For example, there is not always a clear-cut distinction between Computer Awareness and computer competence, since there is no clear line between familiarisation and competence. Indeed the two objectives can work together to satisfy the Social rationale, in the sense that both aim to cultivate computer skilled individuals, who are able to cope in modern adult society (Hawkridge 1996). The Computer Competence objective, although it may aim to cultivate well-informed citizens, it may also aim to prepare students for employment, since nowadays computer-related skills tend to be a necessary qualification in the job market. Thus, it may satisfy a Vocational rationale. This distinction, however, between Computer Awareness and Computer Competence is considered necessary for the analysis of the use of computers in the Greek context.³

Next, the "Computer Science" objective aims for students to acquire the basic knowledge on computer science, including programming. The Computer Science objective can also be interpreted as the "next" step to the Computer Awareness objective. In order to realise the Computer Science objective, children are introduced to "computer science" or "computer literacy" courses. Students are taught basic programming techniques and systems design. This way, they acquire control and confidence in computer use, and they may later pursue a career in computer science. Thus it satisfies a Vocational rationale (Hawkridge 1996; McKinsey & Company 1997).

At this point, the objective that the use of programming may promote, needs to be further clarified. As mentioned before, teaching students programming skills promotes the

² **competent** / adj. 1 a (usu. foll. by to + infin. or for) adequately qualified or capable (not competent to drive). b effective (a competent batsman).

³ Greek students entering gymnasium do not have prior experience with computers. Thus, the Computer Awareness objective constitutes a part of the Greek IT Curriculum.

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Computer Science objective. Use of programming, though, may be used to investigate and explore ideas and meanings. For example, students may use Logo programming to explore the properties of a rectangle. Students hypothesise, write simple programs, test their hypotheses, express and negotiate their ideas with their classmates and draw up conclusions. In this case, the aim of the use of programming is not the development of programming skills, but the cultivation of analytical and synthetic thinking, creative expression and of methodological skills. Thus, in this case, the use of programming promotes the Catalytic objective which is discussed in detail next.

Turning now to the second category of computer use, the term "Information Technology in Education" (ITE) is used throughout the thesis. In general, ITE focuses on the learning process. In this case, computer use does not influence only *what* students learn, but also the *way* they learn (Hawkrige 1996, Pelgrum, Anderson and Polydorides 1996, Walker 1996, McKinsey & Company 1997, Molenda 1996). This way an Educational rationale is satisfied, in the sense that computers are used in schools to improve the education that is provided. At the level of a national curriculum, there is no study content related to the computer, but its role is specified.

In fact, in this category of computer use, two objectives are distinguished, in terms of the role of the computer in the educational process. First, according to a Pedagogic objective, the computer use aims to improve methods of realising *existing* educational aims. As classified by Hawkrige (1996), and supported also by other researchers, when a Pedagogic objective is proposed, the introduction of computers aims to enhance and improve teaching of curriculum subjects, providing a "better" method or a "better" tool. In this case, routines of the classroom and roles of the teacher and the student do not change. (Pelgrum, Anderson and Polydorides 1996; Walker 1996, McKinsey & Company 1997).

It needs to be highlighted that the computer is used as a tool to perform in a better way, activities similar to those within the conventional curriculum and previous classroom routine. For example, students can use CAI software to perform drill and practice activities similar to those they did in their paper work. This way teaching of the curriculum is enhanced, since students may practice already learned skills or acquire new knowledge on a specific teaching unit, at their own pace, offering at the same time the chance for the teacher to work more closely with other students that need more help. Students can also use word processors as a tool for writing essays similar to those they wrote in their paper work. This way, students may produce a better quality of work, while students that have difficulties, become more motivated to participate in the learning process. Students may also use web-sites for project work, or use electronic encyclopaedias to write conventional essays. This way the teaching process is enhanced, since students access and process more easily the necessary information. Moreover, the teacher may use the computer to demonstrate an experiment that he/she could not do in the school lab, such as a chain reaction.

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Turning to a Catalytic objective, the computer use aims to improve education by proposing new aims, roles and practices. When a Catalytic objective is proposed, the computer presents a medium for performing new activities and realising innovative educational aims. Computer use is integrated within school activities to alter education, to question and change teaching and learning. In this case the computer is used as a medium to construct new learning contexts. Everyday classroom routines and roles of the teacher and the student change.

In this case, the use of the computer aims to enhance the shift from traditional to open learning approaches, from product towards process oriented learning. The computer use is not related to specific curriculum content. Its use aims to develop children's thinking, and cultivate general methodological skills such as problem solving, offering more control of the learning process to the student (Underwood & Underwood). New educational goals such as cultivation of problem solving and productive (as opposed to reproductive) skills, are realised (Pelgrum, Anderson and Polydorides 1996, McKinsey & Company 1997). For example, students may use mathematical software to construct geometrical shapes, discover their properties, and find relationships between them. They may use communication networks to share information or work on collaborative projects with other students from other schools or countries. They may work in groups, use a simulation program in combination with database and spreadsheet packages to experiment, collect and insert data, process the information and test their own hypotheses. They may also use a word processing package in combination with desktop publishing to present their work. In these cases, the computer does not "do" something, but it is used by students to "express" their ideas, or their teacher's aspirations about the teaching and learning situation. Moreover, using the computer may provoke teachers to question the existing curriculum. Curriculum makers may have to consider the need to achieve a balance between computer and traditional activities (word processing vs. handwriting) or teach new skills (computer searches, electronic communications) (Walker 1996).

At this point it needs to be noted that the same piece of software may be used to promote different objectives. For example, a generic piece of software may be used in different ways by the teacher or by the student, promoting different objectives. For example, a word processing package may be used to familiarise students with word processing, promoting the Computer Awareness objective. Students may also use a word processor to develop and practice high level skills on word processing, promoting the Computer Competence objective. Moreover, students may use a word processor to present in a better way a conventional essay, promoting the Pedagogic objective. Finally, students may use a word processing in a creative way, drafting and redrafting, copying and pasting, using the word processor to rethink and reflect on their first ideas, as they redraft it, promoting this way the Catalytic objective.

Another example showing the way in which the same piece of software may promote different objectives follows. Teachers and students may use a simulation program promoting Pedagogic or Catalytic objective depending on the way they use its potential. In the first case, the teacher can integrate the use of the simulation program to improve his/her teaching and

Table 3.1. IT and ITE: two broad categories of computer use

Computer use	The role of the computer	Rationale	Objectives	Specific aims	Examples of activities
IT	Learn about the computer	Social	Computer Awareness	To familiarise students with technology and basic use of computers	Familiarisation with basic use of the computer and computer applications
			Computer Competence	To develop skills for using computer applications	Practice on skills on computer applications
	Vocational	Computer Science	To familiarise students with theoretical concepts of technology	Learn about programming techniques and computer design.	
ITE	Learn with the computer	Educational	Pedagogic	To support teaching of curriculum subjects	Use of a simulation program to demonstrate an experiment.
			Catalytic	To cultivate methodological skills	Students use a simulation program to hypothesise, experiment, discuss, conclude on new knowledge.

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his/her students' learning, without changing the routine of the classroom and the roles of the teacher and students. He/she can still explain the new teaching unit, provide new information on the unit and then demonstrate or encourage students to perform specific experiments on the computer that he had previously designed. This way a Pedagogic objective is promoted, since have the chance to try out experiments by themselves, in an easier and safer way, and possibly many more times that they could in the traditional lab. In this case, however, the teacher remains the one who controls the teaching and learning process, while students, although take a more active role, they still follow teachers' steps and initiatives.

In the second case, the teacher can pose a problem related to the specific taught unit and encourage students to hypothesise and use the software to test their hypotheses. Within this framework, the students design their own experiments, they discuss them, they test their hypotheses, they collaborate and exchange thoughts and ideas, and finally they draw up conclusions. In this case, students take the responsibility of their learning, speculating, trying out, and finally discovering knowledge. The teacher becomes a facilitator of knowledge, the one who encourages and helps the students' explorations.

As seen, Pedagogic and Catalytic rationales are distinguished in terms of the role that the computer is called to play in the educational process. Some examples presenting the computer paradigms, the rationales promoted and the objectives proposed are presented in Table 3.1. Specific aims as well as some examples on possible activities that may be performed are also presented. It needs to be mentioned that the activities presented do not represent classification on software used, but examples on how computer applications can be used to promote the objectives defined.

Summing up, this section presented IT and ITE uses of computers in schools, specified different rationales for their use, as well as the way these may be presented in a National Curriculum through specific objectives (Table 3.1). Next, the discussion shifts to another level, the policy level. The value of IT and ITE as perceived by policy makers, in relation to national needs that are to be satisfied, is discussed.

3.1.2 The value of computer use: expectations at the national level

As discussed in chapter two, policy makers promote innovations whose objectives are congruent with what is perceived as the priority needs for education. This section discusses the value that IT and ITE may have at the national level.

In the case of IT, students are familiarised with computers and develop a basic competence in using computer applications (Computer Awareness objective) in their current and future personal life (section 3.1.1). Promotion of computer awareness objective in addition to the welfare of future citizens, may also indirectly promote political initiatives, aiming to satisfy commercial pressures. Indeed, manufacturers, through their marketing policy, try to encourage or influence the introduction of computers in education aiming to disseminate computer use, create more users, new customers, and thus, mobilise the market (Dugeut 1990).

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This however, has a knock-on effect. Information technology industry is empowered to satisfy the created commercial interest. Computer technology evolves offering more and user friendlier applications. The increased range of applications, and the decreasing of cost, in their turn, facilitates provision, while at the same time interest on computer applications in home and in school continues to evolve. Indirectly economical development is also encouraged. (Dugeut 1990) In parallel, the media frequently report on economic and social changes related to technological development, which again feeds back and encourages a computer culture. This supports the assumption that computer familiarisation is a skill necessary to be cultivated within general education in a technologically oriented society.

As a result, social pressure from parents may be created, and a positive influence towards promoting the introduction of computers in schools expressed, as a demand to increase children's qualifications or satisfy their interest in technology (Dugeut 1990). As a result, policy makers in order to satisfy social needs, modernise curriculum in terms of its content, by promoting the Computer Awareness objective.

Computer use in schools may also aim to develop students' IT skills (Computer Competence objective) in order to be able to use computers not only in their personal life, but also to become skilled enough to enter the job market (section 3.1.1). In this sense, the future skilled computer workers are expected to fulfil back office jobs after graduation and thus, enhance the modernisation of the country. In addition, interested students are expected to pursue academic courses in computer science (Computer Science objective), in order to become computer engineers, and thus promote the development of a national computer industry (Hawkrigde 1996; Dugeut 1990).

As indicated by the above, there is a vicious circle between IT in schools, economy, society and education. Commercial pressures demand cultivation of computer users that create a computer culture, which in its turn encourages market or industry development and social pressures, that are more likely to occur in a technologically oriented society, with developed industries and markets. Of course it cannot be suggested where the starting point is. As discussed in chapter two, countries try to modernise their economy through the development of technology. Thus, the introduction of IT into schools provides the medium for this, creating not only a technological infrastructure (scientists, engineers), but a technologically oriented society (computerised industry, market). Thus, it is suggested that introduction of IT, seen at the national level, is more related to the satisfaction of economic and social needs of the country.

Turning now to ITE, the national expectation of its introduction into schools is the improvement of education. Improvement of the teaching practice is expected to take place through the promotion of the Pedagogic and the Catalytic objectives (section 3.1.1). In the first case (Pedagogic objective), the use of the computer is expected to improve existing practices. The dominant assumption is that the computer is a powerful tool that can be used to enrich teaching of curriculum subjects, making possible activities that could not be performed by traditional methods. For example, students may watch a chain reaction in a computer monitor,

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something that could never happen without the computer. In the second case (Catalytic objective), more fundamental changes are expected. The dominant assumption is that future citizens need to be personally equipped with new learning skills, such as analytic and synthetic thinking, critical processing of mass information, and that a learning attitude in a continuously changing society is cultivated. The learning environment changes, since students work in collaborative ways, exchanging ideas, moving towards a discovery approach to learning and towards process than product oriented learning (section 3.1.1).

However, the Computer Awareness or even more Computer Competence objectives need to be realised first, in order for the students to be able to use the computer as a tool in their work or as a medium for new learning situations. This way, IT is also promoted indirectly or even sometimes directly in the curriculum.

In addition, ITE does not only have educational potential. Indirectly, economic pressures may also be satisfied. Promoting the Pedagogic rationale, it is assumed that the computer can teach (Hawkrigde 1996). In this way, teaching time devoted by the teacher to students may be organised very differently. For example while some students use the computer alone to learn skills and acquire or practise knowledge, the teacher may devote his teaching time to those students who need him more. In the same line of argument the same teacher can teach more students, thus minimising the cost of education. Thus, it is suggested that by realising a pedagogic rationale at student level, the cost effectiveness rationale as mentioned by Hawkrigde (1996) is realised at the national level.

Moreover, introducing ITE, a further need for development of educational software is created, thus, industry and other private or national organisations and publishers develop in order to meet the new need. This way, the economy and market may be encouraged and be developed.

Summing up, it is suggested the value of the computer use (IT and ITE), as perceived by policy makers, relates to the satisfaction of their country's educational and socio-economic needs and priorities. It is suggested that introduction of IT is more related to economic needs, while introduction of ITE is more related to the educational potential of computers. However, although IT and ITE emphasise different aspects and expectations at the national level, it has to be acknowledged that both IT and ITE can directly or even indirectly satisfy some educational or economic needs.

Next, the implications of introducing IT and ITE at the school level are discussed.

3.1.3 The complexity of computer use: implications at the school level

This section discusses a different level of complexity from that which the introduction of IT and ITE present for schools.

Like other innovations, the introduction of computers into education proposes changes in education, influencing some or even possibly all of the content, methods and aims of education. As it was shown in the educational innovation studies (Chapter Two) the more the

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proposed changes, the more complex the implementation. Introduction of computers into education is a complex endeavour, introduction, however, of ITE is more complex than IT.

As argued in Chapter Two, the level of relevance of the proposed innovation to the teachers, as well as readiness of teachers within their school context to put the innovation in practice are two important issues that influence its implementation.

Looking at the issue of readiness, in the case of IT, specialist teachers or teachers from other disciplines may be appointed to teach the new subject or discuss the new curriculum units related to it. One might expect that since they are specialist (or specially interested) teachers, they acquire competence and confidence to use computer. By contrast, in the case of ITE, teachers from disparate disciplines are called upon to use computers, while their knowledge and skills of computer use cannot, and should not be taken for granted. In parallel, teachers confront many problems concerning not only their ability to choose and use software but also the lack of time to explore and experiment with new software and plan computer-based lessons.

Turning at the issue of relevance of the innovation to teachers, in the case of IT, one might expect that since these teachers have a special interest to computing and technology, the introduction of IT is relevant to them. Moreover, introduction of IT into school curriculum does not change existing teaching practices and beliefs. The researcher does not suggest that IT cannot be realised following pioneer or original pedagogical and educational approaches, but the fact that introduction of IT is content-oriented, and usually follows the pedagogical and educational orientations that already apply to all other subjects of the curriculum. For example, the teacher can still deliver information about the new subject to students, and students can continue to work in traditional ways in the classroom.

By contrast, in the case of ITE, the issue of relevance of the innovation to teachers becomes of great importance, since the introduction of ITE proposes changes that relate not only to teaching materials, but also to teaching practices and beliefs. The use of computers aiming at a catalytic objective has the potential to create new educational situations, while changing not only the physical environment of learning but also human interactions (Collis 1989). New roles may be created for the participants in the learning process. Teaching styles go beyond traditional information delivery, and teachers become facilitators of students' learning (Pelgrum & Plomp, 1991, OTA, 1988). Computers may also change the conceptions of the existing education and schooling (Kemmis 1987). Changes can be made in the forms of communication, since collaborative work is encouraged, as well as in the content of school and in the classroom language. As a result, teachers' beliefs about schooling, about their subject, about their teaching and about the process of their students' learning may also be questioned. Thus, the role of the teacher in the integration of computers within classrooms becomes crucial. (Pelgrum & Plomp 1991; OTA 1988, Carmichael 1985; Watson 1993).

As discussed in Chapter Two, teachers want to preserve their every day routines and practices that have been proven to be effective. This issue has been highlighted in the case of the introduction of ITE in schools. It has been suggested (Carmichael 1985; Fraser 1988) that it

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is difficult for teachers to adopt changes in roles and practices that the computer may bring to the classroom teaching⁴. Teachers feel threatened or unable to take up these new practices. (Morris 1982; Zucker 1982; Olson 1988; Boyd-Barrett 1990; Watson 1993; Brummelhuis and Plomp 1993; Pelgrum and Plomp 1993; Anderson and Polydorides 1996). It has been argued that teachers, in order to avoid disruption, shape the use of computers in their classrooms influenced by their pedagogical beliefs. Olson (1988, 1992), investigating the way teachers introduce computers into their teaching, pointed out that some teachers introduced computers into their teaching preserving their existing practices and routines, while other teachers introduced computers as mediums that encouraged new roles and practices⁵. In the same line of argument, Hoyles (1992) identified four ways in which computers can serve teacher's pre-existing beliefs and practices, thus, either minimising or further illuminating the computer's role in teaching and learning process. She identified four processes by which the Trojan horse can become a Trojan mouse, the ways by which the computer comes to provide just an alternative medium within a conventional framework of teachers' practice⁶. Watson, Cox and Johnson also reported in the Impact Report results that effective use of IT was supported by individual teacher's understanding of, and willingness to experiment with, the underlying philosophy of the software being considered for use by pupils. (Watson et al 1993: p.159). Moreover, they reported that teachers used to support their existing pedagogical pedagogy and practice, and

⁴ Bliss et al (1986) reported that teachers expressed three main concerns (which they found troubling) in terms of the introduction of computers into the classroom. The first issue was about the changes that the computer brings to their role of being in authority. That is, the introduction of computers into the classroom challenges the traditional role of the teacher, particularly in terms of control and classroom management. The second issue was concerned with changes in themselves as an authority. That is, computers' use requires expertise which sometimes students already have. The final issue was concerned with changes in their teaching situation. That is, changes were required in terms of teaching method, or the organisation of the classroom.

⁵ Olson (1988, 1992) investigated the way computers influence teachers' practices and how teachers react to the computer's implications for their teaching. To describe this process, he discussed with teachers and observed their classrooms. In order to describe the two roles that the computer played, he introduced two concepts, "Trojan horse" and "Teacher's pet". In the first case, the computer came to disturb existing practices and classroom routines, bringing new ways of teaching and management of the classroom incompatible with the existing ones. In this case the computer can provoke a reflection upon these practices and the curriculum. That is, teachers may start to question curriculum and resources and begin to make changes in what they teach and how they teach. In the second case, the computer comes to serve the teacher's projection of him/herself as *avant-garde*, i.e. to express the teacher's interest in modern trends and his/her ability to cope with the latest technologies in his/her classroom. Thus, the computer is used to support existing practices and routines.

⁶ These four processes mentioned are: pedagogising, compartmentalising, incorporating and neutralising. By the first process, Hoyles argues that teachers' intentions and beliefs shape the nature of teachers' interventions, and as a result, computers are integrated within the classrooms in very different ways by different teachers. By the second process, she argues that when the computer is integrated into schools, the disruption is limited either by presenting the computer as a topic by itself (IT), or by marginalising it by keeping it insulated from the mainstream work. By the third process, the computer is embedded in the school context to make it teachable. For example, Logo becomes a set of commands for the learning of drawing shapes and for the learning of notions of distance and direction. That is, the philosophy underlying the software is lost. Finally, by the fourth process the computer is neutralised and presented as a modern tool, with no special role.

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believed that computers were used to complement rather than change their existing practice. Similarly, Hoyles, Noss & Sutherland (1991), in the evaluation of the Microworlds Course also discussed attitudes of mathematics teachers towards computers, in terms of their beliefs in mathematics teaching and learning.⁷ It was reported that all participants' views and practices on computers were strongly influenced by previous attitudes and pedagogical beliefs, which resulted in different adaptation and purpose of utilisation of computers in their teaching. Participants viewed the computer as a means to provide a vehicle for moving in a direction that had already been established⁸ (Hoyles, Noss, Sutherland 1991: Vol. II, p.61). As a result, there was a variation on the use of computers by teachers⁹.

Relevance of the innovation to the teacher and his/her readiness to put it in practice are not the only factors that influence the implementation of IT or ITE. As discussed in Chapter Two, the context within which the innovation is introduced is of great importance too. In the case of the introduction of computers into education, the context, in terms of resources and support plays a very important role in the implementation of IT or ITE.

Additionally to other innovations, the introduction of computers into education needs a lot of technical resources. In both cases (IT and ITE) large costs for equipping schools with hardware and software, for upgrading of resources, for maintenance and technical support are involved. In the case of ITE the issue of computer resources and access is however more complex. In the case of IT, computers are usually used in special computer labs organised for this purpose, or within classrooms used for other subjects. In the case of ITE, integration of computers within existing subjects of the curriculum presupposes a smaller computer: student ratio, whether in the computer lab or in the classroom. That is because the use of computers is disseminated through more disciplines or even more through various school activities, and thus, more resources are needed to satisfy the demand from different teachers or students. As a consequence, ITE presupposes higher costs for governments or schools for equipment provision and maintenance that has been found to be a difficult task. First, provision and standardisation have been a problem. Although the computer student ratio has been decreased internationally, and it may have seemed sufficient for teaching the use of computers as a separate subject in

⁷ Five caricatures were created by the researchers. Mary: the frustrated idealist, Rowena: the confident investigator, Denis: the controlling pragmatist, Fiona, the anxious traditionalist, and Bob: the curriculum deliverer. The caricatures were a synthesis of the views attitudes and practices of a set of individual course participants which had been developed to do what caricatures do best- to focus attention on the significant points, by exaggerating them [...] and to allow a loss of fine-grained detail in order to highlight variants and invariants across subjects of the data (Hoyles, Noss, Sutherland, 1991, Vol. II:p.15)

⁸ Fiona, who was insecure about mathematics, found in the computer a medium through which she could express mathematical ideas. Bob, who was committed to curriculum delivering, found a medium through which he could achieve his goals. Mary, who had already appreciated the computer as a tool for teaching mathematics, found a medium through which she could offer the opportunity to her pupils to build confidence in themselves.

⁹ Researchers report the following practices related to computers: integration as an organic part of pedagogical practice (Rowena and Bob); failure to use it all (Fiona); use it in strictly limited and controlled ways (Denis). (Hoyles, Noss, Sutherland 1991: Vol. II: p.60)

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computer labs, this was not the case for the computers' integration into existing subjects. In addition, technical support and equipment maintenance have been found to be difficult or inadequate (Morris 1982; Boyd-Barrett 1990; Brummelhuis and Plomp 1993).

Additionally, easy access and availability have been proven important factors for computer use in schools. It is argued that school policy, in terms of time schedules and organisation of subjects, plays an important role in hindering or facilitating computer access (Watson 1992). For example, half of the secondary teachers who had attended the "Microworlds course"¹⁰ aiming to use computers in their everyday teaching, seven years later, did not use them in their classroom due to school policy in combination with limited provision of resources¹¹ (Vavouraki 1993).

In parallel, in the case of ITE, when teachers integrate computers into their practice, they need "resources, time and perseverance - factors necessary to survive the phase of "disruption" in the face of an innovation and maintain a willingness to reflect upon the new classroom dynamic" (Hoyles 1993: p.16). It has been acknowledged that teachers lacked the necessary time to think about, experiment with and develop computer-based lessons (Brummelhuis and Plomp 1994, Pelgrum and Plomp 1993). Continuing support, communication between teachers, and reflection on their practice need to be organised and encouraged. Teacher training needs rethinking and reorganisation. The shift from technical aspects to pedagogical and classroom management issues have already been pointed out, and sandwich courses which combine theoretical issues with teaching practice have already been proposed (Morris 1982; Jones 1991; Strand 1991). Moreover, the evaluation of the Dutch project for the computer integration in education, suggested that differentiated training is needed depending on the level of implementation of computers in schools. Teachers who already have experience on using computers in their practices have different training needs from their inexperienced colleagues (Brummelhuis and Plomp 1994).

The researcher does not imply that training is necessary only in the case of ITE. By contrast, technology evolves quickly and the need for teachers to be informed about latest

¹⁰ The Microworlds Course took place at the Institute of Education, University of London and was supported by Local Authorities. The aims of the Microworlds Course were for the participants to:
 -develop competence and confidence in the use of the computer as a mathematical problem solving tool
 -reflect on their own learning process and relate these to the learning of the pupils within their classrooms
 -develop ways of structuring the computer environment within their mathematics classrooms and evaluate its role in terms of pupils' learning
 -confront the issue of the computer's influence on the role of the teacher, and to increase awareness of individual learning styles and to
 -disseminate their expertise amongst colleagues in schools and Local Education Authorities (Hoyles, Noss & Sutherland, 1991, Vol.I, p.1-2)

¹¹ The Microworlds course was evaluated long term (seven years after). The research included interviews with the participants, who were at the same or different positions in the educational sector. Caricatures were created to illustrate different practices of teachers. Looking at caricatures created as a result of the analysis, George, who was Head of department and believed strongly in the use of computer for learning, used it a lot and also promoted its use in his department. One can say that he had both the "commitment" and "power" to promote a certain computer policy within "his" department for computer use to be disseminated. On the contrary, Don, although he had the "commitment", did not have the power to influence school policy. Thus, he was found to be disappointed.

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applications is apparent. The specialist teachers in the case of IT also need in-service training. Training needs for IT though are simpler to be tackled, since they focus on the latest evolution of technology and are not concerned with pedagogical or educational issues too.

Finally, as for software, there is the cost, but in addition, while in the case of IT software applications are available in the market, in the case of ITE the demand for high quality educational software is huge and its availability problematic. The development of educational software has been proved to be a costly and difficult endeavour for all countries (Plomp, Anderson, Kontogiannopoulou 1996).

Commercial packages seem not to be adequate for use in the classroom, since curriculum fit needs to be taken into consideration. It has to be noticed that teachers in the Netherlands who were provided with a starter pack of software and sample courseware, did not manage to integrate them into their practice. Although they valued the experience that their students had with these sample lessons, they did not manage to find a way to incorporate these practices into their curriculum (Morris 1982; Zucker 1982; Jones 1991; Brummelhuis and Plomp 1993; Pelgrum and Plomp 1993).

Summing up, the introduction of computers into schools (IT or ITE) presents a complex endeavour. Issues of readiness of teachers to use computers in their teaching, relevance of computer use as perceived by teachers, as well as available resources and support are issues that need careful consideration. Introduction though of ITE, is more complex than IT, not only because it needs more resources, but also because the way teachers perceive the relevance of computer use and teachers' readiness to use them is crucial for its implementation.

3.2 Policies for the introduction of computers into education

This section focuses on the level of policy and discusses national policies related to the introduction of computers in education. First, it classifies policies in two categories -restrictive and comprehensive- and illustrates them through the paradigms adopted by two countries, Germany and England. Next, it explores policy rationales for the promotion of these policies, which are illustrated through the cases of Germany and England. Finally, it discusses implementation strategies that nations follow when introducing computers into education.

3.2.1 Restricted and comprehensive policies

Looking at the ways in which countries introduced computers into their educational systems, it emerges that some of them focused on promoting IT, namely the use of computers in schools with the aim of familiarising students with computers and technology, or even to cultivate future computer engineers. "Australia, Austria, Belgium, Finland, the Federal Republic of Germany, Greece, Ireland, Italy, Japan, the Netherlands, Norway, Sweden, Switzerland and the most states of United States" followed this restricted approach focusing on the promotion of IT (Dugeut 1990: 166). Other countries chose to promote both IT and ITE, following what is called a comprehensive policy. The best examples of countries (or provinces) with "comprehensive"

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policies were probably Canada (Ontario), France and the United Kingdom" (Dugeut 1990: p.166). Restricted and comprehensive policies are illustrated through a closer look at the policies relating to the introduction of computers into education as promoted in Germany and in England. These countries were chosen because they present good paradigms of these two policy approaches.

3.2.1.1 Germany: a paradigm illustrating the restricted policy for computer use in schools

Germany was one of the countries that in its early efforts to introduce computers into schools followed a restricted approach. In Germany, the issue of introduction of computers into compulsory education was not tackled at the national level before early eighties¹². In 1983, IT was introduced in German schools¹³. The representatives of the Bund and the Länder (Country and States) of the BLK agreed that all areas of education had to accept the challenge of the New Information and Communication Technologies¹⁴. According to BLK-Concept, knowledge and skills concerning New Information Technologies should be imparted in secondary, vocational and higher education. Primary schools were left out of the BLK concept (Rommel 1992). According BLK-Frame-Concept computer education was introduced in schools broadly in two ways. First, computers were introduced as a compulsory general introduction to Information Technologies without introducing a new subject (Information - Technological Basic Education), and second as an optional separate subject dealing with the fundamentals of Informatics.

The Computer Awareness objective was promoted through the introduction of Information - Technological Basic Education that was introduced as compulsory instruction for all 12 to 15 year old students, in general educational schools (grades 7-10). The new subject (although not presented as a new discipline) aimed to provide basic insights about New Information Technologies, their applications and societal effects¹⁵ promoting a Social rationale.

¹² It seems that educational policy in the early seventies in West Germany left the development of Information Technology to individual initiative. There were apparently no public bodies that regarded computer literacy as a basic cultural requirement, almost certainly because of insufficient general awareness as to its value (Gorny 1982). There was general agreement among educational administrators on the value of Information Technology as an optional subject at upper secondary level, while its introduction into curricula as a separate subject at lower secondary level was considered premature. Moreover, there was a scope for partial integration of computer education into other subjects, such as mathematics, physics and business organisation at both upper and lower secondary levels. As far as primary schools were concerned, no Information Technology or computer-oriented teaching was offered at that time. (Gorny 1982)

¹³ The starting point of the BLK concept was an introduction for all students *independently from subject-related instruction*, to Information Technology. However, according to the BLK concept, the computer could be used as a universal tool and as a problem-solving device, while the use of computers as additional medium in subject-related instruction of schools had *no* priority at that time.

¹⁴ BLK from 1984 to 1986 presented the BLK - Concept for School and Vocational Training, the BLK-Concept for Universities and the BLK-Concept for Continuing Education of Adults.

¹⁵ In all Länder after the adoption of the BLK Concept, the Information Technological Education was presented as a unified concept concerning the development of the Information-Technological Education in Schools. The following objectives were mentioned:

- the pupils shall have the opportunity to reflect their individual experience with information technology
- they shall learn about fundamental structures and concepts, which are important for information technology
- they shall be able to handle a computer and its peripherals

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However, an indication of the educational potential of computers was given, since "problem solving in algorithmic form", "creative and playful possibilities" of computers, "reasonable use for information storage and retrieval" were suggested. At this point, it has to be pointed out that although the emphasis on Computer Awareness is clear, these comments allowed the exploration of the educational potential of computers, allowing space for personal interpretation and manoeuvre. And indeed this was the case for Germany, since the German States (as will be discussed in section 3.3.2) introduced the proposed IT in three different ways focusing on different objectives, while at the same time following the generally accepted rationale.

Furthermore, the Computer Science objective was to be promoted through the subject on Computer Science Studies, for 15 to 16 year old students (grades 10-11) of General Academic schools. In this case, the computer was introduced within a special subject aiming to give basic knowledge of computers' capacities and limitations, problem solving methods, programming languages, and performing calculations and graphics. The subject seems to have been aimed at special groups of interested students who were going to be streamed into more specialised computer science classes at the next educational level (secondary level II in gymnasiums on grades 10-13). Future computer engineers were expected to be cultivated since the students could, under certain conditions, select the subject as an examination subject for University access.

As can be seen, following the Restricted approach, IT was introduced into general secondary education, promoting the Computer Awareness and Computer Science objectives. At the same time, space was left –intentionally or unintentionally- for educational objectives also to be explored and tried out, based on the schools' initiative.

3.2.1.2 England: a paradigm illustrating the comprehensive policy for computer use in schools

England was one of the countries that in its early efforts to introduce computers into schools, promoted and encouraged both IT and ITE.

In fact, looking at the beginning of computer introduction in England, it can be seen that both IT and ITE were encouraged to flourish in English schools¹⁶. In 1973, the Schools Council launched their 'Computers in the Curriculum' project to explore ways of using computers in the curriculum. At the same time, the National Development Programme in Computer Assisted

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- they shall receive an introduction into problem solving in algorithmic form
 - they shall have an overview over the history of information technology
 - they shall acquire a reasonable attitude towards the social and economic effects connected with the penetration of microelectronics into society, including the changes and risks
 - they shall receive an introduction into the problem of privacy and data protection
- The concept included the "reasonable" use of computers for information storage and retrieval, without blocking their creative and playful possibilities. Also different forms of social organisation of their use especially stressing collaboration in the teaching and learning process should be used. (Gorny 19)

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Learning (NDPCAL) was launched, which was the first government recognition that Information Technology had educational potential (McKinsey & Company 1997; Gwyn 1982; Tagg 1995). In 1978, both computer studies and experiments on the introduction of computer assisted learning by enthusiastic teachers, co-existed (Gwyn 1982; Tagg 1995). The dual objectives of the use of the computer continued with the launch of MEP programme in 1981, supporting two group of projects, reflecting both IT and ITE approaches (Gwyn 1982, Brown 1993, Forthergill 1988).

The first group of projects promoted the IT approach. Looking more closely at the objectives of the first group of the projects¹⁷, it seems that the Social and Vocational rationales were promoted, along with the Computer Awareness and Computer Competence objectives. Well-informed citizens and computer skilled future workers were expected to be cultivated. In addition, the Computer Science objective was apparent within computer science courses and computer linked studies.

In parallel, ITE was also promoted through the second group of projects¹⁸. It is not clear if pedagogic or catalytic objectives were proposed since not all the necessary information is available. However, an Educational rationale is stressed and encouraged within mathematics, technology, geography and business courses. It seems that improvement was expected in the teaching of the above subjects, while the exploration of the computers' potential in learning was also encouraged.

The two categories of computer use (IT and ITE) were again apparent within Information Technology in HMI's documents and in the National Curriculum, when Information Technology became a compulsory element of school education under the Educational Reform Act of 1988 (Watson 1997).

In the Information Technology National Curriculum of 1989, both IT and ITE were promoted. IT aimed both to enrich curriculum subjects and to help students become "knowledgeable about the nature of information, comfortable with the new technology". All objectives were promoted within this document¹⁹. Under the IT approach, the use of computers

¹⁶ In England, "IT was on the educational agenda as early as 1967" (McKinsey & Company 1997:7). It is interesting that as early as 1969, the CET (Council for Educational Technology) emphasised the distinction between 'computing for education' and 'education about computing'.

¹⁷ Within the first group of projects, the introduction of new topics into school curriculum was supported. Some of the new introduced topics were: microelectronics in control technology; electronics and its applications in particular systems; computer studies; computer linked studies; data logging and data processing; word processing and other office techniques; the use of computers as a means of information retrieval from databases. (Gwyn 1982, Brown 1993)

¹⁸ Within the second group of projects, the use of computer as an aid for teaching and learning was supported. Priority was given to mathematics, technology, and geography and business courses. (Gwyn 1982, Brown 1993)

¹⁹ *The aims of working with IT are:*

to enrich and extend learning throughout the curriculum, using technology to support collaborative learning, independent study and re-working of initial ideas as well as to work at a more demanding level by obviating some routine tasks; (*pedagogic and catalytic*)

To help young people acquire confidence and pleasure using IT, (computer competence) become familiar with some everyday applications and be able to evaluate the technology's potential and limitations; (*computer competence*)

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promoted Computer Awareness, Computer Competence and Computer Science objectives (the latter however only for interested students). Under the ITE approach, the educational potential (it is not clear whether a catalytic objective was promoted) was mentioned and computer use presented a medium to improve learning, but also its context.

Information Technology National Curriculum in 1995 continued to reflect both IT and ITE. Although the title 'IT Capability'²⁰ seemed to promote the Computer Competence objective, IT capability itself became the means for other activities. The analysis, processing and presentation of information, and modelling, measurement and control of external events were the aims of the use of the computer. Thus, through the promotion of the Computer Competence objective, an educational rationale was also proposed.

Indeed, this is one way of interpreting the Information Technology National Curriculum. By contrast, Watson (1997) argues that the objectives of Information Technology within the National Curriculum²¹ were more "technocentric", emphasising knowledge and familiarity with the use of the computer, while learning through the computer became a secondary option. The objective of computer use turned out to be the development of "information technology capabilities through a range of curriculum activities". Moreover, distinguishing IT skills, which had to be measurable and tested, put an indirect pressure on teachers to focus on these IT skills, while the role of computers in supporting subject-based learning had been reduced to a recommendation. Under this line of argument, it seems that it is more the Social rather than the Educational rationale that was emphasised.

to encourage the flexibility and openness of mind necessary to adjust to, and take advantage of, the ever-quickening pace of technological change, while being alert to ethical implications and consequences for individuals and society;(computer awareness)

to harness the power of technology to help pupils with special educational needs or physical handicaps to increase their independence and develop their interests and abilities;(unclassified)

to help interested pupils undertake detailed study of computing and to design IT systems for solving problems (computer science) (HMI 1989)

The objectives of the computer use are presented in the parenthesis

²⁰ Information Technology (IT) capability is characterised by an ability to use effectively IT tools and information sources to analyse, process and present information, and to model measure and control external events. This involves:

using information sources and IT tools to solve problems;

using IT tools and information sources, such as computer systems and software packages, to support learning in a variety of contexts;

understanding the implications of IT for working life and society.

Pupils should be given opportunities, where appropriate, to develop and apply their IT capability in their study of National Curriculum subjects' (DFE 1995: p.1)

²¹ In each key stage pupils should develop information technology capabilities through a range of curriculum activities which will:

develop confidence and satisfaction in the use of Information Technology;

broaden pupils' understanding of the effects of the use of future developments in Information Technology;

encourage the flexibility needed to take advantage of future developments in Information Technology;

enable pupils to become familiar with the computer keyboard;

encourage the development of perseverance;

enable pupils to take greater responsibility for their own learning, and provide opportunities for them to decide when it is appropriate to use Information Technology in their work (DES 1990, after Watson 1997, p. 79)

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I argue therefore that England followed a Comprehensive approach, promoting both IT and ITE. IT focused on the Computer Awareness, Computer Competence and the Computer Science objectives, while ITE focused on the Educational rationale (both pedagogic and catalytic objectives). It is not clear whether the emphasis is on the Computer Competence or on the Educational rationale, which may indicate two different directions.

3.2.2 Policy rationales

This section discusses reasons why national policies when introducing computers in schools, follow either a restricted or a comprehensive policy.

Computers and technology evolve over time, while computer culture²² for education changes too. Powerful hardware and software that offer new educational potential, change orientations and philosophy of educational technology. Moreover, social and market needs change influencing educational orientations.

Looking at the introduction of computers in schools over time, it seems that the dominant computer culture has been continuously changing. One can point out that the seventies were generally dominated by programming that was considered to be "the skill" which all students needed in order to enter the new technological society. As for educational software, the first efforts in that direction, were focused on content specific drill and practice applications and tutorials. The mid- and late eighties encouraged the familiarisation of students with generic software applications. Finally, the nineties focused on adopting and using office automation applications within existing subjects of the curriculum, followed by a boom in hypermedia and multimedia (Pelgrum 1994). The educational potential of the computer use was enhanced in the late eighties by the development of new applications, research findings and successful through isolated paradigms (Rommel 1992).

As a result, different countries that initiated computers at different times, have been influenced by different dominating computer cultures. For example, countries that introduced ITE in the early seventies led a pioneer way towards ITE, focusing more on the exploration of educational possibilities than on the implementation of successful paradigms. Countries that introduced computers in the mid-eighties had a more solid ground under their feet, since many ideas relating to ITE had already been explored. This of course does not imply that computer technology and culture do not still evolve. On the contrary, it evolves continuously offering more new possibilities and innovative ideas to be explored. The discussion for the integration of computers as mediums for learning existing school subjects that started up in the early seventies, continues, proposing a new perspective on computing education other than IT.

Looking, however, across countries at the same time, it seems that countries did not always choose to introduce computers in education according to the dominant (at that time) computer culture. For example, looking at the early eighties, countries such as Germany and

²² In the sense of up to date technology and new pedagogical directions

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the Netherlands introduced IT. Netherlands (NIVO: 1984) introduced ICL (Information Computer Literacy), while Germany was proceeding to the introduction of "Education on Information Technology" within the framework of BLK concept of Basic Education on Information Technology. Countries such as the UK and France, in addition to IT, chose to make the first steps of introducing ITE aiming at the modernisation of teaching and learning. England (MEP:1980-86) declared the objective as being to help and enrich the teaching and learning of existing curriculum subjects, promoting at the same time the development of educational software. France announced (IPT: 1985) three levels of computing, as a culture, as a field of study, and as a teaching aid, launching at the same time an open invitation for developing educational software.

As argued in Chapter Two, policy makers choose to promote an innovation considering the value of the innovation, as this relates to the priority needs of the country. Thus, the priority needs of the country, as perceived by policy-makers, influence the promotion of IT or ITE. As discussed previously (section 3.1.2), IT is more related to socio-economic needs, while ITE is more related to the educational potential of computers. Thus, national policies that promote IT focus on the familiarisation of citizens with technology, and modernisation of the country, aiming to satisfy mainly economic needs of the country. National policies that promote ITE focus on the modernisation of teaching and learning, satisfying educational needs. It has to be acknowledged that although the above mentioned policy rationales can be classified and defined theoretically, they do not exist in isolation of each other. Both IT and ITE can directly or even indirectly satisfy some educational or economic needs. However, the two approaches emphasise different aspects and expectations at the national level, presenting a different justification for their promotion at the national level (section 3.1.2).

Next, another factor that influences national policies, is the issue of complexity related to existing, technical and human infrastructure. The introduction of computers in schools is an educational innovation that involves a lot of resources and high costs (section 3.1.3). Availability of funds plays a crucial role in the introduction of computers in education. What is more, it may also question teachers' existing practices and beliefs. As discussed previously, challenging and changing existing well-established practices is a very difficult process. The introduction of the ITE presents a more complex endeavour (section 3.1.3), and thus, in some cases remains a second step or it is not included in policy plans.

Finally, it is useful to refer to Dugeut (1990) who points out that the introduction of computers in education is a good way for politicians to demonstrate visible educational improvement. The expansion of simple practices on computers across the country is an intriguing target for politicians.

Summing up, a number of factors influence the promotion of IT and ITE: the timing of the introduction in relation to dominant computer culture, the value of computer use in relation to priority needs of the country, the complexity of the promoted use of computers, and political

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intentions. The next section attempts to illustrate rationales for restricted and comprehensive policies, through the paradigms of Germany and England.

3.2.2.1 Germany: a national policy focusing on IT

Looking at Germany, IT was not introduced into schools until the early eighties. It could be considered a late evolution compared to other countries such as the England and France that had been discussing the introduction of Information Technology in education since the early seventies. The reason for this seems to be lack of a computer culture and of a computer-related infrastructure at that time²³.

When computer education was nationally introduced in schools in the mid-eighties, the national policy focused on IT²⁴ and it seems that the socio-economic argument was the driving force. As Rommel (1992) claimed, the subject of computer education introduced into schools, was "interrelated with the societal, vocational, and working worlds; with economy and science" (p.14). Through the realisation of Social and Vocational rationales, the German state needed on the one hand for future citizens to be sensitised and familiarised with computers, and on the other, computer engineers graduated from upper, vocational, and higher education. Thus, students were familiarised first with computers and then, computer education was gradually specialised within a framework of vocational and scientific activities. (Rommel 1992).

At that point the introduction of ITE had neither priority, nor justification. The educational potential of ITE had not been accepted²⁵ (Rommel 1992, Gorny 1982). What computers could offer could be included in IT. As Gorny nicely illustrated, "the ironic labelling of CAL, suggesting that "the computer is used as page-turning machine" has been reinforced as its public image, though a number of recent reports show that the field of CAL applications will concentrate on simulation and interactive problem-solving, thus, meeting the goals for informatics curricula" (Gorny 1982: p.347).

Germany had no intention of changing teaching and learning practices at that time. Gorny interestingly quotes the Secretary of the State Granzow in the Ministry of Education and Science saying: "on the whole we do not need a fundamentally different educational policy than at present because of new technologies" (Gorny 1982: p. 350). Noss & Hoyles (1996) discuss the important role of an academic debate that sealed the fate of Logo in German schools²⁶.

²³ As Gorny (1982) claims, "there are (then) apparently no public bodies which regard computer literacy as a basic cultural requirement". As he claims, this was because Information Technology involved applications and methods derived from other subjects, which had been already well established within the German education system. In addition, there was lack of teachers and of hardware and teaching materials to realise such an endeavour (Gorny 1982: p.341).

²⁴ see also section 3.2.1.1

²⁵ In 1971, the Second Federal Data Processing Programme made the following statement as quoted by Gorny: "we do not know exactly, to what degree of efficiency and economy data processing can be used in the education system" (p.347). Even more, "Information Technology in Education" had a bad name. It had nothing more to offer than what was already dealt with within "Education on Information Technology".

²⁶ After "Mindstorms" were published and prorogued as "*the best book to be read by everybody concerned with teaching mathematics*" (Janhke 1983: p.100, after Noss & Hoyles 1996) an academic debate started on the "value" of Logo. Bender wrote a paper, which determined future of Logo in Germany arguing for the

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Logo's educational potential for open learning approaches could not fit within the academic, product-oriented German curriculum.

As indicated from the above, German national policy in the mid-eighties focused on IT to satisfy socio-economic needs. The two main reasons ITE was not promoted, were its non-proven educational potential and its complexity. As Gorny (1982) claimed, in Germany, "there was less enthusiasm, partly because of the enormous hardware costs, partly because of difficulties in the design of teaching programmes, but mostly because of psychological and educational misgivings" (p.346.)

The introduction of ITE was not considered before the late eighties. The situation by then had changed, providing a more mature ground for ITE to be promoted. First, the educational potential of computers had been widely discussed in the international community. ITE had gained ground in schools and most countries had started to introduce ITE. Moreover, paradigms of computer use started to be disseminated and discussed around the world. As a consequence, interest for the development of educational software had been developed²⁷ and German teachers' interest²⁸ had been expressed. Second, the technical infrastructure of the country had been already developed through the introduction of IT. Finally, a new pedagogical orientation towards more open learning approaches, compatible with proposed computer paradigms, was another reason that seems to have encouraged the introduction of ITE in schools. New learning approaches, such as discovery learning as opposed to product-oriented learning, and self-oriented learning had gained acceptance (Lehmann, 1994). As Rommel and Land (1996) illustrate, most of these new learning contexts "can clearly be seen as compatible with several and various corresponding uses of the computer" (p.217).

Summing up, Germany followed a restricted two-step approach. Empirical information relating to policy makers' perceptions about the introduction of computers into education is missing. However, from the documents collected, it is indicated that the country first promoted the introduction of IT in order to satisfy socio-economic needs of the country that seemed to have been prioritised at that time. ITE was left as a second step, since not only its educational potential had not been proved, but also the complexity of its introduction was pointed out. Loose

"educational damage that would follow from Logo's adoption". Although two other papers published in the next journal issue followed Bender's paper, it seems that Bender's argument was never adequately countered. As a result, *"it's (Logo's) fate was sealed: those who had previously been its advocates either maintained their silence or were easily ignored through being labelled as "Logo people" "* (Noss & Hoyles 1996, p. 160).

²⁷ In 1992, integration of computers into education emerged as a framework for learning objectives within curriculum subjects. In parallel, two big producers of hardware and software have started activities collaborating with experts on educational authorities. The "Information Technology in Education" emerged from development of instructional software for different disciplines. Drill and practice and tutorials had emerged for English and German language instruction and mathematics, in addition to mathematical construction programmes such as Cabri Geometry, simulation packages developed for science, chemistry and biology classes.

²⁸ In 1989, enthusiastic primary school teachers had been developed ideas on "Information Technology in Education", but these experiences circulated in a very limited way. In a federal symposium all agreed that "primary school should not be jeopardised by including computers in primary instruction" However,

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objectives though in the national curriculum left space for teachers to experiment with the educational possibilities of the computer use. ITE was promoted as a second step, after the diffusion of IT into German schools. It is indicated that ITE was promoted at that time because the following. IT had already been diffused into schools, thus, the socio-economic priorities had already been satisfied. Initial trial efforts with ITE by some enthusiastic teachers in combination with the international interest towards ITE created a base to start discussions about the introduction of ITE. The infrastructure developed in schools through the introduction of IT gave the necessary resources to accommodate the introduction of ITE. Finally, the shift of pedagogical orientation of the educational system towards more open learning approaches encouraged the introduction of ITE.

3.2.2.2 England: a national policy promoting IT and ITE

In the last decade the English educational system shifted from a decentralised system allowing high levels of school autonomy towards a more centralised system following a National Curriculum within the Educational Reform Act in 1988. The government desired to acquire more control over education and on what schools teach (Lawton & Gordon 1996).

Looking at the years before the National Curriculum, when the introduction of computers in schools was left to individual schools, both the IT and the ITE approaches were to be found in English schools (section 3.2.1.2). It is difficult to trace reasons why schools were choosing to participate in various computer related projects. It seems though that there was a computer culture²⁹ emerging and enthusiastic teachers were getting into the new paths of education. This experimentation seems to have been encouraged both by the decentralised system and also by attitude of teachers. It can be hypothesised that the issue of complexity of ITE was overcome by the enthusiasm of those interested teachers.

In the early eighties, the government supported the introduction of computers in English schools through the MEP project. It seems that the government expected both economic and educational needs to be satisfied³⁰. The aim was for the computer to reach all secondary schools. It seems though that the expansion of the computer's presence in schools was more important than prescribing a specific use that would promote specific objectives. Additionally, one has also to consider that the decentralised system would not allow such an approach. Both categories of computer use (IT and ITE) were encouraged, and teachers were left to decide which projects to initiate. The government, provided the means, but did not define a specific

²⁸ "computers as tools for writing/text design, as a medium for learning/practising, and finally as a tool for simulation" were considered as possibilities to be piloted in schools.

²⁹ In the sense of interest towards potential of technology in education

³⁰ "The DTI's main objective was to foster an indigenous information technology (IT) economy, and the main aim of MEP was to prepare children for it" (Boyd-Barrett 1990: p. 170). At the same time the technology was an innovation which "offered teachers and children the prospect of a whole new approach to the teaching and learning of their subject, and probably the option of a new curriculum as well" (Forthergill 1988: p.305)

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policy³¹. “MEP continued the soft-nosed, pluralist approach to curriculum development” (Boyd-Barrett 1990: p.173). However, the government mainly focused on secondary schools, and on fostering links between schools, FE and industry³² (Brown 1993: p. 18). Meanwhile, a computer culture evolved that encouraged the introduction of computers in schools. The media had started to talk about computer technology and the way it transforms society in business and in family life. In parallel, social pressure from parents was encouraging the introduction of computers in schools (Boyd – Barrett 1990, Russell 1987).

Later on, the governmental support turned to governmental influence through the proposal for “New Technology for Better Schools”. In this document, the government promoted ITE by emphasising the educational argument³³, since the aim of technology in schools was to “harness the potential of IT for enhancing the quality of teaching and learning across the curriculum” (Boyd – Barrett 1990: p. 175). At the same time though, it seems that the economic argument was implicitly promoted since schools were encouraged to buy British machines. The implicit argument for fostering the country’s industry was not invisible.

In the late eighties, the scene changed considerably in English education since the government became to take more and more responsibility for what schools should teach. The National Curriculum was developed within which the use of the computer was imposed on schools. The government now controlled the introduction of computers in schools together with the objectives to be realised³⁴. The government through the National Curriculum promoted (and still does), both IT and ITE (section 3.2.1.2). It is difficult to trace the rationale behind it, since a lot more information is needed from policy makers and document analysis, which is not possible within the scope of this research. However, economic reasoning can be traced in the National Curriculum since students are expected to cultivate computer skills. A shift towards “IT capability” which is meant to be measurable and tested can be seen to reflect attention on to industrial and commercial values. It implicitly forces the argument that England (like other European countries) in the 90s shifted towards modernisation of industry, competitiveness, international comparisons through measurable abilities and skills and educational standards (Lawton & Gordon 1996)

At the same time, the educational argument was put forward supporting ITE, since students were expected to use their newly acquired skills in computing, to support their learning

³¹ Although government through MEP promoted both IT and ITE in order to satisfy both economic and educational needs it was left to schools and LEAs to decide what kind of projects related to computers *they* would introduce, realising what objectives *they* valued. There is not enough documentation to discuss what approach schools followed and for what reasons.

³² Priority was given to applications in mathematics, the sciences, craft design and technology, geography and courses related to business or commercial occupations. Some attention was also to be given to career education, language and the humanities and to the needs of pupils with learning difficulties.

³³ IT had no place in schools since it should be the employers that had to train future-workers.

³⁴ This time the decision centre was not the school, but the central government. Computers were not to be introduced and used by enthusiastic or interested teachers. Their educational value and need in schools was decided -for the first time in England- at the policy level, and their introduction was compulsory (Brown 1993, Boyd-Barrett 1990). With the introduction of the National Curriculum, “computing no longer depended on teachers’ perceptions of usefulness or cost-effectiveness” (Boyd-Barrett 1990: p. 177).

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by taking more responsibility for it. It seems that the national curriculum at that time could promote ITE, since at least some infrastructure had been developed already in schools. The educational potential of the use of the computer had been discussed in England since the early eighties. Computers had been already used in English schools within other curriculum subjects and many teachers were familiar with their use.

Looking at a survey carried out in English schools before the development of the National Curriculum (DES 1991), one can see that in 1988 all schools had been equipped at least with some computers, while around half of the school teachers reported themselves to be confident in using computers. In parallel, half of all primary teachers and one third of secondary teachers were already using computers in their teaching³⁵.

Interestingly, integration of computers within all school subjects was expected in "schools that have sufficiently IT-literate and IT-enthusiastic staff (who) may wish to cover IT through a totally cross-curricular programme of work" (NCET 1995: p.9).

Summing up, England followed a different approach towards the introduction of computers into education than Germany. In the early years there was no national curriculum and the initiation of an innovation was a matter for schools and teachers. Within this decentralised educational system the government promoted a comprehensive policy, supporting the introduction of both IT and ITE, aiming to satisfy both socio-economic and educational needs. The promotion of a comprehensive policy continued when the National Curriculum was published and government took more control of education. Although empirical information is missing, it seems that the government promoted IT in order to satisfy socio-economic needs of the country. At the same time it promoted ITE not only because its value was accepted, but also because half of teachers had reported familiarity with computer use. The latter seems that it was considered a strong base to start such an effort.

3.3 Implementation Strategies

This section focuses on the implementation of the innovation and discusses implementation strategies related to restricted or comprehensive policies for the introduction of computers into education. First, it discusses the development of support structures and the relevance of innovation to teachers. Next, it discusses the transition from IT towards ITE.

3.3.1 Comprehensive policies: developing the infrastructure

Most countries have launched national large-scale policies to encourage the introduction of computers into education. It seems that initial policies for the introduction of computers in

³⁵ In 1988, the computer: student ratio was 1:67 in primary and 1:32 in secondary schools respectively. At the same time 56 percent of primary and 48 percent of secondary teachers reported confidence in the use of IT. Next, 50 percent of primary and 30 percent of secondary teachers reported regular use of computers. Finally, 19 percent of primary and 17 percent of secondary schools reported that computers

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education focused on availability of resources, as well as readiness of teachers in terms of technical skills and supportive structures available. They focused on providing hardware, encouraging software development and distribution and finally on providing teachers' training.

Although these policies led to expansion in the use of computers in schools, they failed to integrate computers into everyday teaching practice. The issue of relevance, in terms of the way teachers perceive the need of innovation, was also highlighted to be an important factor for the integration of computers in schools. (Plomp, Anderson, Polydorides 1996; Pelgrum & Plomp 1993; Pelgrum 1993; Dugeut 1990; Brummelhuis 1995). (see also section 3.1.3)

Looking closely at the case of England, in the early eighties, the government announced the importance of the introduction of computers into education and encouraged the origins of a nation wide effort to introduce them into schools. MEP was launched, operating in three areas: curriculum development, teacher training and support of resources. The programme was sponsored by the government initially for three and then for a further two and a half years, and 23 million pounds were spent. (Forthergill 1988, Boyd-Barrett 1990, Brown 1993).

As for the organisation of resources, Regional Information Centres (RIC) were established, each co-ordinating resources for a group of LEAs³⁶. RICs were encouraged to collaborate with industry and private companies, not only for hardware provision, but also for the development of educational software. This led not only to the development of software and materials, but also helped the companies to understand the issues surrounding this development so that they could continue to develop materials after the end of the Programme. MEP made possible the development of some good software. The most positive outcome were model examples of how to relate software to the concept of good practice. However, by the end of the decade generic software took the lead.

MEP gave also the opportunity for large scale training for teachers, advisory teachers and trainers, which was organised at the local level³⁷. The strategy adopted for in-service training was the "cascade model"³⁸, and it was expected that a large number of teachers would be reached in a relatively short time. An estimated 41000 teachers took part in courses during the period January

had made a substantial contribution to teaching and learning. Finally, 95 percent in primary and 73 percent of students in secondary schools had "hands on" experience of microcomputers.

³⁶ It was left to the LEAs themselves to agree their own grouping of the Regional Centre which was not always geographically oriented. Their principal function was to make information available to teachers and trainers as to how developments in microtechnology and computing might contribute to different subject studies in schools.

³⁷ MEP identified its aim as being "to stimulate an effective pattern of provision and develop materials for training in order to strengthen what already exists and assist the training institutions to make appropriate provision" (Gwyn 1982: p.365). The programme identified which types of courses might be needed, but the definitions were general. Three type of courses were proposed: courses aimed at improving general awareness and familiarisation (1-3 days duration); short specialist familiarisation courses for teachers enthused by the awareness courses and for those wishing to modify their subject teaching to include new topics with the use of computers (up to one week duration); and longer specialist courses for teachers requiring additional training in particular fields (up to three months duration)

³⁸ The idea was that the training given by regional co-ordinators in each domain would be directed at advisory and other nominated teachers in the LEAs. These teachers would train others in their LEAs or schools.

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1982 to March 1986 and teachers received an average of only 1.7 course days (Gardner et al, 1988). Later on, MESU co-ordinated a nation-wide programme of courses to assist in the training of advisory teachers³⁹.

In general, many teachers had attended short-term training courses on computers and acquired familiarity with computers. MEP courses reached 120000 teachers, not including courses provided by LEAs.

MEP, despite its inadequacies, was considered to be largely successful, as a nation wide encouragement of the integration of computers in education. Looking at the situation nationally five years later, as in the DES reports, in 1984-85, 13.4 computers had been placed in each secondary school, which presented a ratio of 1:60 of computers availability to students. In 1987-88, the ratio had become 1:32. Till 1988, 96.300 computers had been bought for schools. Furthermore, 48 percent of teachers reported confidence in using computers in his/her teaching. Finally, 30 per cent of teachers reported making regular use of computers as part of teaching and learning, while 17 per cent reported that computers had made a substantial contribution to learning.

A decade later, DFE (1997), in a survey of the academic year 1995-96, reported that on average the number of computers in each school was 95.9, which represents a computer student ratio of 1:9. Finally, 344,600 computers have found a place in schools. There is however considerable variation between schools and between primary and secondary level in terms of hardware. In addition, although hardware provision in terms of numbers seems adequate, many of the machines can not run up to date software (McKinsey & Company 1997).

In parallel, 63 per cent of teachers report themselves confident uses of IT for teaching, while 34 per cent of schools report that IT made a substantial contribution to teaching. However, a minority of 29 per cent of teachers makes regular use of IT in their classrooms DFE (1997).

Interestingly, while schools acquire more resources, and at the same time more teachers report they are confident about using computers for teaching, those who make regular use of computers are no more than those of a decade ago. There is not empirical information to argue for reasons why this happens. Some suggestions however can be attempted, based on the literature and on the specificity of the English educational system and of the National Curriculum.

As has already been suggested, the integration of computers into schools does not need only resources (section 3.1.3). It needs interested teachers to take the risk and join the adventure. As argued by Brummelhuis (1995), perceived innovation relevance, school policy and problem-coping strategy are of great importance. At the same time, one can consider the

³⁹ More than 30 courses were planned and mounted by MESU. The courses had to address the professional skills needed for advisory work and at the second stage to focus on particular phases, subjects or aspects of the curriculum. It was also desirable for networks to be established between advisory teachers after they returned to their LEAs (Brown 1993).

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flexibility of the English National Curriculum (although it tends to be more and more centralised), that still respects the professionalism and autonomy of the teacher.

As presented before (section 3.2.1.2), the use of computers was started by enthusiastic teachers in the early seventies. It was encouraged by MEP –the first centralised project in England- providing resources and training, influencing at the same time rationales. Finally, it became compulsory through the introduction of the National Curriculum, where specific objectives were set.

As presented before, Information Technology National Curriculum promoted both IT and ITE, proposing all objectives. IT skills were considered necessary to be cultivated, and use of computers within teaching was expected. However, although NCET explained the "requirements of the revised curriculum Order for IT" it only suggested "where IT could be used appropriately within other subjects" (NCET 1997:3)

Variation in the use of computers either on IT or ITE was expected. NCET⁴⁰ pointed out suggestions did not attempt to dictate how to deliver IT, since this was for individual schools to decide. It is pointed out that 'what it can be said for certain is that there is no right way to organise the delivery of IT'⁴¹ Moreover, as for ITE specifically, it recognises that the introduction of ITE is a process that needs time to evolve. It describes the three stages that teachers go through introducing computers within their classrooms⁴² and describes different ways in which schools run IT courses. (NCET 1995) Specifically, some schools run courses based on competencies, some schools based on study skills, others develop courses based on topics such as 'healthy eating'. Next, other schools develop courses on demand of other curriculum subjects. For example the use of CD-ROMs is covered during a study of the events of 'The Twentieth Century World'. Finally, some schools cover IT capability without developing a discrete course (NCET 1995: 9). However, the introduction of ITE seems to be left to interested and enthusiastic teachers. As pointed out 'schools that have a sufficiently IT-literate and IT-enthusiastic staff may wish to cover IT through a totally cross-curricular programme of work'. (NCET 1995:9)

Thus, on the one hand, the autonomy but also the power of teachers is recognised, while in parallel, the difficulty of the process is also recognised, challenging enthusiastic teachers to join the adventure. At this point it is very interesting to zoom in and look at the

⁴⁰ NCET distributed 'Delivering Capability in IT' aimed at 'IT coordinators in secondary schools who may be in the process of developing or reviewing a mechanism to ensure that all students of their schools receive their statutory entitlement to Information Technology experiences'.

⁴¹ In the booklet, four approaches for delivering IT capability are discussed as follows. The *centralised model* where IT is delivered through a clearly defined taught programme. IT is used as a tool where necessary in all subjects, but there is no map for this usage. The *skills core approach*, which offers a small central core of IT, running through each year and aimed at developing skills that can be then used across the curriculum. The *kick-start* approach, which offers the skills training only at the beginning of key stage three with all further development being through cross-curricular use. Finally, the *cross-curricular* approach, where delivery of IT is entirely cross-curricular, with departments agreeing which components of the IT curriculum each will offer.

⁴² First, they introduce the computer as an extra item, as a useful addition. Second, they integrate it into the lesson plan, as another tool. Finally, teachers begin to use IT for tasks that could not been undertaken before, or to tackle topics in a different way. (NCET 1995: 3),

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CBMAC (Computer Based Modelling Across Curriculum) Project, aiming to look in more detail at how secondary teachers in England may respond more generally to a proposed program of innovation.

The main aim of the CBMAC project was to produce teacher support materials that would help teachers to integrate computer based modelling into their teaching. Project officers had organised the project this way so that project teachers would have a dynamic participation in the project, opportunity to give and receive feedback and continuous support. Thus, teachers had the opportunity to develop their own materials as well as to use other teachers' materials. They were also given time to familiarise themselves with software, to practice, to prepare classroom activities; and project officers offered regular support. It was expected that teachers would integrate CBM into their classrooms and disseminate CBM to their departments.

Although dynamic participation of teachers was encouraged, the top-down selection of schools proved to be some times problematic in terms of teachers' IT confidence and competence, as did the problem of getting time out of school, and as it proved, more importantly, there could also be problems with teachers' perceptions of modelling and their motivation to participate in the project. Researchers concluded that at the end, the adoption of the modelling approach of the project by participants varied, and it depended on the level of consensus between teachers' beliefs and the projects' approach. This evidence supports the fact that teachers are those who control their classrooms (chapter two) and this seems to be the case in the introduction of computers in education (section 3.1.3)

Although the CBMAC project was introduced when modelling was a compulsory element in the National Curriculum, its compulsion did not guarantee the acceptance of teachers who shape the innovation in the classroom according to their needs and beliefs. Even so, as concluded by research officers of the project, "lack of attention to the political and cultural dimensions⁴³ of innovation may contribute to its not being fully adopted" (Stevenson and Hassell, 1994: p.212).

Summing up, it is indicated that IT was more diffused than ITE into the English schools in the late nineties. Empirical information is missing to argue for reasons why this happened and even to have a clear view of the implementation of IT and of ITE. It is indicated though that a lot of variation existed (at least till late nineties) between English schools in relation to the computer use in schools. This seems to be on the one hand because of the loose IT national curriculum that allowed schools and teachers to decide on the way they would realise the objectives of the IT national curriculum, and on the other hand, because of the complexity of the implementation of ITE. It is indicated that despite readiness in terms of available support structures to accommodate the integration of computers in schools, its relevance for teachers is also an important factor in the process of implementation. It seems that not only availability of resources

⁴³ political dimension stands for innovation-in-context and cultural dimension stands for school-context.

(hardware and software) but also teacher development are issues of great importance, especially in case of ITE.

3.3.2 Restricted policies: from IT towards ITE

As discussed before (section 3.2.1) some national efforts at the early stages of the innovation followed a restricted approach to promoting IT, leaving the introduction of ITE as a secondary possibility to be explored. It was expected that the introduction of IT would stimulate computers' integration into other subjects (Brummelhuis and Plomp 1993), while the educational community would have been prepared to confront the challenge. As discussed in this section, it seems that IT by itself may not be a catalyst for the introduction of ITE.

The paradigm of Germany can provide a good example for discussing this issue. The federal organisation of the educational system, on the one hand, proposed common educational goals, while on the other each state was free to realise agreed goals in different ways⁴⁴.

In all States after the adoption of the BLK Concept (see also section 3.2.1.1), the Information Technological Education was presented as a unified concept concerning the development of the Information-Technological Education in Schools⁴⁵. Overall, the 11 States reduced this broad and large-scale general concept in highly differing directions⁴⁶. Thus, while all States followed the same general line of introducing general education on New Information Technologies with specific and common agreed educational objectives (see also section 3.2.1.1), at the same time, under the same general concept, a large number of different implementation approaches had been developed. Two broad approaches can be identified. First, states such as Baden-Württemberg decided to introduce IT by offering knowledge about

⁴⁴ At national level, the German constitutional system is organised in a federal way. At state level, it is organised in a centralised manner. The freedom of creative solutions of the governments of the states resides in the free enforcement of the federal laws issued from the responsibility of the Country. The Ministries of Education with its subordinated school administrators at regional and in part at local level, determine the design and implementation of innovations, the organisation and time planning as well as most of the design of the In-service Continuing Teacher Training.

⁴⁵ The following objectives were mentioned:

- the pupils shall have the opportunity to reflect their individual experience with information technology
- they shall learn about fundamental structures and concepts, which are important for information technology
- they shall be able to handle a computer and its peripherals
- they shall receive an introduction into problem solving in algorithmic form
- they shall have an overview over the history of information technology
- they shall acquire a reasonable attitude towards the social and economic effects connected with the penetration of microelectronics into society, including the changes and risks
- they shall receive an introduction into the problem of privacy and data protection

The concept included also the reasonable use of computers for information storage and retrieval, exploiting their creative and playful possibilities. Also different forms of social organisation of their use especially stressing collaboration in the teaching and learning process should be used.

⁴⁶ a/ in the southern states the new subject matter has been added to one or two traditional school subjects

b/ in some other states an interdisciplinary approach has been chosen, organised in projects i.e. in a continuously organised teaching of one theme across several subjects in a short period of the school year, for example up to 3 weeks

c/ in Niedersachsen the new subject did not appear at all in the curriculum, but it was integrated into practically all traditional subjects

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computers and computer science studies through one or a few main subjects. These subjects were generally Mathematics, Political and Social Studies, Science and German. Other states such as North Rhine-Westphalia decided to introduce computer education through interdisciplinary projects dealing with data handling, text processing, file organisation, model building and simulation. In one state, Lower Saxony, IT was introduced in all curriculum subjects.

All states successfully introduced IT into their schools. However, it seems that the approach they followed, influenced the take-up of ITE later on. Specifically, Baden-Wurtemberg introduced IT through three main existing curriculum subjects. IT aimed to offer knowledge about computers and computer science studies, applications and the social effects of computers. In this way it was considered that objectives of the BLK-Frame Concept could be realised. At the same time, this way was quicker and safer since not many teachers were involved and it involved little disruption to existing practices and routines.

The state began quite early with the systemic introduction to all schools in a few subjects and low teaching load. However, during the second phase since 1992 it diffused IT to a group of other subjects up to the integration of project-oriented instructional units. Strategies of linking a prototype test with a gradual spread of involved schools were employed. Next, implementation of a revised curriculum with clearly defined, limited instructional prescriptions along with variable local introduction after receiving personnel, material, and space conditions for labs were employed. These strategies presupposed fast preparation of a great number of teachers and provision of easily applicable software.

The state did achieve the early integration of IT into the curriculum, since in 1988/89 the state was ready to introduce IT in all schools. Turning to the computer integration within curriculum subjects, the state assumed that the use of computers as an instructional tool was not to be viewed separately, but as a constituent part of introducing IT. Computer use could support the introduction of IT as an instructional tool in the very same way as by adding traditional contents within specific subjects.

A very different approach was initiated in North Rhine Westphalia. The State introduced IT through three interdisciplinary projects, dealing with: data processing; text processing, file organisation and calculation; model building and simulation. That project work could be performed autonomously within project weeks or as a special phase generally covering several days within subject instruction. In special guidance for instruction, the objectives for developing open and discovery learning for the development of skills concerning problem-oriented thinking were emphasised.

Strategies for supporting pilot projects with limited participation of schools and extensive development and provision of inter-disciplinary project oriented or subject related educational software for a greater range of subjects were employed. Gradual introduction into all schools with fixed time limit, by means of frame regulations or ministerial decisions, followed. The end of the test phase and final introduction for all schools was fixed for the school year 1992-93.

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The above strategies presupposed the development of instructional materials and instructional programs. Moreover, interdisciplinary organisation was to be tested in two different organisational forms developed. During 1992 and onwards the schools were given great freedom concerning the duration and subject specific integration into the teaching schedules of schools.

In 1992, IT was realised through a project unit called "Newspaper". A newspaper was produced printed and disseminated by means of computers. In this way IT reached beyond the narrow use of computers and application programs. The state also integrated computers within curriculum subjects. Computer use in the German language was compulsory. Even if regulations were lacking in the curricula, good instances and examples, as well as information materials with practical hints were available to teachers.

In Lower Saxony a different approach within schools was employed. IT was introduced into all existing curriculum subjects. The Ministry established a commission for each curriculum subject like the commissions for curriculum development. The curriculum commission assumed that the contents and themes of IT could be tackled through active computer use within instruction. In parallel with propositions for instruction, the necessary educational and standard software of the free market was selected according to the proposed themes and included in the implementation of the instructional themes.

An important component of that concept was to combine the present curricula and the corresponding IT only with educational software that accurately and convincingly demonstrated pedagogical enrichment by computer use. Commissions developed their own software from scratch in the sense of an open curriculum approach simulation and building software for some of the subjects and variable text processing for students. After a test phase in the schools by the members of the commission nineteen extensive booklets and diskettes with the above mentioned exemplary software formed the basis for in service training and further evaluations in schools until overall introduction

Lower Saxony employed the same strategies as those used by North Rhine Westphalia but without any fixed time limit for the introduction into all schools. The strategy of Lower Saxony was adjusted to permit a long duration of the test phase, in combination with a large dissemination of instructional materials and straightforward teacher training and consultation until 1994, based on voluntary participation of teachers and schools, on teachers' conviction that taking IT is necessary. Although there are no results yet for the level of computers' integration within schools in Lower Saxony, full take-over of IT was announced for 1995, and Lower Saxony is a very good market for educational software.

As presented above, although all states successfully introduced IT under the same general objectives, very different approaches were followed, leading to very different practices in different states. Moreover, successful introduction of IT did not guarantee the integration of computers within other curriculum subjects as mediums for learning later on. In the case of Baden-Wurttemberg, quick and easy introduction of learning about computers did not lead to

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high levels of learning through computers. On the contrary, computers as learning mediums were introduced as another aspect of IT.

Finally, it seems that introduction of ITE was positively influenced by the open approaches that the two other states followed. In both states, the objectives of IT went beyond the acquisition of knowledge and familiarisation with computer applications. In parallel, long duration of the pilot phase in combination with provision of teaching materials and teachers' consultation was employed. As presented above, in the last two states the integration of computers was achieved at higher levels. It could be hypothesised that the more open approaches that the two states followed helped the integration of computers into teaching later on. Of course much primary information to argue for this is missing, but it seems that this is an issue that needs to be taken into consideration.

3.4 Summary

In this chapter, a conceptual framework aiming to explore the process of the introduction of computers in education as an educational innovation was presented.

The computer use in schools was classified in two broad categories: "Education on Information Technology" (IT) and "Information Technology in Education" (ITE). As presented in this chapter, IT focuses on the teaching of computer and technology. Students are familiarised with the use of computers and the use of computer applications (Computer Awareness and Computer Competence objectives). They may also be familiarised with programming and Computer Science (Computer Science objective). As a result, students are prepared to participate in the modern technologically oriented society (Social rationale), or even more, they are prepared to enter the modern market and industry (Vocational rationale). By contrast, ITE focuses on computer teaching that aims to realise an Educational rationale. Computers are used within other curriculum subjects to improve the realisation of existing educational aims and practices, or even more to provide a medium for realising new ones. These are reflected in a national curriculum through the Pedagogic and the Catalytic objectives respectively.

Turning to the process of the introduction of computers into education, it was presented that different countries in their first steps of the introduction of computers into education, followed either Restricted or Comprehensive policies. Restricted policies focused on the introduction of IT, leaving ITE as a secondary possibility to be explored, while Comprehensive policies promoted the introduction of both IT and ITE. For example, Germany in the early eighties promoted a Restricted Policy. IT was introduced promoting the Social and Vocational rationales and specifically proposing a Computer awareness, and a Computer Science objective. Educational rationale was implicitly proposed. ITE was promoted in a second phase, at early nineties. On the other hand, England promoted a Comprehensive Policy. Since seventies ITE was introduced in parallel with IT. Till late nineties, both IT and ITE were promoted, while all objectives were proposed in the IT National Curriculum.

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Looking at the reasons why a country promoted a restricted or a comprehensive policy, it was indicated that similarly to other educational innovations, different countries promoted IT or ITE, considering the value of the use of computers in relation to the country's priority needs. It is suggested that introduction of IT is more related to economic needs, while introduction of ITE is more related to the educational potential of computers. The countries also considered the complexity that the introduction of the use of computer involved for their introduction into the school, in respect to the available resources and to the necessary changes on the educational structure. The introduction of computers into schools (IT or ITE) presents a complex endeavour. Issues of readiness of teachers use computers into their teaching, relevance of the computer use the way teachers perceive it, as well as available resources and support are issues that need careful consideration. Introduction though of ITE, is more complex than IT, not only because it needs more resources, but also because the way teachers perceive the relevance of computer use and teachers' readiness to use them, is crucial for its implementation.

Germany in its early steps followed a restricted approach promoting only IT in order to satisfy socio-economic needs of the country that seemed prioritised at that time. ITE was left as a second step, since not only its educational potential had not been proved, but also the complexity of its introduction was pointed out. ITE was promoted as a second step, after the diffusion of IT into German schools. It is indicated that ITE was promoted at this second step of the innovation for the following reasons. IT had already been diffused into German schools and the socio-economic needs of the country had already been satisfied. Next, initial trial efforts with ITE by some enthusiastic teachers in combination with the international interest towards ITE created a base to start discussions about the introduction of ITE. Additionally, the infrastructure developed in schools through the introduction of IT gave the necessary resources to accommodate the introduction of ITE, while the shift of pedagogical orientation of the educational system towards more open learning approaches encouraged its introduction.

On the other hand, England promoted both IT and ITE. In the early days, introduction of computers emerged from enthusiastic teachers within a decentralised flexible educational system allowed experimentation (teacher-centred innovation attitude, exploratory, process). Later on, when the use of computers in schools became compulsory, both IT and ITE were promoted. It is not clear whether the emphasis was on the Computer Competence or on the Educational rationale, which may indicate two different directions. It is indicated that the government promoted IT for economic reasons, since economic development and raise of standards dominated in a competitive country in the international arena. At the same time it promoted ITE not only because its value was accepted, but also because an infrastructure had been developed to accommodate its introduction. Hardware and software had already been put in schools, hardware industry had been developed and one third of teachers were already using computers in their classroom.

Turning to the implications for the implementation of a specific computer use in school, important issues were revealed in this chapter. As reviewed, the two countries followed different

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implementation strategies for the introduction of computers into education, influenced by their educational system and priorities. Both countries managed to integrate IT into school activities, while diffusion of ITE was found more difficult to be achieved.

In the case of England IT and ITE were promoted at the same time, within a flexible national curriculum. As it was presented, lot of variation existed (at least till late nineties) among English schools in relation to the computer use in schools. This seems to be on one hand because of the loose IT national curriculum that allowed schools and teachers to decide on the way they would realise the objectives of the IT national curriculum, and on the other hand, because of the complexity of the implementation of ITE. It is indicated that despite readiness in terms of available support structures to accommodate the integration of computers in schools, its relevance for teachers is also an important factor in the process of implementation. It seems that not only availability of resources (hardware and software) but also teacher development are issues of great importance, especially in case of ITE.

In the case of Germany, IT was introduced first, while introduction of ITE followed seven years later. As it was presented, introduction of IT was not by definition a catalyst for the introduction of ITE. It seems though that introduction of ITE was positively influenced by the open approaches that some of the states followed. It seems that in the states where the objectives of IT went beyond the acquisition of knowledge and familiarisation with computer applications, and thus more teachers from other subjects were involved, a more mature ground was developed for the introduction of ITE.

The theoretical considerations as illustrated in the cases of the two countries, England and Germany, provided useful information and indicated the importance of the above-discussed issues. It has to be mentioned though that important information is missing to be in the position to analyse the complexities of the process of initiation and implementation in the two countries. For example, rationales that presented for the introduction of computers into both countries were based only on documents collected and not on the actual perceptions of the policy makers. Similarly, implementation of IT or ITE was reviewed from research papers and statistical information, while no empirical data was available. Additionally, perceptions of teachers were not available, to explain the computer use in schools. Finally, the specificity of the educational system needs to be considered in more depth. For example, teachers' perceptions and the way they react to a proposed innovation is not necessarily similar.

The Greek case study was considered important to provide this necessary information in order to give these further insights to the introduction of computers in education.

Chapter 4

General education in Greece: the context for the introduction of computers into schools

In this chapter I focus on Greece. As indicated in the theoretical considerations of the thesis, the process of the introduction of computers into education is shaped by the context within which computers are introduced; that is the educational system, the innovation policy, the pedagogical orientations, as well as the priorities of the country. Thus, in this chapter, I present the Greek context.

The first section presents the structure and main aims of Greek general education with special reference to the lower secondary school level (gymnasium). The next section presents the management of the Greek educational system, and discusses the decision-making process and innovation policy. The chapter proceeds to the third section by discussing the way the educational objectives set at the policy level are realised in schools. The development of a National Curriculum, student books and teacher books are discussed, since they make up the core of Greek educational practice. The role and status of Greek teachers are also presented, since teachers are the basic actors of everyday school practice, and thus, their role and attitude influence the implementation of an innovation. The final section provides an insight to the pedagogical trends of the Greek education, giving special emphasis to the trends that emerged on early nineties.

4.1 Structure and educational aims of the Greek general education

Two general values are declared by the Greek Ministry of Education to be promoted in general education; equal opportunities in education for all Greek citizens, and a classical, academic and humanistic orientation in the National Curriculum.

The Greek State offers free access to all Greek citizens, to general education. The basic principle of the Greek educational system is to provide “*an education that fights to secure equal opportunities, access and support for all students in all levels of general education.*” (MNER 1994: p.21)

The Greek general education consists of two levels; Primary and Secondary. *Primary Education* caters for pupils of 6 to 12 years of age, comprises six grades, and is compulsory for

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all Greek pupils. Students proceed from primary to secondary education on condition they have the certificate of graduation from the first level.

Secondary Education caters for pupils of 12 to 18 years of age, and is divided in two stages, *Gymnasium* and *Unified Lyceum*. *Gymnasium* caters for pupils of 12 to 15 years of age, comprises three grades, and is also compulsory for all Greek pupils. After graduation from *gymnasium* students continue their studies in general education (*Lyceum*), or enter technical education. *Lyceum* caters for pupils of 15 to 18 years of age, comprises three grades and is not compulsory. Students proceed from *gymnasium* to *Lyceum* without examinations on condition they have the certificate of graduation from the previous level. Students who have graduated from *Lyceum* and succeed to the Pan-Hellenic examinations register for University. Graduates from *Lyceum* who failed in the Pan-Hellenic examinations, either participate again next year, or enter the work market.

All educational issues, such as the aims of education, are stated in the constitution of the Greek Republic in national laws voted on by the Greek Parliament and in executive acts. The aim of the Greek general education is to cultivate students' mind, body, aptitudes, interests and talents. Awareness and consciousness of social and moral values, parity of mental and manual work and correct practice, are also expected benefits for the students. As stated in the educational law 1566/85, the aim of general education is to: "*contribute to an all-out harmonious and balanced development of pupils' mental, psychological and physical powers, in order for them -regardless of their gender or origin- to be able to evolve into integrated personalities and live creatively.*"

Specifically, Greek general education aims to help students:

a/ to become free, responsible and democratic citizens, to defend national independence and democracy, to be inspired for love of man, animals and nature and to have faith to the country and original elements of Christian Orthodox tradition. However, freedom of pupil's religious consciousness is inviolable

b/ to cultivate and develop in a balanced way their mind, body, talents, interests and abilities, to develop through their education, social identity and consciousness, to understand the value and equality of mental and manual work, to be informed and trained to the right and beneficial use as well as the exploitation of the modern civilisation's goods as well as our traditional values

c/ to develop creative and critical thought and the idea of group effort and collaboration, in order to take initiatives and to contribute to the advance of the society and the development of our country

d/ to understand the importance of art, science and technology, to respect human values and to protect and to promote culture

e/ to develop spirit of friendship and co-operation with all people of the earth, leading to a better world, that is both fair and peaceful (Law 1566/85; p.2)

Secondary education

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Secondary Education for the last one hundred years has emphasised literature that covered half of the material of the National Curriculum. Since late seventies, a new period of reformulation of secondary education started, aiming to modernise the curriculum (Massialas, Flouris & Kassotakis 1988, Benekos 1991). However, it "*still contains a classical bias and falls short of harmonising educational with social and economic development aims in the way intended*" (Ifanti 1992, p.104).

In 1990 the representative of the Greek Ministry of National Education and Religion declared:

The philosophy underlying the Greek Educational system reflects the values and schools of thought of the Greek Nation. Thus, though a significant number of changes, experimentation and improvements have taken place, a great focus is being given on the Classical studies since the latter provide the basis for all the streams of the current knowledge and scientific thinking (cited in Ifanti 1992, p.396). The academic humanistic nature of the Secondary curriculum is supported and reproduced by high selectivity for University candidates who come from Lyceum.

4.2. Administration and management of the Greek educational system

The Greek educational system is highly centralised (Koutouzis 1999, OECD 1997, Andreou & Papakonstantinou 1994) and bureaucratic (Samatas 1995). The space left for managerial decisions at regional, local and school level is very limited.

According to the legislation in force (Law 1566/85), the *Minister of Education and Religion Affairs* is at the top of the administration and control of Greek education. Educational policy, mainly in the form of government laws and presidential decrees, is decided by the minister of education. The Minister of Education introduces educational laws in Parliament to be voted on and issues executive acts concerning all areas of the school system (Koutouzis 1999, OECD 1997, Kontogiannopoulou Polydorides et al. 1995, Andreou & Papakonstantinou 1994). He/she is assisted by one or two *deputy Ministers* and a *General Secretary*.

The Minister of Education and Religion, the corresponding Deputy Minister and the *secretary-general of the Ministry of Education* are charged with the *overall* responsibility of administering *all* activities and resources related to education: supervision, finance, textbooks, personnel, buildings, equipment, as well as curriculum development. General and particular goals are conceived, developed and issued by the Ministry of Education. (OECD 1997, Kontogiannopoulou – Polydorides et al. 1995)

The dominant strategy planning body is the *Pedagogical Institute*, with its *school consultants* being in direct two-way contact with the Ministry, the schools and all administrative units. The *Pedagogical Institute* is a public service, staffed by highly qualified teachers that is answerable to the Minister of Education. It is responsible for drawing up guidelines for education, developing the National Curriculum and detailed timetables, developing teaching

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methods and schoolbooks, as well as assisting *School Consultants* in guiding teaching in schools. School Consultants are experienced subject specialists, often holding post-graduate degrees and they assist teachers by offering advice and disseminating good practices. Their role is centrally determined. However, the Pedagogical Institute as well as School Consultants are advisory bodies, thus final decisions are taken by the Ministry of Education.

In parallel, a number of supporting bodies with consultative nature is also established at the National, Prefecture, District and School level. At the national level, the *National Council of Education* draws up general proposals for the Government on educational issues. It is composed of: the Minister of Education or his/her representative; representatives of other Ministers; political parties; trade unions; and industrial associations. However, the National Council of Education has never been in operation since being established.

Councils of Primary, Secondary, Special, Higher and Technical Education, are advisory bodies that provide recommendations to the Minister of Education on educational issues concerned with their respective area and level of education. They are composed of: the Minister of Education or his/her representative; representatives of other Ministers; teachers; scientists; trade unions and social organisations.

Turning to the Prefecture and District level, the *Prefect*, is the head of each Prefecture (administrative division) who is appointed by the government. The Prefect deals mainly with financial and organisational matters in accordance with governmental policy. The *Prefectural Board of Education*, recommends educational issues to the *Prefectural Council* (a non elected body chaired by the prefecture) and to Prefecture, concerning allocation of funding to municipalities and communities, the establishment, the abolition and the merger of schools as well as the running of schools. It is composed mainly of the Prefecture as the chairman, School Consultants, Heads of Primary and Secondary Education and representatives of teachers and municipal authorities. *Directorates of Primary and Secondary Education*, are based in the capital of each Prefecture and are responsible for the administration and control of schools and their personnel in the Prefecture. An appointed Head manages each Directorate. *Offices of Primary and Secondary Education*, practice administration and control over the schools and their personnel in the district of their responsibility. An appointed Head manages the several Offices in each Prefecture, and they are all answerable to the Directorate.

In the Municipal and Communal level, *the Headmaster, the deputy Headmaster and the teachers' council* are responsible for the effective implementation of educational laws and decisions made in upper administrative levels. *School Council* is composed of the teachers' council, representatives of parents' association, the municipal or communal authorities and students (only in secondary education). It is responsible for the smooth running of school. *School Board*, is responsible for the management of running costs of the school. It is composed of the Headmaster and representatives of the municipal or communal authorities and students. *Municipal/Communal Board of Education* submit proposals for funding and running matters of schools to the municipal/communal authorities as well as to the Prefecture authorities. It is

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composed of the Major/Chairman of the community, the school Headmaster and parents' and teachers' representatives. Municipal/Communal authorities are elected every four-year period.

Table 4.1 Administrative Control and Territorial Levels

	NATIONAL LEVEL	PREFECTURAL LEVEL	DISTRICT LEVEL	SCHOOL LEVEL
Minister of Education and Religion	√	√	√	√
Prefect		√	√	√
Head of Directorate of Primary/Secondary Education		√	√	√
Head of Office of Primary/Secondary Education			√	√
Headmaster of School				√

At School level, duties of the School Council and the School Board are defined as subservient to the management of the school. There is no autonomy in decision-making but the upper levels transmit decisions. Ensuring for example the regular operation of the school and the management of funding including in the duties of the School Council and the School Board, are nothing more than actions which follow the decisions of the central authority.

Parents' association can play an important role as it can apply pressure at all levels of power. But again, those associations deal with running issues of school, providing occasional financial help for the running costs, necessary teaching equipment and so on and thus substituting the legislated bodies, and intervene when a problem in teacher-student relations emerges. On the other hand Parents' associations lack parental participation, since not many parents participate in their elections and much less take part in possible representations and protests.

The need for participation at all levels of decision-making was recognised when the socialist government voted in the educational law 1566/85, and the above advisory bodies were established. However, the advisory role of the above mentioned bodies does not allow them to take decisions on important matters and consequently to exercise power over the administration. Their intervention concerns issues of minor importance and usually operational problems of schools. Moreover, in case of examination of more important problems they are only allowed to recommend possible solutions. Therefore the Ministry can implement the educational choices of the government or even Minister's choices without operating the legislated bodies (Michalopoulos 1987).

The acts of the bodies outside school are mainly advisory either to the central power or to the upper level of administration. The recommendations of the Municipal Board of Education for example, are addressed to the Mayor and simultaneously to the Prefect. Similar procedures are also followed by the Prefectural Board of Education and by other advisory councils.

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Thus, although these organisations are out of the hierarchical system of administration, their function is subject to the principles of hierarchical organisation. Their acts lie with hierarchy and the final decisions rest with the central power (Michalopoulos 1987, Kazamias 1993).

Ifanti (1992) who studied the politics of the Greek secondary curriculum has also highlighted the central and bureaucratic control by the Ministry of Education and Religious Affairs. She emphasises that in Greece, the power is concentrated in the executive who exercise the ability to restrict access to relatively few favoured groups. Moreover, despite teachers' association's statements, teachers still lack a serious professional status, and are not able to challenge the dominance of hierarchical superiors in curriculum policy making. (Ifanti 1992)

The Ministry of education is also responsible for all the costs of education. It is responsible to provide all necessary resources for the realisation of the National Curriculum.

4.3 The realisation of the objectives

Realisation of the objectives of the Greek education is heavily influenced by the official National Curriculum voted by the government, the authorised student textbook and a book distributed to teachers (see section 4.3.1). Last but not least, it is dependent on the teachers and the school context.

As law 1566/85 states,

"the basic factors for the realisation of the above aims (see section 1) are:

a/the personality and grounding of all employees of any specialisation in all levels of education,

b/the National Curriculum, the Schoolbooks and all other teaching material as well as their right use,

c/ all necessary conditions for the well running of schools,

d/development of necessary pedagogical climate through the development of harmonious interpersonal relationships in school and classroom as well as through respect for the personality of each student" (Law 1566/85, p. 3)

Next, the development of the official documents published by the government -National Curriculum, student textbook, teacher book- and status of Greek secondary teachers are discussed.

4.3.1 The triangle of the National Curriculum, the student textbook and the teacher book.

The triangle of the National Curriculum, the student textbook and the teacher book determines the implementation of the proposed educational aims.

The development of the National Curriculum takes place at the national level, following the bureaucratic and centralist educational management (Kontogiannopoulou-Polydorides 1995). Ifanti (1992), studying the influencing bodies for the development of the National

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curriculum, concludes that neither University of Athens, nor teachers' unions had an important role to play, leaving the Ministry of Education and Religion with its centralised organs to be the main decision-making centre. As she states, the *teachers' association (O.L.M.E.) was more concerned with claims for the satisfaction of the socio-economic demands of its members, without providing an articulate programme for curriculum change.* (Ifanti 1992, p.403)

Under the authorisation of the Ministry of Education and of the Pedagogical Institute (PI) working groups that are specific to the subject and level, work out the National Curriculum. The National Curriculum, which is differentiated for each school subject, follows the same procedure for every subject. In the phase of designing, the educational aims and the methods of realisation are developed by the relevant (Primary/Secondary) Directorate of Education of the Ministry of Education and Religion. Representatives of the relevant level of Education as well as representatives of higher level of Education participate in this phase. However, as mentioned before, their influence on decision making is of minor importance.

The proposed aims, together with general aims and sub-aims which are to be attained in any specific subject, as well as detailed curricula and time schedules are submitted to the Pedagogical Institute. They are refined and final approval rests with the Ministry of Education. The approved National Curriculum by the Ministry of Education is adopted through Presidential Decree and is published in the government Gazette.

Not only centralisation, but also uniformity, are the main characteristics of Greek curriculum practice (Kontogiannopoulou-Polydorides et al. 1995). All secondary schools follow the same National Curriculum. The Ministry of Education decides its scope and detailed content and prepares a unique formal syllabus for each grade. The syllabus is directly linked to a specific textbook developed by individuals or teams following specific guidelines, under the authority of the Ministry of Education and the Pedagogical Institute (Kontogiannopoulou-Polydorides et al. 1995). After the curriculum and its time schedule have been determined, the Ministry of Education and Religion in collaboration with the Pedagogical Institute appoints a person or a group of persons to write a student textbook for the subject. After the completion of the book, a committee is appointed to evaluate the book. The book may be rejected or modifications and improvements may be proposed. After the final acceptance, it is published and distributed to all schools across Greece. All students receive the standard student textbooks free of charge. Very few initiatives have been taken by principals or by individual teachers to break the one textbook rule. Teachers can not be expected to do more than the strictly necessary, due to lack of facilities and absence of any reward for extra performance or initiative (OECD 1997).

Along with the student textbooks, a teacher book is also developed at the national level for each subject. This book suggests ways of conducting the lessons for specific contents for every grade. The relevant teacher book is distributed to each teacher that explains the aims of the subject and provides some teaching guidance based on the specific student textbook.

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It seems that a centralised bureaucratic orientation is dominant not only in the development of the National Curriculum, leaving representatives of secondary education with a minor influence on its development, but also in its realisation to the school level.

The realisation, application and follow up of the National Curriculum rest with the Primary/Secondary Directorate of the Ministry of Education. The Primary/Secondary Directorate of the Ministry of Education and Religion, informs all Offices of Primary/Secondary Education spread across Greece regions about the aims and methods of realisation of National Curriculum, which in their turn, communicate these to all the schools in their region. School directors and school counsellors are expected to monitor the exact implementation and progress of the relevant syllabus in every classroom throughout the country by means of a register where teachers have to write down what they have taught in their classroom. (Kontogiannopoulou-Polydorides et al. 1995).

4.3.2 The secondary teachers

Secondary school teachers teach the subject of their specialisation. According to the subject they teach they need to hold a four-year University degree in the subject concerned.¹

The majority of teachers are civil servants with permanent posts. Teachers in public schools are appointed by the government based on a priority list containing all the names of teacher graduates who wish to be appointed as schoolteachers. The order of priority is defined by the year of the submission of their application (Kontogiannopoulou-Polydorides et al. 1995).

Teachers who teach in secondary school are not offered teacher training (although in some university departments they receive some basic sessions on learning theories). An attempt has been made to provide them with pedagogical training before they are appointed to a school. Pre-service training has been put into place, located in every prefecture. In-service training has also been organised but is not sufficient to accommodate all teachers at regular

¹ *Necessary degrees for teachers' appointment to schools are as follows:*
Teachers of Greek Language and Literature, History, Philosophy, Psychology and Latin: degree of a Greek Faculty of Philosophy
Teachers of Mathematics: a university degree of a mathematics department
Teachers of Physical sciences: a university degree of Physics/Chemistry/Natural Sciences/Biology/Geology department. It has to be mentioned that Physical sciences are taught as separate subjects of the curriculum.
Teachers of foreign language: a university degree on the according language literature
Teachers of Arts and Crafts: degree of painting/sculptural/engraving of University School of Fine Arts. (Law 1566/85).

It has to be mentioned that at that time there were no specifications for the IT teachers, since the subject had not been introduced at that time into schools. The first teachers who were allowed by the Ministry of Education to teach IT after consultation by the Pedagogical Institute, were teachers that taught other disciplines (mainly mathematics and science) in the school and had knowledge on Computer Science. In 1990, the specialisation of IT teachers was established and official specifications for their qualifications were edited by the Pedagogical Institute as follows: university degree on Computer Science, or University degree in any subject in addition to postgraduate studies on Computer Science. (see also page 96, and page 109, footnote33.)

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intervals. Besides, there is no incentive for the teachers to attend in-service training, since promotion and progression in salary are entirely dependent on seniority (OECD 1997).

As for teachers' role on the implementation of the National Curriculum, it seems they have a minor role in the organisation of teaching and of curriculum. When they are appointed to a school, they have to follow a regularly fixed school timetable by the Ministry of Education. They follow the approved detailed National Curriculum that is supported by the relevant school books authorised by the Pedagogical Institute and printed and distributed by the Ministry of Education. As for the teaching practice, it seems that it still places an emphasis on memorization rather than critical thinking (OECD 1997). The traditional teacher-centered, subject and textbook-based teaching, with very few opportunities for classroom discussion, group work or library or laboratory work still seems to constitute the main form of instructional practice (Kontogiannopoulou-Polydorides et al. 1995).

4.4 Trends for education and intentions by the Ministry of Education and Religious Affairs in the mid-nineties

In the mid nineties, the Greek government declared the intention to modernise the Greek Education, both in terms of its objectives, content and administration. This intention was expressed in the project "Education and Initial Professional Training" that was submitted to the European Committee on 29 April 1994 for funding. The European Community Committee approved the submitted proposal² providing total funds (max. of 1.385.600.000 ECU's) for the period from 1/1/1994 to 31/12/1999. The fulfilment of European Community's obligations was due to the submitted financing table and the progress of the realisation of the project. (MNER 1994)

The project presented the educational policy of the government for the years 1994-2000 and declared a new orientation for Greek education³. The Greek educational policy can be presented along three axes. First, policy for equal opportunities remained the dominant principle of the new Greek educational policy, ensured by compulsory nine-year general education for *all* Greek children and more opportunities for all Greek students to attend upper secondary and higher education⁴.

² As it is stated in the project, *The current proposal of the Ministry of Education and Religion for the Operational Project "Education and Initial Professional Training" of the 2nd Community's Support Program presents the continuation of the initial proposal submitted by the MER on March 1994. It has been formulated in congruency with what it was co-decided during the common meetings of representatives of the European Community Committee and the according Ministries of Greece (Education, National Economy, Labour)*

³ The aims of the project were as follows:

- * *all youth between 15 to 20 years old to acquire access to education and professional training*
- * *education and initial professional training to be reformulated, upgraded and developed, in order to develop flexibility, attract students and take in consideration the latest development and needs of the market*

- * *the infrastructure -including libraries and educational resources- that is necessary for the realisation of the above aims to be improved - (MNER, 1994: p.4)*

⁴ Till end of nineties access to higher education was after highly selective Pan-Hellenic examinations.

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Second, the existing administration system was characterised as highly bureaucratic and a more flexible management of educational issues allowing more participation by local and school authorities was proposed. For the first time, local authorities (Directorates/Offices of education and school organisations) were allowed to interfere in the school curriculum. School Consultants, Heads of Offices and of Directorates of education and School directors were expected to have a more important role in decisions about school curriculum, about teachers' in-service training, or about initiatives for pedagogical innovation, conditioning they would evaluate the implementation of these initiatives.

Since the National Curriculum is the core of the Greek education, its modification was also proposed. A new "open" -instead of "closed" curriculum - was proposed allowing autonomy, initiation, creativity and self-activity for students and teachers. For the development of such National Curriculum, the need for co-operation between special scientists, scientific accusations, teachers, and productive conveyors was vital. Finally, the "one and only" student textbook as the only medium for information was challenged with the use of the "multiple book" (a list of authorised books) together with the development of school libraries and information networks.

The change of the role of the teacher was proposed not only through his/her role in the school, but also through his own professional development. The teacher's role was recognised as being not only the teaching of his/her subject but also his/her involvement in students' socialising and career guidance. As a consequence, it was argued that subject specialist teachers could not serve the educational/pedagogical aims of education. *"The view that "talent" can be an adequate condition in order for the teacher to need only a specialised training on his/her teaching subject is considered totally over ruled"* (MNER 1994: p.33) Many problems of the existing pre-service training were highlighted. First, departments in Universities were fragmented, and thus they could not help in the broader teaching needs. Second, young students, who most of them were going to be teachers in secondary schools, were dealt with as future researchers and were not offered teacher training. Next, the lack of pedagogical and educational background of university students, led future secondary teachers to be based on their practical experience concerning teaching, and management of the classroom. Thus, the need for teacher training and the improvement of in-service training, especially on educational, pedagogical, and psychological issues was highlighted.

Last but not least, general compulsory education, which consisted from primary school and gymnasium, was strengthened and was considered as one level of education. The distinction between primary and secondary was mentioned as being only administrative. Its aims and objectives were modernised to meet the needs of the post-industrial age. The importance of the introduction of Information Technology in education was emphasised.

Looking closer at the aims of the compulsory education, one can see that although humanistic objectives were retained, there was a new orientation. European consciousness, communication with the international society through learning of foreign languages, connection

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of school with life and work, exploitation and enforcement of students' special interests and talents and emphasis on new technology and production were mentioned.

The last but no less important aspect that was highlighted was New Information Technology (NIT) in Education. As cited in the proposal "*Information Technology determines the evolution of developed industrial societies. It will also determine the evolution of our country. That's why we have to proceed in a step by step and planned way for its introduction to all levels of education, not only to the teaching of Information Technology, but also to the use of Information Technology as a tool for the upgrading of educational practice.*" (MNER 1994: p.38)

The introduction of Information Technology as a tool for learning and teaching was mentioned, while its introduction as a separate subject, remained an issue of great importance. The argument for the cultivation of people who were going to participate in the international work force concerning NIT, and the education of all Greeks in order to be able to function in the new established social realities was apparent.

4.5 Summary

Greek educational system is (at least till the late nineties) bound up with a legalistic and centralised system that does not encourage initiative and creativity. The administration of the Greek general education is highly centralised, since the Minister of Education is the top administrator and is charged with the overall responsibility on all educational matters. A number of advisory bodies have been established, under the authority of the Minister, who has an advisory role on strategy making and planing. Final decisions though rest with the Minister of Education.

Two issues dominate in the declared policy for Greek general education: a policy for equal opportunities for all Greek students; and an academic and humanistic orientation, forwarding all-round development of students.

The realisation of the objectives of Greek general education is ensured through the development and implementation of the National Curriculum, the edition and distribution of a specific student textbook and a teacher book. The development of all National Curriculum, student textbook and teacher book, takes place at the national level under the authority of the Ministry of Education, by special established working groups and the advice of the Pedagogical Institute. Uniformity of teaching practice is another characteristic of the Greek educational system. The subjects are common and compulsory for all students. All schools must follow the National Curriculum and the distributed student textbook, while school directors and counsellors are expected to monitor the exact implementation and progress of the given syllabus.

Secondary school teachers do not participate in decision making. They are graduates on the discipline they teach with minor teacher training. They follow the authorised student textbook that corresponds to the published National Curriculum. As for the teaching practice, it seems that it still emphasises transmission and acquisition of knowledge rather than critical

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into schools*

thinking, while instructional practice follows traditional teacher-centred, subject and textbook-based teaching with few opportunities for group work and discussion.

In the mid nineties, the Ministry of Education declared the intention to modernise Greek education in terms of its aims, content and management. According to the declared policy, policy for equal opportunities still dominated, since upper secondary and higher education were to become more accessible to more Greek students. Management of education was to become more flexible, since local and school authorities were to be allowed to interfere on the school curriculum for the first time. The National Curriculum itself was to become more "open", allowing more autonomy, creativity and self-activity from teachers and students. The role of the teacher also was to change through the empowerment of his role in the classroom and through his professional development. Finally, general education was to be strengthened and its objectives were to be reoriented. European consciousness, international communication, connection between school and life situation, enforcement of students' interests, and finally emphasis on new technologies, and shift from product to process oriented learning were to become of importance. However, as any educational innovation, the proposed changes are still in process and not an educational reality.

After discussing the Greek general education, that presents the national context for the introduction of computers in Greek schools, the thesis proceeds to the analysis of the Greek effort to introduce computers in education. However, the methodology used in the case study needs to be presented before this. Thus, the next chapter presents the development of methodological tools, as well as the research that took place in Greece.

Chapter 5

Methodology used in the Greek case study

In this chapter, I present the methods used to investigate the research questions of the case study.

Conducting a case study in Greece was considered appropriate to investigate the process of introducing computers into education as an educational innovation. Specifically, the case study aims to provide insights into factors that influence the promotion of a category of computer use, the way this is perceived by the participants of the innovation, as well as to examine the factors that influence its shaping in the transition from policy to implementation.

The case study was considered appropriate for the following reasons. First, the cases of the two countries (England and Germany), highlighted the importance of the context within which an innovation is initiated (chapter three). It is particular, however, to case study research that it recognises the importance of the *context* (Stake, 1995; Yin, 1994), while case study research is *open* and *flexible* to evolving issues and challenges provided by the context and the subjects under study (Stake, 1995). Second, a case study is the preferred research strategy when 'how' or 'why' questions are posed (Yin, 1994). Moreover, a case study approaches the *perceptions* of persons, allows rich description while portraying issues and persons and lets the latter tell their own stories in context (Geertz, 1973; Simons, 1995), which is important for the current study, since it explores the views of the participants of the innovation.

Case study research is criticised, though, for lacking rigor and possibility for scientific generalisation (Yin, 1994). It is true that case studies, by dealing with one or a few more cases, are only 'partial accounts' of the whole population (Guba and Lincoln, 1981). Indeed, Greece was by no means chosen as a representative case. Its uniqueness was acknowledged. However, studying a single case can significantly promote understanding and it is the researcher's role to relate the findings of the case study to other existing findings and to discuss the 'typicality' of the case studied (Golby, 1994; Yin, 1994).

This study, first, explores the policy rationale for the introduction of computers into secondary schools. It focuses on the policy level and investigates in what way and for what reasons the objectives of computer use in Greek general education have changed during the

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period between 1985¹ and 1997. As presented in Chapter Four, the main actor in the initiation phase of an innovation in Greece is the Ministry of Education with its advisory bodies. Thus, in order to explore this issue, the research focused on the policy makers at the highest level of the educational hierarchy. Historical research and interviews with initiators of the use of computers in schools were employed.

Second, the study focuses on a specific computer use, that is IT, and explores the way this was initiated by policy makers and implemented by IT teachers. In order to explore the way the objectives of IT were perceived by its initiators, historical research and interviews with the policy makers were employed. In order to explore the way the objectives of IT were perceived by teachers, as well as possible reasons for any discrepancies between them and the policy makers, questionnaires were distributed to PLINETS², as well as to IT teachers who taught IT in gymnasiums. Additionally, interviews were held with a sample of these IT teachers.

The research methods used to explore each of the research issues and specific research questions (Chapter One) can be seen in table 5.1, and are presented in detail within the current chapter as follows. The first section of the chapter presents the aims of the historical research, the documents collected, as well as the process of this part of the empirical research. The second section presents the aims of the questionnaires in the pilot and main study. The last section presents the aims of the interviews, again in the pilot and the main study.

5.1 The Historical Research

According to Cohen and Manion (1994), historical research is “*the systematic and objective location, evaluation and synthesis of evidence in order to establish facts and draw conclusions about past events*” (p. 45). Historical research was employed in order to investigate the history of the introduction of computers in schools and, specifically, the way the objectives of computer use in general education changed over time, as well as the way the use of computers was perceived by policy makers. For all difficulties, it was decided to search for primary rather than secondary resources related to the above issues, since these do not run the risk of not being original or for providing misinterpreted information (Cohen and Manion, 1994).

The specific aims of the historical research, the documents decided on for collection, as well as the process followed and the difficulties encountered, are presented below.

¹ In 1985 discussions about the introduction of computers into general education had started (see also chapter six)

² Persons responsible of PLINET offices in Directorates of Secondary education. PLINETs were high-qualified IT teachers positioned in the capital of the Prefecture. They did not teach IT, while their role was to record and report any problems related to infrastructure in their Region to the Ministry of Education, report for issues concerning expansion of IT into schools in their Region, organise local teachers' training and support teachers with their work. (see also section 7.3.4.1)

table 5.1. Issues investigated, Research Questions and Research Methods

Issues investigated	Research Questions	Historical Research	Interviews with Initiators	Questionnaires to PLINETS	Questionnaires To IT Teachers	Interviews with IT Teachers
The history of the introduction of computers in general education. The period between 1985 and 1997.	1. In what way the proposed objectives for the computer use in general education changed over time?	✓	✓			
	2. In what way the policy rationale for the introduction of computers in general education changed over time?	✓	✓			
IT as perceived by its initiators and by IT teachers.	3. In what way policy makers perceived the objectives of IT in gymnasiums?	✓	✓			
	4. In what way the objectives of IT were reflected in the policy documents?	✓				
	5. In what way IT teachers perceived the objectives of IT?				✓	✓
	6. In what way IT teachers perceived the implementation of IT?				✓	✓
	7. What was the context of implementation of IT?				✓	✓

5.1.1 The aim of the historical research

The aims of the historical research were the following. First, to provide information relating to the history of the introduction of computers in Greek general education between the years 1985 and 1997. Second, to provide information relating to the way that decision-makers perceived the objectives of IT, as designed to be taught in the IT Curriculum in 1995³ (see table 5.1, questions 1 to 4).

Concerning the first issue, historical research was expected to reveal information relating to the way that proposed objectives and policy rationales for the use of computers in general education changed between the years 1985 and 1997 (see table 5.1, questions 1 and 2). As presented in Chapter Four, educational policy and initiation of curriculum subjects in Greek schools are the responsibility of the Ministry of Education, which makes its decisions following recommendations by the Pedagogical Institute and by specially appointed working groups. Next, the Ministry of Education publishes the respective National Curriculum to be followed by all Greek schools. Thus, in order to discuss the above issues, the following documents were collected:

- a. Proposals for the introduction of computers in gymnasiums, submitted to the Ministry of Education by the Pedagogical Institute since 1985.
- b. Proposals for the introduction of computers in gymnasiums, submitted to the Ministry of Education by the appointed working groups (IT committees) since 1985.
- c. Reports by the Ministry of Education relating to the introduction of computers in gymnasiums since 1985.
- d. Presidential Decrees for the IT Curriculum since 1985

As for the second issue, historical research was expected to reveal information relating to the proposed objectives for IT in gymnasiums as this was decided to be taught in schools in 1995 (see table 5.1, questions 3 and 4). Moreover, information about the way in which these objectives were reflected in the policy documents was expected. As discussed in Chapter Four, the core of each school subject in Greece consists of the National Curriculum, the student textbook and the teacher book. Thus, in order to discuss the above issues, the following documents were collected.

- a. The Draft Proposal for the IT Curriculum (1995), submitted to the Ministry of Education by the appointed working group at that time
- b. Reports by the Ministry of Education relating to the introduction of the IT subject in gymnasiums
- c. Presidential Decrees for the IT Curriculum for gymnasiums.
- d. Official student textbooks published by the Ministry of Education for teaching IT in gymnasiums.

³ The researcher chose to investigate in detail the IT Curriculum of 1995, since it was the IT Curriculum in force when the empirical research in gymnasiums took place in 1997 and 1998.

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- e. Official teaching guidelines published by the Ministry of Education for the IT teachers who taught IT in gymnasiums.

5.1.3 The process and difficulties

The collection of primary data took place in April and May of 1995. Collecting all the documents proved to be an endeavour. In addition to lack of organised archives and of a data processing system in the Ministry of Education, authorisation for access to the archives of public services was time consuming. It has to be said, however, that employees in different services were willing, for all their workload, to help in this effort.

Specifically, there were no archives in the Ministry of Education relating to the introduction of computers in schools, since the effort was not co-ordinated by a specific department or section within the Ministry. All issues relating to the introduction of computers into education were co-ordinated by Section D of the Secondary Education Department in the Ministry of Education, together with all other issues for secondary education.

Additionally, there was no computer-based data processing system for the records of the Ministry of Education. All the documents found in the Ministry were classified by the date. Thus, investigating the history of the introduction of computers into general education was very difficult, considering that the dates of the key events for the introduction of computers into schools were not known at that point. Many days were spent browsing through the documents of the Ministry of Education since 1985. In spite of all the effort, much information before 1992 was still missing⁴. The missing documents were found through personal contact with persons responsible for proposals and evaluation projects for the introduction of computers into gymnasiums.

The situation was the same at the Pedagogical Institute. There was no data processing centre, and the criterion for the classification of the documents was the date. After authorisation for access to the archives by the President of the Institute, many days were spent browsing one by one all the documents from meetings in the Pedagogical Institute to discover the ones concerned with IT in gymnasium.

Both numerous visits to organisations and personal contacts were made, in order to find all the documents needed, since documents already found in the Ministry of Education indicated other documents submitted to the Pedagogical Institute and vice versa.

Presidential Decrees also proved to be difficult to find, since the Government Newspaper had no data processing service apart from date of publication. Thus, the exact newspapers' numbers from the authorising Ministry -in this case the Ministry of Education- had to be found first and then bought from the Government's Gazette.

Student textbooks were the only easy data to find since they were sold in bookshops mainly for students attending private schools.

⁴ Proposals and evaluation projects submitted before 1992 were not in the position of MNER.

The documents collected were analysed in terms of the research questions and according to the theoretical framework presented in Chapter Three. The information relating to the history of the introduction of computers into general education, in terms of the policy rationale and the proposed objectives of computer use, is discussed in Chapter Six.

5.2 The Questionnaires

Two questionnaires were developed: one for the teachers who taught IT in gymnasiums (IT teachers) and one for the PLINETs. The first questionnaire aimed to collect information relating to the way IT teachers perceived the objectives of IT, the way they perceived its implementation in schools, and the context of its implementation. The second questionnaire aimed to collect information relating to the context of implementation of IT and to the way this was perceived by the PLINETs (Table 5.1).

As Cohen and Manion (1994) argue, "what is perhaps the most commonly used descriptive method in educational research" is the survey. Since the data to be collected was mainly descriptive, distribution of questionnaires was considered an appropriate method to collect such information. The more specific aims of the questionnaires, their development, the main study, their coding and analysis are presented next.

5.2.1 The aim of the questionnaires

The aim of the Teacher-Questionnaire was to provide information on the following issues: information about the teachers themselves; the way they perceived the objectives of IT; teachers' possible initiatives; the context of the implementation of IT; some information about their perceptions concerning the integration of computers in education that was intended by the Ministry of Education. The specific questions that were developed to explore the above issues are presented in section 5.2.2.

The aim of the PLINET-Questionnaire was to provide information on the following issues: PLINETs themselves; the district they were appointed to; the context of the implementation of IT; their role on teachers' training and support; the way in which an IT should be organised; and some information about their perceptions concerning the integration of computers in education that was intended by the Ministry of Education. The specific questions that were developed to explore the above issues are presented in section 5.2.2.

5.2.2 The development of the questionnaires

In order to develop the questionnaires for the PLINET and the Teacher, other questionnaires investigating similar issues were taken into consideration (IEA 1988, NTUA 1999).

Similarly to the previous questionnaires, mainly specific questions were used rather than general ones, trying to minimise the danger of misinterpretations, difficulties on the coding and on the analysis (Robson, 1993).

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Questions with multiple possible answers were given so that the survey participants need only tick boxes providing the necessary information. However, the choice “other” or “other comments” was added so the survey participants would not feel restricted and would have the chance to express themselves more efficiently (pilot TQ q. 11)⁵. In some of the questions further information was asked (pilot TQ q. 13). In questions where perceptions of the survey participants were requested, the reasons for the answer were also asked in the form of open-ended reasoning (pilot TQ, q 63).

Likert-type scale questions (Anastasi 1990) were used in cases where respondents were asked to give their views (pilot TQ q. 23). In cases where teachers were asked about their perceptions on general issues, the answer “not enough evidence to judge” was provided in case survey participants were unable or did not wish to give an answer (pilot TQ q 53). Thus the danger of respondents manufacturing an opinion was limited (Robson, 1993).

Finally, a small number of open-ended questions were included (pilot TQ q.40) in order to give the chance to the respondents to express their views and experiences. Not many open questions were included, not only because they are too time consuming for the respondents, but also because they would present difficulties in coding.

5.2.2.1 The Pilot Study

Pilot studies were conducted in Athens in order to test the Teacher-Questionnaire and the PLINET-Questionnaire. The purpose of testing both questionnaires was to explore whether the questions were unambiguous and meaningful to the survey participants, as well as whether they were easy to fill in and not too time consuming. The latter was considered to be very important considering teachers and PLINET officers' heavy schedule.

Since the responses to the pilot questionnaires were not to be analysed in detail, they were only given to teachers and PLINET officers in Athens and not in different regions of Greece. Seven IT teachers in different Regions of Attica filled in seven questionnaires⁶. Four of them were teachers in the private sector and three of them were teachers in the public sector. Three PLINET Officers filled in the PLINET-Questionnaire⁷ in different Regions of Attica. The researcher had the opportunity to discuss the content and structure of the questionnaires with the IT teachers and the PLINETs.

The IT teachers and the PLINETs found the questionnaire generally easy to fill in and the meaning of the questions clear. However, some of the questions were rephrased, in order for their meaning to be clearer and to avoid misinterpretations (Appendix 5.3 and 5.4).

⁵ pilot TQ, q11 stands for Pilot Teacher Questionnaire, question 11

⁶ The pilot Teacher-questionnaire as translated in English, is cited in the appendix 5.2

⁷ The pilot PLINET-questionnaire as translated in English is cited in the appendix 5.1

5.2.2.2 The organisation of the main Questionnaires

The main Teacher-Questionnaire⁸ consisted of five parts. Part A concerned Teachers' personal information: teacher's position in school, experience and his/her education in IT.

Part B was concerned with school information: school size (q 1,2); computer resources (q 3-8); and school initiatives (q 9).

Part C was concerned with IT in gymnasiums. Specifically, information was requested about the way the IT teachers perceived the aims of IT (q 10), the IT Curriculum (q 15, 22, 23, 24), the student textbook (q 25, 26, 27), and the teacher book (q 28, 29, 30). Information was also expected to be revealed about the way the IT teachers perceived the guidance and support they received (q 13, 14, 15, 23, 26, 27, 29, 30, 31, 32), in-service training (q 33, 34), and students' attitudes (q 35, 36). Finally, information was requested about any initiatives they had taken (q12, 16, 17, 18, 19, 20, 21), and any problems they had faced in their teaching (q 11, 37).

Part D was concerned with the teachers' views about IT in education in general. Information was requested about teachers' perceptions concerning the aims and objectives that IT should realise (q 38), an IT Curriculum (q 24, 41, 42), a student textbook (q 43, 44, 45), a teacher book (q 39, 40), as well as concerning the teaching of IT (Q 46), the support required (q 40, 42, 45, 53, 54, 55), need for in-service training (q 48, 49), flexibility for initiatives (q 50,51), and the role they could have on the innovation (q 52).

Part E was concerned with Teachers' views concerning the planned integration of computers within existing curriculum subjects. Information was requested on the teachers' access to information (q 56,57), their views on the need for integration (q 58), as well as their views on the feasibility of the effort (q 59), and the role they could have in it (q 60).

Turning to the PLINET questionnaire⁹, it consisted of four parts. Part A was concerned with information about their Region and about the PLINETs: number of schools in region; number of PLINETs; number of teachers within the region; PLINETs education on IT and experience in teaching the IT subject.

Part B was concerned with IT subjects in gymnasiums. Information related to: schools' problems (q 3,4,16); schools' resources (q 1,2); Parents' Association role in computer introduction in schools (q 5); teachers' problems (q 6,7,17); teachers' practice including possible initiatives (q 14,15); PLINETs problems (q 18); information access (q 11, 12, 13); teachers support (q 8,9,10, 13); and teachers in-service training (q 19).

Part C was concerned with the way the PLINETs perceived that an IT subject should be organised. Specifically, information related to perceptions of the PLINETs concerning: the aims that an IT subject (q 20) an IT Curriculum (q 21) a student textbook (q 22) and a teacher book (q 23) should realise; and the bodies that should be involved in the initiation of the IT (q 24).

⁸ The main Teacher-questionnaire is cited in the appendix 5.5.

⁹ The main PLINET-questionnaire is cited in the appendix 5.6.

Part D was concerned with perceptions of PLINETs of the integration of computers within curriculum subjects. Information requested related to: information access (q 25,26); PLINETs' perceptions concerning the need for integration (q 27); the feasibility of the innovation (q 28), their perceptions of their role and the role of IT teachers in computer integration (q 29, 30).

5.2.2.3 The sample, the process of distribution and collection of the questionnaires

The Teacher-Questionnaire

The Teacher-Questionnaire was distributed to all IT teachers across Greece, including those who were on a temporary contract. The latter were included in order to explore possible differences on the investigated issues in relation to permanent teachers. This was an ambitious goal, since rarely do researchers attempt to contact every member (Cohen and Manion 1994), but it was attempted since important data could be provided. However, this proved to be an endeavour beyond the time limits of a doctoral thesis. In addition, a long strike from teachers during that school year, made the effort even more difficult since after a month away from schools teachers were found to be very busy trying to make up for the lost teaching hours.

The questionnaires (original despatch) were distributed in spring 1997. In a few cases, there was personal contact with the PLINET of the Region for the facilitation of the process, i.e. the questionnaires were sent to the PLINETs who forwarded them to the schools. In the remaining regions, the questionnaires were sent to the teachers themselves, since a list of their names was provided by the Ministry of Education (Appendix 5.7).

A total of one thousand one hundred and three questionnaires were distributed in schools. A covering letter was included (appendix 5.8), indicating the aim of the survey, conveying its importance, and assuring its confidentiality, in order to increase the response (Robson, 1993). A stamped envelope was also included for the convenience of the teachers.

The collection of the questionnaires proved to be difficult for two reasons. First, mail questionnaires have a low response rate (Cohen and Manion, 1994), at least at the first despatch. Second, in the school year 1996-97, as mentioned before, the biggest strike of secondary school teachers in the history of education in Greece took place. For more than one month teachers remained away from schools. After the strike, the Ministry of Education extended the school schedule in an effort to cover the lost teaching hours so the National Curriculum could be covered and teachers undertook the responsibility to work overtime. Thus, teachers were too busy to deal with any questionnaire distributed at that time.

By the end of May, only two hundred and eighty questionnaires (25,4% of those sent out) had been collected, although a first follow up letter had been sent (Appendix 5.9). Since the school year was nearing the summer holidays, there was no time left for a second follow up. The researcher decided to personally contact the IT teachers who had not replied. Additional questionnaires were sent to those IT teachers who no longer had the questionnaire. It is worth

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mentioning that only one IT teacher refused to reply to the questionnaire, while all the rest promised to send the questionnaire by the end of the school year. However not all did. After many telephone calls across Greece, many teachers responded and, for all their workload, sent the questionnaires back. A total of five hundred ninety one questionnaires were collected which corresponded to fifty four percent of all IT teachers, i.e. of those sent out. The detailed response rate according to each region is cited in Appendix 5.7.

The PLINET-Questionnaire

It was decided to send the questionnaire to all PLINET officers of Greek educational regions, even though each region maybe had two PLINETs. This was decided because, although the information on the region was the same for the PLINETs in the same region, their perceptions concerning the IT subject and about the integration of computers in schools might be different.

A total of sixty-one questionnaires were distributed. A covering letter was included, (Appendix 5.10), together with a stamped envelope. The researcher personally contacted the PLINETs that had not replied following the first despatch. A follow up letter was sent (Appendix 5.11), and additional questionnaires were sent to those PLINETs that did not have the questionnaire at that time. Only one PLINET refused to reply to the questionnaire, while one of them was lost in the post together with the questionnaires of the teachers of the region. Finally, four of the PLINETs completed the Teacher-questionnaire by mistake and therefore they were not coded. Fifty-one questionnaires were collected (83,6% of those sent out). The detailed response rate according to each region is cited in Appendix 5.12.

5.2.2.4 Coding of the Questionnaires

In order for the collected information from the Teacher and the PLINET questionnaires to be coded, specific variables were developed (Appendix 5.13 and 5.14 respectively) and symbols were used to identify particular responses to each question. The same method was followed for coding both questionnaires, thus it is presented in the same section.

A number of methods were used and are presented briefly.

a. Closed questions

First, a group of questions were coded by using the actual number given in the questionnaire. For example the question concerning the teacher's age, was coded with the actual number of years of age. Second, in specific questions where teachers had to tick their answer, numerical symbols were identified. For example, number "0" was given for "male" and number "1" for "female". In factual questions where teachers had to tick, but where an open choice had also been provided, in addition to the numerical symbols identified for each optional answer given, categories were created. For example, in question five of section B, "0" was given for equipment consisting of 8088 PCs, "1" was given for equipment including 8088 and/or 286 and/or 386, "2" was given for equipment including 386 and/or 486, and "3" was given for equipment including 486 and/or Pentiums.

b. Open questions

In open questions, the detailed information given in the response was coded using a limited number of categories. Categories were created from studying the first 100 questionnaires. However, there were some cases where new categories were added in the process of coding.

The categories developed were based on the theoretical framework (Chapter Three) or on the classification of the content of the teachers' answers. For example, coding of teachers' answers to question number ten was based on the theoretical framework of the research. That is, teachers' answers were coded according to the objectives of IT National Curriculum presented in Chapter Three: Computer Awareness, Computer Competence, Computer Science, Educational, Vocational (Appendix 8.1).

Coding of the teachers' answers to question number forty-one was based on the classification of the content of their answers. That is, in order to code problems that teachers reported they faced while teaching the IT subject, the following categories were developed: problems related to infrastructure, students' attitudes, colleagues' attitudes, teaching process, parents, other.

5.3 The Interviews

Interviews are quite common in educational research, since they appear to be a good way to collect information (Robson, 1993). The interview has been defined as "a two person conversation initiated by the interviewer for a specific purpose of obtaining research-relevant information, and focused by him on content specified by research objectives of systematic description, prediction or explanation" (Cannell and Kahn, 1968 cited in Cohen and Manion, 1994). Although interviews may have the disadvantage of subjectivity and bias on the part of the interviewer, they are considered to be very good technique in case in-depth information needs to be gathered (Cohen and Manion, 1994, Robson, 1993). In addition, in cases of historical research they may be the only technique for collecting required information.

The researcher used the interview technique to get in-depth information on the history of the introduction of computers to Greek schools, and on the way the policy makers and IT teachers perceived the IT subject. Thus, interviews were held with policy makers and IT teachers. The aims of the interviews, their method and process are presented in the following sections, separately for the interviews with decision makers and IT teachers.

5.3.1 The Interviews with the Decision-Makers

5.3.1.1 The aim and the design of the Interviews with the decision makers

The aim of the interviews with decision makers was to complement information collected by historical research on the history of the introduction of computers in Greek general education,

and on the way policy makers perceived the objectives of the IT subject introduced in gymnasiums.

The interviews aimed to gather information on the way the policy rationale and proposed objectives for computer use in general education changed over the period between 1985 and 1997. Additionally, the interviews aimed to collect information on the way policy makers perceived the objectives of IT in gymnasiums in 1995.

In order to collect information on the above issues, semi-structured interviews were employed, in the sense that the interviewer had worked out a set of questions in advance (Appendix 5.19), but she was left free to modify them based upon the interviewee's history in terms of his involvement in the introduction of computers in schools, but also based upon the context of the interview (Robson, 1993). This was decided for two reasons. First, most of the interviewees were in more than one working groups or committees, and had different roles and participated in working groups over different chronological periods. Thus, it was impossible to tackle all the issues involved by following a structured interview schedule. Secondly, it was considered very important to allow the interviewees the freedom to expand on any issues discussed, since this would throw light on their perceptions and rationales. However, a semi-structured schedule was considered important in order not to lose the focus of the research issues.

The interview schedule that was developed included three main issues for discussion based upon the research questions (Chapter One) but also upon the theoretical framework of the research (Chapter Three) as follows.

A. Objectives of the proposed introduction of computers into general education. The interviewees were asked about the rationale for the computer use in schools at the time they were involved with the effort, as they perceived it. They were prompted to distinguish between learning about the computer and about technology, and learning through the use of the computer.

B. Policy rationale for the introduction of computers in general education. The interviewees were asked about reasons they thought a specific computer use was initiated at the time they were involved with the effort. They were prompted to discuss the value, as well as the complexity of the proposed computer use, or even more the reasons they thought a specific computer use was rejected that time.

C. Objectives of the IT subject in gymnasiums. The interviewees were prompted to discuss the objectives of the proposed IT Curriculum for gymnasiums.

5.3.1.2 The selection of the Interviewees and the process of the interviews

In order to investigate the issues discussed above, the persons involved in the introduction of computers in education in Greece from 1985 when the effort started, up to 1997 when the research took place, were traced. Persons involved in the reformulation of the IT Curriculum in 1995 were also traced. Their names were found from the historical research that had been

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employed before. Those who were involved in the introduction of computers into education and in the reformulation of the IT Curriculum, were either positioned in the Pedagogical Institute, or in Department D of Secondary education in the Ministry of Education, or appointed to special committees for the introduction of IT in education, or appointed to the working group for the IT National Curriculum (see also chapters four and six).

In most of the cases a specific person was involved in more than one committee or working group, or participated in a working group as a representative from the Pedagogical Institute or the Ministry of Education. A detailed list with interviewees and their specific involvement with the introduction of computers in education or with the IT National Curriculum is cited in Appendix 5.15.

The interviews were held in April 1998. An initial contact between the researcher and the interviewees was made by telephone. This first contact aimed to explain the aims of the research and the necessity of the interviews. In some cases the research proposal as well as a brief interview schedule was sent by email to the interviewees. The interviewees for all their workload agreed to participate in the research. At that time introduction of computers into education attracted a lot of attention, while very limited research had taken place in Greece on this topic. It seems that this fact in combination with the fact that the research was funded by the Greek State Scholarship Foundation encouraged the interviewees to participate in the research. After scheduling the appointments with the interviewees, the interviews took place in the interviewees' Institutions. All interviews were recorded and transcribed. The transcriptions were sent back to the interviewees who were free to make additional comments or interventions. This was decided in order for the interviewees to feel free to express themselves on policy issues. However, none of them did.

5.3.2 The Interviews with the IT teachers

5.3.2.1 The aim of the Interviews with the IT teachers

Interviews allow for greater depth than other methods of data collection, such as questionnaires. Interviews with IT teachers were used in the case study to get in depth information on the way they perceived the objectives, the implementation and the implementation context of IT.

Concerning the first issue, interviews aimed to gather information on the way IT teachers perceived the objectives of the proposed teaching units, that is the aim of the teaching units "Communication by computer", "Basic Computer Applications" and "Investigations through symbolic expression within a computer environment". Concerning the second issue, the interviews aimed to collect information on the way IT teaching units were taught in their classrooms, the way teaching was organised over the year and any possible emphases in the different teaching units. As for the final issue, the interviews aimed to collect information on the problems that teachers faced, the support they were or were not provided with, as well as any provision of training.

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As with the interviews with the decision makers, in order to collect information on the above issues, semi-structured interviews were employed, again because it was important to let the interviewees free to expand on the discussed issues, while not losing sight of the research foci.

5.3.2.2 The development of the interview schedule for the IT teachers

The pilot study

Three pre-pilot and one pilot interviews were held with teachers positioned in gymnasiums in Athens. The purpose of the pre-pilot interviews was, first, to test the content of the interviews, in terms of the extent to which all the necessary information could be collected through the set questions. Next, the pre-pilot interviews aimed to test if embarrassing or misleading questions and discussion issues were included in the interview schedule. Finally, the pre-pilot interviews aimed to test the time needed for the completion of the interview.

The schedule of the pre-pilot interview included three main issues for discussion that were based upon the research questions (Chapter One) but also upon the theoretical framework of the research (Chapter Three) as follows.

Part A. Implementation of IT. Teachers were to be asked about the teaching of IT and possible initiatives. They were also to be asked about problems that they faced relating to the IT subject.

Part B. Context of implementation of IT. Teachers were to be asked about their perceptions concerning the National Curriculum, the student textbook and the teacher book. They were also to be asked about efficiency of technical and educational support and of in-service training.

Part C. Teachers' role on the IT introduction and on the integration of computers within other curriculum subjects. Teachers were to be asked about their perceptions of their role in the introduction of the IT subject, and about the role of local authorities and of parents in IT implementation. They were also to be asked about their perceptions of the intention of the government to integrate computers within other curriculum subjects and about their role in it.

Although none of the discussion issues proved to be embarrassing to the teachers, the length of time required for the completion of the interview was too demanding for the teachers. Moreover, not enough information was collected in the teaching of the IT subject and teachers' perceptions about its objectives.

Considering the above, the following changes were decided. First, the third part of the pre-pilot interview was excluded. Although interesting information was expected to be collected, the issues involved were of secondary importance to the research.

Second, part A was re-organised. It was decided to include more specific issues on the teaching of IT. For example, teachers were to be asked what teaching units they covered, how they organised their teaching across the year, and which of them they gave emphasis to. A new part was added to the interview schedule, relating to the way IT teachers perceived the objectives of the IT subject.

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Since there were many changes in the interview schedule, an additional pilot interview was held with an IT teacher. No more changes were decided on and the schedule for the main interview was confirmed.

The schedule of the main Interview

The interview schedule that was developed included three main issues for discussion as follows.

Part A. Implementation of IT. The interviewees were first asked about what teaching units they covered within the teaching of the IT subject. They were prompted to discuss the way they chose these teaching units, the way they organised their teaching across the year and if they covered a teaching unit beyond the National Curriculum. Finally they were prompted to answer whether they emphasised a specific teaching unit and the reason why.

Part B. Objectives of IT in gymnasiums. The interviewees were asked about the way they perceived the objectives of the proposed IT Curriculum for gymnasiums. Specifically they were asked about the aims of the theoretical part of IT, of computer applications and use of programming.

Part C. The context of implementation of IT. The interviewees were asked about the problems they faced, and the way they overcome them. They were also asked about the support they received on problems relating to technical and educational issues, as well as the training they received and the way they felt about it. They were asked about the support they received or not from the PLINET positioned in their region, and finally the way they felt about the National Curriculum, the student textbook and the teacher book distributed by the Ministry of Education.

5.3.2.3 The selection of the interviewees

As mentioned earlier (Section 5.3.2.1), the aim of the interviews was to collect in depth information on the way IT teachers perceived the objectives of IT, its implementation and its implementation context. At this point it has to be highlighted that information collected was focused on the way teachers perceived the implementation of IT and not its actual implementation in the classroom, since no classroom observations took place. The latter, although it might give additional interesting information, it could not be undertaken under the time limits of the current research.

The interviews aimed to provide further information on differing views of IT teachers about IT and to get in depth information on IT implementation in various settings,. As discussed in Chapter Two, teachers' perceptions are influenced by their background, as well as the context within which they work, in terms of resources they have and support they are provided with.

As for IT teachers' background, anticipating different views, it was decided for the sample to include teachers with different first degree, contract with the school and teaching

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experience. Thus, the sample of the interviewees was to include teachers with IT or other first degree, teachers with permanent and temporary contracts with schools as well as newly appointed and experienced teachers.

There was no reason to suggest that teachers' background in terms of their first degree differed across regions according to a specific pattern, since all Greek teachers are appointed centrally by the Ministry of Education (Chapter Five). By contrast, it seems that they differed in the contract they had with the school and experience. It is suggested that teachers appointed in the centre of the Prefecture were usually senior teachers who had been employed for many years. Temporary teachers could be found both in the centre of the Prefecture (replacing a permanent teacher) and in the periphery (being placed in a school that did not justify a permanent post). However, more temporary IT teachers were found in the periphery of the Prefecture (Chapter Five).

As for the context of implementation, the researcher tried to include schools with different resources available, as well as schools where different level of support was provided to teachers.

Although not all schools were provided with new equipment, there was no reason to believe that school resources across different regions differed according to a specific pattern, since they were centrally provided by the Ministry, based on equal expansion policy (Chapters Five and Six). Similarly, there was no reason to suggest that schools in the periphery of the Prefecture necessarily differed from schools in the centre in terms of resources and provision of information, since the Ministry of Education distributed resources with an equal policy mentality. This also applies to the distribution of books and teaching aids.

Additionally, indirect support provided to teachers through official guidance by means of documents and books did not differ across regions or among schools within regions, since the same information network was established by the Ministry of Education to the Directors of Education within each Prefecture.

This was not the case for direct support that teachers were provided by the PLINET. A PLINET had not been appointed in all regions of Greece. In addition, teachers positioned in the capital of the region had a better opportunity for PLINET support, than those teachers positioned in the periphery, especially in areas where contact was difficult. Moreover, teachers in different Regions seem not to be provided with the same level of assistance by the provider Computer Company that equipped schools. Teachers positioned in schools in the capital where the provider Computer Company was based, had a better chance for quick repairs of damages of equipment. Last but not least, it is suggested that PLINET support provided differed for teachers based in the periphery and those in the centre, especially in areas where contact was difficult. For example, it is suggested that in Regions that included many islands, such as Cyclades, the PLINET could easier contact teachers positioned in the island where he is located than those positioned in the other islands of the region.

Thus, the sample of the interviews was to include teachers positioned in Central and

Table 5.2 Criteria for selecting the sample for interviews with IT teachers

REGION	IT TEACHERS
ATHENS-B Central Region Plinet positioned	Differed on First degree Teaching experience Contract with the school
ATHENS-A Central Region Plinet not positioned	Differed on First degree Teaching experience Contract with the school
CYCLADES Syros Island Distant Region Plinet positioned	Differed on First degree Teaching experience Contract with the school
CYCLADES Paros and Santorini Islands Distant Region Plinet positioned, difficulty in communication	Differed on First degree Teaching experience Contract with the school

Distant areas, as well as those positioned in the capital and in the periphery of the region.

5.3.2.4 The Interviewees and the process of the main study

Based on the above, the following sampling was decided upon.

Two regions in Attica were selected, Athens-B and Athens-A, as central regions. Both regions are in Athens, the capital of Greece. They are large Regions with many IT teachers

appointed to. These teachers are considered to be in the centre of information dissemination, since many seminars are organised and different bodies run courses in the public and private sectors on Information Technology or educational technology. Moreover, access to further information, i.e. bookshops, hardware, software etc. is readily available. Athens-B was selected because two PLINETs were appointed in the Region. In Athens-A, no PLINET was appointed at that time.

The region of Cyclades was selected because it is considered an isolated are. Besides, the Cyclades include many small islands where travel from island to island is difficult. In the Cyclades, one PLINET was positioned. Contact though between the PLINET who was positioned in the capital of Cyclades and teachers in other islands was expected to be difficult especially in winter during the school period.

At the same time, within each Region, it was decided for the sample to include teachers who differ as to the type of contract with the school (permanent or temporary), total teaching experience and first degree (IT or other). The sample of the IT teachers who were selected to be interviewed according to the above criteria is shown in Table 5.2. The Regions selected to conduct the interviews are cited in the Appendix 5.16.

The interviews were held in May 1998 after scheduling with the interviewees. The teachers to be interviewed were randomly chosen through telephone contact with schools in the selected regions. The teachers were personally contacted and chosen to meet the set criteria.

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Eighteen interviews were scheduled (Appendix 5.17) according to the sample selection criteria. Seventeen interviews were held with the selected IT teachers, while one of them did not take place, since the teacher was unable to attend at the last moment.

All interviews were recorded and transcribed. One of the recorded interviews was lost due to very poor recording.

5.4 Summary

This study was set out to investigate the process of the introduction of computers into education as an educational innovation. It was set out to explore for what category of computer use and for what reasons it was promoted and introduced into schools, as well as to investigate the way the promoted computer use was shaped in the transition from policy to implementation. In order to explore the above issues, different kinds of research tools were used, according to the specific aim to be achieved: historical research; questionnaires and interviews.

Historical research aimed to collect information, firstly, related to the history of the introduction of computers into general education, secondly, to the way policy makers perceived the objectives of IT, and thirdly, to the way the objectives of IT were reflected in the policy documents. Proposals submitted to the Ministry of Education concerned with the introduction of computers into education, IT curriculum, student textbooks and teacher books were collected and analysed in relation to the above research questions, based on the theoretical framework developed in chapter three. Interviews with the policy makers aimed to collect information in depth related to the first two issues.

Questionnaires distributed to IT teachers aimed to collect information related to the way IT teachers perceived the objectives of IT, its implementation, and the context within which IT was taught. Phrasing of questions, necessary time to fill in, and the content of the questionnaire were firstly tested, and consequently were filled in by seven teachers from Attica, and finally were corrected as necessary. The main questionnaires were distributed to all IT teachers across Greece under permanent and temporarily contract. More than half of the questionnaires were collected, coded and analysed, based on the theoretical framework developed in chapter three. Interviews to the IT teachers aimed to gather more information in depth on the above issues.

Finally, questionnaires distributed to PLINETs aimed to collect information related to the context within which IT was taught. Similarly with the Teacher-questionnaire, the PLINET-questionnaire was tested, corrected as necessary and distributed to all PLINETs across Greece. Eighty four percent of the questionnaires were collected, coded and analysed, based on the theoretical framework developed in chapter three.

As one can see, in order to investigate each research question set in chapter one, one or more of the research tools were used. Specifically, in order to explore in what way the proposed objectives and policy rationale for the computer use in general education changed over time, desk research was employed and interviews with the policy makers were conducted. Similarly, in order to explore in what way policy makers perceived the objectives of IT taught in

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gymnasiums, desk research was employed and interviews with the policy makers were conducted. In order to investigate the way the objectives of IT were reflected in the policy documents desk research was employed. In order to explore the way IT teachers perceived the objectives of IT and its implementation, questionnaires were distributed to IT teachers, and interviews were conducted with a small sample of them. Finally, in order to investigate the context of IT implementation, questionnaires were distributed to IT teachers and to PLINETs, and interviews were conducted with a small sample of IT teachers.

The next three chapters of the thesis present the results of the case study. The results however, are not presented separately for each of the research tools used in the empirical research. Results from different sources feed the discussion for the investigated issues. Specifically, chapter six presents results related to the history of introduction of computers into general education. Results from the desk research and the interviews with the policy makers are integrated into this chapter. Chapter seven presents results related to the way policy makers perceived the objectives of IT, and in what way the objectives of IT are reflected in the policy documents. Results from the desk research, the interviews with the policy makers and the analysis of the policy documents are also integrated into this chapter. Finally, chapter eight presents the results related to the way teachers perceived the objectives and the implementation of IT as well as results related to the context of the implementation of IT. Results from the Teacher-questionnaire, the PLINET questionnaire, and the interviews with the IT teachers are also integrated into this chapter.

Chapter 6

Policies for the introduction of computers into gymnasiums over time

In this chapter I discuss the introduction of computers into Greek gymnasiums. I focus on the policy level and how the policy around introducing computers into education evolved over time.

The Ministry of Education was the main actor in the promotion of the use of computers in Greek gymnasiums. However, the Ministry established specialised advisory groups to consult on the issue. In this chapter I discuss the policies adopted by the Ministry of Education and their implications for implementation.

The Ministry of Education put forward different rationales for the use of computers in gymnasiums at different periods of time. The organisation of the chapter follows these rationales and is therefore organised in three sections corresponding to three periods: 1985-1990; 1991-1993; and 1994-1997.

Each section first discusses policy approaches that were promoted by the Ministry of Education in that period and the policy rationales that led the government to decide on these approaches. Next, the realisation of the decided approaches and possible discrepancies between promoted and realised policies are discussed. This discussion is based on an analysis of documents collected and a range of interviews that were conducted. The documents used refer to the policy level, that is, advisory proposals, official governmental documents, and the IT Curriculum. The interviews analysed in this chapter are those undertaken with key policy makers and members of groups that were established to advise the Ministry.

6.1. Introduction of IT subject (1985-1990)

The first period of the introduction of computers in gymnasiums was between the years 1985 and 1990. Within this period, the first discussions about the introduction of computers in gymnasiums in Greece took place.

6.1.1 The first steps: IT and ITE on the scene

In the mid-eighties, the introduction of both IT and ITE was welcomed. The introduction of computers in schools was considered important since it would promote the economic development of the country, as well as improve education.

First, the use of computers in schools was declared to be the basis of a national policy aimed at the development of Information Technology across the country. Computers in education would enhance development of IT applications and products. As illustrated below, all the participants who were involved in initiating the introduction of computers agreed on this goal.

In the early eighties, a first report advising the Ministry of Education on Information Technology in education¹ claimed that *"any delay in the study of computers' introduction in secondary education should be considered unjustified, especially in these days that our country (Greece) fights to catch the "second industrial revolution", the revolution of computers, the "Information Technology revolution"* (Alexandris 1982: p.3). A little later, the Pedagogical Institute² argued: *"The introduction of computers in education, is a necessity for our country (Greece), considering the huge development of IT world-wide"* (Adamopoulos et al., 1985: p.1). In parallel, the *"Report on the Strategy for computers' introduction into education"* submitted to the Ministry of Education, stated the following: *"Educational policy on Information Technology is not only a part, but also the basis of a general national policy, aimed at the development of Information Technology across the country; the applications of Information Technology and to the production of Information Technology products. As a consequence, it has to be the first priority of Central Council of Ministry of Education."* (Maritsas et al 1985: p.1)

One year later, the economic value of the introduction of computers in schools was announced by the Ministry of Education, who stated: *"In the central recommendation by the Prime Minister, it is highlighted that educational policy on IT is not simply a part, but a basic condition for the success of a National Policy for Information Technology"* (MNER 1987: p. 1). In parallel, the Minister of Education, opening the first five-month in-service training course on computers for fifty secondary teachers (mainly mathematicians and science teachers), declared: *"...educational policy on Information Technology is not only a part but the base of a successful large national policy for the development of Information Technology..."* (A. Kaklamanis, Minister of Education, 1986, cited in Papas G. 1989:p. 26)

In parallel with economic value, the *educational* value of the use of computers in schools through the introduction of ITE was acknowledged. Since the early eighties, a first report to the Ministry of Education for the Information Technology in education pointed out the need the introduction of computers in education as a medium for learning other curriculum subjects (Alexandris 1982). The educational potential of computers was also highlighted in the *"Report for the Strategy for computers' introduction into education"* (Maritsas et al., 1985).

Thus, both the economic and the educational value of computers use in education was pointed out by advisory bodies. At that time, a clear distinction between IT and ITE was made, while both were considered valuable for the Greek educational system. It was highlighted that IT

¹ Mr Alexandris participated in the "Workshop of Pedagogical Research on New Technology" in Frascati, Italy. It was organised from the Ministry of Education of Italy in co-operation with the European Council. Mr Alexandris participated as a representative of Greece with the responsibility to report back and advice the Ministry of Education on New Technology and Education

² at that time KEME

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(Information Technology or computer science), "should be a part of a course of general education in primary and secondary education, exactly as with other curriculum subjects. It is (then) considered necessary for the basic education of a person to include elements and basic concepts of Information Technology independently of his/her profession". It was also mentioned that, "the terminology "Information Technology in Education" (ITE) is used to indicate the use of Information Technology as a "tool" for the **reformation**³ of procedure and to a great extent of methodology of education in general... it is obvious that the two phases (IT and ITE) of computer introduction synthesise the problem of educational policy for IT..." (Maritsas et al. 1985: p 5-8)

Both approaches to the use of computers in schools were again acknowledged within technical and financial reports submitted to the Ministry of Education. The dual objective that was promoted, was first "to offer general education concerning the computer and the way Information Technology influences other sciences and our daily life ...with emphasis not to teaching a specific programming language, but to explaining theoretically the computer operation and Information Technology applications..." and second "to support teaching of any curriculum subject" (Kanellopoulos 1986: p.18)

Interviews with members of advisory bodies in that period revealed the intention at that time for both IT and ITE approaches to be introduced into Greek education, as illustrated below:

"The aim of IT in gymnasium was the familiarisation of students with computers, demystification of the computer, yes, but also the use of the computer as a tool" (interviewee A)⁴

"the important thing is that since then, the philosophy of computers' introduction was focused on what is called educational software, on the use of the computer as an aid to other curriculum subjects" (interviewee B)

Although introduction of both IT and ITE were considered important and valuable for Greek schools, the complexity of the introduction of ITE was at the same time recognised. As stated in the "Report on the Strategy for computers' introduction in education", "The introduction of IT as a curriculum subject in Greek education (IT)⁵ does not present serious "local" problems... the only problem indirectly concerns the specification of lab infrastructure... the implementation of its broad scale introduction presents other problems concerned with lack of infrastructure mainly on teacher training, and editing and distribution of student books... ITE presents strong national character and needs specific dealing from each country... according to its national culture, educational traditions... and national mentality...." (Maritsas et al. 1985: p.6)

It was not clearly stated in the report the way that the introduction of ITE conflicted with Greek educational values and structures at that time. As discussed in Chapter Four, Greek gymnasiums offered many separate curriculum subjects, within an academic, classical-biased

³ my emphasis

⁴ All interviewees and the way they were involved with the initiation of computer use in education are cited in the Appendix 5.15

⁵ parenthesis mine

IT Curriculum, encouraging theoretical knowledge, focusing on product-oriented learning and assessment needs. Students had little space to exercise their own initiative with little if any practical involvement (for example, exercises in the science lab). The introduction of ITE proposing more student-centred learning, discovery approaches to knowledge, and focusing on the process rather than the product of learning, would mean huge changes, not only in relation to the use of resources and teaching materials, but also in the pedagogical orientations of the system; something that although pointed out as welcome, was very difficult to attempt at that time.

Complexity in terms of incompatibility with the educational structures were illustrated in the interviews with advisors (at that time). Interviewee A argued that *"the way the Greek educational structure is, introduction of IT was easier"* and specified that *"school schedule did not help... we (in Greece) have organisation of school classroom according to students and not according to school subjects. This presents a great difficulty, not only for the use of computer, but also of any other teaching aid... for example a mathematician needs to bring the computer into his classroom, while a mathematician who is based permanently in a mathematics classroom, if he wished to study graphs through secondary equations, it would be easier for him to use..."*

In addition to educational incompatibility at that time, the technical infrastructure was also poor. In 1985, the advisory bodies highlighted the embryonic situation of Greece in terms of computer development and infrastructure, both technical and human. First, Greece was not a manufacturing country for computers and the provision of imported hardware was expensive, considering that all schools were to be equipped by the State. Second, there was a lack of human resources for the staffing of even the small number of places in Universities and there was a very small number of graduates in computer engineering. Third, the vast majority of public secondary schools did not use computers at all and did not teach IT. Finally, there was a lack of teachers with knowledge about computers and IT (Marirtsas et al. 1985).

Summing up, both IT and ITE were considered valuable for Greek education aiming to satisfy the economic development of the country and its educational needs. At the same time, the complexity of ITE was recognised. First, ITE would be incompatible with the existing educational structure and pedagogical orientation. Second, there was lack of technical infrastructure and of sensitisation of the educational community to accommodate ITE. As discussed next, a Restricted policy was decided upon to first promote IT, while leaving ITE to be introduced at a later stage.

6.1.2 A Restricted, two-step approach

In 1987, the Ministry of Education officially stated its intention to introduce both IT and ITE into gymnasiums⁶. However, the complexity of the introduction of ITE led to the decision to follow a

⁶ The Ministry of Education stated:

Restricted policy. IT was to be promoted, while ITE remained a long-term goal. As illustrated by the Ministry of Education Preamble:

“Because the current situation is not yet mature for the introduction of IT as a medium of other curriculum subjects and in educational research, within the current phase, introduction of IT for the familiarisation and use of computers by students and as an administration aid, is attempted”.

(Ministry of Education Preamble, Γ2/2070/28-4-1987)

At the same time, the Minister of Education announced a two-step approach for the introduction of computers in schools. IT was to be a first step towards the introduction of ITE.

“the first priority will be students' familiarisation with the computer and of its use for problem solving and of acquisition of a simple programming language... the second phase will be computers integration within existing curriculum subjects as a medium of learning...” (A. Kaklamanis, Minister of Education, 1986, cited in Papas G. 1989:p. 26)

The expectation, as proposed by the advisory committee, was that the introduction of IT in schools, would develop the appropriate infrastructure for the accommodation of ITE later.

“It is obvious that the two phases that synthesise the problem of educational policy on Information Technology are chronologically rated because of the specific existing situation. The phase of education on Information Technology (IT) precedes and can be directly realised -even within a limited schema at the start. The second phase, i.e. the introduction of Information Technology as a “tool” (ITE) in education follows. The development of the first phase will create the necessary infrastructure of human resources, who will make possible the realisation of the second phase.” and continues *“The committee unanimously decided to propose for no disruption of existing educational system in primary and secondary education at this time,... ”* (Maritsas et al. 1985: p 8)

Looking more closely at the way that infrastructure was expected to develop during this first phase of innovation, it seems that this was related to the following issues. First, computer labs that would have been developed in gymnasiums would provide the technical infrastructure necessary to accommodate the use of computers within ITE. Second, teachers of other subjects (other than IT teachers) would be familiarised with the use of computers as teaching aids in their subjects and they would prepare the ground for the introduction of ITE. This was to take place in each school where a computer lab was organised for the introduction of IT. Third, a couple of teachers in each school would be informed about the administrative use of computers and this way computers would also be used for school administration. Finally, the working group

“The Ministry of Education in its effort to meet modern needs of education and to be harmonious with technological evolution, decided to introduce IT in secondary education... as follows:

a/ familiarisation with computers and their use

b/ IT as a medium for teaching of other curriculum subjects

c/ use of IT in administration of schools and of Educational Directorates

d/ use of IT in educational research

(Ministry of Education Preamble, Γ2/2070/28-4-1987)

proposed the establishment of an Institute aiming to study the introduction of the ITE (Maritsas et al. 1985).

This two-step approach as well as the expectation that introduction of IT would prepare the ground for the introduction of ITE, were illustrated by both members of the advisory committee in the interviews.

"...the basic aim was the use of the computer as a tool, it should be introduced though also as a subject... for the transition to the second phase (introduction of ITE), appropriate infrastructure needed to be developed. This infrastructure concerned three axes: students; technical resources; teachers. As for students, they needed to demystify computers and be familiar with their use. As for technical infrastructure, labs needed to be created. As for teachers, they needed to be informed..." (Interviewee A)

"we had said that there are two stages. The first one is the introduction of IT in order to develop the initiative base that would accept the essential use, the second phase that needed to be designed, which would be the use of computer as a medium into the educational process" (Interviewee B)

Thus, introduction of IT was announced as the first step. The Ministry of Education within the "Plan of Immediate Action of Ministry of Education and Religion for the period 1987-1988 announced the intention to introduce IT in Greek gymnasiums. As stated in the Ministry of Education's report, the immediate plan was the introduction of IT in *all* secondary schools. Economic reasons were clearly put forward.

"Actions of the Ministry of Education within 1987-1988 will have a character of immediate intervention in crucial points, in order for the conditions to be developed, for the realisation of a plan within the framework of a five-year developmental educational program of 1987-1991... the results of which will be catalytic for the introduction of the country in the IT age". (MNER 1987: p. 1)

The introduction of IT in all schools before proceeding to the introduction of ITE was clearly stated in a briefing report of Ministry of Education in the same year. This report stated: *"Computers that schools will be provided with, can be used as aids for teaching other curriculum subjects. The beginning of a program should start **after**⁷ the diffusion of the introduction of IT as a general education subject."* (MNER 1987 Briefing report, 17/7/87: p. 7) In this report, parallel actions for the development of an infrastructure, specifically for the introduction of ITE later, are also mentioned. As illustrated in the quotation, *"in the meantime, teachers will have been familiarised with computers and the infrastructure for necessary software development will have been established."* (MNER 1987 Briefing report, 17/7/87: p.7).

Interestingly, these actions were not mentioned in the *"Plan of Immediate Action of Ministry of Education and Religion for the period between 1987 and 1988"*. In this policy document, all actions focused on the introduction of IT. Specifically, the plan was to pilot, evaluate and expand IT in all secondary schools. The intention was to start from 30 pilot

⁷ my emphasis

schools, and expand gradually to 120 and finally to 400 schools in the next five years. In parallel, in-service training was to be organised for IT teachers⁸.

Summing up, the government decided on a Restricted two-step policy promoting IT while ITE was to be introduced in the next phase. It was expected that the introduction of IT would develop the technical and human infrastructure to accommodate the introduction of ITE later on. Although advisory bodies proposed some parallel actions related to ITE (familiarisation of other subject teachers, establishment of an Institute to study ITE), the Ministry of Education declared the intention to introduce IT first in all schools, and then proceed to the introduction of ITE. The realised policy and the actions that did and did not take place within the period 1985 and 1990 are discussed next.

6.1.3 The establishment of IT in gymnasiums.

The interview responses discussed in this section serve to illustrate how computers were not introduced into schools in quite the way envisaged and proposed by advisory committees.

"...finally, introduction of IT was not realised the way we planned it. The aim of computers' introduction was both (IT and ITE). The realisation was limited to the first one" (Interviewee A)

"till now, after fifteen years, this has remained in the making ... fifteen years passed in order for the state to come around to this plan" (Interviewee B)

Within this period (1987-1990), actions by the Ministry of Education focused on the introduction of IT, while introduction of ITE remained as a next step. IT was introduced into Greek schools as a new self-contained subject in the school curriculum. IT did not differ from the other school subjects, and was not related to them in any way. A content specific IT Curriculum was developed and student books distributed to all using- gymnasiums. In parallel, structures were developed to support the new subject. Schools were provided with equipment, hardware and software, and special labs were created to accommodate it. A group of specialist teachers was created to teach the new subject. (Table 6.1).

6.1.3.1 The IT

The new subject was introduced exactly as any other new subject added to the existing IT Curriculum. IT was piloted, evaluated, established by the development of the IT Curriculum

⁸ Nine specific actions are mentioned to this plan for this period. Those that concerned with IT for secondary education were:

a/ evaluation of pilot program for IT in different types of secondary schools and pilot expansion to 30 schools

b/ planning of introduction of IT in all secondary education; included planning of content, teaching method and realisation method

c/ development of in-service teacher training of secondary teachers in order for IT to be introduced gradually in gymnasiums and lyceums within the five next years

d/ expansion of introduction of IT in 90 more schools of secondary education

e/ development of infrastructure towards complete introduction of IT in all schools of secondary education (the first phase of the project includes 400 more gymnasiums) (MNER 1987: p 1-3).

Table 6.1 The process of introduction of IT and ITE in gymnasiums between 1985 and 1998

	IT		ITE
Phase A: 1985-1990	Introduction of IT		Introduction of ITE: a second step
	<i>IT in gymnasiums</i>	<i>Development of Support structures</i>	
1986-88	Pilot introduction into 22 and 51 gymnasiums in the first and second year accordingly.	Pilot IT curriculum for grade C. Hardware provision. Software distribution. Teachers' notes. Teachers from other disciplines to teach IT. Teachers' short training. Development of a permanent list for the appointment of IT teachers.	
1989-90	Expansion into 128 more schools.	IT curriculum for grade C Student textbook	
Phase B: 1991-93	1 st ECSF proposal, aiming at the expansion of IT and the introduction of ITE.		
	Expansion of IT in gymnasiums		Development of a strategy for the introduction of ITE
	<i>IT expansion in gymnasiums</i>	<i>Development of Support structures</i>	
1991-92	Expansion into 63 more schools.	IT Teachers appointed	
1993	Expansion into 784 more schools.	IT curriculum: grades A, B, C. Hardware provision. Software distribution. PLINETs positioned. Teachers' short training. Instructions for teaching IT.	Invitation to tender for educational software development cancelled. ORION: educational software for the teaching of IT
Phase C: 1994-97	IT, an established curriculum subject		The introduction of ITE
1994			2 nd ECSF aiming at the introduction of ITE.
1995	IT curriculum reformulation		
1996	Student textbook for grade A		Odyssea technical reports
1997	Student textbook for grade B		
1998	Student textbook for grade C		Pilot introduction of ITE in 20 schools. Hardware provision. Software distribution. Teacher training.

and expanded in more schools. On 1992, four hundred and ten gymnasiums across Greece offered IT representing the 23.2% of total gymnasiums.

As for the subject itself, it was compatible with existing educational objectives and structures. It can be considered to have a content specific and academic orientation, since students were assessed on what they have "learned" with written exams at the end of the school year. It was designed to be a new separate subject with its own attainment targets that were not related to other curriculum subjects. Two more teaching sessions were added on to the school time schedule to accommodate the new subject. Special computer labs were equipped in order for the subject to have its "own" space within the secondary school schedule. Due to a lack of IT graduates, no new teachers were employed to teach the new subject. The Ministry of Education after consultation from the Pedagogical Institute, appointed teachers who already taught other curriculum disciplines (mainly mathematics and science) to teach IT, on condition that they had at least some training on computers, or some experience on the area (professional or educational). Looking at the Draft Proposal⁹, it is indicated that a Social rationale was promoted. It seems that the new subject aimed to prepare students for their future role in a modern technological oriented society, where computers present an important tool¹⁰. The *Computer Awareness* objective was proposed, since the new subject aimed at "*the familiarisation of students with computers and awareness of their potential*" (Adamopoulos et al., 1986: p.1). It has to be highlighted at this point that Greek students had no prior contact with computers in primary school, so familiarisation was a necessary first step.

Looking though at the three teaching units of the IT Curriculum¹¹, the first two seem to propose the *Computer Awareness* objective, while the third was unclear. Specifically, the *Computer Awareness* objective was proposed in the first teaching unit, *IT Science and Computers*. Through that unit, students were to be familiarised with basic issues on the computer science and computer operation. The unit was to be taught as a theoretical subject in the traditional school classroom within ten teaching sessions.

The second unit, *Use of application programmes*, proposed the *Computer Awareness* objective. Students were to be familiarised with the use of some computer applications. Familiarisation with word processing, databases, simulations and graphic applications, was

⁹ The Draft Proposal for IT curriculum was submitted on June 1985 by the working group established by the Ministry of Education and was confirmed from the Pedagogical Institute. The first pilot schools followed that curriculum. The teaching material presented within the official IT Curriculum was classified in specific teaching units. Interestingly, the objectives of the new subject were not mentioned at all. Thus, the objectives that were to be realised through the new subject are discussed based on the teaching units defined on the IT Curriculum and on the objectives mentioned in the Draft Proposal.

¹⁰ "...the future citizen, independently of his/her profession, needs to be able to be integrated in a social, financial and cultural environment which continuously evolves... students need to be able to use the computer as a medium for problem solving and they need to be informed about the consequences of computer use on every day life and on social life in general." (Adamopoulos et al. 1986, p.1)

¹¹ The pilot consisted by four teaching units: students' familiarisation with structure of the computer and computer operation; students' awareness of IT Science and its applications; students' ability to use computers for problem solving; students' acquisition of basic knowledge on algorithmic problem solving and on computer programming. The two first teaching units presented the first on the official IT Curriculum

going to take place in computer labs within eighteen practical sessions. However, it is not clear how simulation programs were to be used. An indication towards the educational objective could be traced, since simulations could be used to teach units of other curriculum subjects. Simulations, though, were never used in schools.

The third unit, *Programming the computer*, referred to acquisition of basic knowledge of algorithmic solution of problems, and of programming. It is not clear though if the *Computer Science* objective or the *Educational rationale* was proposed. It is not clear whether programming was the attainment target or whether programming was to be used as a medium for problem solving which represents a general skill.

On one hand, the aim of the teaching unit highlighted problem solving, on the other hand, organisation of teaching units focused on the theory of programming. Seventeen teaching sessions were devoted to theoretical issues of programming (commands, programming languages, phases of programming) taking place in the classroom, while only five sessions were to be take place on the computer lab.

Additionally, BASIC and Logo programming languages were proposed. Logo was also proposed as an alternative programming language, because it was considered a programming language with more educational potential. As illustrated by a member of the advisory group, writer of the student book, "...the pedagogical objectives of a computer familiarisation, which enhances intellectual abilities, through exploration of ideas and through an interdisciplinary mentality of exploitation of the computer, was difficult to be realised in the environment of BASIC..." (Alexandris et al., 1995).

As shown from the above, a Social rationale was promoted and the Computer Awareness objective was proposed. However, an implicit inclination towards the educational objective can also be traced (Table 6.2).

6.1.3.2 Support Structures developed

Support structures for the introduction of the new subject in schools were established (Table 6.1). Both human and technical resources were organised and provided by the Ministry of Education for each using-school¹². First, the majority of using-schools were equipped with one computer lab (1 PC, 8086 with hard disk and floppy disk drive, 7 PCs without hard disk, one printer), which was used also by near gymnasiums that did not have a computer lab.

Second, software was also distributed (DOS system, word processing, databases, Logo) by the Ministry. No simulation packages were distributed. There was a minority of schools that provided equipment at their own expense, following the Ministry's specifications. Although the IT Curriculum did not specify the exact software to be used, (for example which word processor or programming language) schools clearly used the software provided. This way the

¹² The phrase using-school is used for those schools where IT subject was introduced

Table 6.2 Rationales promoted and objectives proposed in the policy documents for the introduction of computers into gymnasiums between 1986 and 1997.

	IT	ITE
Phase A: 1985-1990 Introduction of IT in gymnasium		
86	Pilot IT curriculum CA Objective Social Rationale	
89	IT Curriculum CA Objective, Social Rationale Lack of clarity for the use of Logo: CSc/Vocational or Cat/Educational	
Phase B: Expansion of IT and the development of a strategy for ITE		
MNER: 1st ECSF proposal		
92	Social and Vocational Rationales	Pedagogic Objective Educational Rationale
92	Draft proposal for the IT Curriculum CA objective as a step towards the Cat Objective/Educational Rationale	
93	IT curriculum Emphasis on CA objective, Social Rationale Indirect mention to Cat objective, Educational rationale	
Phase C: The introduction of ITE aiming at the Catalytic objective		
MNER: 2nd ECSF proposal		
94	Social and Vocational Rationales	Catalytic Objective Educational Rationale
95	Draft proposal for the IT Curriculum Contradictions between 1 st and 2 nd part. 1 st part: CA/Social rationale, and CC and Cat objective as a step towards Educational Rationale 2 nd part: CA, CC, Cat and CSc objectives, promoting all Rationales	
	IT curriculum Contradictions between 1 st and 2 nd part, proposing CA, CC, Cat and CSc objectives and all rationales.	
96		Odysseia project Catalytic Objective Educational Rationale

Ministry of Education intentionally or unintentionally controlled the software to be used or not used (such as simulations).

Third, a new student book for teachers and students was written to be distributed to all using schools reflecting the IT Curriculum. The book was not edited before the development of the official IT Curriculum for IT. *"The editing of the book was based on that IT Curriculum, and begun in 1989."* According to the writers, *"we (the writers) did not focus on teaching programming commands and their understanding, ... but to an algorithmic approach to problem solving... with special emphasis on the phase of analysis"* (Alexandris et al., 1995). The above quotation brings up again the educational objective of the third unit. The student book though, did not reach schools before 1990, which was the fifth school year of IT implementation. For the first four years of IT implementation teacher notes were edited and distributed as guidance for the first IT teachers. Teacher notes were a "pilot student book" and included information on teaching units proposed in the pilot IT Curriculum as well as teaching instructions for IT teachers.

As for human resources, teachers involved in the teaching of IT, had already permanent places in educational sector, teaching other disciplines. Mathematics teachers or other specialist teachers who were already employed in gymnasiums were teaching the new subject after short in-service training courses organised by the Ministry. In the fourth year of IT implementation (school year 1989-90), for the first time it was decided for specialist IT teachers to be employed. Thus, according to the Greek educational system, an employment list for IT teachers needed to be developed and qualifications for IT teachers needed to be set and published. The Pedagogical Institute set the criteria for IT teachers as follows: university degree on IT, or university degree in any subject in addition to postgraduate studies on IT. (PI, 33/90).

As far as the training courses that had been offered by Ministry of Education were concerned, they were considered to have a computer science orientation. It is true that there was a shift towards educational issues, but programming continued to represent a main part of the courses. Specifically, the first training course included 80 hours on Introduction to IT, 60 hours on programming design, 140 hours on Programming languages, 60 hours on Design and analysis of computer applications, and finally 60 hours on specialisation issues such as databases, organisation and running of computerised centres. (cited on Papas G. 1989: p.111) The second course were offered to teachers, aiming to offer the knowledge and experience in order to be able to realise the aims of the IT subject in gymnasiums. (MNER, Briefing report/22.12.87, Papas 1989). The third year, in-service training included 10 hours on IT science, 60 hours on programming, 30 hours on the use of application programmes. It has to be mentioned that programming languages COBOL and FORTRAN were no longer taught, while BASIC remained and LOGO was included. Moreover, it was planned for a presentation on "Teaching and Pedagogy of IT" to be given at the closing of each seminar. (MNER 1988, MNER, Γ2/3327/1.9.88)1

With regard to teachers' support in their practice in school, no technical or educational support was offered. Teachers had to struggle alone in classrooms with two pages of brief official guidance concerned with content and context of IT. It is interesting that the report submitted to the Ministry of Education for the expansion of IT, pointed out that 1300 teachers were teaching IT without any guidance or support (Vavaleskos 1990).

What did not happen within these six school years, was the development of an infrastructure to accommodate ITE later. There were a number of proposed actions by the advisory committee that were not included in policy decisions. The "Institute for the development of ITE" was not established. Development of educational software was not encouraged by the Ministry of Education. Finally and most importantly, training of other subject teachers on computer use as a teaching aid or medium for learning did not happen. Instead, the Ministry of Education focused on developing a technical infrastructure, establishing computer labs and establishing a new teacher community, the "IT Teacher" community.

Although this was not consistent with the proposals of the advisory group, it seems that it was in accordance with the plans of the Ministry that decided to expand first IT in all schools and then prepare the introduction of the ITE. As discussed in the next section, on the next phase of the introduction of computers in education, expansion of IT in all schools was planned and preparation of the introduction of the ITE started.

6.2 Expansion of IT and the development of a strategy for ITE (1991-1993)

This section describes the introduction of computers in gymnasiums from 1991 till 1993, when discussions at the policy level focused on the introduction of ITE.

6.2.1 Discussions about the introduction of the ITE

In this period, although the introduction of ITE was announced as the main aim of the Ministry's policy, the expansion of IT was in fact dominant and a target of immediate priority.

In 1991, the Ministry of Education submitted a project-plan to the EC for the introduction of computers in education, applying for funds within the 1st European Community Support Framework. According to this proposal, three actions were organised reflecting the already announced policy of the Ministry to expand the introduction of the IT to all schools and prepare the ground for the introduction of ITE. Specifically, the proposed steps were as follows: first to establish computer labs in all remaining gymnasiums to accommodate IT; second, to develop CAL software for six curriculum subjects; and third to establish teacher-training centres for 38,000 teachers (McGrath 1992).

The rejection of the above proposal¹³ by the European Community resulted in confusion and the need to rethink the project. The Ministry of Education established a new committee

¹³ The proposal submitted to the EC was rejected on the following grounds:

- Lack of clear rationale to support plan for Informatics in the schools

(MNER, Γ2/6075/19-10-92) to reformulate the proposal, in order that it could be resubmitted to the EC. In parallel, advice was sought from the Computer Technology Institute (CTI) (Γ2/4394/17-7-92).

The advisory proposal (Astrolavos) submitted by the CTI to the Ministry of Education, and the final proposal submitted to the EC (planned by the established IT committee) are discussed next. The discussion focuses on the proposed objectives for the introduction of computers and implementation strategies envisaged.

6.2.1.1 *Astrolavos*¹⁴: A Catalytic objective for introducing computers

CTI proposed a comprehensive approach. It focused on the educational process, and proposed the use of the computers with a new perspective. It proposed innovative use of computers proposing a Catalytic objective, within a small scale of implementation.

The main philosophy of the proposal was that educational practice could be evolved through a complete and interdisciplinary use of computers in schools. Computers were to be integrated into school life and be related to all curriculum subjects and activities presenting an every day dynamic tool for all. Astrolavos proposed an innovative use of computers, proposing changes in educational practice and influencing teaching materials, teaching practices, and teacher beliefs, as well as changes in students' learning. Computers were to be used as tools for general use, as learning tools, and as communication mediums.

"For gymnasiums, IT is introduced as a general education subject aiming to familiarise students with the computer as a multidimensional and powerful tool... while at the same time the computer is used to help learning of other school subjects i.e. Mathematics, Science, Geography, History and Language." (Maritsas et al. 1992: p 19)

For the computers as tools of general use the subject IT was to remain. Re-organisation of IT was however proposed, with a Catalytic objective clearly proposed. Specifically, the IT Curriculum was to be reformulated with the aim of giving students a global understanding of the use of computers as tools, their ability to express their ideas through computers and their ability to solve problems. Second, an interdisciplinary approach was proposed by introducing the idea of project work, which was a new teaching practice for Greek schools. Finally, the upgrading of hardware and software was proposed to meet the new needs (Maritsas et al. 1992).

For the computer as a medium for learning, the proposal promoted both Pedagogical and Catalytic objectives. The following were proposed: development of content specific

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- No clear organisational structure in place to support an implementation of this scale
 - Over emphasis on technical consideration/capital goods while the more important issues of: integration within the curriculum, teacher support, curriculum design, follow up support etc. are not adequately dealt with.
 - Failure to make available work and results mentioned in the report. (*continues to next page*)
 - Unrealistic budgetary proposal in terms of CAL courseware development
 - Lack of suitable teaching staff to implement program - suggested and implausible teacher training scheme via the PEKs which are not in existence as yet apart from two experimental SELME centres (Mc Grath 1992, P: 21)

educational software supporting the existing school curriculum; the adjustment or development of a word-processing application supported with spelling, grammar and syntax analysis for teaching of Greek language; the collection of internationally successful software packages for investigations in Mathematics (Cabri, Logo, ISETL); the development of computer simulations in Science. It is clear that the content-specific software proposed, reflected the intention to realise the Pedagogic objective, while the powerful applications proposed reflected the intention to realise the Catalytic objective, offering new learning experiences to Greek students¹⁵.

For the use of computer as a communication medium, Astrolavos proposed the establishment of a pilot educational network for the exchange of ideas and experiences within the educational sector. The network would support communication between teachers and students that would be a new experience for Greek students.

As for the implementation strategy, the philosophy of the project was to introduce Complete Paradigms¹⁶ for the use of computers in a small number of schools. It was expected that these first paradigms would inform the educational community about the educational value of computers and would be spread gradually into more and more schools (Maritsas et al. 1992).

It was recognised that the introduction of computers in schools proposing the Catalytic objective presented a very complex endeavour, influencing all of teaching materials, practices and teachers' beliefs. Even if resources could be provided to all using-schools, adequate support for teachers could not be offered in a systemic approach.

As argued in the proposal, the provision of schools just with technology, would be an inadequate step towards the integration of computers in educational practice, since strong support would need to be provided in using-schools. Although the educational software that would be developed or translated could be easily distributed into all gymnasiums, support structures for teachers could not be provided in a broad scale of implementation. In-service training and everyday support for teachers were considered of great importance. Thus, the report proposed long term training (two years) for teachers in combination with support in their classroom when they were to use computers¹⁷. Moreover, since not only IT teachers were to use computers, a large number of computers needed to be provided. In most cases more than one computer lab needed to be established in one using-school.

According to Astrolavos, by the end of 1997, computers would have been introduced in this way in one hundred fifty schools, which represented eight per cent of all Greek gymnasiums. One thousand nine hundred and twenty computer labs would have been

¹⁴ Astrolavos was the name of the proposal (Mc Grath 1992, p.7-8)

¹⁵ As discussed in chapter four, Greek education supported teacher centred and product oriented learning.

¹⁶ The term is introduced in the proposal. As presented before, computers were to present general use tools, learning tools and communication mediums.

¹⁷ The programme of training was planned to last for two years. For the first six months teachers would be out of school, attending the training course for six hours per week. The next six months, teachers would return to school while they would attend the course for 6-8 hours every 15 days. For the second year, teachers would attend the course for 6-8 hours per week, while they would at the same time teach in their classroom. (Maritsas et al. 1992: p.26)

established within these schools, and ten thousand two hundred teachers would have been trained and supported in the use of computers within their teaching practice in innovative ways, supporting new methods of learning.

"Astrolavos' philosophy was the need for a long-term strategy for gradual integration of technology in education, that would include upgrading and maintenance of technology, a strategy that would perceive the use of these tools as mediums for the gradual setting up of new practices, of new ways of education..." (Interviewee D)

As presented above, Astrolavos proposed an educational innovation influencing educational practice that was to be implemented in a small scale. It is indicated though that educational innovation was not in the priorities of the Ministry. It is indicated that the Ministry did not want to change the targets that were set in the doomed proposal of 1991, but only to improve the proposal so as to proceed to its implementation and obtain the funds from the European Community. As illustrated by the president of the IT committee, the EC did not influence the objectives of the project, but rather pushed the government to present a more coherent plan.

"The European Community did not influence the philosophy of the introduction (of computers), it influenced the project because we had to do something of good quality, we started from a no that should become a yes, the Minister wanted for this to move on" (Interviewee C)

In parallel, it is indicated that the Ministry of Education was determined to proceed to a large-scale computer introduction across Greece. The policy for equal educational opportunities that was dominant in Greek education¹⁸ was apparent. As illustrated within Ministry of Education's strategy plan: *"students that graduate from an educational level should have same knowledge in all subjects. This is not possible if IT is not taught in all gymnasiums"* (MNER 1992 p.45)

As illustrated from the interview with the president of the IT committee at that time, the intention of the government was large-scale introduction of computers, and that was the policy line that the committee had to follow. Astrolavos was considered a project that concerned only a small number of schools, which was therefore not compatible with this current educational policy.

"The Minister looked for someone who had dealt with IT management, ... how we plan and introduce IT at a national level,... we studied it as a Pan-Hellenic project... Astrolavos was a small thing,... we saw it as a reform, a national project, a strategy..." (Interviewee C)

The CTI member also illustrates this position.

"...the difference of Astrolavos was that it proposed to the Ministry of Education not to proceed only to horizontal actions, the Ministry of Education operates with the mentality of reform, whatever it does, it is either for all schools or it does not do it..." (Interviewee D)

Thus, the Ministry did not embrace Astrolavos and decided to expand the introduction of computers in schools through a broad scale of implementation.

6.2.1.2 The IT Committee: Expansion of IT and introduction of ITE aiming at the Pedagogic objective

The IT Committee established by the Ministry proposed a restricted two-step approach. It focused on the introduction of IT into schools and left ITE as a second step to follow. Thus, it proposed a systemic introduction of computers and focused more on the development of organisational structures –technical and human - across Greece to support it. The philosophy was expansion of IT across Greece. In parallel, the introduction of ITE was to be prepared. Educational software would be developed and would be installed in the computer labs established through IT, and teachers would be familiarised with use of the provided software. This way, “simple paradigms” of computer use would sensitise the educational community and motivate further exploration of computer use aimed at more complex uses later on (MNER 1992).

As illustrated below, the Social rationale and Pedagogic objective were put forward, while the Catalytic objective remained a long-term target.

“Strategy of the Ministry of Education for the period between 1992-97 is to evolve the initial project, and based on the infrastructure and experience of the past seven years, to implement the “pragmatic” approach, and to develop the infrastructure for the “complete” approach...¹⁹

Thus, targets of the Ministry of Education for the period between 1992-97 are:

development and broad use of complete educational packages that have to realise pedagogical aims of secondary education and be technologically accepted

familiarisation of students and of teachers in secondary education with IT, through dynamic use of tools and applications of IT, as well as through special subjects”

(MNER 1992: p. 5)

Looking at the 1992 proposal, the philosophy of the plan of 1991 that was rejected by the EC was still apparent. IT was to expand in all schools, and the introduction of ITE was to be prepared. Content specific software was to be developed for the main curriculum subjects and teachers were to be familiarised with computers and software use.

Looking more closely at the objectives to be realised through the use of computers, it seems that IT promoted Social and Vocational rationales. *“Nowadays needs of society and of market force, demand knowledge on the use of computers. ... Therefore, expansion of teaching*

¹⁸ see also chapter four

¹⁹ The Ministry of Education defines the Pragmatic approach as: teaching curriculum subjects through specially designed software for this purpose. Within this model, emphasis is placed on cognitive and social perspectives of computer use in educational process. The importance of familiarisation with computers and of programming is minimised.

Complete approach: use of computers as a broad unified educational tool, that combines computer familiarisation with computers and computers’ use within other subjects without specific reference to those subjects.

Chapter six, Policies for the Introduction of Computers in Gymnasiums over time of IT as a general education subject in all gymnasiums of the country is a target of immediate priority.” (MNER 1992: p.45)

Looking at the aims of the introduction of ITE, namely of the use of computers as mediums of teaching, an Educational rationale was promoted. There were, however, contradictions and lack of clarity between Pedagogic and Catalytic objectives. Although construction of new learning (Catalytic objective) was mentioned, so was the transmission of knowledge (Pedagogic objective), while educational software was presented to “do” things for the teacher or for the student. As the proposal stated: *“General aim is: the use of New Technologies for transmission of knowledge and for construction of new learning through the computer”* (MNER 1992: p.61). Or elsewhere, the proposal stated: *“Educational software that will be used, should fulfil teaching needs, i.e. needs of the student, of the teacher and of the curriculum subject. (MNER 1992: p. 59)”* It is not clear though what this “new learning” meant and how it was to be developed through the use of computers. Neither students’, teachers’ and subjects’ needs were explained and mentioned.

Looking at the educational software and specifications mentioned, Pedagogic and Catalytic objectives were proposed.

As stated: *“Software needs to present in a simple and definite way abstract concepts, that till now the teacher could not realise; to simulate experiments from Science; to study complex phenomena, that were not easy to study by traditional methods; to initiate students to research and justification through information and data processing (MNER 1992: p.63)*

The two-step approach was clearly reflected in the realisation of the project. The implementation policy focused on one hand on the expansion of IT, while in parallel, the introduction of ITE was prepared through development of educational software and teachers’ sensitisation to the use of computers.

As illustrated by the president of the IT committee:

“the philosophy was the expansion of IT as a curriculum subject and the introduction of computers as a medium of learning... for us the target was the computer as a medium for learning, but we could not go there, we had to get through a phase of familiarisation, to introduce the computer as a subject, that would create infrastructure for the second, that’s why we started with establishing labs, software was to come one year after...” (Interviewee C)

Thus, expansion of IT in all gymnasiums had two roles. First, to realise a Social rationale, i.e. familiarise all Greek students with computers, and second, to develop an appropriate infrastructure for the introduction of ITE. As far as the first is concerned, the Ministry of Education argued that the expansion of IT to *all* gymnasiums was considered a target of immediate priority since the need for equity among all Greek students who graduate from general compulsory education was fulfilled (MNER 1992: p.45). IT was to be expanded gradually to all gymnasiums, while the IT Curriculum was to be reformulated. In parallel, one thousand four hundred specialist teachers would be employed to teach IT and all of them would

be trained through a short introductory course²⁰. Additionally, permanent in-service training was organised in such a way that enabled every teacher to attend an in-service training course every two years²¹.

As for the latter, it was expected that the introduction of IT would provide the hardware to accommodate the educational software for other curriculum subjects (MNER 1992: p. 45). All using-schools were to be equipped by the Ministry of Education. It was expected that CAL software developed would be installed on that equipment. By the end of 1995, one thousand seven hundred sixty three gymnasiums would be equipped.

Finally, the introduction of the ITE would be based on the development of educational software, familiarisation of all teachers with computers and short training courses for teachers who were going to use educational software. As for educational software, thirteen packages were to be translated or developed, piloted and distributed in schools by the end of 1997. For each software package, fourteen teachers would participate in software development.

As for teacher training, first all teachers would be familiarised with the use of computers. It was expected that sixty thousand teachers of curriculum subjects other than IT would have been familiarised with the use of computers²². Teachers who were to use educational software, were to attend short in-service training courses, based on the developed educational software. Teachers who participated in the process of software development would be the trainers of their colleagues. Teachers' support was organised mainly through the provision of materials (books, hardware/software) and from the newly established PLINETs on the level of Prefecture.

The philosophy of the project was that introducing computer use within teaching of other curriculum subjects (ITE) on simple activities (Pedagogic objective) would not disturb the usual practices too much. This would motivate teachers to take on technology and would motivate them again at a later stage, to use computers in more complex ways, towards more complex ways of using computers in their practice (Catalytic objective).

"...philosophy was expansion of the subject (IT) educational software development, teacher training... it was more realistic, we took five lessons, mathematics, science, chemistry, foreign languages, Greek language, we followed the IT Curriculum and complemented it,... in a first level it should be implemented in a pan-Hellenic scale on simple issues, that creates infrastructure in schools, creates teacher infrastructure, directs educational community on new tools, new mediums..." (Interviewee B)

²⁰ Introductory course of IT teachers would include training on the following subjects: structure and operation of network; graphics user interface; MS-DOS 5.0 system; UNIX system. For the first year an introductory course would be organised by 150 specially trained trainers (by the computer provider). Starting in 1993, introductory course would be organised in the newly established PEK (peripheral in-service training centres) and would last for three months (360 hours). Academics would organise these courses.

²¹ Permanent in-service training was organised in two ways. First, teachers could be off-duty for three months and would attend the in-service training course. Second, teachers could attend the training course once a week for six months (150 hours total).

²² Training would be organised again in PEK, providing a short 20-hour course, aiming to their familiarisation on the use of computers.

Additionally, the proposal introduced a new organisational structure -organised in three levels: macro (Ministry of Education), meso (Prefecture) and micro (school). The new structure emphasised the level of Prefecture, which was considered an innovative element for the Greek centralised educational system. The Prefecture became the centre of activities and a new position "PLINET" (Responsible for Information Technologies) was established to help distribution and support of the project within every Prefecture. Training was based at the level of Prefecture²³, and teachers participating in software development would be equally distributed across Prefectures²⁴.

As argued from the president of the IT committee, this was expected to decentralise initiatives and give a boost to the project.

"Introduction of computers in education was an innovation. That's why we needed the right organisational structure.... When you set up a national project, you need to create a support structure..., that's why we said that there should be support on the level of Prefecture, we proposed PLINETs, they had a broad supportive role... we wanted to make a decentralised system... to take decisions in the level of Prefecture... " (Interviewee C)

Within this decentralised schema, a number of teachers were actively involved with the innovation, in this case through software development and training. This way, it was expected that teachers would feel ownership of the project and commitment and thus, they would serve a core function at the level of Prefecture by disseminating and spreading the innovation to other colleagues within the Prefecture. The introduction of computers was expected to have a pan-Hellenic character, since all fourteen Prefectures were actively involved with the project.

...we said that it could be one from each Prefecture, I had a policy based on Prefecture, a small group would create it, then we would train him and he would disseminate...we proposed in-service training, we tried to bring them all together, to develop commitment... (Interviewee C)

"we proposed the way that teachers would be trained, we proposed an exemplary way of software development, where for each curriculum subject there was a group of teachers, it was not done... we had to find the crusaders, those who we were going to put forward, it was difficult, they would feel that it owned it.." (Interviewee C)

Looking at the whole project, it is indicated that the government proceeded to the above implementation approach because it could satisfy the Ministry's priorities for the country and for Greek education.

First, gradual expansion of IT into all Greek schools was a governmental priority, since satisfaction of socio-economic needs were again prioritised. Students were to be familiarised with the use of computers and be prepared for their future needs in adult life (Social rationale). In parallel, sensitisation of students to technology could indirectly lead to the technological development of the country, which was also a desirable outcome (Vocational rationale). Greek

²³ 14 PEKs (Regional Training centres) were established in 14 Prefectures

²⁴ In each software package development 14 teachers would participate, one from each Prefecture

policy of equity in students' education was also fulfilled, since all students were familiarised with computers and computer applications.

Improvement of teaching practice was considered valuable, but not the first priority. Thus introduction of ITE was left as a second step after the diffusion of IT. Moreover, diffusion of IT was expected to facilitate the introduction of ITE that would follow. The introduction of ITE promoted the Pedagogic and not the Catalytic objective, not because it was the latter was not welcome, but because of its complexity. Computer use proposing the Catalytic objective would not only propose new materials (computers) to be used within teaching, but it would also disturb teachers' beliefs and existing practices. Such an endeavour would be too complex to be attempted within a broad scale of implementation, which was the usual and accepted educational practice of the Ministry.

Thus, the Ministry favoured the introduction of ITE proposing a Pedagogic objective that could be introduced within a broad scale of implementation, since it presented a simpler project. This way, all Greek schools would use computers in five basic curriculum subjects, learning in a better way what they had previously learned in school. At the same time, although the Catalytic objective was not proposed in the current phase of computers' introduction, it was expected to be included in the long-term plans of the Ministry.

The European Community accepted and funded the proposal. Realisation of the project began six months later.

6.2.2 Realised Policy

On June 1993, a new committee (National Committee for Informatics and New Information Technologies in Education), was established by the Ministry of Education, with multidimensional responsibilities. In addition to the planning of national policy for the expansion of IT in primary and secondary education, the committee was responsible for the development of the IT Curriculum, hardware and software, computer lab specifications, and even more establishment of committees of specialists in case needed. In the opening meeting, the Minister of Education himself was present, declaring the importance of Information Technology in Education.

**Introduction of IT in schools is a very important issue. We lead the child in a modern perception and place in society. The project that is implemented by the Ministry of Education is of great importance. Greek school is being modernised. Perceptions of parents and of society change. The Ministry of Education perceives pedagogical and scientific content of teaching to be of great significance. I point out the following:*

a/ by September, educational software development has to be assigned

b/ 30% expansion of current contract concerned with provision of 714 computer systems has to be done, in order for more schools to introduce IT

c/ teachers training to be assigned to OEEK

d/ by the end of school year 1994-95 all schools have to be equipped with computers

e/ The National Curriculum needs to be reformulated in order for IT to be taught in all grades of gymnasium

f/ IT will be funded on priority by the Ministry of Education"

(Souflias G. Minister of Education, 1993, minutes of first meeting of NCSINTE, 13-7-93: p.3-4)

As illustrated by the president of the IT committee though, the Ministry of Education's plans remained incomplete, since the government changed a few months later, at the end of 1993.

"...unfortunately, the government fell, if it had only stayed for one month more... the bet for IT was lost for one month..." (Interviewee C)

However, at that time and within the 1st ECSF, the first step of the project (expansion of IT) was organised and realised. IT was strengthened as a separate curriculum subject and diffused into the majority of Greek gymnasiums. After the Pedagogical Institute's confirmation (PI 26/1993/15.7.1993) the National Curriculum for gymnasiums was reformulated and IT expanded within gymnasiums across all grades. But looking at the teaching material of the subject, it remained almost the same as in 1989, but was spread across the three grades of gymnasium. One teaching session per week was proposed for first and second grade, and two sessions per week remained in the third grade. For organisational reasons²⁵, IT was to be taught in computer lab (practical sessions) and in the classroom (theoretical sessions) in rotation.

A new IT Curriculum was voted (ΦΕΚ 187Α/8.10.93) and new student textbooks were written based on the new IT Curriculum, after Ministry's order and consultation with PI' (PI 3/94, PI 11/94, PI 19/94). In parallel, IT teachers were employed for the first time as subject specialists, and an IT culture²⁶ was created within schools and across the country. As for the introduction of ITE, nothing was done in that direction, since the project was not completed. There was no time for left development of educational software, and sensitisation of other subject teachers in computers did not happen (Table 6.1).

Next, the development of the new IT Curriculum and the support structures set up by the Ministry to support the implementation of IT are discussed more extensively.

6.2.2.1 The development of a new IT Curriculum

The new IT Curriculum had already been proposed by a specially established group by the Ministry of Education (Γ2/1248/5.3.92). As discussed next, while the Educational rationale was apparently the main aim of the subject²⁷ proposed by the advisory group, it was surprisingly only mentioned indirectly in the published IT Curriculum.

²⁵ Only one computer lab with seven work stations was established in each using-schools. Since each Greek classroom usually includes 30 students, it was considered necessary for students to be divided in two groups

²⁶ In the sense that IT was established as a separate curriculum subject, with distinctive aims, unrelated to other curriculum subjects.

²⁷ General aim of the IT subject for gymnasium was proposed to be "the transmission of basic notions of this new science, the familiarisation with the new tools supporting thinking and familiarisation with the logical and technological structures on which computers are based. In this way, students will acquire basic skills to exploit computer potential not only within school life (interdisciplinary tool) but also as they enter adult society for their educational, professional or personal needs."

Looking at the Draft Proposal, an Educational rationale was promoted and specifically, a Catalytic objective was proposed.

"IT as a curriculum subject, beyond familiarisation with the use of computers, permits access to a new cultural perception that enforces acquisition and dynamic construction of knowledge and develops methodological abilities." (Chatzopoulos et al: p. 4)

For the realisation of the subject's objectives, the following attainment targets were proposed: introduction to Computer Science; basic computer applications (word processing, drawing, data bases, spreadsheets); programming and problem solving (Logo); critical view of the technological evolution and their consequences on financial and social developments.

The proposal promoted a Catalytic objective for each attainment target and for each unit of IT. Familiarisation with the computer was proposed not as a skill to be cultivated per se, but as the necessary skill of students to use the computer in other activities or within other subjects. Students were expected to use application programmes as dynamic tools in the school activities. For example, students were not familiarised with a word processing per se. They were familiarised with word processing in order to use within language activities in order to cultivate the habit of notional and aesthetic text improvement, rarely realised in schools without a computer. Similarly, students were to use spreadsheets for processing values and establishing basic mathematical concepts, and databases to handle and process information. They were to use programming not to become skilful in a specific programming language, but to develop methods for problem solving and self-assessment. Finding and correcting mistakes was to become a learning procedure. Finally, through the teaching unit "Critical evaluation of technological evolution and relation with social and financial changes", they were to cultivate of a critical mind and ability to argue for their opinion. (Chatzopoulos 1992)

A close examination of the documents reveals an interesting and important distinction between the *direct* and the *indirect* aims of the teaching units. For example, within word processing use, direct and indirect aims were distinguished and defined, but the importance of the latter was highlighted. Looking at those aims (below) it is indicated that the direct (or typical) aims proposed the Computer Awareness objective, since they were limited to familiarisation of students with basic use of word processing. On the other hand, the indirect aims clearly proposed the Catalytic objective since they focused on the process of writing.

*"The subject of word processing has a **direct** and obvious aim and another **indirect aim that is much broader and escapes from a narrow view of IT**²⁸. The direct aim is*

By the end of compulsory education students should know: to use computers; to manage diskettes and files; to explore and use alone application packages; to be able to exploit computers for their written expression of ideas and for search, collection, organisation and transmission of information; to understand the nature of a problem and the possibility of solving through computers. In general they should be able to be in the position to follow up, understand and evaluate economical and social changes based on evolution of science and technology"

(Chatzopoulos 1992, p. 3-4)

²⁸ Emphasis mine

familiarisation with a specific word processing package. This presents the typical aim of IT Curriculum that follows. An indirect aim could be perceived as follows:

- a. The structure of word processing itself and organisation and content of menus, make visible process of writing
- b. use of word processing frees one who writes from direct concern with draft layout, while in the meantime presents the importance of layout
- c. word processing can be used for teaching of composition or of a foreign language
- d. word processing can be used as a tool for any kind of written presentations

Thus, it is important, through teaching of the typical content of word processing, that the theoretical background and indirect aims be made explicit. Teaching through certain activities (such as editing of a newspaper, teaching composition) could be important help in that direction.²⁹

Typical aims of the subject are:

1. Blind system typing. It would be important for students not to distract their attention by looking at the keyboard
 2. broad view of potential of word processing
 3. broad view of ways of communication through word processing
 4. Writing of text. Ways of writing. Move through text. Delete/insert lines or characters. Position/Search cursor. Search/replace fonts. Line spacing.
 5. Selection of text for deleting/moving/coping.
 6. Layout of text, use of ruler. Layout of text, indents, underlining etc. Insert of graphics if possible.
 7. Preparation for printing. Printing. Necessity of the driver in a PC.”
- (Chatzopoulos 1992: p 15)

In parallel, it was made clear that the indirect aims should be realised through the direct aims that were less important. For example, students would learn to use a word processor (direct aim) within school activities or project work aiming to create a written presentation (indirect aim). Thus, the realisation of a Computer Awareness objective that was proposed in the direct aims (familiarisation with a word processor) was the necessary first step towards the realisation of a Catalytic objective (write a presentation), which was the most important. Thus, the Draft Proposal emphasised the Catalytic objective.

Looking at the published IT Curriculum (1993), one can identify a distortion of objectives. The Computer Awareness objective was emphasised, while the Educational rationale was only indirectly and not clearly mentioned (Table 6.2). That is because some parts of the Draft Proposal were excluded from the official IT Curriculum, and these parts were those that presented the philosophy of the Draft Proposal. Specifically, indirect aims that were considered by the committee to be the most important, were excluded by the IT Curriculum. It is

²⁹ Emphasis mine

doubtful whether the indirect aims ever reached teachers, since the only guidance they were given within the school was brief guidance on what pages of the student book they would teach. It is also doubtful whether those indirect aims reached teachers through the short training courses offered from Ministry of Education.

6.2.2.2 Support Structures

The Ministry of Education intended, according to the initial plan, to strengthen both technical and human resources related both to IT and ITE. Support structures though, because of lack of time, focused on the support of IT, which was the first and immediate priority, while very limited work was done towards ITE (Table 6.1). As discussed next, this way, IT was strengthened and an IT culture³⁰ was developed in schools.

As for technical resources, the Ministry of Education established computer labs in all schools where IT was introduced (MNER 4.5.93). This was considered a usual policy of the Ministry, since it was responsible for any resources needed in schools. A small number of schools were equipped at their own expense, conditional on following the Ministry of Education's specifications. This is also a usual policy, where parents' associations can intervene and offer resources in order to improve the running of the school. However, any action has to be approved by the Ministry first (see also chapter four). Although only some schools were provided with equipment by parents, this indicates the parents' interest in IT.

Using-schools were also provided with the needed software for the needs of the teaching of IT according to the IT curriculum. Using-schools were provided with office automation software (word processor, spreadsheet and database) and Logo³¹. It seems that although the educational potential of programming was not clear within the IT Curriculum, Logo remained, since it was the programming language proposed by the advisory group. The extent to which Logo kept its philosophy and educational potential, it seems was a matter for the teacher in the classroom to discover.

In parallel, teachers were appointed to teach IT according to the existing traditional structure. A new teacher specialisation (IT teachers) was established (Law 2009/92)³². These teachers would have the responsibility of teaching IT in school. By the end of 1993, five hundred and five IT teachers were in position. Two hundred of those IT teachers had already been employed to teach other curriculum subjects in school (mainly mathematics and science). The employment of IT teachers was followed existing educational policy through the newly established IT teacher waiting list (see also chapter four). In order to face the financial cost, the government decided to employ teachers gradually on a permanent basis, while filling any

³⁰ in the sense that computers were the tools of the future and schools must familiarise students with their use

³¹ The committee voted for a complete working package under specifications of the new equipment already ordered by the Ministry (windows environment) that included word processing, spreadsheet, graphics, and databases and signed the contract with the software company. (National Committee for Informatics and New Information Technologies in Education, 1993)

vacancies with temporary teachers. Since there were not enough graduates from IT University departments, teachers from other subject specialisation were deemed to be qualified to teach the subject (PI 33/90), on condition that they had some experience or qualifications in IT³³. IT was the only subject where a qualification other than university degree was acceptable for a secondary teacher.

In parallel, short introductory courses were planned for all IT teachers, aiming to prepare the new teachers for teaching the new subject (IT). Permanent or temporary teachers were trained through short introductory courses organised by the Ministry of Education and the company that had provided the equipment. Introductory courses included sessions on: Introduction on IT (3 hours); MS DOS (6 hours); Novell 2.2. (12 hours); Windows 3.1. (15 hours); General application software in addition to two more content specific software (9 hours). In parallel, PEK (Peripheral in-service training centres) were established and a small number of teachers had the opportunity to attend some of the courses. Participation in those courses depended on teachers' initiative, no matter whether their school offered IT or not. These were two kinds of courses. First, courses that aimed at familiarisation of teachers with computer use, and second, courses related to the use of the computer within existing curriculum subjects.

Finally, maintenance and technical support was assigned by contract with the provider Computer Company. This was an important step, although that was the case for only the new contracts (after 1992). According to the contract, any equipment damage should be fixed within three working days, and thus, proper operation of the computer labs had been ensured.

Moreover, support was planned for teachers in the form of materials and of books provided (PI 3/94, PI 11/94, PI 19/94). The Ministry of Education after consultation from the Pedagogical Institute sent detailed instructions for the teaching to IT in all gymnasiums (MNER, Γ2/7223/23.12.93). These instructions were related to the organisation of the subject, the resources to be used, as well as to its teaching. According to these instructions, all schools had to follow the same subject organisation. IT was going to be taught for one session per week in the first and second grades of gymnasium and two sessions per week in the third grade. As for resources, IT was to be taught in the computer labs. Since there were no student books for the first two grades, it was proposed that teachers could use the book for the third grade that had been already distributed in schools. Finally, these instructions proposed to teachers to teach IT through project work, which was an innovative teaching approach for Greek classrooms. In these instructions Educational rationale was again promoted for IT.

Early in 1994, the Pedagogical Institute (PI, 3/94, PI, 11/94) decided to establish a new committee in order to develop IT student books for the three grades of gymnasiums, in

³² One thousand four hundred teachers were to be employed to teach IT.

³³ Ministry concerned with the criteria of teachers who could be in the list of permanent IT teachers, asked for consultation from Pedagogical Institute (MNER, Γ2/2812/27.7.1990). Pedagogical Institute argued for the following criteria: university degree on IT, or university degree in any subject in addition to postgraduate studies on IT. As far as the teachers already involved in the teaching of IT, they had already permanent places in educational sector (PI, 33/90).

combination with teacher books, and defined specifications. Moreover, the PI assigned research on the meaning of programming in gymnasiums to University of Athens. However, later on, the Pedagogical Institute recognising the need for the IT Curriculum to be reformulated based on the new operating system Windows which was proposed by the permanent committee and bought by the Ministry of Education, established a new committee under the presidency of Mr Alexandris in order to proceed to the above action. (PI, 19/94). It has to be noted that although the 1993 IT Curriculum referred to the first two grades of gymnasiums³⁴ it was not yet in use.

Additionally, direct support was planned on a basis of Prefectural level. A new position for PLINETs in each Prefecture was established aiming to support the project and the newly employed IT teachers. They were to provide help and support on technical issues and every-day problems. PLINETs would be IT teachers according to their interest in taking up such a position and their application for the job. PLINETs would be responsible for the following: *"help teachers in their work, recording of hardware and software problems, local in-service training organisation, teachers training, collection of statistical data, yearly report for issues concerning expansion of IT in schools of their Region"* (MNER, Γ2/5049/27.9.93).

As for ITE, the effort of the Ministry of Education, at that time, focused on educational software development. A project named "PLATON" was originated and educational software was expected to be developed by December 1994, in areas such as Mathematics, Science, IT, Geography, History. Basic conditions that educational software had to meet were: compatibility with the school curriculum and confirmation from the Pedagogical Institute; use of multimedia and interaction; medium for facilitating learning; combination of theory, exercises and review; potential for updating; student evaluation possibility; use of reward. The invitation to tender for software development was cancelled. Thus, software development did not happen within this period. Only one content-specific educational software was developed ORION³⁵, which was distributed for teaching basic concepts of IT. ORION was a tutorial and aimed to improve the teaching of the IT subject (Pedagogic objective). Its use, though, was not compulsory.

Summing up, the project was not completed, since the government changed. During this period, only the first step of the project was realised. A new IT curriculum was published and support structures for the implementation of IT were set up. Discrepancies were found between the Draft Proposal and the published IT curriculum. Catalytic objective that was promoted by the IT working group in the Draft Proposal, was only implicitly mentioned in the IT published curriculum, were Computer Awareness objective was emphasised. Additionally, the Ministry of Education set up support structures that encouraged the implementation of IT exactly the way as it was proposed through the IT curriculum. IT was organised as a separate subject according to the existing educational structures. Specialist IT teachers were positioned to teach the subject, who attained short courses on teaching of IT as proposed in the IT curriculum.

³⁴ IT Curriculum for the third grade had already been published on 89

³⁵ ORION was an educational software package, aiming to help teachers and students to understand better concepts of IT science and of programming. It could be characterised as a tutoring package

Resources and books chosen to be distributed into schools were based to the published IT curriculum. This way, the Ministry of Education, intentionally or unintentionally, controlled the implementation of IT.

6.3 The introduction of ITE aiming at the Catalytic objective (1994-1997)

This section explores the introduction of computers into gymnasiums from early 1994 to 1997. Within this period, IT expanded into the vast majority of gymnasiums and a new implementation strategy for the introduction of ITE was promoted (Table 6.1).

6.3.1 Discussions for the introduction of the ITE: towards an intervention to the educational practice

On February 1994, the Minister of Education established a new special committee³⁶ "Permanent Committee for IT in Education" (PCITE) to study and propose strategies for the continuation of the introduction of computers in education³⁷. The president of the committee was the Director of CTI. The committee was accountable only to the Minister, and dominated the scene within the first two years of that period. "PCITE drafted the proposal for the 2nd ECSF May 1995" (Kotsiopoulos, MNER)

During the years 1994 to 1997, discussions at policy level focused on the introduction of ITE. Although the philosophy of the government was still to complete the expansion of IT in all Greek schools before proceeding to the introduction of ITE, the analysis that follows suggests that the European Community influenced the course of the project towards the introduction of ITE.

At that time, the Greek government requested support from European Community for various projects under the 2nd European Community Support Framework (2nd EUSF). Two of the projects³⁸ were related to Information Technology in Education. EC, through the 2nd ECSF, pushed the Greek project towards introduction of ITE as suggested in the interview below.

"Our policy was first expansion to every school, and then use of computer as an educational tool, E.C was pushing towards the latter, we needed the European support we couldn't do anything else" ... "E.C pushed us to introduce computers as a medium. "E.C. would financially support us only in case of computer use as an educational tool" "It (ITE) was within our philosophy but it gave the priority, there were the first projects (Ulysses) that begun." (Interviewee F)
If we planed to establish a computer lab in each school, that program would be rejected. We needed to have an integrated position." (Interviewee E)

³⁶ The committee consisted of sixteen members. Most of them (13/16) were academics from different universities of Greece, while two of them were secondary teachers. One of academics represented Pedagogical Institute (he was vice-president), one of the members represented Department of Secondary Education, Ministry of Education.

³⁷ The new Minister dissolved IT committee (NCITE) established just eight months before by the previous government.

³⁸ Action 1.1.b. "IT in Education", and action 1.4.c. "IT"

Although EC supported the introduction of ITE, it did not influence the objectives of the computer use through the introduction of ITE. As illustrated by the responsible for "Odyssey"³⁹:

"EU helped us to be disciplined on our words, to make integrated plans, it did not intervene with the philosophy. Greek authorities can express their educational philosophy and position, considering they do it well." (Interviewee E)

This time a comprehensive approach was adopted. The governmental policy related to new technologies in general at that time, expected computer use to fulfil a multidimensional role. The proposal that was submitted to the Ministry of Education by the IT committee at that time (PCITE) for the introduction of computers in Greek schools for the period 1994-1999, proposed the Social, and Vocational rationales as well as the Catalytic objective. Students were to be aware of computer technologies and participate in society (Social rationale); to be prepared for the work force (Vocational rationale). At the same time, computers were to present a medium for innovations at classroom level (Catalytic objective). (Spirakis et al., 1994a) As illustrated in the advisory proposal:

The aim of the IT programme for the period of time 1994-1999 is to:

- *update the teaching environment through innovations*
 - *update "school" into a place of broad education and learning*
 - *link school environment with the citizen space*
 - *familiarisation with new technologies and preparation for the work force"*
- (Spirakis et al., 1994a: p.3)

However, despite this broad approach, the focus of the proposal was on the Educational rationale.

The final aim of the programme is for the New Information Technologies to present a medium for teaching and learning and includes educational software supported by multimedia and educational network. This network will be used also for support of educational services. (Spirakis et al., 1994a: p.7)

The Educational rationale was also reflected in the official general master plan⁴⁰ submitted to the EC within the 2nd ECSF.

"The aim of the Ministry for the period 1994-1997 is to exploit IT as an educational tool. I.e. to use IT to help teaching process of specific curriculum subjects" (MNER 1994, p.22)

In the master plan for IT in Secondary education⁴¹, educational policy in general, highlighted the multidimensional role of computers in schools⁴². Four uses of computers⁴³ were

³⁹ the strategic plan for the introduction of ITE

⁴⁰ It referred in brief to all actions and projects to be realised within the 2nd ECSF

⁴¹ Master plan that refereed only to the introduction of IT in education

⁴² The current educational policy, specialising in the introduction of computers aims to:

- update the teaching environment through New Information Technologies
 - update "school" into a place of broad education and learning
 - link school environment with the citizen space
 - familiarisation with new technologies and preparation for the work force
 - introduction of IT as a medium of teaching and learning, through the use of innovations such as networks and multimedia
- (MNER 1995: p.26)

identified for Greek schools. However, the final aim of the project highlighted that the governmental plan focused on the introduction of ITE.

The final aim of the programme is for the New Information Technologies to present a medium for teaching and learning and includes educational software based on the technological platform of multimedia and of the Pan-Hellenic Educational Network. (MNER 1995: p.40)

IT was not mentioned at all in the master plan, while all actions at governmental level shifted towards ITE. However, IT remained in schools as an established curriculum subject, promoting mainly the Social rationale (Computer Awareness objective). The Vocational rationale was implicitly proposed through the Computer Competence objective. The Educational rationale although clearly promoted by the working group, was not clearly proposed in the published IT Curriculum⁴⁴. The satisfaction of socio-economic needs as well as equal opportunities in education was again apparent.

IT remains, and it remains because we want to be a fair educational system, if we want all students to familiarise with these machines we can not do it otherwise than through IT subject.... (Interviewee H)

IT remained under the responsibility of the Pedagogical Institute⁴⁵, since it was an already established curriculum subject in schools. Any alteration to the IT Curriculum⁴⁶ or other initiative was under the control of the Pedagogical Institute, and thus, there was no need for it to be discussed within the framework of PCITE. As illustrated by the responsible for IT in the PI:

"PCITE did not deal with IT because it was a responsibility of PI. The IT Curriculum and books, are the responsibility of PI. Since IT was another subject in schools, it was not an issue that PCITE had to deal with." (Interviewee H).

Thus, IT remained under the responsibility of the Pedagogical Institute, while ITE was promoted in the master plan of the government as the new initiative. Introduction of ITE considered the following: the introduction of educational software into schools as a medium of teaching, upgrading and expansion of computer resources, establishment of an educational network, and teachers' training and support. (MNER 1995)

As expressed within the general master plan submitted to the EC, the educational objective for computer use in schools was clearly proposed. The computer represented a tool that would help the educational process. The Catalytic objective was promoted.

⁴³ "Computer use in education is various. It can be classified into four categories. All of them are important and should develop in parallel.

General education separate subject (preparation for educational and professional development, every day needs of the person for their future.

Information source. Familiarity with internet, natural right of every citizen.

Mind tool. That use of cognitive structures and processes with the help of which learning through discovery can be discovered and constructed.

Teaching aid.

(MNER 1995, p:10-11)

⁴⁴ See next chapter for more detailed discussion.

⁴⁵ Pedagogical Institute is responsible for educational policy of school curriculum in general. See also chapter four.

⁴⁶ Reformulation of the IT Curriculum on 1995 is discussed extensively in sections 7.1.2 and 7.2.1

“New Information Technologies, with the computer as a main tool, can offer pedagogical environments that support educational process. Exploitation of the above environments can improve teaching process, but also educational practice in general, through its adjustment to various models of development of ways of thinking and of learning... Through them (the computers), development of new didactic models are possible, where the student discovers knowledge and teacher play the role of catalyst in the process of knowledge acquisition”

“In parallel, New Communication Technologies ... may present a factor for the development of new learning environments...may help to overcome geographical isolation or other kind of isolation... they may play crucial role to professional development of teachers...”

All the above mediums may also manage to educate youth in every day use of technology in society, in order to avoid technology illiteracy”
(MNER 1995, p.9)

The Master plan for the introduction of computers in schools was finalised on the summer of 1996 in a project that included thirty smaller projects⁴⁷. The Catalytic objective was apparent.

“A course towards a society of people capable of learning and not of accumulating unchangeable knowledge is necessary. The current project of ECSF consists of studies that will enforce the above course and specifically aims to:

Develop integrated educational programs in schools based on computational and network technologies, which lead to dynamic encounter of knowledge, by teachers and students. ...

Meta-evolution and upgrading the role of teachers through high quality training and in-service training. ...”

(Odyssey 1996: p.2)

The Catalytic objective was also illustrated by project co-ordinator.

“We think that Odyssey will offer teachers the chance to develop new educational practices, focusing mainly on issues like students group work, either collectively or competitively, questioning of one and only truth, the fact that we are moving away from “study my child!”⁴⁸...we want to use educational software, exploit the potential of network technology with the main aim to intervene in the way of teaching, learning and communication in school ” (Interviewee E)

Technical reports of the project were written by CTI that came on the scene again as the main actor, after problems revealed in the management and the realisation of the project⁴⁹,

⁴⁷ Odyssey master plan is presented and discussed in the next section

⁴⁸ This is a Greek saying, emphasising the effort of Greek students to study and memorise knowledge, being able to reproduce it

⁴⁹ One year after submission of the master plan for the 2nd ECSF, problems in the realisation of the project were encountered.

“Till summer 1996 nothing happened... PCITE submitted the proposal but there was neither a realisation conveyor, nor a management conveyor... when realisation conveyor was found, there were problems of how the money would reach him, within which procedure, and who is going to manage all this money, big problems that are bureaucracy problems... (Interviewee F)

There were many procedural and managerial difficulties, MNER didn't know yet how to do these things... ECSF became alive when MNER decided to appoint a special secretary” (Interviewee E).

This, led to the establishment of ECSF Office within the Ministry, aiming to exploit the funds from 2nd ECSF in general. The special secretary for the ECSF that was appointed, assigned the management of the project to CTI, since it seems it was an independent organisation very close to the Ministry. In parallel, PCITE became inactive⁴⁹.

and it is clear that the active involvement of CTI greatly influenced the philosophy of the project. Astrolavos –submitted to the Ministry in 1992- came on the scene again.

“Astrolavos was a proposal that influenced next steps. It was not realised at that time. I think it is a preamble of Odyssey” (Interviewee E)

This time though, Astrolavos' philosophy found mature ground on which to flourish.

We believe that success of Odyssey is expected, because it is addressed to mature social needs (Interviewee E)

This was because, EC would not to fund technical resources this time, and thus, it would not expand expansion of IT. Additionally, the Greek government had declared new educational orientations for Greek education for the period beginning in 1994. More open learning approaches were proposed, the importance of discovery learning and investigations were pointed out, and teacher student roles were proposed to be changed (Chapter Four).

Thus, CTI's philosophy proposing the integrated model of the use of computers in schools that proposed a Catalytic objective was promoted. Next, implementation policy is discussed.

6.3.2 Odyssey: a small scale model for introducing complete paradigms of the computer use in schools

During this period (1994-1997), a comprehensive approach within a small scale of implementation was planned. This time, the project involved introducing computers into a small number of schools. Three hundred schools were going to be involved in the project, presenting a percentage of nearly thirty per cent of total. The schools involved would be provided with technical resources (hardware and software), while teachers from those schools (around 6000), irrespective of their specialisation, would be trained and be supported to integrate computers into their teaching. The small scale of implementation that was proposed was contradictory to the existing policy for equal opportunities in education, and many discussions were around this issue.

However, this time, it was acknowledged that the introduction of ITE proposing a Catalytic objective, was an educational innovation, influencing not only educational practices, but also the aims of education and pedagogical beliefs (see also chapter three). Thus, it was acknowledged by all participants to the innovation at that time (CTI, PI, MNER) that it was impossible to be attempted within a broad scale of innovation.

*The ECSF Office is established which helps the procedures to move on and supports all projects in general. In the summer of 1996 the Office gave management responsibility to CTI and thus, CTI submits technical reports... then PCITE becomes inactive and stops to meet...(Interviewee F)
CTI was always close to the Ministry. They had submitted proposals for educational networks, for Ministry's computerisation, for public services networking. It had a broader role. These people participated in PCITE. Later they built up technical reports, they submitted proposals to the EU. (Interviewee F)*

"A strong battle ensued to be able to proceed with what some people call a small number of schools, 300 schools is a small number within a specific scope, but considering what you can achieve is not a small number... It is not possible to go to 1300 schools ... It is too difficult to intervene in teaching method, that's why we chose this number" (Interviewee E)

"Dissemination to all subjects cannot be achieved in a broad scale immediately... If we had the power to do it through all subjects there would be no objection, this is an... emergency solution" (Interviewee H)

"The Ministry of Education realised that it could not proceed to a systemic implementation to all schools in the country if it had not first studied thoroughly a pilot program of this kind of computer use and its results. That's why Odyssey was created that included all kind of actions, training, hardware issues, software development, everything... It started with Ulysses and Sirens, which were about networks and software, to see what happens as a pilot phase and then to expand (Interviewee F)

Thus, the implementation policy promoted careful introduction of computers in a small number of schools, aiming first to pilot the new approach of the use of computers in schools.

We couldn't introduce educational software in all schools, we have never applied that. Ministry of Education embraces the idea of cells, introduce the program to a small number of schools, evaluate the results, and gradually expand to the rest of schools (Interviewee F)

We will first set up technical infrastructure... in the meantime we develop educational software for schools and we train and support teachers (Interviewee E)

The project Odyssey included many smaller projects within six main categories. The project is briefly presented here since it was not implemented till 1997, when the empirical research took place. The main philosophy of the project was first to pilot integrated models of the use of computers in a small number of schools (sixty schools). These projects were to explore technical, organisational and educational issues that would emerge from the use of computers in education proposing a Catalytic objective⁵⁰. It has to be mentioned that within these projects, actions for provision of resources, establishment of school networks, development of educational software, teachers training and support were included. These pilot projects presented the first group of projects within Odyssey.

Based on the experience of those pilot projects, other projects within the framework of Odyssey would start on the same axes, involving the 240 more schools.

50 This Action comprises smaller pilot projects... aiming to design prototypes and prove their effectiveness as well as their viability.

In a technological perspective, they represent the necessary step to prove a/ the viability in low cost and in adequate availability of networks in a systemic scale at the school level (computer lab) and at a periphery level and b/ and potential for domestic production of high quality educational software

In an organisational perspective, they represent the necessary step between the existing situation and the introduction of Information Technology at a national scale, exploring organisational and administrative problems and proposing methods and practices for their solution.

At an educational perspective, they study pedagogical approaches in the use of computers and the ways in which educational aims can be codified into prescriptions for the development of educational software.

(Odyssey technical report: p.9)

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This way, the second group of projects was related to development and distribution of educational software and of digital material⁵¹. In addition to the provision of educational software to Odyssey schools, another implicit aim was to motivate the Greek market by their involvement in the development and adjustment of educational software and of digital materials. For the latter, many types of educational software were to be welcome (exploratory, drill & practice, presentation, reference).

In parallel, within the third group of projects, development of technical infrastructure (computers and network) was organised for all future-involved 300 schools. Emphasis was given to communication, not only within school through local networks, but also through Internet⁵².

Emphasis was also given to teachers' training, in-service training and support. Within this group of projects, new methods and new organisational structures were proposed. First, familiarisation with NT and with their role in education was organised for all Odyssey teachers within intensive short courses (40 hours). Second and most importantly training was to take place in school, over a long period, focusing on pedagogical issues, supporting at the same time teachers in their practice in the classroom and encouraging collaboration between them and exchange of ideas.⁵³ For this to happen, new organisational structures in the Greek educational sector were proposed, since in-service training in general till then was weak and not based in school (chapter four). In addition, a cascade model was proposed, establishing special in-service training units, and involving working teachers.

51 This project aims to

- Support of the realisation of educational aims of secondary education
- Support teaching aims of education of special needs
- Establish production mechanisms, support, promote and upgrade the Greek market in educational software (Odyssey technical report: p.10)

Software would be either exploratory, or reference type, or drill and practice or presentation type, in order for the computer to be a useful tool for

- Teaching and learning of general education subjects (maths, language mother tongue and foreign language, Science, Geography, History)
- General interest issues (civilisation, environment)
- Professional training in specialisation subjects (machines operation and maintenance, computers, support medicine...) (Odyssey technical report p. 10, 11)

52 This group of projects aims to

- Develop school labs equipped in such a way as to support teaching of curriculum subjects through computer use to 20% of secondary education schools
- Connect school labs among them, in parallel with connection to internet and with other institutions such as the Pedagogical Institute and other regional offices
- Development of services or other mechanisms for the maintenance and upgrading of equipment and network ... (Odyssey technical report p. 11)

53 This group of projects aims

For all teachers to be in the position to use computational tools for the teaching of curriculum subjects, independently of those who teach IT

- to encourage the use of computers and networks within an open learning process supporting students in exploring issues through computer networks within a framework of constructive projects and environmental studies
- to integrate computers into everyday school life exploiting computer potential ... (Odyssey technical report p.12, 13)

The two last groups of projects were concerned first with very specialised projects of high technology (for example high-speed networks), and the second with organisational and support projects. The first were to be implemented in a very small number of schools, aiming to encourage and support activities that will advise on new uses of technologies in general education and professional training, evaluating their educational appropriateness and the possibility of their introduction into schools. The second aimed at the management and co-ordination of the projects, dissemination of results, evaluation and support studies. The last one was considered of great importance since it was to alert the society and ensure its support for the exploitation of the computer and of CT in education.

Within this period (1994-97), the governmental plan for the introduction of ITE although moved on, in the sense that it was organised in detail and technical reports were written, suffered from managerial and bureaucratic problems that delayed implementation. Thus, till summer of 1998⁵⁴, only twenty schools had been provided with equipment, and two phases of in-service training courses had been completed for teachers whose schools had been involved in Ulysses⁵⁵. The computers were not used in classrooms other than in some isolated cases since the labs were established. The first pilot use was expected to take place within the academic year 1998-99. Thus, no empirical data is available for the use of computers in the classroom.

6.4 Summary

Efforts to introduce computers in general education in Greece started on 1985. According to the standard Greek educational policy, the Ministry of Education and the specially appointed advisory groups were the main actors of the initiation of computer use into schools. The decision-maker was the Minister.

In the first period (1985-1990) introduction of IT and ITE were considered valuable for Greek education, aiming to satisfy the economic development as well as educational needs of the country. However, because of the technical and educational complexity of ITE, the advisory bodies proposed a two step restricted approach. They proposed IT to be introduced, while at the same time ITE would be prepared. It was expected that the introduction of IT would facilitate the introduction of ITE at the next stage. The Ministry of Education however decided to introduce IT in *all* schools, and *then* proceed to the introduction of ITE. Consequently, any support structures that were developed focused on IT, while ITE was abandoned. At this period, IT was introduced into Greek schools as an additional subject in the National Curriculum, compatible with existing educational structures. Support structures were also set up to support the implementation of the specific published IT curriculum, controlling intentionally or unintentionally the implementation of

⁵⁴ The empirical part of the research ended that time, so no more empirical information is available.

⁵⁵ The first pilot project concerning integration of computers within school subjects, including also software development, teachers training and evaluation.

IT. What did not happen during these six school years, was the preparation for the introduction of ITE that the advisory bodies had proposed. The Ministry did not include it in the policy plans.

In the next period (1991-1993), the government applied for funds available by the European Community to support the introduction of computers into education. The EC did not influence the objectives of the project, but rather pushed the government to present a coherent plan. Although introduction of ITE aiming at the Catalytic objective was proposed by one of the advisory bodies, a restricted approach was promoted again by the Ministry of Education in this period. Expansion of IT to all schools was a first priority, while introduction of ITE aiming at the Pedagogic objective was to follow. The government promoted this approach for the following reasons. First, policy for equal opportunities suggested a systemic innovation since this way all students across Greece should have some hands-on experience with computers. Second, *economic* needs were to be satisfied. Through Social rationale students were prepared for their future adulthood in a modernised country. At the same time the *educational* potential of computers' introduction was to be fulfilled on the second step of the innovation, since improvement in teaching was expected (Pedagogic objective). An educational innovation proposing new educational aims and practices (Catalytic objective) did not represent a target for the Ministry of Education at that time. The governmental plan however, was not completed, since the government changed in 1993. Within this period, only the first part, i.e. the diffusion of IT was realised. IT was introduced in the majority of schools and was strengthened as a separate subject in the school curriculum. As for ITE, only one piece of educational software for the teaching of IT was developed, while teacher training did not take place.

In the third period (1994-1997), a comprehensive policy promoting the introduction of the ITE was adopted. Although the philosophy of the Ministry of Education was still to complete the expansion of IT first and then to proceed to the introduction of ITE, European Community pushed the project towards ITE. Since an infrastructure had still not been developed, the implementation focused on a small scale. It was planned first to be piloted in a small number of schools, and then to expand to more schools. Emphasis was given to teachers' in-service training and support. The European Community did not influence the objectives of ITE (Pedagogic or Catalytic objective). A general shift in the Greek educational system towards more open learning approaches seems to have influenced the shift of the project towards the Catalytic objective of ITE. The use of computers, this time, presented a medium for realising new educational aims and practices. This fact also supported the argument for a small-scale implementation, since much attention needed to be given to the school context. In parallel, IT was not abandoned. It was, however, distinguished by the ITE. ITE was included in the governmental plan, while IT remained under the authority of the Pedagogical Institute as an established curriculum subject.

After discussing policy issues on the introduction of computers in Greek schools over time, the discussion of the thesis turns to issues related to its implementation. The next chapter

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focuses on the IT subject in a specific time and discusses, in detail, the development of the IT Curriculum as well as the structures developed to support its implementation.

Chapter 7

From Policy to Implementation: The Introduction of IT into Gymnasiums in 1995

In this chapter I focus on the initiation of IT. I focus on the policy level only, and I present the way policy makers perceived the IT, as well as structures put in place to support its implementation.

As presented in chapter four, the Ministry of Education is responsible not only for the initiation but also for the implementation of all curriculum subjects. The Ministry of Education supervises the development of the National Curriculum and of the context of implementation of the subject, in terms of its place within the school curriculum of gymnasium. In parallel, it provides all necessary resources technical and human. In the case of IT, in addition to the development of the IT Curriculum, the student and teacher books, it provided hardware and software for using-schools¹, and ensured the employment and position of teachers for the new subject. Finally, the Ministry of Education provided support for the implementation of the subject as well as training for IT teachers.

The aim of this chapter is to explore the way policy makers perceived the objectives of the IT, as well as the way these were expressed in the implementation policy adopted. In the first section I focus on the objectives of the IT as expressed by members of advisory groups and reflected within submitted proposals, and I discuss discrepancies and contradictions among them. In the second section I explore the way the objectives of the IT were reflected within the policy documents. Discussion focuses on the IT Curriculum, the student books and the teacher book, since these are considered to be the official texts that reflect the objectives of the subject. In the third section, I explore the structures developed to support the implementation of the IT, and the way these reflected the official policy. First the context for the IT is presented. Next, the provision of resources (hardware and software) is discussed. Finally, the issue of human resources and of teachers' training and support is presented.

Discussion in this chapter is based first, on the analysis of documents collected, second, of interviews with the policy makers at that time, and finally on questionnaires distributed to IT teachers and PLINETs. Specifically, the documents analysed were the Draft Proposal for the IT Curriculum, the published IT Curriculum, the student textbooks, the teacher book, and official guidelines. Interviews were conducted with members of the advisory group

¹ I use the term using-school for each school that offered IT

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for the IT Curriculum, a representative of the Ministry of Education, and one member of the Pedagogical Institute. Finally, information collected about the infrastructure developed by the Ministry of Education, from the Teacher and Plinet Questionnaires, was analysed for the needs of the present chapter.

7.1 The Proposed IT Curriculum

As discussed before (chapter six) IT was under the responsibility of the Pedagogical Institute (PI) and in the control of the Ministry of Education (MNER). PI, on the orders of the MNER, established an advisory committee to propose an IT Curriculum. This section explores the way members of the advisory group perceived the objectives of the IT Curriculum, and the way these were expressed in the Draft Proposal for the IT Curriculum.

7.1.1 Perceptions of the Policy Makers of IT

In 1995, the IT Curriculum in operation had been voted two years before and it referred to all grades of gymnasium (see chapter six). Its reformulation was a result of a large order of purchase of equipment for gymnasiums within the school year 1993-94 (see chapter six), by the Ministry of Education. There was not any explicit intention by policy makers in the Ministry of Education to change the objectives of the subject, but only to adjust the IT Curriculum to a new operating system² (Γ2/341/20-1-94). The Pedagogical Institute under orders from the Ministry of Education (Γ2/341/20-1-94) established a committee³ to redraft the existing IT Curriculum (PI 19/94). The President of the committee for the development of the previous IT Curriculum (1993) also participated in the committee.

Presenting the philosophy of the committee for the IT Curriculum, the committee (NC-Wgr) argued that the new operating environment of Windows was “an important opportunity to escape from the technical oriented approach that characterised IT in general education in the previous years”⁴ (Alexandris 1995). Indeed, Windows provide a user-friendlier environment for students, and the process of learning is facilitated since students do not need to concentrate on remembering commands and keyboard combinations. In addition, there is powerful software that can run under Windows environment that encourages constructive learning through investigations. However, the Windows environment on its own can not be considered as a panacea for open approaches to learning. For example Logo can run under DOS and can provide an environment for investigations and the development of constructive knowledge. At

² Gymnasiums were equipped with modern (at that time) computers, operating under Windows.

³ The committee consisted of six academics from university of Athens and of Piraeus, one representative of Pedagogical Institute and of eight teachers detached for that year in the Ministry of Education (one of them was Head of Section D, Secondary Education, in the MNER) or in the Pedagogical Institute. President of the committee was Dr. Alexandris (University of Piraeus).

⁴ «... an important opportunity to overcome the technocentric orientation that characterised education in Information Technology in general education for the last years » (Alexandris 1995)

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the same time, tutorials that run under Windows provide individualised guided knowledge acquisition and focus on the product of learning rather than the process.

Trying to explore the perceptions of the policy makers, the discussion shifts to interviews with members of the IT Curriculum working group. One can see from the information provided below, that the objectives of IT were perceived differently by the different participants.

One of the academics involved with the IT Curriculum committee promoted an Educational rationale and specifically, the Catalytic objective. As he said:

“The purpose was to move from computer literacy towards basic uses of technology, which was written expression and processing of numbers...”(Interviewee D)

This becomes clearer when he talked about the nature of the teaching unit “Applications”. He talked about the integration of the computer into the learning process, where for example students study weather phenomena and in doing so, explore phenomena in science. They can also use computers to present their work. In these ways, the computer is a powerful medium for investigations and constructive approaches to knowledge acquisition, but also is a tool for written expression, organisation and presentation of projects:

“... As I understand them, ...I want to work on a project, for example to study weather phenomena or to study elements of movement. For this project I need to think which computer applications to use and for what reasons. A spreadsheet to insert numbers and calculate, a database to insert data, a simulator to do an experiment, a drawing package to make a nice covering page, and a word processing to write about them...” (Interviewee D)

Another member of the committee promoted a Social rationale, and viewed the Computer Awareness objective as the main aim of computer use. The Educational rationale was also proposed, aiming to a Pedagogic objective, since computers presented tools for delivering in better ways what students were already doing. The project work though remained another “part” of the IT Curriculum, which was added on to the previous one. IT did not change, but it was enriched.

“Main aim always remains⁵ familiarisation with computer use, ... the only thing added to the IT Curriculum after 1993, was the development of projects, a new pedagogical dimension, students to create work with computer tools, and not to learn how to type. It was a new dimension that has to be introduced in all subjects” (Interviewee B)

The Member of Pedagogical Institute, current Counsellor for IT, who participated then as a teacher to the committee for the IT Curriculum proposed both Social and Educational rationales. His words indicated the proposal for a Computer Awareness objective, since the role of school was seen to provide students with necessary personal equipment to enter the adult life. The Educational rationale was also promoted through the promotion of the Catalytic objective, since the interviewee talked about “methodological skills”, such as exploration,

⁵ my emphasis

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creation, organisation, classification. In this way, the use of the computer aims to cultivate general learning skills.

“The target was to familiarise students with new technologies... students meet IT applications in their lives, thus, school had to offer them the opportunity to meet mediums and tools of IT, but also its applications,... as for programming... the aim was not to teach students programming, but to use programming as a tool to develop methodological skills...” (Interviewee H)

The Head of section D of Secondary Education, Ministry of Education, promoted another dimension of IT, where Social and Vocational rationales were proposed. Computer Competence objective was proposed, since the school was seen to provide students with all the necessary skills to be integrated to a modern society. School would familiarise students with technologies in order to provide them with a necessary dynamic tool for their personal life, and the qualifications to enter the modern market.

“We want to give them necessary personal equipment to face modern market,... to become good users, ...mainly use of computers and realisation of how this tool will be useful in their lives...” (Interviewee F)

As shown from the above, interviewees perceived differently the objectives of IT and promoted different rationales. The first quotation proposed clearly an Educational rationale, where computers were mediums that encouraged exploratory learning, the interdisciplinary use of computers, and the development of constructive knowledge. In parallel, computers presented tools that improve school activities. The second promoted a Social rationale with an Educational rationale more implicitly proposed viewing project work as an add-on to previous established aims. The third proposed both Social and Educational rationales, while the last one promoted Social and Vocational rationales.

This diversity could be expected, since as argued, people in different educational sectors or levels in the educational hierarchy have not only their own beliefs and values, but also their own biographies (Bowe and Ball 1992; Sarason 1990; Hargreaves 1994; Fullan 1993). As presented before, the national IT Curriculum committee consisted of academics, one representative of Pedagogical Institute and eight highly qualified teachers. All teachers were attached to the Pedagogical Institute or Ministry of Education. One of them was Head of Section D, Secondary Education, Ministry of Education, one of them was currently elected in Pedagogical Institute responsible for IT matters. Their perceptions of IT reflected differences in background, position, implicit interests and agendas.

The Ministry of Education had an agenda to educate all students across Greece to be integrated into the society, trying to ensure equality of education. In Greece, education is a very important “good” and thus, a political one. The Ministry of Education is interested in a curriculum that can be implemented broadly for all and by all students in the country (chapter four). Furthermore, at that time government was interested in the modernisation of the country through familiarising future citizens with technologies (chapter six). One can see this agenda reflected to the interviewee's perceptions of IT.

The Pedagogical Institute draws up educational approaches and policy for the school level, but at the same time considers all schools within a centralised educational system (chapter four). Thus a combination of pedagogical sensitivity and social awareness was apparent by the member of Pedagogical Institute, proposing both Social and Educational rationales.

The interviewee who is an academic had a different perspective. He was more conscious of the pedagogical potential of the use of computer in the classroom. His research interests lie in computer use within learning. Thus he was more focused on classroom learning and educational innovation than reform in schools.

The committee submitted a Proposal of the new IT Curriculum to be delivered by all IT teachers to all students (Alexandris et al., Draft for IT Curriculum, March 1995). The way all these disparate perceptions were reflected –or not- within the Proposal is discussed in the next section.

7.1.2 The Draft Proposal for the IT Curriculum

Before discussing the objectives proposed within the Draft Proposal for the IT Curriculum, it is necessary to present its organisation. The Proposal⁶, first, presented the general and specific aims of IT, as well as the four subject areas to be covered for the realisation of these aims. Next, it focused on each grade of gymnasium and presented the IT Curriculum Teaching Units, Sub-Units and Attainment Targets specifically for each grade of the gymnasium (Appendix 7.0). Looking at the Proposal, it can be divided in two parts, in terms of its organisation. The first part presented the main philosophy of the IT, while the second part specified the ways in which proposed aims of the subject were to be realised in each grade.

As discussed below, in the transition from the first to the second part, the objectives and the philosophy of the subject were distorted. Looking at the first part, Social and Educational rationales were promoted, either focusing more on one or the other in different sections. Specifically, in the “Introduction” the Proposal clearly proposed an Educational rationale as the main aim of the IT Curriculum, proposing the Catalytic objective, since it referred to a “new pedagogical view”, the cultivation of “methodological skills” and reformulation of the educational process.

The Proposal proceeded presenting the General Aims. Again, one can see a level of generality, where all rationales were implicitly promoted. Specifically, the first General Aim (GA) of IT Curriculum proposed the Social rationale, since students were to be familiarised with technology. The second GA implicitly reflects all the rationales since all educational, professional and personal needs might be fulfilled through the use of computers in the future (Appendix 7.1). Computer competence objective was proposed since students were to develop skills for future computer use:

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“for students to acquire necessary skills in order to exploit the computer potential not only within their school life⁷ but also after their graduation, for their educational, professional and personal needs. (IT Curriculum 1995, 260/22/12/95)

Further specifications followed, where Social and Educational rationales were proposed since Computer Awareness, Computer Competence, Pedagogic and Catalytic objectives were promoted. (Appendix 7.1) For example, it was stated that students needed to discern the nature of a problem and the possibility of its solution through programming. In this case, programming was used for problem solving, and thus, proposed Catalytic objective (chapter three, section 1).

The Proposal proceeded presenting the way in which the General Aims were to be realised through the Specific Aims of IT and of the four axes⁸ of curriculum. (Appendix 7.2) Within Specific Aims, the IT Curriculum proposed Educational rationale since Pedagogic and Catalytic objectives were promoted. For example it was mentioned that the computer offers a tool for learning, it offers a medium for expressing and exploring ideas, and facilitates learning within other subjects.

The Four Axes chosen for the realisation of the General and Specific aims were “Introduction to IT Science”; “Basic Computer applications”; “Investigation with symbolic expression through programming environment” and “Critical view of technological evolution and connection with financial and social changes” (Appendix 7.2). As presented below, the Social rationale was proposed in the introductory theoretical sessions since the Computer Awareness objective was promoted. The Educational rationale was proposed in the computer applications unit, and in the use of programming.

Specifically, “Introduction to Computer Science” and “Critical view of technological evolution and connection with financial and social changes” proposed clearly a Social rationale since the Computer Awareness objective was promoted. “Basic Computer applications” proposed the Computer Competence objective, but it is unclear at that point what rationale was proposed, since competence in using computer applications can fulfil all Social, Vocational or even Educational rationales. For example, a computer competent student can use the computer not only for his/her personal needs, but also to be appointed in the future in a back office job, or even more, use the computer within the learning process of other curriculum subjects or investigations.

However, as the Proposal continued it becomes clear that an Educational rationale was proposed. Within the “General teaching methodology”, it was suggested that the subject should be approached through specially selected projects. It was mentioned that emphasis should be given not on specific concepts of IT, but to the development of an integrated view of the subject. Thus, familiarisation with “Basic Computer Applications” did not present an isolated teaching unit of the IT Curriculum, but it was integrated within other school activities. Students

⁶ I use the term Proposal when I refer to the Draft Proposal for the IT Curriculum.

⁷ my emphasis

⁸ The four “axes” presented the subject areas that needed to be covered in order for the general aims to

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were not to be taught about computer applications per se, but they were expected to use the computer as a tool for school activities, or a medium to approach knowledge in an interdisciplinary way. Thus, Educational rationale was put forward in the “Basic Computer Applications” through project work. Although not clearly stated, it could be said that Pedagogic objective was promoted as computers presented a tool for existed school activities, and Catalytic objective was promoted as computers were to be used for approaching knowledge in new ways.

As illustrated in the Proposal, *“complete projects should be assigned to students with every opportunity. Projects should combine computer applications with other school activities. Through this, students would understand that the computer consists a tool for interdisciplinary approach of knowledge”* (Proposal, May 1995: p.5)

Finally, “Investigation with symbolic expression through programming environment” clearly proposed an Educational rationale, since the Catalytic objective was proposed. For example, two of the aims of this axe were “use of symbols for expression and the exploration of ideas” and “exploitation of parametric environment for development of generalisation and abstraction skills. (IT Curriculum 1995, Proposal, May 1995)

Turning to the second part of the Proposal, one can see that it offered IT in “teachable” units. Teaching Units and sub-units were proposed for the realisation of IT in each grade. For each Teaching Unit general and specific attainment targets were stated. For each sub-unit, its attainment Target was also stated in parallel with the teaching content and proposed activities. As presented below, the more specific the teaching units became, the more the educational rationale became limited and unclear within the attainment targets, while the Computer Science objective appeared in the third grade. These transformations of objectives are presented below.

First, the two axes “Introduction to IT” and “Critical view of technological development and connection with financial and social changes” presented a unified Teaching Unit “Communication with the Computer” (TU 1), which was to be offered in all grades. As can be seen (Appendix 7.3), the teaching unit continued to promote a Social rationale since Computer Awareness objective was proposed.

“Investigation with symbolic expression through programming environment” (TU 3) remained and was included in both second and third grades of gymnasium. The Catalytic objective was apparent within the unit for the second grade, since programming aimed to cultivate problem solving and the exploration of ideas. An Educational rationale though was not clear in the third grade, while an implicit mention of the Computer Science objective can be traced, since “knowledge of programming” and “IT concepts” appeared. (Appendix 7.3)

Going further, although in the first part, “Basic Computer Applications” were to be approached through interdisciplinary projects, in this part they presented separate Teaching Units with General Attainment Targets. “Drawing” (TU 2) and “Word Processing” (TU 3) were included in the first grade, while “Spreadsheet” (TU 2) and “Database” (TU 2) units were

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included in the second and third grade respectively. Drawing had been chosen for the first grade as a “starting point” since it was considered simpler to be approached by students (Alexandris et al. 1995).

Initial objectives stated in the first part of the Proposal had been transformed. The Educational rationale promoted in the first part, was transformed to Computer Awareness or Computer Competence objective in the second part. That was because interdisciplinary projects that were proposed to present the method to approach computer applications were transformed in the separate teaching unit “Applications” that was included in all grades. For example in first grade, “Communication with the Computer”, “Word processing”, “Drawing” and “Applications” presented separate teaching units. This way, while in the first part of the Proposal the use of computer applications promoted an Educational rationale, in the second part, Educational rationale was promoted only in the unit “Applications”, and use of computer applications promoted a Computer Awareness or a Computer Competence objective. The Computer Competence objective was proposed in the three Basic Computer Applications (word processing, databases, and spreadsheets) while Computer Awareness objective was promoted in the application of drawing. An emphasis was put to acquisition of transferable skills, since students needed to learn how to use a spreadsheet to handle and present data, which implicitly indicated future every day life use.

These discrepancies and contradictions between the General objectives and the way that they were to be realised in schools can be traced further as the IT Curriculum is further detailed to sub-units of each Teaching Unit for each grade. For example, word processing became a set of specific tasks such as name and save document files, select characters, copy and delete text (Appendix 7.4).

In the same line of argument, the Educational rationale which was already not clearly stated in General Attainment targets of “Investigation with symbolic expression under programming environment”, became more controversial within General and Specific attainment targets of the unit, and distorted in the Attainment targets of the sub-units.

Looking at general attainment targets of the unit for the third grade, a strange mixture of aims can be identified. First, students needed to expand their knowledge of programming and of IT concepts. Thus, the Computer Science objective was proposed. Next, students needed to develop a “higher ability” to investigate through symbolic expression within a programming environment, which promoted an Educational rationale. It seems that the Computer Science objective realisation was the first step towards the the Educational rationale that seemed to be the main aim. Finally, students had to be able to develop software related to their school subjects, which promoted again a Computer Science objective.

Looking at the attainment targets as a whole, it seems that the implicit philosophy was a step by step process for students, since they had to start with understanding programming concepts, and end up developing software programs for specific units of school subjects. (Appendix 7.5) As can be seen, the Educational rationale was transformed to a Computer Science objective, since as appeared in the Proposal, students at the end did not investigate

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mathematical concepts, but they used their knowledge of programming to create specific programs for mathematics.

This transformation of objectives is even clearer, as the Proposal proceeded to the specific attainment targets. It is interesting that six out of eight specific aims of the unit referred to conceptualisation and understanding of programming concepts. Most of the aims were formulated in a passive voice suggesting that the student was not the starting point or focus of teaching. For example, problems needed “to be solved”. Furthermore, students needed to learn how to use interactive programs and not to interact with them.

Compartmentalisation of “Investigation with symbolic expression under programming environment”, continues as the Proposal proceeded to sub-units and their attainment targets, which defined specific teachings units for teacher to follow in his teaching. For example, recursion consisted of a separate unit with its own attainment target. Furthermore, solving of mathematical functions presented another teaching sub-unit. The issue here is that students did not use programming to explore mathematical functions, but they used mathematical functions and their formulas to explore programming functions (Appendix 7.5).

Summing up, in the first part of the Proposal, Social and Educational rationales were promoted, since all Computer Awareness, Computer Competence, Pedagogic and Catalytic objectives were proposed. However, as the IT Curriculum proceeded, rationales and objectives were transformed. Specifically, the Computer Awareness objective remained to be promoted in the unit “Communication with the computer”, the Educational rationale was transformed to a Computer Competence objective in the unit “Basic Computer Applications”. Finally, the Educational rationale that proposed a Catalytic objective in the unit “Investigations through symbolic expression within programming environment” was transformed to a Computer Science objective. Thus, through these transformations, the Educational rationale was not promoted, while Computer Science objective appeared (Table 7.1).

Next, the way these objectives were reflected within the published IT Curriculum, student and teacher textbooks, is discussed.

7.2 The policy documents

After the submission of the proposal by the established advisory bodies, the IT Curriculum is published. Next, the Pedagogical Institute under the authority of the Ministry of Education supervises the writing of the one student textbook for the curriculum subject, and a teacher book to accompany the student textbook. The student textbook is distributed to all Greek students free of charge aiming to provide a book of reference of teaching material defined by the IT Curriculum, but also a work book for students to practice on “acquired knowledge” or “skills”. The Teacher book accompanies the student textbook aiming to offer teaching guidance or occasionally more information on teaching material to teachers. Usually, the authors of the teacher and student book are the same (chapter four).

Table 7.1 Objectives proposed and rationales promoted in the Draft Proposal for the IT curriculum in 1995

		Introduction			
		Cat/EDU			
		General Aim			
		SOCIAL VOCATIONAL EDUCATIONAL			
1 st part	4 axes: Specific Aims				
	Introduction to Computer Science	Critical View of Technological Evolution...	Basic Computer Applications	Investigations	
	CA SO	CA SO	CC EDU	Cat EDU	
	SOCIAL EDUCATIONAL				
Teaching Units: General Attainment Target					
2 nd part	Basic Computer Applications				
	Communication with the Computer	Drawing	Word Processing	Data Bases	Spreadsheet
	CA SO	CA SO	CC (Unclear rationale)	CC (Unclear rationale)	CC (Unclear rationale)
	SOCIAL EDUCATIONAL VOCATIONAL				
Teaching Units: Specific Attainment Targets					
CA SO	CA SO	CC (Unclear rationale)	CC (Unclear rationale)	CC	B grade: Cat, EDU C grade: CSc, VOC
SOCIAL VOCATIONAL EDUCATIONAL					
Cat-EDU CC-SO					

Table 7.2 Objectives proposed and rationales promoted in the IT curriculum in 1995

1 st part	Introduction							
	Cat/EDU							
2 nd part	General Aim							
	SOCIAL VOCATIONAL EDUCATIONAL							
	Teaching Units: General Attainment Target							
	Basic Computer Applications							
	Communication with the Computer	Drawing	Word Processing	Data Bases	Spreadsheet	Investigations...	Applications	
		CA SO	CC (Unclear rationale)	CC (Unclear rationale)	CC (Unclear rationale)	B grade: Cat, EDU C grade: CSc, VOC	Cat, EDU	
	SOCIAL EDUCATIONAL VOCATIONAL							
	Teaching Units: Specific Attainment Targets							
	CA	CA SO	CC (Unclear rationale)	CC (Unclear rationale)	CC	B grade: Cat, EDU C grade: CSc, VOC	Cat, EDU CC, SO	
		SOCIAL EDUCATIONAL VOCATIONAL						

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The student and teacher books present the first level of implementation of the objectives of IT as defined by the IT Curriculum. As OECD (1997) puts it “an advantage of the single textbook and the centrally prescribed curriculum could be that it makes rapid curriculum change possible” (OECD 1997, p.158). Moreover, “very few initiatives seem to have been taken by principals or by individual teachers to break the one textbook rule” (OECD 1997, p.149). It has to be considered that teachers have not been exposed to other practices. Even in higher education, the one-textbook rule still applies in most of the cases.

In this section I explore the way the objectives of IT, as proposed by the advisory committee, are directly or indirectly presented or not in the policy documents. That is the published IT Curriculum, the student textbook, and the teacher book.

7.2.1 The published IT Curriculum

The published IT Curriculum was a smaller version of the Proposal. The difference between the two texts is not that the first was a summary of the second, but that the IT Curriculum⁹ excluded some paragraphs of the Proposal. As discussed next, this exclusion, resulted more distortion of its initial proposed objectives.

As presented previously (section 7.1.2), the main philosophy of the IT and the proposed objectives were presented in the four axes of the Proposal. The two axes, «Introduction to IT» and «Critical view of technological evolution and connection with financial and social changes», promoted a Social rationale since the Computer Awareness objective was proposed. The axis «Basic computer applications» in combination with the proposed project work promoted an Educational rationale since pedagogic and even catalytic objective were proposed. Finally, the axis «Investigation with symbolic expression through programming environment» promoted an Educational rationale too since the catalytic objective was proposed (section 7.1.2).

The four axes of IT and their objectives were in fact excluded from the IT Curriculum. As a result, the IT Curriculum was stripped of the proposed philosophy of the Proposal. What remained were only the General and Specific aims of the IT, the Teaching Units and the Attainment Targets for each grade, in which as I have argued became distorted.

Thus, although the General Aims promoted Social and Educational rationales, at a certain level of generality, these became distorted within the Attainment Targets for each Unit (see also section 7.1.2). The Social rationale promoted in the two axes «Introduction to IT» and «Critical view of technological evolution and connection with financial and social changes», remained within the unified Teaching Unit «Communication with the Computer» proposing a Computer Awareness objective. Furthermore, the Educational rationale promoted within «Basic Computer applications» was transformed to Computer Competence objective, while a new Teaching Unit «Applications» promoted Educational rationale, but separately to other teaching units. Next, the Educational rationale promoted in the axis «Investigation with symbolic

expression through programming environment» was transformed to Computer Science objective at least in the third grade (Table 7.2).

7.2.2 The student textbooks

As IT spread to all grades of gymnasium, new books needed to be written. The Ministry of Education assigned the Pedagogical Institute to supervise writing of IT student textbooks. In early 1994, the Pedagogical Institute (PI, 3/94, PI, 11/94) proposed the establishment of a new committee in order to develop IT student textbooks for the three grades of gymnasiums, in combination with teacher books for each grade.

It seems that the authors promoted a Social rationale and implicitly an Educational rationale for the IT in general. As they argued: *«through IT students are introduced in basic information and concepts, and acquire basic skills that the modern man needs.... The subject should be approached in an exploratory way that develops critical mind.»* (Alexandris 1995: p. 8)

This view was reflected in the introduction to the student textbook, where Social and Educational rationales were promoted. As they wrote, *«All persons in the future will need to be familiarised with the computer and to be able to use it in a low or high level... In addition to the new jobs that have been created, the computer will be useful to us for writing, calculating, exchange, store and relate information, exploring, being facilitated in our works, practising our skills with educational and art programs»*. A paragraph was also dedicated to the *«different way of teaching and learning in school»*, mainly referring to students' collaboration.

The Educational rationale becomes clearer, since according to the authors, at the end of each book, the chapter called «applications» was included in order for *«the students to understand that all these tools -hardware and software- that they learn to use, consist a group aiming to serve learning»*. (Alexandris et. al. 1995, p: 8) As they argued, project work that was proposed, was to be related to disparate school activities in order for the students to understand that the computer allow us to approach knowledge in interdisciplinary ways. It was also highlighted that co-operation between students could also be encouraged, an approach that presented a new classroom organisation for the average Greek classroom.

As for the organisation of the student textbook, it mirrored the IT Curriculum proving the «patronising character» of the IT Curriculum (OEDC 1997). As the authors of the student textbooks highlighted, the material presented in the book needed to follow the IT Curriculum, as published by the Ministry of Education, and monitored by the Pedagogical Institute. As illustrated in the interview with one of the authors, *«It (the book) wouldn't be authorised by the Pedagogical Institute if it did not mirror the IT Curriculum»* (teacher 10)¹⁰.

Indeed, high correspondence was shown between the organisation of the student textbook and the teaching units defined in the IT Curriculum. Following the IT Curriculum,

⁹ I use the term IT Curriculum for the official published IT Curriculum for IT in gymnasiums.

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drawing and word processing were included in the book for the first grade, spreadsheet and databases were included in the books for second and third grades respectively. Theoretical sections presented always the first chapters of the books, while applications were presented in the last chapter. There was also correspondence between the sections of the books and the sub-units defined by the IT Curriculum. For example, for the word processing teaching unit, information was presented on the use of a word processing package (Write). Units of the book followed sub-units of the section of IT Curriculum for word processing. (Appendix 7.8)

This high level of correspondence did not refer only to the organisation of the book, but also to the objectives promoted. The book reflected the attainment targets proposed in the IT Curriculum for each teaching unit. Looking at the books and the way information was presented, although authors promoted Social and Educational rationale in the introduction of the book, it seems that the Computer Competence objective was dominant, especially within sections of basic computer applications.

Detailed content analysis of the student textbook is not in the scope of this research. However, an example from the student textbooks below, illustrates the way the Educational rationale was transformed to a Computer Competence objective.

Word Processing in grade A

The role of word processing in school and the aim of the chapter were implicitly presented in

Image redacted due to third party rights or other legal issues

the first page of chapter four of the book, referring to word processing (IT student textbook, grade A, p. 38). As one can see, in the picture (cited above), the computer was presented as a modern tool for writing, which has

replaced traditional tools. All students have computers in front of them. When the teacher ask them to take off their pencils to write something, they seem surprised and ask one another «what is a pencil». It was implicitly indicated in this picture that although the teacher still uses a traditional tool of writing (the pencil), students do not even remember what a pencil is, since they use word processors. Interestingly however, nothing has changed in the teaching context.

¹⁰ Teacher 10 was one of the authors of the IT student textbooks.

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The teacher is still in front of students and asks them to write something. Students are sitting on their desks facing the teacher waiting for his guidance. The traditional blackboard is still on the wall that the students face. Students still work individually. No collaboration and interaction between students is expected. Thus, the concepts of exploration, investigation and collaboration between students mentioned in the introduction of the book do not exist at least within the picture.

Over the picture, the title of the chapter «Word Processing with Write¹¹», implicitly reflected the aim of the chapter, and a Computer Competence objective was proposed. As a reader expects from the title, the chapter showed and explained the way someone can use the program WRITE to write a document. The chapter proceeds explaining the way WRITE works. Keys on the keyboard and their operation were explained. For example, the way to shift from Greek to English language was presented mentioning the specific combination of keys (Alt-Ctrl-Space). Many other operations were explained. For example, margins, ruler, saving, deleting, editing, printing, were explained. Pictures of the computer screen with WRITE in use were included to illustrate different actions.

In some of the sub-units of the chapter, specific steps were proposed, guiding students to specific actions. For example, the book proposed to students to practice on typing by writing a specific text¹² (p.48) cited in the book under the unit «How we write a text». As the book proceeded, within the sub-unit «How we edit», students were asked to go back to the text they had written before, and insert the words «very strong» in between the words «new» and «excitement». It is indicated that students were perceived as passive learners that had to follow specific linear steps to acquire the necessary knowledge. Word processing became a skill to be acquired by students.

Thus, the Educational rationale was not promoted, in terms that word processing was not linked with students' interests, work or school life. Information was presented in a way to explain specific actions in a specific word processing program. Some applications linked with students' interests and school life were however proposed at the end of the book. For example, the authors proposed students to develop a program (leaflet) for a Christmas Concert that was hypothetically organised in the School.

Going back to the authors' intentions and to the advisory committee's suggestions for applications, it can be assumed that since the student book aimed to be a resource book, teachers might or might not use it. Even more, it can be assumed that teachers might use the examples of the book or might propose different ones related to students' work or personal interests. In the same line of argument, teachers might focus on a project and encourage their students to use the student textbook as a reference for different actions.

Following the example of the program of the School Concert, it could be hypothesised that a teacher could use the application proposed in the final unit «Applications», as the main

¹¹ WRITE is the name of a word processor

¹² The prompt of the book is: Lets now type the following text

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activity of students, aiming to cultivate students; word processing and drawing skills, as well as to encourage the development of students' analytic and synthetic thinking, as well as of students' problem solving skills. The organisation of the book however, did not encourage such an assumption. This application was presented separately from «word processing» unit and it was included in the «Applications» unit. In case the above assumption was right, the main part of the book should be the applications that students could do, while the help provided with specific operations of the program should be cited as an appendix. By contrast, word processing and applications presented two different chapters of the book, as well as the two of the four teaching units of the IT curriculum for grade A. Thus, these two parts of the book seemed to be unrelated to each other presenting different activities. The unit "Word processing with WRITE" presented the unit aiming to cultivate word processing skills and the unit "Applications" represented another unit aiming to apply or even assess the acquired skills.

Moreover, looking at the examples presented in the chapter "Applications", and the way these were presented, the hypothesis that applications were the starting point for open learning, becomes weaker. The unit presented a specific task and explained the way each part of it was created. For example, one of the tasks presented in the unit, was the editing of a program for a hypothetical Christmas Concert in the school. The task combined both drawing and word processing programs, thus the students needed to write the text (both Greek and English text) and create the drawings. Interestingly, detailed instructions were given for each part of the task. For example it explained in detail the way the bell presented in the program could be created¹³.

At this point, it is useful to refer to the exploratory study, where some indicative classroom observations were employed¹⁴. The teacher within the teaching session was teaching fonts and different appearance and size of them. The session focused on the student textbook. The teacher told students to open their student textbook on the relative page. It was interesting that most of the students, when asked to write the party invitation simply copied the invitation cited in the textbook, showing that student textbooks were not used as resource books for student's tasks, but as books that guided them on specific given tasks.

Summing up, the organisation and structure of the student textbook, as well as the way the activities were presented did not encourage any Educational rationale, but rather the Computer Competence objective. It seems that the IT Curriculum did not encourage constructive ways of approaching knowledge. Specific units were presented following the Teaching Units of the IT Curriculum. The easy way for teachers was to follow them. On the

¹³ Instructions for the bell are as follows:

Bell

We create the half of the outline using dark yellow, next its symmetrical, and finally we carefully join them. For the curve on the low side of the bell, we use the respective tool (curvilinear figure tool). In a first phase the line seems to be a line. Moving though the cursor in the middle of it, we can bend it, moving the mouse and at the same time pushing the right button towards where we want it to bend. To stabilise the curve, we move the pointer of the mouse at the end of the curve and double click the left button. For the clapper we use coloured cycle in the same colour. For shadows we use the spray. We can draw the ribbon piece by piece and move it in its place in the bell. (p. 99)

¹⁴ Exploratory study is cited in the Appendix 5.18

other hand, teachers might use the book the other way round, starting from applications and use the basic chapters as reference for specific actions. The way that IT teachers actually used the student textbook remains to be investigated.

7.2.3 The teacher book

The student textbook was accompanied with a teacher textbook. The teacher book for the first grade was edited on February 1995 and distributed to schools through the local Directorates.

Teacher textbooks for the second and third grades were not published. Thus, Ministry of Education sent brief guidelines (Instructions for teachers) to all schools that had new equipment through the Directorates. Guidelines for IT for the second grade and third grade followed the new books published for IT, and thus, they were sent to schools on school years 1996-97, and 1997-98. These guidelines were basically the first draft of Teacher books for second and third grade.

As presented below, the teacher textbooks, although promoting an Educational rationale in their introduction and guidance for teaching methodology, this became transformed to Computer Awareness or Computer Competence objectives as the teacher books proceeded to the teaching units.

For example, in the introduction of the teacher textbook for grade A, it was stated that *“through this curriculum subject a new didactical approach is attempted...the student learns ways of thinking and behaviour that point out the exploratory, discovery, critical and social elements”* (teacher textbook, grade A: p.ii).

Through these guidelines, teachers were encouraged to enrich their teaching, using other materials too, such as work sheets prepared by teachers, transparencies and demonstration of old equipment. Moreover, teachers were encouraged to group students on mixed abilities groups to encourage collaboration and exchange of ideas, which was a new element for the average Greek classroom.

The Educational rationale was promoted also when the teacher textbook referred to teaching methodology. It was highlighted that the student textbook must be a resource book for students. Teacher must not feel obliged to teach «all the pages» at the expense of time to be offered for knowledge and applications that had more pedagogical value. Thus, the teacher textbook encouraged for the final teaching unit “Applications” not to be necessary limited presenting a separate unit, but to present a base for discussion and motivation for project work. It also encouraged project work, that might also be assigned related to other curriculum subjects such as environmental studies, professional/career guidance.

The above prompts are contradictory though with the guidance provided for the teaching of specific computer applications. For example, Computer Awareness rationale was apparent within the aim of word processing. As illustrated next: *“Of course, the aim of this chapter, is not for students to be professional typists. In this grade we simply want them to*

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understand the basic principles and philosophy of a word processing package”(teacher book, grade A: p. 9).

Even more, for the teaching unit “Format Text” the aim as explained was: *“To be clear that we can format our text in the level of page, paragraph or character”.*(teacher book, grade A: p.12)

In the same line of argument, within guidance for teaching of spreadsheets in the second grade, the teacher controlled the learning process, since as illustrated: *“A common course of practising, of asking students to follow step by step, would facilitate teaching and would allow us (the teachers) to give attention to the main issues (teacher book for the second grade p. 10).*

Within this teaching unit, the issue of “applications” was again tackled, in a different way this time, reflecting teacher-centred activities, proposing a Computer Awareness objective. As illustrated in the teacher textbook: *“After familiarisation of students with basic concepts and actions of spreadsheet, we complete a small application as described step by step in the student textbook in order for students to know the basic techniques.” teacher book for the second grade p. 10)*

The Educational rationale was promoted again within the theoretical sessions and within the section of teaching Logo. In the first case, teachers when not in the lab were encouraged: *“not teach only theoretical subjects but also to prepare applications to be done in the lab, in order for students to develop analytical thinking and problem solving strategies.” (Teacher textbook, grade B, p. 5)*

In the second case, it was suggested that when teaching Logo, emphasis should be put on exploration skills, symbolic expression, and generalisation, which are mental skills necessary to face problems with the computer.

In addition, the book provided some practical guidance for teachers. For example, teachers were encouraged to create different directories for each school that used the same computer lab. The guidelines continued with a detailed example for creating separate files and shortcuts. Interestingly, encouragement to “stick” to the student textbook is apparent. As illustrated next: *«It is good to ask the company that provided the equipment to install both Windows 3.11 and Windows 95. This way, first, teaching could be according to the student textbook, but also a couple of sessions could be offered to the new environment» (Teacher book, p.4)*

Indeed in the case students worked in Windows 95, the student book would be useless, since it referred to a specific environment and specific applications. Thus, the student textbook in combination with teacher guidance limited teachers’ initiatives or flexibility to use something else that the prescribed in the student textbook.

7.3 Structures put in place for the implementation of IT

As already mentioned, the Ministry of Education is responsible not only for the initiation of but for the implementation of curriculum subjects too. In this section, I discuss the structure put in place by the Ministry of Education to support the implementation of the IT in using-schools. That is the organisation and role of IT within the school curriculum, the teachers appointed to teach IT, the provision of books and resources (hardware and software), and organisation of support and teacher training. Discussion in this section is based first, on interviews with the policy makers at that time and of questionnaires distributed to IT teachers and PLINETs.

7.3.1 The Context of Implementation

IT was to be implemented within the context of a separate curriculum subject with its own identity in the school curriculum. The subject was neither related to nor dependent on other school subjects.

The Pedagogical Institute reformulated school time schedules in order for the second foreign language and IT to be integrated into the school schedule. IT was to be offered in all grades of gymnasiums one hour per week from the school year 1995-96 (after the transitional phase). This way, the subject was spread into all grades of gymnasium but at the same time, the number of teaching sessions within each grade was limited. IT was to be offered for around thirty teaching sessions throughout the school year. The Pedagogical Institute and the Ministry of Education later recognised that this presented a problem for the realisation of the subject.

“There are too many teaching units. The way the subject is organised, one hour per week, it is impossible for the teaching units to be covered.” (Interviewee H)

“The Pedagogical Institute considered that it would be better for the subject to be taught in all grades of gymnasium. Later on, it was shown that one hour per week was not enough, many sessions were lost, students did not remember from one week to another, they went into the lab once in two weeks.” (Interviewee F)

However, there was no more time within the school schedule that could be devoted to the IT, since students could not stay in school for more than six sessions per day, and there were already too many curriculum subjects being offered ¹⁵.

“it is impossible to increase the teaching sessions...we face the problem that all European countries face with the new disciplines... they do not fit all in the national curriculum...” (Interviewee H)

As for location of teaching, for practical reasons¹⁶, students were to be split in two groups, rotating in the computer lab. In the first and second grade, IT was to be offered at the

¹⁵ For example, a student in the first grade had to attend the following subjects each week: Religion 2 sessions, Ancient Greek 4 sessions, Greek Language and Literature 5 sessions, History 2 sessions, Foreign Languages 5 sessions, Mathematics 4 sessions, Geography 2 sessions, Biology 2 sessions, Physical Science 3 sessions, Art 2 sessions, IT-Technology 2 sessions

¹⁶ Computer labs established had seven workstations that corresponded to fourteen students working in

same time as Technology, twice a week. On the first session, the first group of students was in the computer lab attending IT and the other group was attending Technology. The groups were rotating in each session. This way, each student attended IT once a week in the computer lab.

In the third grade half of the students were practising in the lab (practical session), while the rest were attending IT in the classroom (theoretical session). (PI 26/1993/15.7.1993) This way though, students had even more limited access to computers, since in cases they were rotating between the classroom and the computer lab, students were entering the lab only once in two weeks. As is illustrated below, although in first and second grade students were always to be in the lab, that was not always the case, since not all schools offered Technology, and small schools could not appoint two IT teachers.

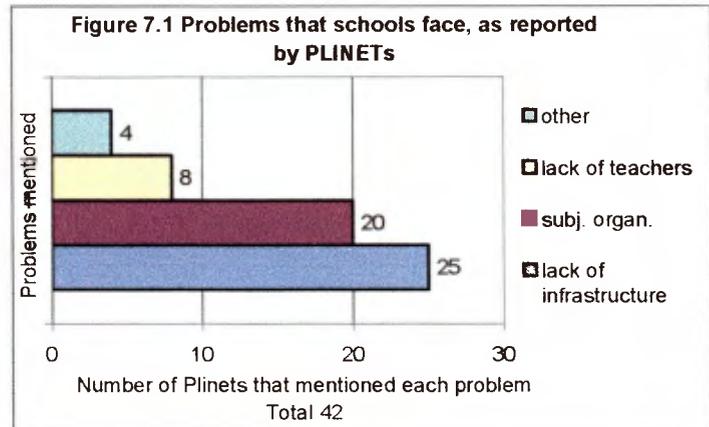
“The IT Curriculum proposed the subject to be taught together with Technology. In many schools there was no Technology teacher... as a result there were two IT teachers. One of them was in the lab, the other one was in the classroom.” (Interviewee F)

This organisation of the subject was considered problematic by nearly half of the Plinets (20 out of 42) too, who mentioned problems related with subject organisation such as one teaching session per week and the students rotation in groups (Figure 7.1).

7.3.2 IT Teachers

According to the organisation of the subject, IT was a separate subject not related to other curriculum subjects. The Ministry of Education in accordance with the usual educational policy, made provision for the employment and position of specialist teachers to teach the subject.

In the early years of IT implementation (1985-90), there were few graduates in IT. Thus, the first teachers who taught IT up until 1992 had been teachers of other disciplines, mainly in mathematics and science subjects (Metaxaki-Kossionides 1993). In 1992, law (N.2009/92) established two new employment-lists (PE19 and PE20) including qualified teachers for IT. The first employment list (PE19) included teachers who held a University degree in IT¹⁷. Because of the lack of IT graduates, the first employment list included also teachers who held other university degrees, conditioning they had some knowledge in the field of Information Technology.

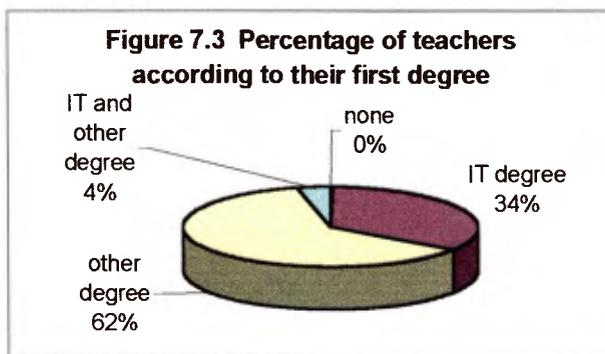
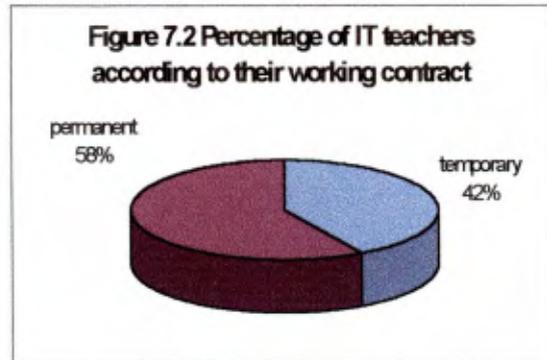


pairs. Since the usual Greek secondary classroom has thirty students, only half of them could practice in the lab.

¹⁷ As discussed in chapter four, secondary teachers are graduates in their respective discipline

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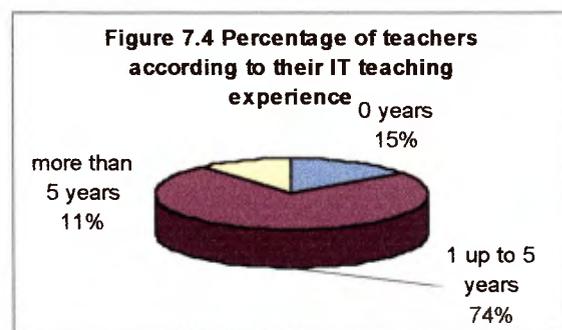
Specifically, the first list included teachers who held either a university degree in Information Technology or a university degree in another subject (mathematics, science, or other) along with a postgraduate degree in IT or university degree in another subject along with to sixteen months of experience on IT teaching¹⁸. The second group of employment lists included teachers holding a degree in IT from Technological Educational Institutions.



In 1992, for the first time, the Ministry of Education appointed IT teachers in permanent positions in schools. These teachers had submitted an application on the PE19 and PE20 employment lists. More than half of them had been already appointed in schools teaching other subjects (mainly mathematics and science) before being involved with IT.

From two hundred and sixty seven appointed IT teachers, one hundred ninety six of them (75%) were transferred from other subject specialisation.¹⁹

The number of appointed teachers though was not enough to cover the needs. Thus, in addition to the first permanently appointed teachers, Directorates appointed temporary teachers from regional educational budgets for secondary education. As revealed in the interview with the Head of the Department D of Directorate of Secondary Education in the Ministry of Education, Greek government could not appoint the needed number of IT teachers immediately. As revealed from the PLINET-questionnaire, lack of IT teachers was one of the most important problems that schools faced in five of the Greek Regions (Figure 7.1).



At the time that questionnaires were employed (1997), nearly half of sample teachers (42 per cent) were on temporary contracts (Figure 7.2). More than half of them were male (57,3%) and held a university degree of other discipline than IT (62%), while a minority of them,

¹⁸ The teachers who had sixteen months experience on the teaching of IT were the first teachers who taught the subject.

¹⁹ The numbers refer to all IT teachers appointed in both low and upper secondary education

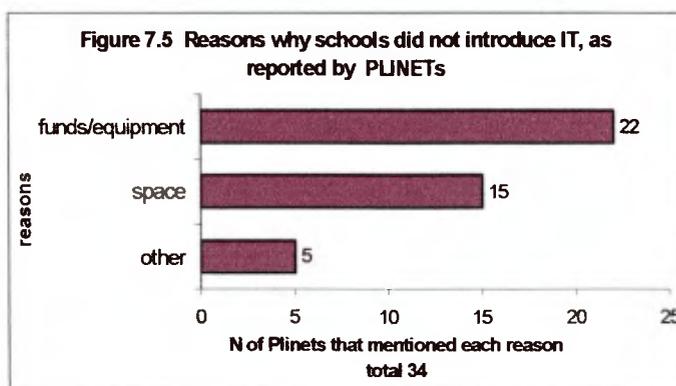
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held an IT degree (Figure 7.3). In parallel, a minority of them, held a postgraduate degree (15,7%) mainly related to IT Science (11,2%).

The large majority of IT teachers had no more than five years of experience (Figure 7.4) and IT teachers were younger (on average) than teachers in other disciplines. This was expected though, since the vast majority of teachers were employed after 1992, and the number of teachers was increasing every year.

7.3.3 Provision of books and resources for IT

In 1997, the majority of gymnasiums (69.2%) offered IT (Statistical Information, MNER 1997).



The Ministry of Education expanded IT within a policy for equal opportunities. IT was to be expanded into all Greek Regions. Distant areas were not excluded, on the contrary they were encouraged to introduce the new subject.

“The main criterion was equal distribution in all Prefectures across

Greece, with special interest for distant areas (Kotsiopoulos, MNER)

The government through the Ministries of Education and Interior is responsible for providing all necessary resources for the implementation of curriculum subjects (see also chapter four). Thus, when the Ministry of Education decided to expand IT into more schools, provided technical resources, hardware and software, to all new user-schools across Greece. The Ministry would gradually equip all Greek gymnasiums. The number of using-schools in each Region depended on availability of funds and available space in schools for creating a computer lab.

According to the PLINET questionnaire, IT had been introduced into all schools in eight out of the forty-four Regions across Greece (Grevena, Zakynthos, Kastoria, Kilkis, Preveza, Rethimno, Chania, Chios). Most of the PLINETs, where IT was not introduced in all schools in their Region, referred to lack of equipment or funds (22 out of 34), or lack of space to create computer lab (15 out of 34) (figure 7.5).

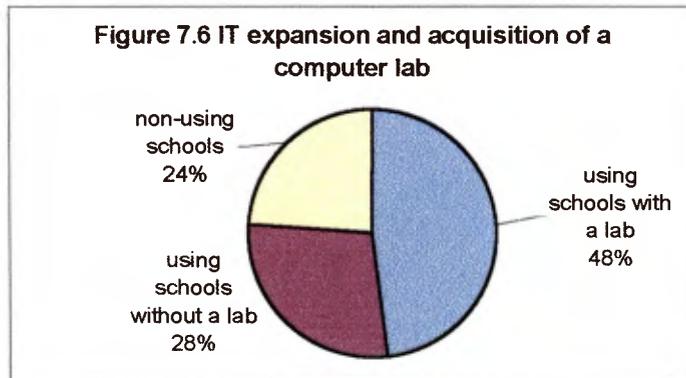
In addition to hardware, the Ministry of Education provided to all new using-schools across Greece software, student textbooks for each student, and a teacher textbook for each IT teacher, as a guideline for the teaching of the subject.

7.3.3.1 Distribution of books

The process of editing a book is time consuming. After publication of the National Curriculum the Pedagogical Institute establishes after authorisation by the Ministry of Education a working group to write the student textbooks and the teacher books.

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The process is time consuming. In the case of IT, the student textbook for the first grade was distributed in schools in school year (1994-95). Books for second and third grade



were distributed in school years 1995-96 and 1996-97 respectively. This way, teachers taught IT based on the new books (on condition they were distributed in schools). In the meantime for those grades that new books had not been edited, teachers used the old book written for the third

grade. In the school year that the teacher-questionnaire was distributed, schools had been provided with student books for the first and second grade.

A teacher textbook accompanied the student textbook. The teacher book for the first grade was edited in February 1995 and distributed to schools through the local Directorates. However, information from teacher questionnaire indicates that only a small minority (13,8%) of teachers had the book.

Teacher books for the second and third grades were not published. Thus, Ministry of Education sent brief guidelines (Instructions for teachers) to all schools with new equipment through the Directorates. Guidelines for IT for the second grade and third grade followed the new books published for IT, and thus, they were sent to schools in school years 1996-97, and 1997-98. These guidelines were basically the first draft of Teacher books for the second and third grade.

7.3.3.2 Provision of hardware

Every school year the Ministry of Education provided a number of new schools with equipment. The biggest provision was made through the 1st European Support Framework within the 1993-94 school year. Seven hundred eighty four gymnasiums across the country were provided with new equipment in the school year 1993-94. Every using-school was provided with one server 80486/25MHz/4MB and seven workstations 80386/33MHz/2MB networked under Novell. The lab was using operating system MS-DOS 6 and Windows environment. Thus, most of gymnasiums²⁰ in which IT had been introduced at that time were equipped with new equipment under windows environment. However, even in 1998 not all schools were equipped with computers.

“Around 23 to 25 % of gymnasiums²¹ do not have computer labs. Moreover a number of other schools which have labs, they have old equipment” “We seek ways of funding” (Interviewee G, MNER)

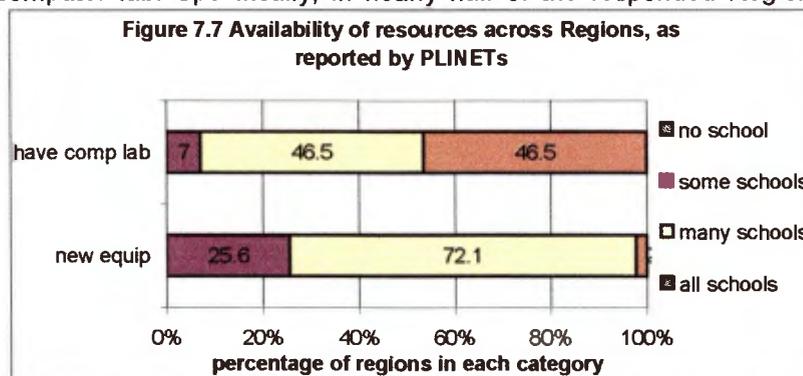
²⁰ Estimated 1000 gymnasiums in total

²¹ He refers to non-using schools

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According to statistical information provided by the Ministry of Education, the majority of using-schools (87.2%) were provided with equipment for a computer lab. The rest of the using-schools used the equipment of another neighbouring gymnasium (Figure 7.6).

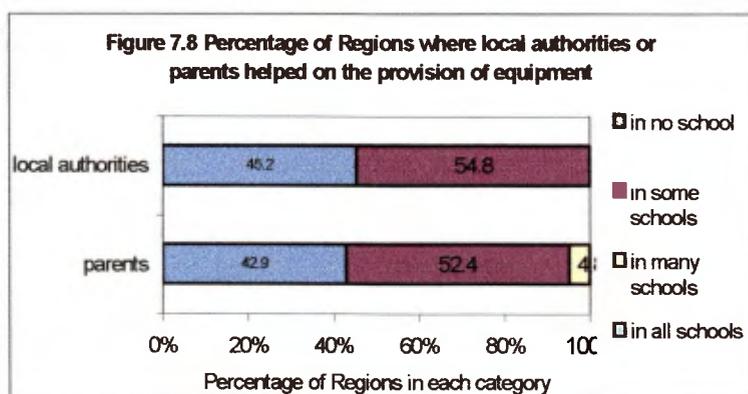
Indeed, information from the PLINET-Questionnaire (PQ q1) showed that in the vast majority of Regions across Greece, many using-schools within the Region had been equipped with a computer lab. Specifically, in nearly half of the responded Regions, all using-schools had a



computer lab, while in nearly half (20 out of 44) many of them. Only in three out of forty four Regions (Piraeus, Ioannina, Preveza) only some of the using-schools had a computer

lab (figure 7.7).²² However, as shown from data from Teacher-Questionnaire, nearly all sample schools had access to a computer lab, either by having a computer lab in their school, or by using the computer lab of another neighbouring using-school.

IT was welcomed by local communities and in a few cases they financed equipment for schools in their region. In these cases equipment had to be compatible with Ministry of Education's specifications and introduction of IT to be authorised by the Ministry of Education, since funds needed to be available for the employment and position of IT teachers to teach the subject to those schools.



Involvement of local authorities though was not frequent. According to statistical information by the Ministry of Education, parents or other local authorities equipped a minority of schools across Greece (14.2%). Indeed,

according to the PLINET-Questionnaire, local financial involvement is presented as to be low across Regions, since, in nearly half of them local authorities or parents' associations were not involved in the establishment of computer labs in their schools. Within half of the regions,

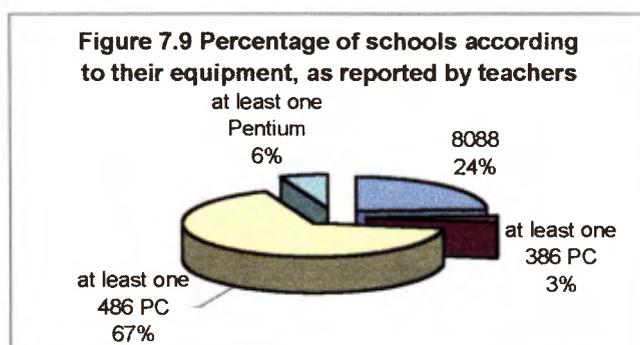
²² This information, however, needs to be treated with caution, since the interpretation of the responders on the meaning of 'some, and many' could vary between one respondee and another. The issue is discussed in detail in chapter nine, section three.

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parents or Communal/Municipal authorities had funded computer labs in some of the schools (Figure 7.8)²³.

It seems that the establishment of a computer lab in the majority of schools followed the Ministerial decision to introduce IT in the gymnasium, considering distribution of national funds and availability of space in the school for the computer lab. It seems that lack of space hindered the introduction of IT in non-using schools. On the contrary, in forty per cent of regions, none of using-schools lack space for computer lab, while in half of the regions, only some of using-schools lack space for the computer lab. Only in three of the Regions (Piraeus,

Helia, Lakonia) was there a lack of space for a computer lab.



As for hardware, it seems that the majority of computer labs had been equipped with new equipment, within school year 1993-94, operating under Windows. Specifically, as mentioned by Plinets, in the majority

of the Regions, many of the using-schools were equipped with 386/486 PCs under Windows environment, while some schools did not have new equipment (Figure 7.7). In the same line of argument, the majority of teachers (67%) reported an acquisition of 386/486 PCs under Windows environment, a small minority (5,7%) had an acquisition of Pentiums, another small minority (3,2%) at least one 386 computer, and one quarter of teachers mentioned having an acquisition of 8088 computers operating under DOS. (Figure 7.9).

7.3.3.3 Provision of software

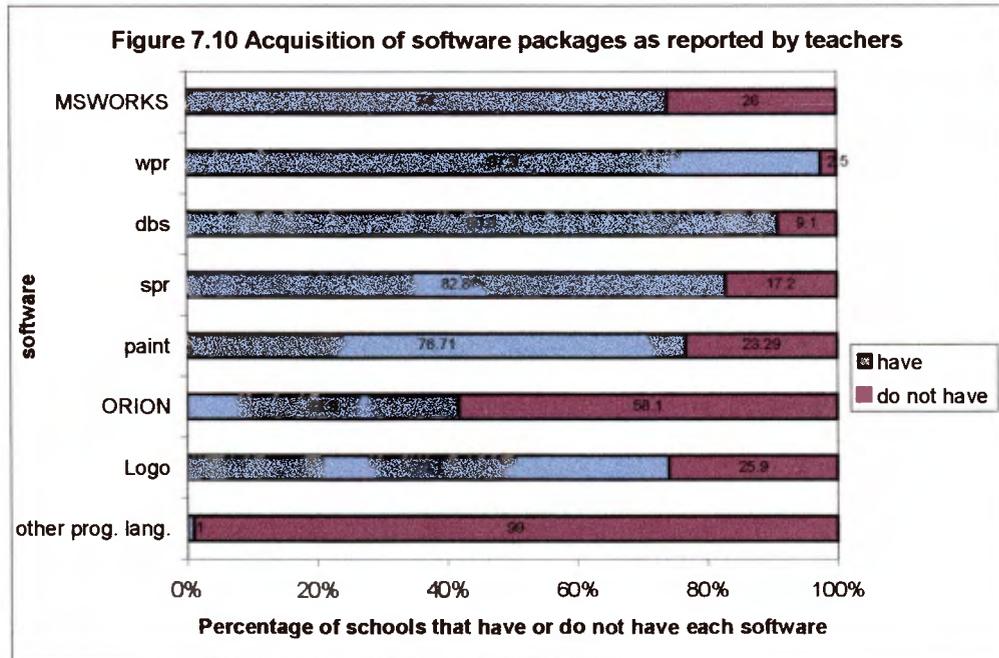
Ministry of Education in addition to computer equipment provided using-schools with software to be installed for the teaching of IT. An office automation package (Microsoft WORKS) was provided including word processor, database and spreadsheet package. Logo was distributed as a programming language. Finally educational software (ORION) for teaching IT was distributed to all PLINET offices for further distribution to schools.

Distributed software was in line with the IT Curriculum. It was also compatible with the new student textbooks that referred to the specific software packages. For example, the student textbook for the first grade referred to the word processor WRITE, which had been distributed into schools. In this way, although IT Curriculum did not specify software to be used in schools, Ministry of Education indirectly imposed specific software to be installed and used by teachers.

Although IT Curriculum did not mention Logo as a programming language to be used in the classroom, it was included in the student textbook, and it was indirectly imposed by

²³ This information, however, needs to be treated with caution, since the interpretation of the responders on the meaning of 'some, and many' could vary between one respondee and another. The issue is discussed in detail in chapter nine, section three.

distributing Logo to all schools. According to the teacher-questionnaire, in the majority of



sample schools, Logo was installed (74.1% of sample schools), while hardly any schools installed additionally Pascal or Cobol. (Figure 7.10)

The majority of sample schools reported the installation of MS Works (74%) while hardly any (0.7%) reported installation of Microsoft Office. The educational program ORION has reached less than half (41.9%) of sample schools. Thus, the majority of schools had installed all applications prescribed by the National Curriculum: word processing, databases and spreadsheets. The rest of the schools reported installation of a combination of programs, such as word processing and databases (8.4%). However, only a small minority of schools reported that they did not have a word processing package (2.5%), a database (9.1%), a spreadsheet (17.2%) while nearly a quarter of schools reported lack of the drawing package "paintbrush"²⁴ (23.29%). The latter though was expected, since these schools were equipped with hardware operating under DOS (Figure 7.10).

As shown from the above, schools had installed the software prescribed in the National Curriculum and distributed by the Ministry of Education. The software each school had installed, was depended on the hardware equipment the school had. Thus, schools with new equipment had all word processing, databases and spreadsheets. Software not prescribed in the National Curriculum, such as ORION, were installed in a minority of schools.

7.3.4 Support structures developed for the implementation of IT

The Ministry of Education also provided for support networks for the expansion of the IT in general, but also for IT teachers. Support was planned at the Prefecture and at the national

²⁴ A drawing application coming with windows 3.11

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level. In each Prefecture, Heads of “Computer Science and New Information Technologies” (Plinets) were positioned. In parallel, technical support was ensured for the maintenance of computer labs and teacher in-service training was organised.

7.3.4.1 The Heads of “Computer Science and New Technologies”

The Ministry of Education established a new Office, “Office for Computer Science and New Technologies”, aiming to support the expansion of the IT in general but also to support IT teachers appointed to teach the subject (Γ2/5049/27.9.93).

In each of the Offices one or more PLINETs (more than one in large Prefectures) were positioned on a two-year contract. PLINETs would be highly qualified IT teachers conditioning their interest in the position and their application for the job. The same procedure was followed every two years (1995 and 1997).

As already mentioned, and illustrated below, the “Office for Computer Science and New Technologies”, aimed to support IT in general but also to support IT teachers. Heads of these Offices would be responsible for the following: *“helping teachers with their work, recording of hardware and software problems, local in-service training organisation, teacher training, collection of statistical data, yearly report for issues concerning expansion of IT in schools of their Region”* (Γ2/5049/27.9.93).

As shown, the definition of the role of Plinets was both general in terms of specific responsibilities, and broad in terms of the covering of possible needs. It was not specified what kind of help Plinets would offer to teachers in “their work”, in addition to hardware and software problems as well as training needs.

In addition to helping teachers, Plinets were supposed to support the expansion of the IT, collecting data for using- and non-using schools, thus, identifying needs and potential for expansion of IT within their region.

The role of Plinets was perceived differently by the Ministry of Education and by the president of the IT committee, who proposed their role and their responsibilities. As illustrated below, the Ministry of Education viewed Plinets more as those to help teachers on the implementation of the IT in schools.

“PLINETs were those who would help IT teachers in Prefectures to implement IT National Curriculum and to help with maintenance of school equipment. Often they were organising seminars related to the National Curriculum, when new IT teachers were appointed either in temporary or permanent positions. Often they were organising seminars not closely related to the National Curriculum. For example introduction to Internet or other.” (Interviewee F)

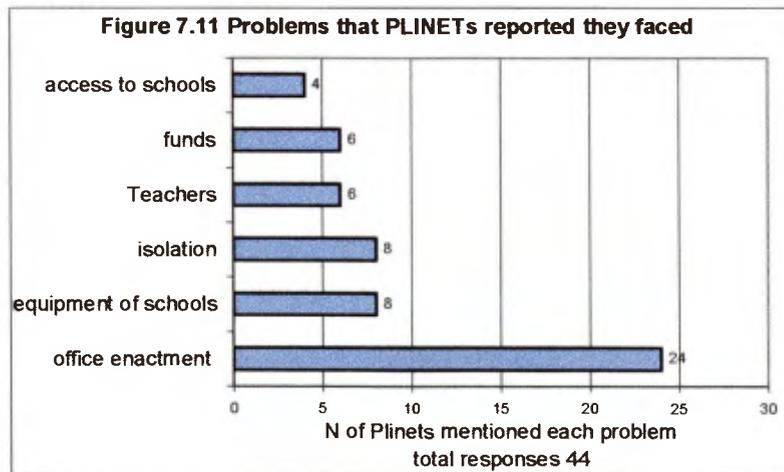
“Teachers contact him (the Plinet) and ask for guidance on educational matters mainly, and on technical issues to a point. Schools that have been equipped earlier on are supported through a contract with Intrasoft²⁵” (Interviewee G)

²⁵ Intrasoft was the provider Computer Company

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The latter viewed Plinets mainly as those who would help with the expansion and continuation of the IT, in terms of organisation in schools and expansion to more schools within the region. As illustrated in his words, since teachers were considered as “capable” to implement IT, Plinets would concentrate on expansion of IT and to the transition on the next phase related with educational software use (see also chapter six).

“First of all, people capable of teaching IT would be employed.” (Interviewee C)

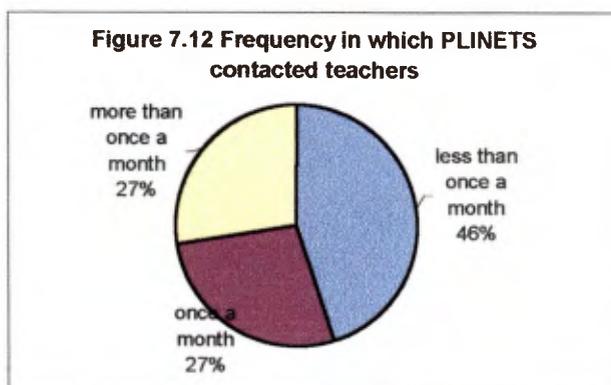


As for their positioning, it seems this presented problems. In 1997, in seven out of the fifty-seven Prefectures across Greece, no Plinet was positioned. In addition, nearly half of PLINETs (24 out of 44) mentioned that they faced problems with the enactment,

organisation and equipment of the Plinets' office, as well as confusion about their role and responsibilities (Figure 7.11). It seems that this was reliant on their motivation and persistence to equip their own office, a fact that was illustrated by the Head of department D of Secondary education in the Ministry of Education

“...they did not have equipment in their office but there was equipment within the Directorate. Those who were really interested in equipment pushed their principals, they found a computer to work on. But the main job of the Plinet was to help teachers on their work, not to do bureaucratic work.” (Interviewee F)

It has to be reiterated that Plinets were appointed to the capital of the Prefecture, and were responsible for all using-schools (Gymnasiums and Lyceums) within their Prefecture.

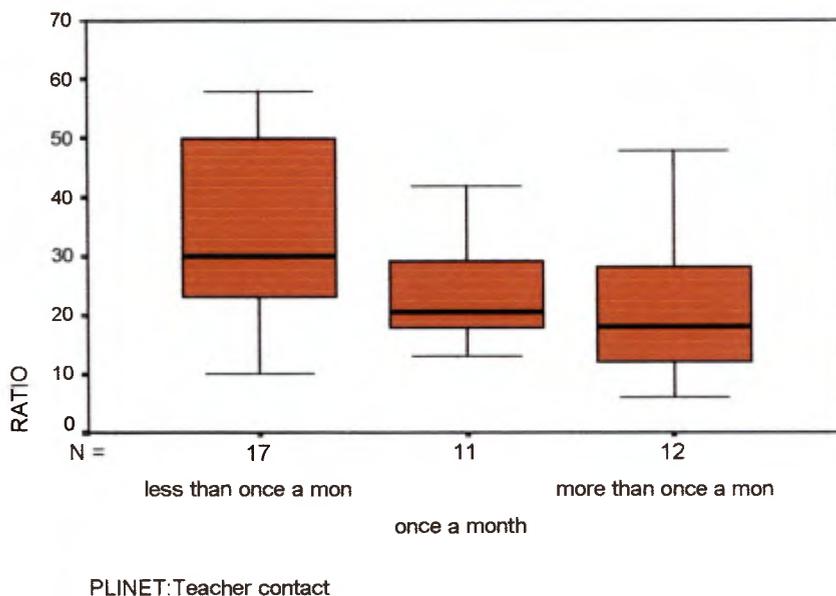


Information from Plinets-questionnaire showed that the mean for the ratio Plinet/teacher was 26,8, while the minimum was six and the maximum was fifty eight teachers under the responsibility of one Plinet.

Looking at the Plinet questionnaire, all Plinets reported that they had personal contact with teachers in their region. Nearly half of the Plinets (23 out of 51) reported that they met teachers less than once a month. A quarter of them (14 out of 51) reported that they met with them once a month or more often (Figure 7.12).

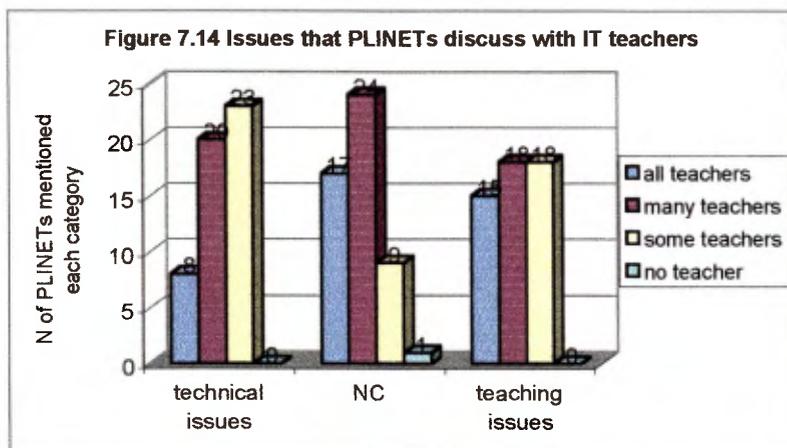
A t-test could not be employed to investigate the significance between the ratio Plinet/Teacher and frequency of visits of Plinets to Teachers, since the ratios within the groups of Plinets who visited teachers once a month, less or

Figure 7.13 PLINET:Teacher contact in relation to PLINET:Teacher ratio



more than this, were not equally distributed. However, looking at the Boxplot in figure 7.13, it seems that Plinets with fewer teachers under their responsibility visited them more often. Of course other reasons could be cited for this. For example, the distance between the position of Plinet and the school could present an additional obstacle for the Plinet to visit the school in addition or even more unrelated to the number of teachers he had under his responsibility. However, only a small minority of Plinets (4 out of 45) mentioned distance or number of schools in their region as being a problem for them (Figure 7.11).

As far as the choice of teachers they visited, it seems that there was no specific pattern, since it differed from Plinet to Plinet. Some Plinets visited specific schools while others visited more often those who faced problems, or those who were newly appointed or on

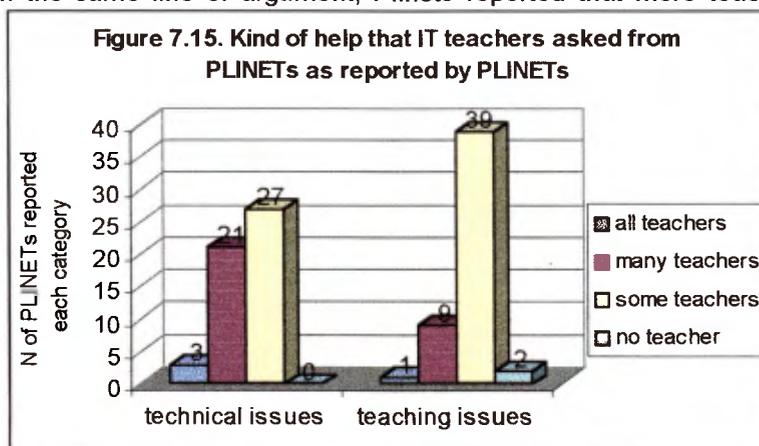


temporary contracts.

As for the kind of help they offered to teachers, Plinets mentioned that they discussed both technical and educational issues with teachers in their region, focusing more on educational issues.

Specifically, the majority of the Plinets mentioned that they had discussed the aims of IT with many or even all of the teachers in their region, while the majority of them had discussed issues of teaching IT with less teachers. In parallel, the majority of Plinets mentioned that they had discussed technical issues with some or many of the teachers in their region (Figure 7.14).

In the same line of argument, Plinets reported that more teachers asked for help on issues



related to the teaching of IT than for help on technical issues (Figure 7.15).²⁶

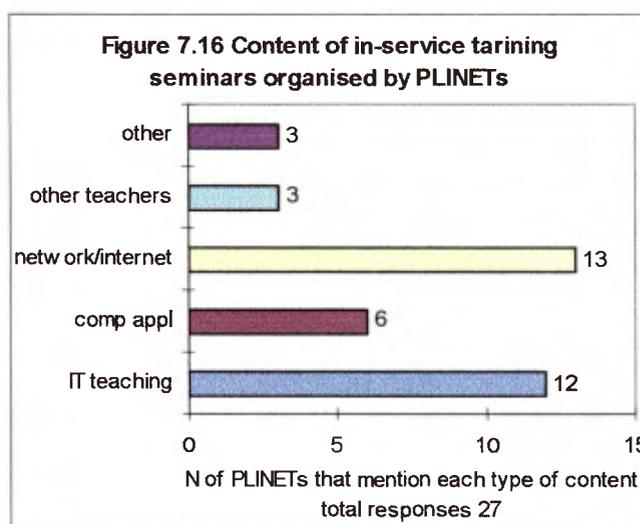
Finally, more than half of the Plinets reported that they had organised in-service training seminars for teachers, mainly on issues related mainly to teaching of IT (44,4%),

networks and internet (48,1%), as well as related to computer applications (22,2%). (Figure 7.16)

7.3.4.2 Teacher Training and Support

As for teachers' training, short introductory courses on IT were provided for all new appointed IT teachers.

In January 1994, seven hundred and ninety four IT-teachers attended a short training course (45 hours). The programme included 36 hours familiarisation with software installed in schools (Windows 3.1, Novell 2.2, MS-WORKS, ORION) and 9 hours on general information on computer science and MS-DOS.



In addition to this seminar, two more training courses were organised and took place within the same school year. As far as the first one is concerned, it was organised by the Computer Company that provided the equipment in schools. It included 125 hours of teaching sessions and it was attained by 45 IT teachers. The aim of the course was the familiarisation of IT teachers with new equipment and software installed. Finally, the organisation of another training course was assigned to National Higher Education Institute of Communication and Computers. This training course included 72 hours and was attained by 240 IT teachers.

It has to be mentioned that all the above courses were attained by IT teachers from all over Greece (all covered expenses) (MNER, Γ2/1650/24.3.1994). Moreover, other short

²⁶ This information, however, needs to be treated with caution, since the interpretation of the responders on the meaning of 'some, and many' could vary between one respondee and another. The issue is discussed in detail in chapter nine, section three.

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seminars were provided for IT teachers in November and July 1994, and January 1995. On November 1994, 330 IT teachers from 13 Prefectures of Greece, were trained on issues relating to the IT Curriculum. On July 1994, 60 IT teachers from all over Greece were trained on multimedia. On January 1995, 130 IT teachers were trained on multimedia.

In parallel with the Ministry's initiatives on short training courses, IT teachers since the school year 1995-96 had the opportunity to attend in-service training courses related to IT issues. As illustrated below, long duration of the courses in early efforts presented a problem for teachers to attend, since teachers did not participate. The short courses developed later, although gained the acceptance and participation of teachers, did not manage to convince them regarding their quality.

PEKs (Regional In-service training Centres) had two different organisations. First (on 1992), they included six month training courses with specific program and compulsory. Later they included short training courses (forty hours) twice a week. The first one took teachers out of the classroom for six months, but there were a lot of problems. The latter ones were very successful in terms of teachers' participation, but failed in quality. (Interviewee F, MNER)

However, these courses were not linked with the policy of the Ministry of Education to support IT. They were separate initiatives within the framework of teachers' in-service training in general.

These courses were not directly linked with Ministry of Education policy. If none would submit a proposal for IT course, they would have not existed. (Interviewee F)

Looking at teachers' support, it seems that it was more indirectly provided than planned. It seems that indirect support related to educational issues, can be considered to be provided in the teacher textbook and the guidelines distributed by the Ministry of Education. In parallel, teachers could consult Plinets positioned in their Region.

Teachers could consult Plinets also for issues related to technical matters for problems. In case of damages in the lab that could not be fixed by teachers or Plinets, the Computer Company was responsible.

7.4 Summary

This chapter focused on the initiation of IT into schools during the third phase of the introduction of computers into Greek schools (1994-1997). During this phase, IT was considered as an established curriculum subject, and expanded into the majority of schools following decisions taken in the previous phase (1991-1993).

As shown in this chapter, the introduction of IT into gymnasiums followed the standard centralised top-down innovation policy. The Ministry, acting on the Pedagogical Institute's advice, appointed a working-group to propose a new IT curriculum, while the Ministry itself was responsible for the expansion of IT into schools, and the development of necessary structures for its implementation. IT was introduced as a new subject according to the standard

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educational structures. It was introduced as an add-on to the existing school curriculum. The overloaded school schedule, however, did not allow for adequate time to be devoted to IT. The subject was introduced as a separate curriculum subject, not related to other subjects, and thus, specialist teachers (IT teachers) were appointed to teach it.

Looking at the genesis of IT, as revealed in the interviews, the members of the working group for the IT curriculum perceived its objectives differently, reflecting different agendas and priority systems. The Ministry promoted the Social and Vocational rationales, reflecting its priorities to educate all Greek students, as well as to modernise the country. The representative of the Pedagogical Institute promoted the Social and Educational rationales, reflecting the Institute's role to advise on a national project but also to improve educational practice. The university scholar promoted the Educational rationale reflecting his priority for new educational practices.

Turning to the way these objectives were reflected in the policy documents, contradictions were shown in different parts of the policy documents on the objectives of IT that resulted in the distortion of the initial objectives. Contradictions were shown in different parts of the Proposal on the objectives of IT. In the first part of the Proposal, the Educational rationale was proposed as the main aim of IT. Students were familiarised with computer applications in order to use computers in school activities. In the second part, however, in the effort to break the subject of IT down into every day teaching units its objectives had been distorted, thus promoting a Social or even a Vocational rationale. Project work that represented a teaching approach to IT in the first part, ended up representing a separate unit and was separated from the computer applications in the second part. Additionally, a shaping of objectives was shown in the transition from the draft Proposal, to the published IT curriculum. This distortion of objectives was more apparent in the published IT Curriculum, since nearly all of the first part of the IT proposal that presented the main philosophy of the subject was excluded. Contradictions were shown in the student textbook, as well as in the teacher's book. Although the Social and Educational rationales were proposed by the writers as the main aims of IT in the introductory sections, as the books proceeded, their organisation and structure, as well as the way activities were presented did not encourage the Educational rationale, but the Computer Competence objective. In an effort to achieve correspondence with the IT Curriculum teaching Units, the objectives were distorted.

Turning to the structures set up for the implementation of IT, the Ministry provided all necessary resources for the implementation of the specific published IT curriculum, encouraging the centralisation of the educational system.

The Ministry provided the large majority of using-schools with hardware. Only a small minority of schools was equipped through local funding and they had to follow the Ministry's specifications on hardware. The Ministry of Education also provided the software prescribed in the IT Curriculum and the newly edited student textbooks. Thus, the Ministry controlled (intentionally or unintentionally) the software to be used in schools. The majority of teachers reported all the software packages prescribed by the IT curriculum had been installed. Student

*Chapter 7, From Policy to Implementation: The Introduction of IT into
gymnasiums in 1995*

textbooks and teacher books were also edited, authorised and distributed by the Ministry of Education, mirroring the published IT curriculum. Finally, the Ministry of Education provided short training courses for IT teachers across Greece, mainly focusing on the software installed in the labs and on the IT Curriculum.

Due to the centralised system however, the provision of resources and support was problematic. The Ministry of Education was responsible to equip all using-schools, which proved to be a difficult task considering the cost but also the fast evolution of technology. In 1997, one quarter of the schools either had no lab or they used old equipment (8086 PCs). Moreover, since only one computer lab per school could be established with the available funds, students were not always in the lab, but they were rotating between the classroom and the lab, split into two groups. As for technical support, a five-year contract with the Provider Company was signed, covering all possible damages caused in the computer labs. Additionally, the editing of books was a time-consuming process. Student textbooks for all grades were not distributed until 1998, that is, three years after the publication of the IT Curriculum. As for the teacher's books, only the first grade book was distributed, while guidelines were sent for the second and third grades.

The role of the PLINETs in this support structure was not clear. The PLINETs reported problems with the enactment of their position and confusion about their role. That was because the position of PLINETs was established in the previous phase (1991-93) with a different role in mind. According to the president of the IT committee at that time, their role was to support the expansion of computer use in general (IT and ITE). Since ITE was separated from IT at the current phase (1994-97), and new support structures were set up to support ITE, the PLINETs' role was limited to the support of IT. That is why the Ministry regarded the PLINETs as the ones whose responsibility it was to support teachers. At the same time, the PLINETs seem to have taken up this role, since they reported personal contact with the teachers in their effort to help them on both technical and educational issues. Additionally, more than half of them reported that they had organised in-service training seminars for teachers in their region.

After discussing the initiation of IT at the policy level, the discussion in the next chapter shifts to the implementation of IT at the school level.

Chapter 8

The Implemented IT Curriculum: The Perceptions of the IT Teachers

In the previous chapter, I discussed the way that the policy makers perceived the objectives of the IT subject and I presented the infrastructure that was developed under the authority of the Ministry of Education to support its implementation. As argued in chapters two and three, teachers shape an innovation in their classroom, according to the meaning of the innovation as they perceive it and the implementation context of the innovation. In this chapter, therefore, I explore the way in which IT teachers in Greece perceived the subject of IT, and how it was taught in their schools.

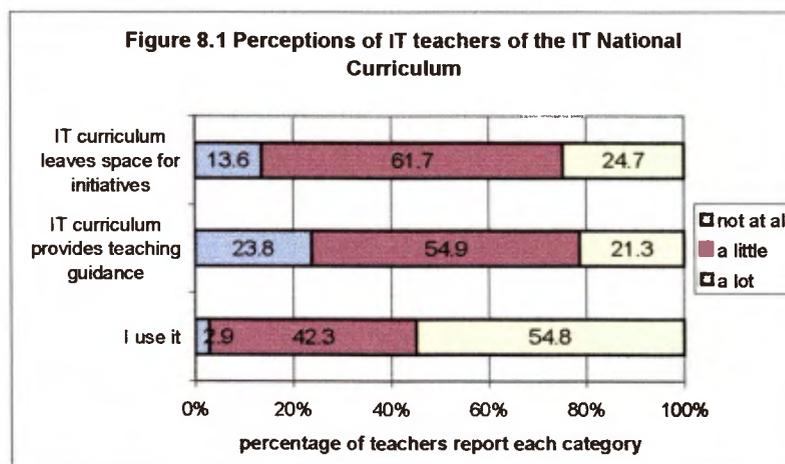
The first section of the chapter presents the implementation of the subject of IT as reported by a sample of IT teachers. The second section presents the way IT teachers perceived the objectives of IT and the way their perceptions were reflected in their initiatives. The next section presents the context of implementation of IT, the problems that teachers reported they faced in their practice and the support structures developed. Finally, the chapter presents the ways that the IT teachers suggested that IT should be organised and taught.

This chapter is based on data collected from the questionnaires collected from 591 IT teachers and the interviews conducted with a sample of seventeen of them.

8.1 The implementation of the IT Curriculum as reported by the IT Teachers

Within the highly centralised Greek educational system (Chapter Four) IT teachers, as other

teachers in Greece, are provided with an IT Curriculum that defines the teaching units to be taught. In parallel, all Greek students are provided with one authorised student textbook that contains information on the topics specified in the



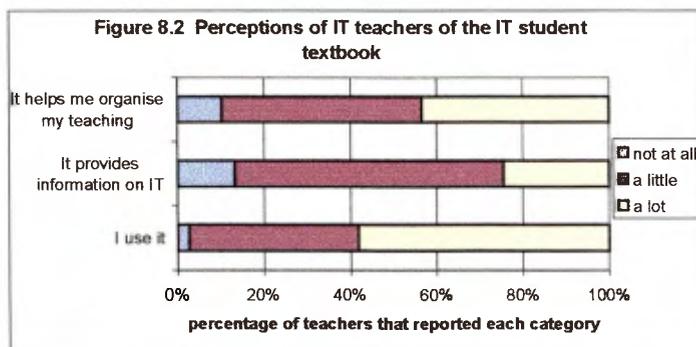
Chapter 8, *The Implemented IT Curriculum: The Perceptions of the IT teachers*

IT Curriculum (Chapter Seven).

Data from the questionnaires and interviews showed that IT teachers tried to cover the IT Curriculum, while at the same time they organised their teaching by the student textbook or by the IT Curriculum. Referring to questionnaire results (TQ, q 24,25)¹ the majority of the IT teachers reported that they used the IT Curriculum and found it useful on issues related to

teaching at least at some level.

(Figure 8.1). Additionally, they viewed the student textbook as the mirror of the IT Curriculum, and they used it to organise their teaching (TQ q 27,29). Specifically, nearly all teachers reported that their students used the student textbook, while the



majority of them reported that they found the student textbook useful to organise their teaching (Figure 8.2).

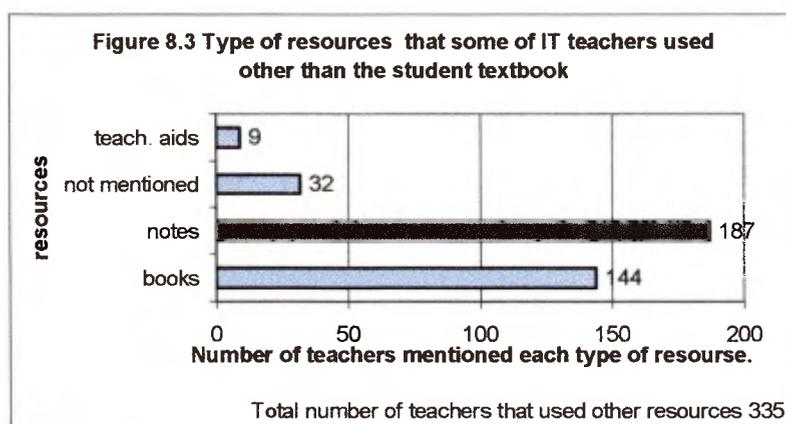
Interview data supported the above evidence.

«...we work based on the student textbooks... first aim for me is to cover the IT Curriculum...» (Teacher 1)

To illustrate the power of the textbook, although four of the schools where interviews were conducted had been provided with Pentium PCs, three of them had in fact installed Windows 3.11 and not Windows 95, since this version was supported and explained in the student textbook.

«This is what we are obliged to teach, we are obliged to follow the IT Curriculum, because there is the student textbook the students have the opportunity to read...» (Teacher 1)

As revealed, however, from the questionnaire data (TQ, q12), sixty per cent of the teachers used in their teaching extra materials (such as old computer parts), notes and additional books for their

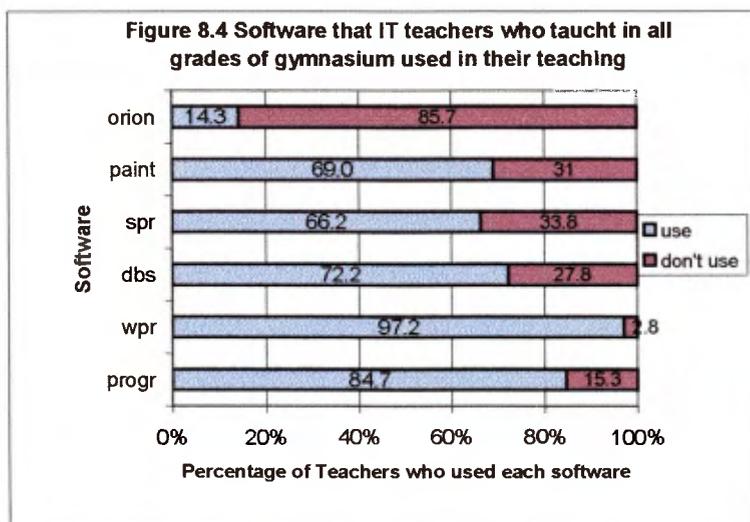


¹ The symbol stands for Teacher Questionnaire (TQ), questions 24,25,26

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students (figure 8.3). It has to be noted that in the year the questionnaire was distributed to the schools, there was no book for the third grade of gymnasiums, and thus teachers had to distribute their own notes. This is illustrated in the interview data.

«... when there were no books we were forced to edit and print notes...»(Teacher 1)



Going further, (TQ, q 20) the majority of the teachers used the software prescribed by the IT Curriculum: a programming language; a word processor; a database; a spreadsheet; a drawing package. A small minority (14.3%) of the teachers reported that they also used ORION, an educational

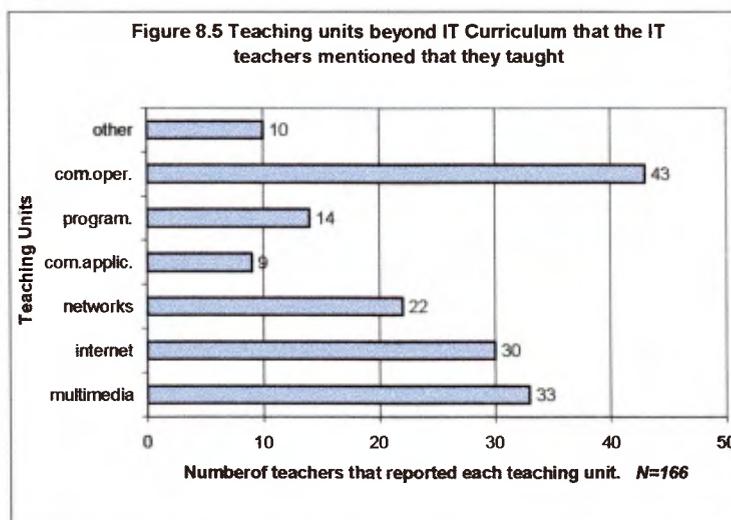
software for teaching IT provided by the Ministry of Education which was not prescribed in the IT Curriculum (see Figure 8.4).

Thus, as it was shown, IT teachers' priority was to cover the IT curriculum, and used the distributed hardware, software and books. At the same time, the majority of them reported (TQ q26) that the IT Curriculum allowed at least some space for initiative to the IT teachers (figure 8.1). It seems that some of the IT teachers exploited this flexibility, since one third of them mentioned that they taught topics other than those prescribed in the IT Curriculum (TQ, q 17).

In an effort to indicate whether teachers' background influenced teachers' initiatives on IT, the teachers' personal information was tested against the way teachers implemented IT. Specifically, chi square or T tests -according to the variables used each time- were employed, relating teachers' age, gender, contract of the teacher with the school, experience in teaching IT and total teaching experience, with whether they taught teaching units beyond the National Curriculum. No statistical differences were found between teachers with different age, gender, contract with the school, teaching experience in the IT subject and total teaching experience, on the above issue. Statistical differences, however, were found between teachers who held an IT degree and those who did not, in terms of their response to the teaching of units beyond the IT Curriculum. IT teachers who held an IT degree were more inclined to cover teaching units which varied from those prescribed in the IT curriculum (Appendix 8.1). Statistical differences were also found between teachers who worked in old computer labs and those who worked in new labs, in terms of their response to the teaching of units beyond IT Curriculum. IT teachers who worked in old computer labs (8086 PCs) were less inclined to cover teaching units other than prescribed in the IT curriculum (Appendix 8.2). It can be assumed that IT teachers who held an

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IT degree were more confident to deviate from the IT curriculum and might had stronger beliefs about their subject. Additionally, teachers who worked in old computer labs could not do much



with the provided equipment.

Looking at what topics IT teachers reported that they taught beyond the IT curriculum, these were related to basic concepts of computers' internal operation, networks, Internet, and multimedia (figure 8.5). The above-mentioned units, however, were included in the IT Curriculum. Thus, it was

assumed that IT teachers emphasised the above units, providing more information on these specific topics. In parallel, although teachers mentioned that they taught multimedia, none of them mentioned that he/she used multimedia software. This suggests that teachers taught about multimedia on the blackboard within theoretical sessions, rather than using multimedia within other school activities or their own teaching.

Interview data supported the above evidence, since teachers interviewed reported that they tried to follow the IT Curriculum and emphasised the priority to cover it. In parallel, they felt free to teach topics additional to the IT Curriculum, emphasising a specific topic.

«I begin from the IT Curriculum for each grade. Based on this, I decide if I want to teach something more and if I have the time to do it and I distribute it ...» (Teacher 2)

«They (the Ministry of Education) want me to cover 100 things. I will cover all of them. But I emphasise the five basic things I judge they (the students) need to learn to proceed to the next grade and that they have to know...» (Teacher 5)

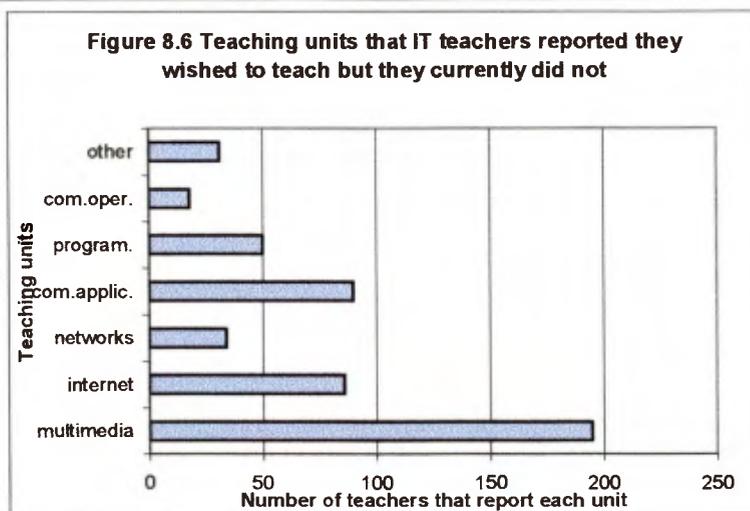
More than half of the teachers emphasised familiarisation of students with the proposed computer applications.

«..on the first grade I emphasise windows... on the second grade I emphasise spreadsheets,... in the third grade the database and the potential of internet without log in...» (Teacher1)

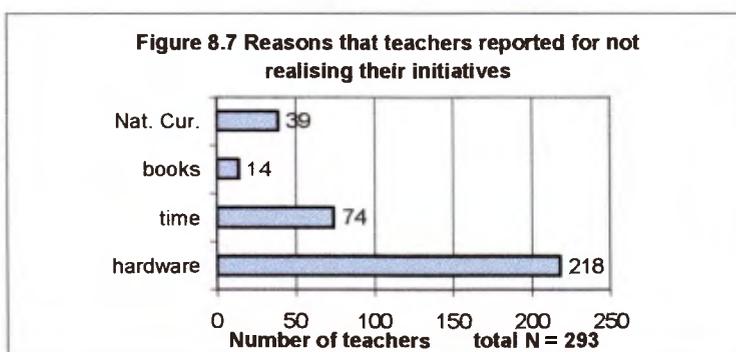
A minority of them had the opportunity to have access to the Internet, so these teachers demonstrated the navigation process to their students. This was expected though, since only the server had access to the Internet. Some of them also used CD-ROMs as teaching aids in their teaching to familiarise their students with the evolution of technology and usefulness.

«I move on based on the student textbook... on the database I brought them the NTC (National Telecommunication Company) CDROM... I brought them a National Health Service card... I mentioned some additional aspects on multimedia, about analogue and digital... I emphasise the computer applications since it is the most possible to use later» (Teacher 14)

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operation (Figure 8.6). The main reason that the teachers gave for not teaching these units was



lack of resources. A minority of the teachers reported lack of time. Only a small minority of teachers mentioned constraints by the IT Curriculum and lack of books (Figure 8.7).

Interview data also showed that more than half of

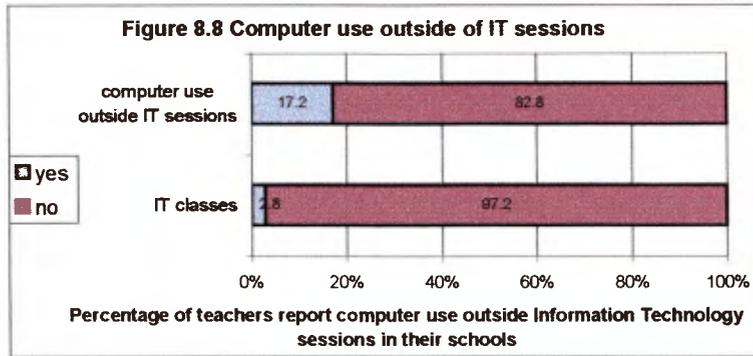
the teachers (10 out of 16) wished to teach a teaching unit or do an activity not included in the IT Curriculum. Specifically, nearly one third of the teachers (5 out of 16) reported that they wished to use the Internet service with their students, and one third of them (5 out of 16) wished to offer more opportunities to students to do project work and familiarisation with computer applications. As they reported, the reason that they did not proceed with these activities was lack of technical infrastructure (hardware, software, connection to Internet) and lack of time.

“... Internet, we may be connected, a network ... there are many things you want to do, but there are firstly financial problems, ...I would like to have a scanner, for students to bring photos and process them...” (Teacher 5)

Additionally, interview data, showed that in a minority of schools, computers were used within activities not prescribed by the IT Curriculum. Specifically, in one of the sample schools, students went through units and activities not included in the IT Curriculum (email, Internet) and in two of the sample schools they used computers within other curriculum subjects. All of the above activities took place outside IT sessions. In the first school students worked as a special group after school hours. In the second school students used computers to work on their mathematics, history, English and technology classes, again in the school breaks or after school hours, with their IT teacher present. In the third school, the computer was used related to

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environmental studies, which took place after school hours to work on a special environmental



project in which the school participated. These data suggests that initiatives such as the above were not considered by the teachers to be a part of IT. It seems that this was the reason why these activities were not reported in the

questionnaires, as initiatives within the framework of IT. They were revealed though indirectly, since a minority of teachers reported in the questionnaires (TQ, q 9,22) that computers were used outside teaching sessions by their students, while a small minority reported that their school organised IT classes after school hours (Figure 8.8).

Additionally, nearly half of the teachers (7 out of 16) reported that they wished to use computers within other subjects, such as environmental studies, a fact that again was not revealed from the questionnaire data. As mentioned before, teachers did not view these activities as being part of teaching IT, and this might be the reason that they did not mention them in the questionnaires. However, looking at the reason why the teachers reported that they did not implement their initiatives, again lack of time in combination with lack of resources were mentioned. At the same time, as IT teachers reported, teachers of other subjects were not interested.

“I would like to relate it (spreadsheet) to science for example, I didn’t have the chance to get them (the students) in the lab, to measure, to use spreadsheets, ... it is a matter of time, ... I came in the middle of the school year, ... I didn’t have the time to do any more. I just tried to cover the IT Curriculum” (Teacher 2)

As presented above, the majority of IT teachers used the distributed by the Ministry hardware, software and books and their priority was to cover IT Curriculum. In parallel, one third of them extended IT curriculum along an IT track by elaborating on the teaching units describing computers’ internal operation and latest evolution of technology. It was indicated that IT teachers who held an IT degree and IT teachers who worked in new computer labs were more inclined to teach teaching units beyond the IT curriculum. Additionally, more than half of IT teachers reported that there were teaching units or activities that they wished they taught, but they mainly did not achieve this because of lack of time and resources. Interview data revealed an interest of IT teachers to extend the use of computers along the ITE track, by using computers within other curriculum subjects. A small minority implemented these initiatives outside though IT sessions. Those who did not implement the above initiatives reported that they had no time (meaning inside IT teaching sessions) or co-operation from their colleagues.

8.2 The IT curriculum as perceived by the IT teachers

As shown from the questionnaires, the majority of IT teachers believed that IT mainly promoted Computer Awareness and Computer Competence objectives. Teachers were asked in an open question on the questionnaire to write what they believed to be the two important aims of the IT Curriculum. Their answers were coded according to the categories of objectives defined in chapter three. Answers relating to familiarisation with computers, social awareness about computers and consensus about their impact on society were coded as related to the Computer Awareness objective; answers related to the use of computer applications and their exploitation in other activities were coded under the Computer Competence objective; answers related to programming or learning of technical issues of technology were coded under the Computer Science objective. Since the question was open, some teachers answered more generally, referring not to specific objectives to be realised, but to rationales in general. For example, when teachers referred to the educational potential of computers their answers did not always specify pedagogic or catalytic objectives. Thus, teachers' answers relating to the educational potential of computers were coded under the Educational rationale in general. Similarly, a very small number of teachers referred to the Vocational rationale in general without

specifying whether this was to be realised through Computer Science or Computer Competence objectives².

Looking at teachers' answers, it seems that the majority of teachers proposed either Computer Awareness objective alone, or Computer Awareness together with another objective. Specifically, nearly half of them (41,2%) put forward only the Computer Awareness objective as the most important objective of the IT subject. A quarter of them (26,2%) proposed Computer Awareness and Computer Competence objectives, another small minority (7,9%) proposed Computer Awareness objective and Educational rationale, and another small minority proposed Computer Awareness and Computer

Table 8.1 Objectives and rationales reflected in IT teachers' answers on TQ,10

Objectives/ Rationales	N of teachers	Pct of teachers
CA	167	41.2
CA-CC	106	26.2
CA-ED	32	7.9
CA-CSc	24	5.9
CC-ED	15	3.7
CC	14	3.5
CSc-CC	13	3.2
CA-CSc-CC	10	2.5
CA-VOC	7	1.7
ED	5	1.2
CSc	4	1
CA-CC-VOC	3	0.7
CC-ED-VOC	3	0.7
VOC	1	0.2
CA-CC-ED	1	0.2
Total responses	405	

CA = Computer Awareness
 CC = Computer Competence
 CSc = Computer Science
 ED = Educational
 VOC = Vocational

² Details on the coding of the answers of the IT teachers are presented in the appendix 8.3.

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Science objectives. The rest of the teachers proposed a combination of objectives, such as

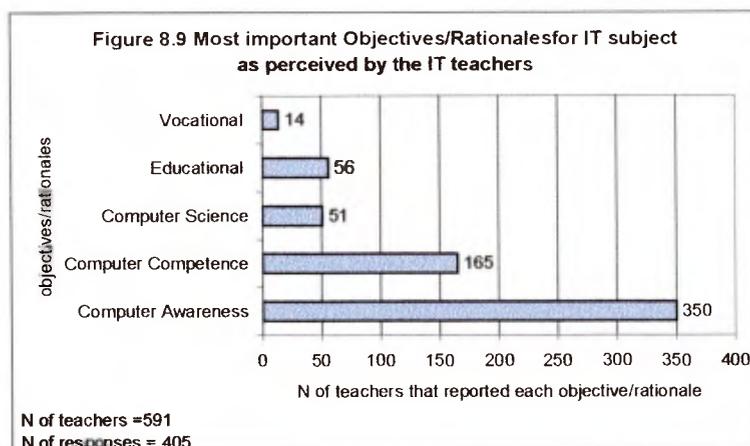
Computer Competence objective and Educational rationale (Table 8.1).

Considering that students had their first contact with computers at the gymnasium, it was expected for teachers to focus first on familiarisation of students with computers and then to

another objective, such as Computer Competence.

Looking at the frequency that objectives were proposed by the IT teachers, it is shown that the Computer Awareness and Computer Competence objectives dominated in their answers. Specifically, the Computer Awareness objective was proposed by the majority of teachers (86,4%), as one of the two important aims of the IT subject, while the Computer Competence objective was proposed by less than half of teachers (40,74%). A minority of teachers (12,5%) proposed the Computer Science objective. Educational rationale was proposed to be one of the most important aims by a minority of teachers (13,8%), while Vocational rationale was proposed by a very small minority of them. (Figure 8.9). Thus, social rationale can be traced in teachers' answers, since the main aim of the IT as it seemed to be perceived by the IT teachers was to familiarise students with computers and computer applications. This emphasis on the Social rationale can be seen in their initiatives in the teaching of IT. As presented before (section 8.1), most of the teachers emphasised computer applications and those who mentioned that they taught something beyond the official IT Curriculum reported that they taught subjects related to computer use (such as File Manager, DOS commands) or to technology (networks, internet, multimedia). Similarly, teachers that reported that they wished to teach a teaching unit that they did not currently teach focused on the same issues. One could discern an implicit argument for students to understand the way the computer works and be informed about the latest evolution of technology, in order to be ready to enter the information society.

The data indicated (chi square test) that there were significant differences ($p < 0.05$) between teachers who held and those who did not hold an IT degree and the promotion of the Computer Science objective as one of the main aims of the IT subject (Appendix 8.4). Teachers who did not hold an IT degree tended more to propose the Computer Science objective. It may be that these teachers who held an IT degree had a deeper knowledge and a wider view of Information Technology and its potential, and so they did not focus that much on programming. Significant differences were not found between teachers who held and those who did not hold an IT degree and the proposal of the other objectives as one of the main aims of the IT subject.



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No significant differences were found between teachers with respect to their sex on the above issue.

Looking at the way in which teachers perceived the objectives of each unit, it was shown that IT teachers aimed to realise the Social Rationale through familiarisation of students with computers and their applications. All teachers proposed the Computer Awareness objective as the main aim of the theoretical part (Communication with the computer) since they believed that the main aim of the unit was to familiarise students with basic knowledge about computers and their operation.

“you teach them (the students) the very basic things, just for them to understand what IT is and nothing more”(Teacher 6)

They all identified the Computer Competence objective as the objective of the second teaching unit, Basic Computer Applications, since they all believed that the aim of the unit was for students to learn to use the main computer applications. Most of the teachers' responses reflected a Social rationale, since they argued that the students needed not only to be familiarised with the specific computer software but to understand the use of computer applications in real life.

“what I am trying show them (the students) is something that relates to real life... (Teacher 7)

“they (computer applications) are important in modern times, since handwriting tends to be used less and less, it is necessary, it is a great help...” (Teacher 8)

“My aim when teaching computer applications is for them (the students) to learn what tools the computer makes available in order to do everyday intellectual work” (Teacher 10)

Only one of them proposed a Vocational rationale, since he believed that learning about or familiarity with computer applications would help students on entry to the future marketplace.

As for the third teaching unit, (Investigations with symbolic expression under programming environment), teachers' answers varied. Eight of the teachers (total 16) proposed only the Computer Science objective reporting that the aim of the unit was for students to become familiar with programming, learning basic commands and understanding what programming was about.

“For them to be introduced to the logic of programming, to design a small program...because Logo appears in a very nice form, I believe it motivates children to get involved.. ” (Teacher 8)

Three of them proposed only the Catalytic objective, reporting that the aim was to cultivate students' thinking or problem solving skills.

“my aim getting through Logo is problem solving and exploration” (Teacher 10)

Three of them proposed both Computer Science and the Catalytic objectives, reporting that the aim of the unit was on the one hand to familiarise students with programming and in parallel, to cultivate thinking or problem solving skills.

“Both to learn programming logic and to think logically, it cultivates logic I think...” (Teacher 2)

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Two of the teachers proposed the Pedagogical objective in addition to the Computer Science objective, talking also about understanding of mathematical concepts in addition to familiarisation with programming.

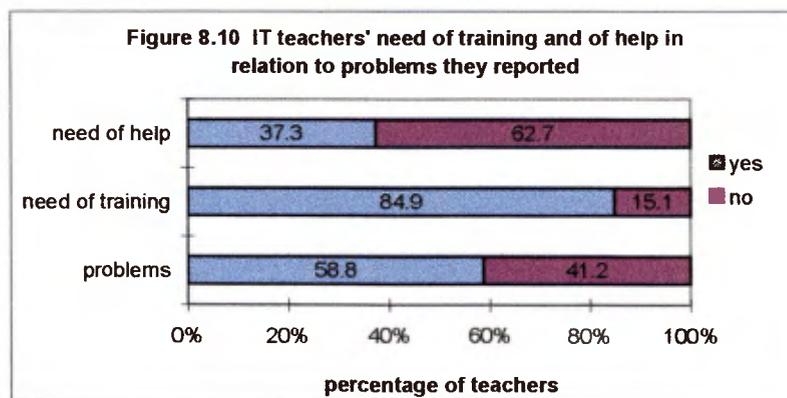
“To help them (the students) to understand mathematical concepts and some things –if we have the time- to understand programming...” (Teacher 12)

As showed by the interviews, IT teachers aimed to realise the Computer Awareness and the Computer Competence objectives (teaching units one and two) through the familiarisation of students with computers and their applications. It is indicated that IT teachers' perceptions about the objectives of IT were in congruency with those promoted in the IT curriculum and in the student textbook (Chapter Seven). As for the teaching unit three (Investigations with Symbolic expression through programming environment), IT teachers perceived its aims differently, since Computer Science, Pedagogic or Catalytic objectives were traced in teachers' views. It is indicated that contradictions found in the IT curriculum itself about the objectives of the third teaching unit (Chapter Seven) left space for interpretations on behalf of the IT teachers, who perceived differently the objective of this unit.

8.3 The context of implementation of IT

8.3.1 The problems reported by the IT teachers

Referring to questionnaire results (TQ, q11)³, teachers in general did not seem to face many problems in their teaching, since nearly half of them mentioned no problems at all (Figure 8.10). Looking at the problems that the rest of the teachers mentioned, problems relating to technical issues seemed to dominate within their answers (Figure 8.11). Teachers did not specify what



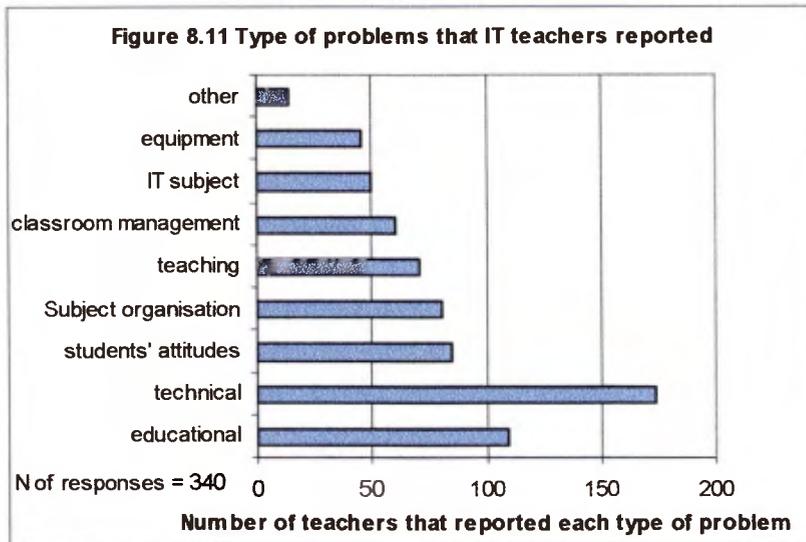
kind of technical problems they faced. Looking though at what they mentioned as their worst experience in the classroom⁴, one can see that 41 per cent of the teachers mentioned problems related to lack of equipment, while only

12 per cent mentioned problems related to technical problems in the classroom.

³ Details on coding of the answers of the IT teachers are presented in the Appendix 8.5.

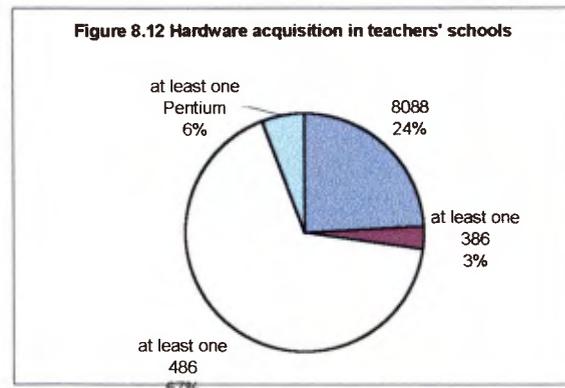
⁴ Question number 42 was a low response question (52 per cent missing answers). However, this could be explained by the fact that open ended questions in general were not answered by teachers since they require more time to be filled in. Details on the coding of the question are cited in the appendix 8.6.

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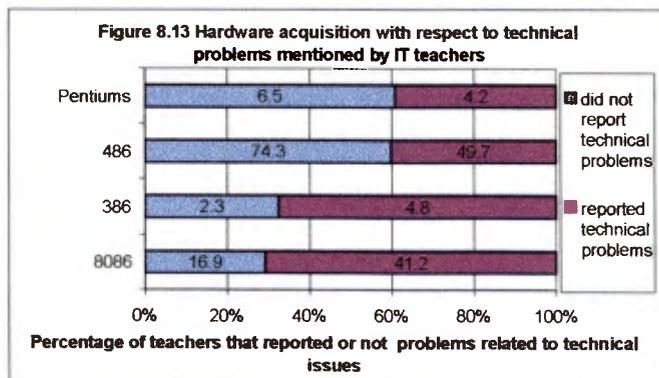


This could be considered to be an indication that teachers in general referred more to lack of equipment than to everyday technical problems in the classroom. The questionnaire data (TQ, q5) revealed that one third of teachers worked in computer labs equipped with 8086

computers operating under DOS (Figure 8.12). It is also indicated from data (Chi square test, $p < 0,005$, appendix 8.7) that there were significant differences between the teachers who mentioned problems relating with technical issues and those who did not, according to the equipment they had in school (8086, 386, 486, Pentiums). It seems that teachers who mentioned problems related to technical issues more frequently had old equipment in their school (Figure 8.13).



A minority of teachers mentioned other problems than those relating to technical issues as follows: a minority of them mentioned problems related to students' attitudes (15 per cent of total teachers); a small minority of teachers mentioned problems related to subject organisation (lack of time, lack of/bad quality of books) (14 per cent); a small minority to teaching (12 per cent of total teachers); a small minority to classroom management (10 per cent of total teachers); and a small



minority to issues related to the Computer Science (9 per cent). One fifth of the teachers (19 per cent) reported problems relating to educational issues in general, that is either to teaching or to classroom management (Figure 8.11).

minority to issues related to the Computer Science (9 per cent). One fifth of the teachers (19 per cent) reported problems relating to educational issues in general, that is either to teaching or to classroom management (Figure 8.11).

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Interview data revealed further that teachers mainly faced problems due to lack of resources and limited teaching time across the school year for the IT subject. Specifically, ten out of the sixteen teachers mentioned lack of resources. Two of them that worked in computer labs equipped with 8086 PCs mentioned that they felt limited in their practice and initiatives. One can see that working with 8086 can be difficult in relation to realising the aims of the IT Curriculum. For example, as teachers reported, they followed a different IT Curriculum that referred to DOS, Logo and Dbase but not on Spreadsheets. Additionally, working in DOS created a negative climate among students, not only because they could not work on the “new” computer applications, but also they could not do any other schoolwork. As illustrated by the teacher:

“We had both old and new books. Students kept asking if they would change books. I was telling them that “you are going to change books in your bookcase, but we can not use them here”... they wanted to print a newspaper and they couldn’t and they kept asking me all the time.” (Teacher 4)

Three of them reported that they needed better equipment (other than 386 PCs) or more resources such as CD-ROMs, while the other five reported problems related to delay response to damages of hardware⁵.

“technical problems... definitely... considering the form of the computer lab and the way the provision was done through a central company in Athens, many problems. When a computer is damaged, we have to do without the machine for a long time.” (Teacher 9)

Another problem revealed from the interviews, was the limited teaching time for the IT subject across the year. As mentioned before (chapter seven), the subject was taught once a week and as reported by nine (out of 16) teachers, the time provided was not enough in relation to the teaching units teachers must cover, especially in the third grade.

“I have a problem with the teaching units I need to cover. You cannot make it. By the time that the school year starts I sit and count how many holidays fall on my teaching days.” (Teacher 5)

“...if you lose five sessions a year... that’s it. Once I had five Thursdays that I hadn’t taught” (Teacher 13)

This fact was also evident in the questionnaire data, although it was not emphasised as much as in the interview data. This can be explained by the fact that the limited time provided by the Pedagogical Institute was not included as a given option in the respective question (TQ, q11) on the teacher- questionnaire. Teachers that reported problems relating to limited time included it into the open-ended option that was provided.

Finally, two of the interviewed teachers in the Cyclades islands reported problems related to isolation, two of the teachers mentioned problem of teaching mixed abilities groups in terms of different level of knowledge of students in the same classroom, and one teacher mentioned negative students’ attitudes.

⁵ This is discussed in more detail on the issue of technical support.

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"When I came here I felt isolated far from Athens. ... you can not find the books you want, only through Internet you can find some information" (Teacher 4)

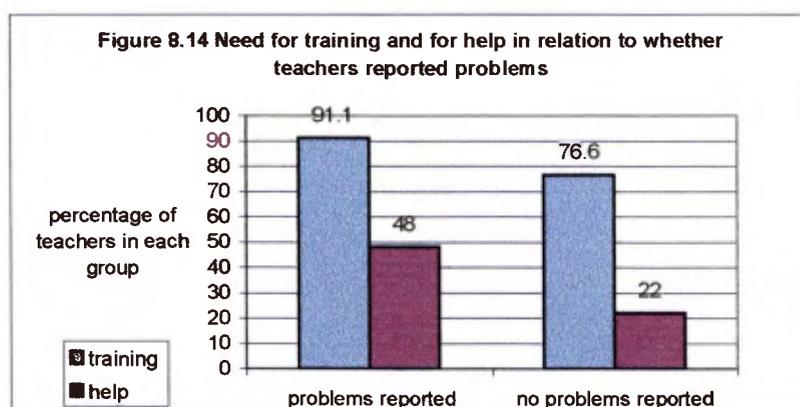
"In the same classroom you may find children who have knowledge on Information Technology, therefore, they have different interests, they want to do something else..." (Teacher 5)

"...this year students developed a negative attitude..." (Teacher 3)

Summing up, questionnaire data showed that one third of the teachers faced technical problems that referred more to lack of infrastructure than technical crashes in the classroom. Interview data revealed that teachers faced in addition to a lack of resources, a lack of time to cover the dense IT curriculum. A minority of teachers referred to problems other than technical, such as subject organisation and educational issues.

8.3.2 Support and training as perceived by the IT teachers

Referring to the questionnaire data (TQ, q13), less than half of the teachers mentioned



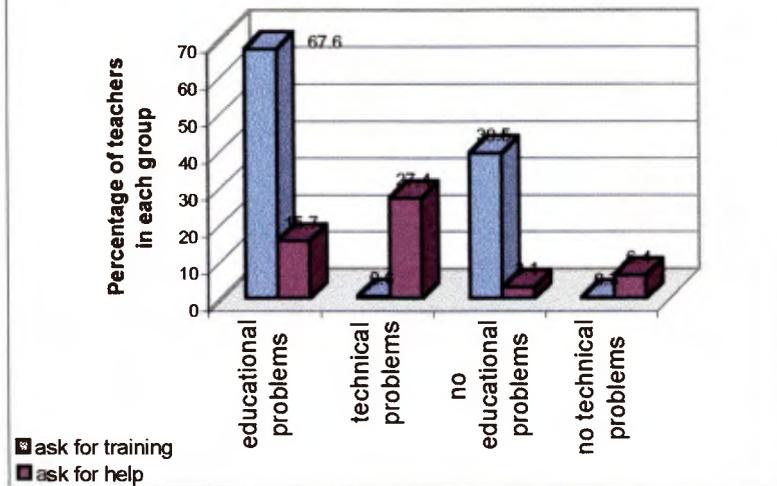
needing help. This can be explained by the low percentage of teachers who mentioned problems. The percentage of the teachers who mentioned needing help though was even lower (Figure 8.10).

Specifically, only thirteen per cent of teachers asked for technical help, six per cent asked for help on teaching issues and six per cent asked for better books and teaching aids. Data indicated (Chi square test, $p < 0,005$, Appendix 8.8) that there were significant differences between teachers who mentioned that they faced problems and those who did not, on help asked for. Teachers who mentioned that they faced problems more frequently asked for help, than teachers who did not (Figure 8.14). Specifically, teachers who mentioned that they faced problems related to educational issues (teaching or classroom organisation) more frequently asked for help on educational issues, than teachers who did not. Similarly, teachers who mentioned facing problems related to technical issues more frequently asked for help on technical issues, than teachers who did not (Figure 8.15).

Additionally, the large majority of the teachers (85 per cent) mentioned that they needed training (Figure 8.10). Nearly half of those teachers that mentioned that they needed training asked for training on educational issues, half of them on computer applications and less than half of them on Computer Science. Data indicated (Chi square test, $p < 0,005$, Appendix 8.9) that there were significant differences between teachers who mentioned that they faced problems and those who did not, on training asked for. Teachers who mentioned that they faced problems

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Figure 8.15 Teachers' need for help and for training in relation to problems they reported

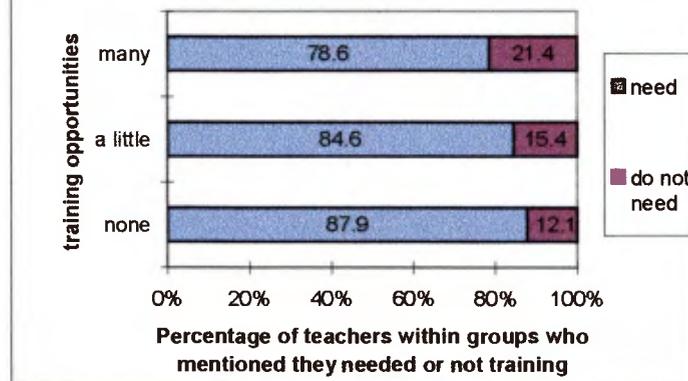


more frequently asked for training, than teachers who did not (Figure 8.14). Specifically, teachers who mentioned that they faced problems related to educational issues (teaching or classroom organisation) more frequently asked for training on educational issues, than teachers who did not.

In general, the majority of teachers reported that they needed training, while less than half reported needing help. Although teachers who faced problems more frequently asked for training, many teachers who did not face problems also asked for training. Training can however be considered a general need for a professional teacher, an effort to be informed on the latest foundations of their profession, not necessarily related to problems faced in classroom practice.

In parallel, the teachers mentioned they did not have many opportunities for in-service training (TQ, q37). Specifically, half of them (49 per cent) mentioned they had no training opportunities at all, and 46 per cent mentioned they had only some training opportunities.⁶ There were no significant differences ($p > 0,005$) between teachers who had none, some or many training opportunities and their needs for in-service training. Even the majority of teachers who mentioned having many training opportunities mentioned the need for training (Figure 8.16). Of course, having training opportunities does not mean that teachers did actually attend training, so they still reported that they need it. Moreover, as mentioned above, training, especially in the case of Information Technology that evolves continuously, is always necessary in order for the teachers to be up to date.

Figure 8.16 Teacher training needs in relation to training opportunities they had



⁶ This information, however, needs to be treated with caution, since the interpretation of the responders on the meaning of 'some, and many' could vary between one respondee and another. The issue is discussed in detail in chapter nine, section three.

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Looking at the kind of support teachers preferred, it was indicated that in relation to educational problems, teachers preferred indirect support through training, while in relation to technical problems, they preferred direct help. The majority of those teachers that mentioned facing problems related to educational issues said they needed training, while only a minority of them mentioned needing help. From those teachers who mentioned problems related to technical issues, one third of them mentioned the need for help, while scarcely any asked for training (Figure 8.15).

Interview data also showed that teachers needed training, since all of them reported they would like to attend in-service training. In parallel, another issue was also revealed. Teachers appointed in Athens reported a lack of training opportunities, while all the teachers interviewed from the Cyclades reported that they had attended a seminar organised by the PLINET. Contrary to the initial hypothesis of the thesis, teachers in isolated islands seemed to have more training opportunities and a better collaborative network with the appointed PLINET. That was unexpected because of the difficulty of communication between the islands. However, according to the teachers, the work of a PLINET could overcome the problem. Additionally, the small number of teachers in the periphery facilitated communication networks between them and with the PLINET.

"in the city , not everybody attends the in-service training. This seminar was for permanent teachers, I am a temporary one, but I attended the seminar. But of course there had to be someone who was willing to organise it. Last year I was in another Prefecture where nothing was organised." (Teacher 5)

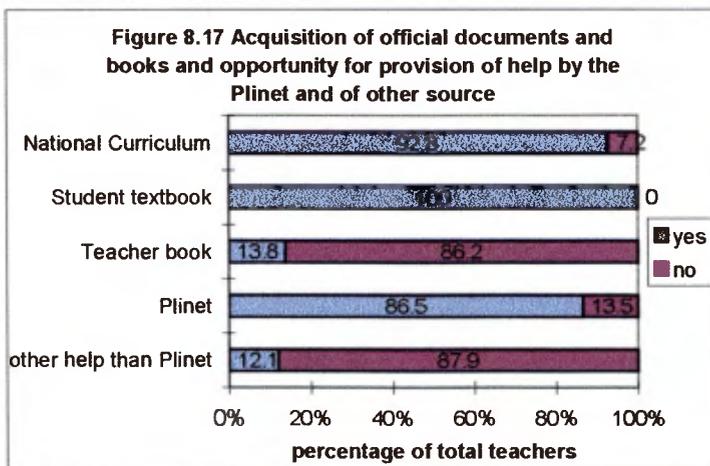
"it is something that I meet for the first time this year. The Office for the Secondary Education is very active" (Teacher 6)

By contrast, teachers in Athens reported that they had no training opportunities except the right to attend a course on the Regional Training Centres, and of course in-service training on from their own initiatives in private or in special centres. However, according to the teachers, the first was rare, since places were too limited, while the second demanded more time from them outside their teaching duties and money for the necessary fees.

"to work , you have to spend money all the time and read, I just upgraded my computer, I do not have many obligations for now, if I had... you learn by yourself, there are no training seminars, you have to be informed by yourself and pay the money, I am married, I do not have children, think if I had, on not being 32 but 42 or 52..." (Teacher 12)

Summing up, the majority of teachers asked for training, while less than half of them asked for help. Although teachers who faced problems were found more inclined to ask for training and help, many of those who did not face problems also asked for training. This can be explained by the need of IT teachers to be up to date with the field of Technology that evolves continuously. Teachers were found to prefer training on educational issues, and help on technical issues. Finally, teachers in the visited isolated islands were found having more training opportunities from their colleagues in the capital. This could be explained by the personal

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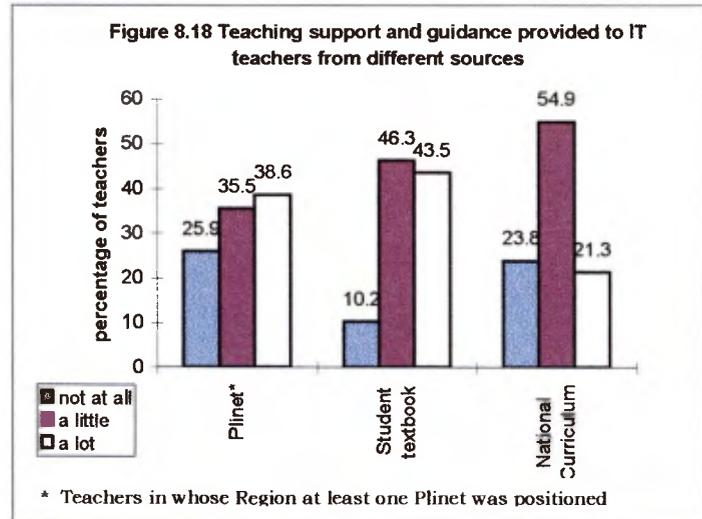


motivation of a specific PLINET. More information from other regions is needed to safely explain this issue.

After looking at the support that the IT teachers mentioned they needed, the discussion turns to the actual support they are provided with. The questionnaire data (TQ, q14), showed that the large

majority of teachers did not receive help other than that planned by the Ministry of Education. That is direct help from PLINET⁷, from the computer Provider Company, and indirect guidance from official books and texts. All teachers had the student textbook since this was distributed to all using schools, and the questionnaire data showed that, nearly all of them had the IT Curriculum (TQ, q15) and a small minority the teacher book (TQ,q16) (Figure 8.17). The level and quality of support that the teachers reported they were offered is discussed in terms of direct support (from PLINET) and indirect support and guidance (from the IT Curriculum or student textbook) provided on issues related to teaching and on technical problems.

As far as the teaching guidance and support is concerned, reliability analysis on the guidance that the IT Curriculum, the student textbook and the positioned PLINET offered to teachers failed (Alfa < 0,7, appendix 8.10)⁸. As a result, grouping these three variables in order to make a scale on teaching help received was considered inappropriate. Thus, the above information was treated separately, hypothesising that teachers used different sources for teaching guidance, or even more that they received different kinds of help from different sources.



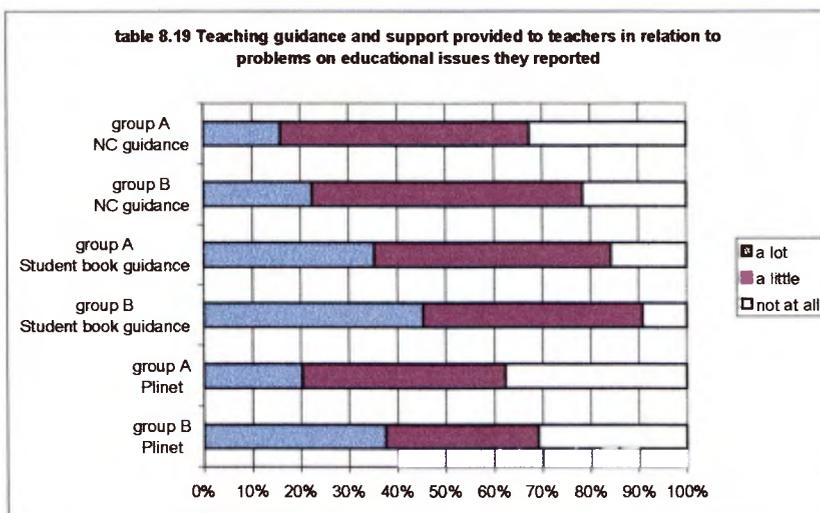
Questionnaire data (TQ,q25) showed that the teachers found the IT Curriculum of little help on teaching issues. On the other hand (TQ,q29) it seems that the student textbook was

⁷ In seven Prefectures (out of fifty-seven) no Plinet is appointed.

⁸ Reliability analysis was done selecting teachers in whose Prefectures at least one Plinet was positioned.

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considered helpful by teachers for organising teaching units of the IT subject (Figure 8.18). Turning to the help provided by PLINET, as mentioned by teachers in whose Prefecture one or



more PLINETs are positioned, it is interesting that one quarter of teachers mentioned no help at all, 36 per cent mentioned some help and 38 per cent mentioned a lot of help (Figure 8.18).

Questionnaire data indicated (Chi square

test, $p < 0,005$, appendix 8.12, 8.13 and 8.14

Group A= teachers who reported problems relating to educational issues
Group B= teachers who did not

respectively) that there were significant differences between teachers who mentioned problems related with educational issues and those who did not, on the way they rated the teaching guidance and help that the IT Curriculum, the student textbook and the PLINET provided.⁹ It seems that teachers who mentioned problems relating to educational issues tended to mention that the IT Curriculum was less useful on teaching issues. These teachers also tended to mention that the student textbook was not very useful on the organisation of their teaching and reported less help provided by the PLINET (Figure 8.19).

As revealed by the interviews, teachers did not feel they had support on educational issues and they did not seem to expect it. This could explain why only few teachers asked for help (questionnaire data).

it doesn't exist (educational support) but it is not a specific problem of the IT subject. We are used to working without educational support" (Teacher 2)

As a result, they tried alone (3 out of 16) or they co-operated with their colleagues (7 out of 16), or they tried to inform themselves by reading books and any available information from official documents (2 out of the 16).

"first, between ourselves, if we find some time available, asking friends, ... (Teacher 1)

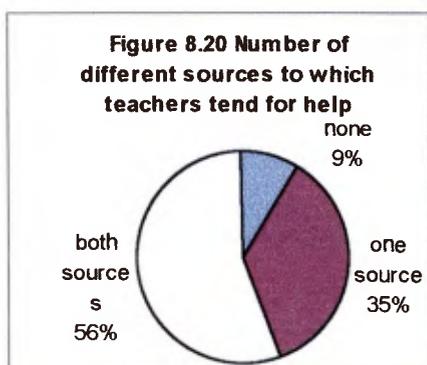
Only four out of the sixteen teachers interviewed mentioned that they received help from the PLINET. The fact that all the teachers who reported help from the PLINET were all from the

⁹ This information, however, needs to be treated with caution, since the interpretation of the responders on the meaning of 'a little, and a 'lot' could vary between one respondee and another. The issue is discussed in detail in chapter nine, section three.

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Cyclades was unexpected¹⁰. As discussed later on, it seems that this was due to the personal commitment of the PLINET who overcame the problem of isolation and difficulty of communication in that specific area.

As for the IT Curriculum, teachers felt it helped them in the sense that it gave general guidelines on what to teach. In parallel, they mentioned that the student textbook, although old and infrequently updated, it was useful for their students as a reference point and for themselves as ready-made material for their students.

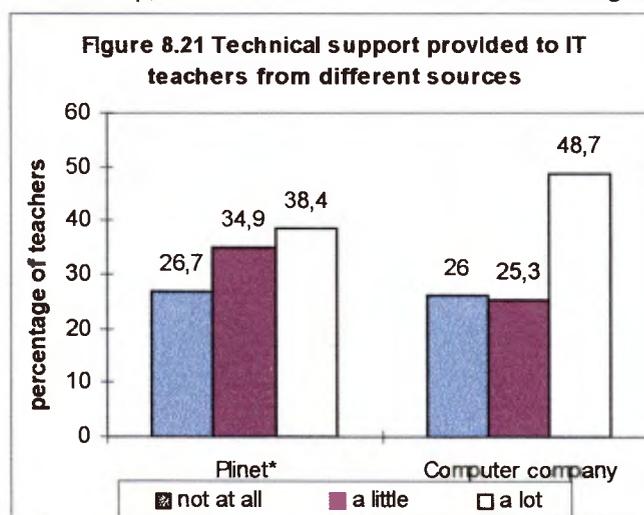


“students have a book to read, ... when there were no books we had to edit notes, print them, explain, reproduce them, a big fuss...” (Teacher 1)

As shown from the above, IT teachers felt that they did not receive adequate support on educational issues.

Teachers' perceptions about the educational support they had from the PLINET differed. As indicated from the interview data, it was a matter of the PLINETs' commitment and persistence to overcome the problems in his/her area and reach teachers. In parallel, IT teachers found the IT curriculum of little help on teaching issues. They found it useful though as a guideline on what to teach. Finally, they found the student textbook useful as a ready-made material to use in their teaching.

Going further into the issue of technical help, teachers had two sources for receiving help: PLINET and the computer provider company that according to the contract, in addition to provision of hardware in schools, had to provide technical support (chapter seven)¹¹. Reliability analysis failed (Alfa < 0,7, appendix 8.11), indicating that teachers seemed to view them as a different kind of technical help. Still though 9 per cent of the teachers mentioned receiving no help at all from either source, while 35 per cent mentioned help from one source, and 56 per cent mentioned help from both sources (Figure 8.20).



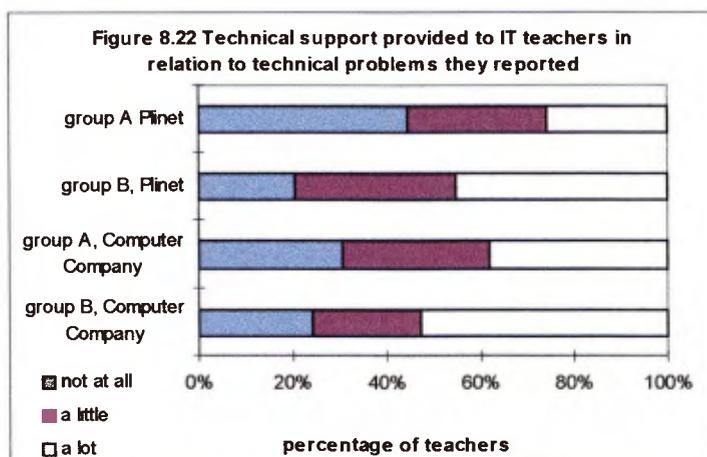
Looking at responses of teachers in whose Prefecture one or more PLINETs were positioned, a minority of the teachers mentioned no help at all by the PLINET, while less than

¹⁰ On the contrary, it was expected that since IT teachers were spread throughout the islands and had not many opportunities to meet the Plinet they would feel more isolated.

¹¹ Not all schools however had a contract with the computer company, since not all schools had new equipment which was under guarantee

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half of them mentioned some or a lot of help. On the other hand, as far as the Computer Company is concerned, nearly half the teachers mentioned a lot of help, while a minority of them mentioned none or some help (Figure 8.21).



Group A= teachers who reported problems relating to technical issues

Group B= teachers who did not

received from PLINET and from the computer company¹². It seems that teachers who mentioned problems related to technical issues, tended to mention less technical help being provided by the PLINET or by the Computer Provider Company (Figure 8.22).

Interview data provided more detailed information on the issue of technical help. As presented below, teachers first tried to solve everyday problems by themselves or in co-operation with their colleagues. They felt that they needed to know about technical issues since they were IT specialists themselves. Indeed, most of them felt confident enough with technical issues and reported they did not need help on everyday problems.

"I can manage all with hard drives, I did all the upgrades alone, except the last one I did not do myself, a student did it, I showed him the way it needed to be done and he did it, it isn't so difficult, especially in the new machines... the teacher has to be in a position to face everyday problems, or what sort of an IT teacher is he?" (Teacher 12)

At the same time they reported that there were problems that they shouldn't have to contend with, such as incompatible software provided by the Ministry of Education. For example the Logo version provided by the Ministry of Education could not run on a network (such as most schools had) but only on DOS. In parallel, the Ministry of Education provided no solution, at least as concerned to the teachers interviewed. As a result some teachers taught Basic.

" I used Basic because Logo didn't run on the network, instead of having the network down all the time and not be able to work, ...since Basic works, if I didn't have network I would use Logo" (Teacher 7)

¹² This information, however, needs to be treated with caution, since the interpretation of the responders on the meaning of 'a little', and 'a lot' could vary between one respondee and another. The issue is discussed in detail in chapter nine, section three.

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Other teachers seemed to have found solutions for themselves. In addition they helped their colleagues to overcome difficulties. However, this was not an easy task to do within all the other responsibilities.

“the problem with Logo for example... now B. from the Ministry of Education sends me more colleagues to explain to them the way I solved the problem. To do that however took many hours. I had the time this year. Will I have as much time next year?” (Teacher 12)

As far as damages were concerned, teachers reported that they tried to fix them first alone. In cases where they could not fix the damage they referred it to whatever technical support they were provided with. Most of them asked a technician or asked for the help of the Computer provider company in cases where their school had a contract. However, the majority of them reported that this was a very time consuming process especially in the islands.

“I have a network, one server and seven workstations. When I came here two of them were out. I tried to find out what happened, and I found two network cards damaged. Thousands of telephone calls, thousands of reports, always to Athens, there is no support here, I had leave in the summer and the technician came when I was not here. He found two network cards wrong. Three months later he sent me two network cards that they were also wrong. Thousands of calls later, he sent me two proper cards and finally, after two years I have two right cards to make the other two PCs to work.”(Teacher 7)

Only one of the teachers who needed help from the computer Provider Company mentioned that she did not have any problem.

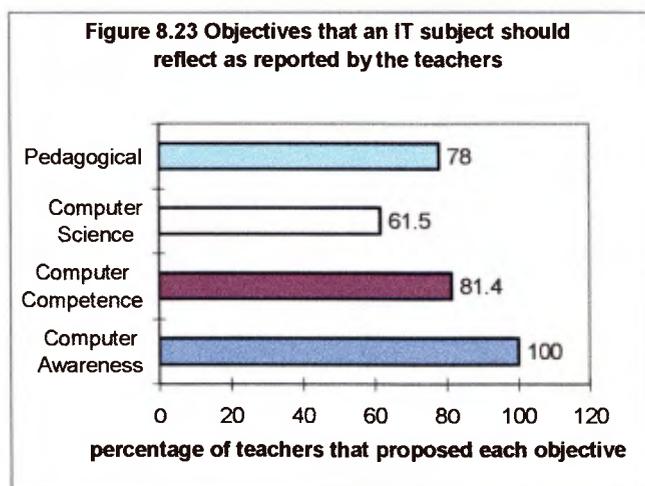
As far as the PLINET is concerned, interestingly teachers did not mention support from the PLINET. They referred only to the computer Provider Company and to their colleagues, while four of them reported that they never asked for technical support.

Summing up, as indicated in the data, IT teachers tried to fix every day technical problems on their own or in co-operation with their colleagues. They felt that they would be able to do so, as specialist IT teachers. In those cases when they did not manage to do so, they tried to exploit whatever help was available. There did not seem to be much help from the PLINET. In

case of damages on the equipment, they addressed the Computer Company. The process though was time consuming, creating problems in the running of the computer labs.

8.4 Teachers' perceptions of IT and of their role

IT teachers were asked on the questionnaire (TQ, q 43) about their own personal view of what the IT

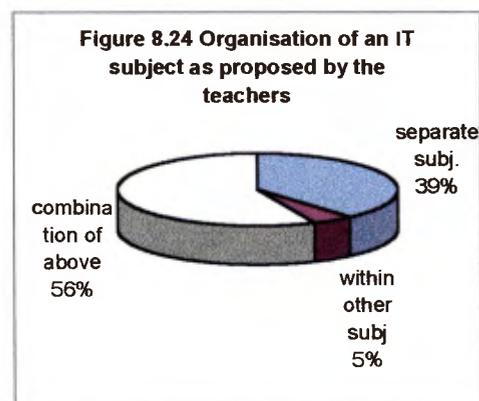
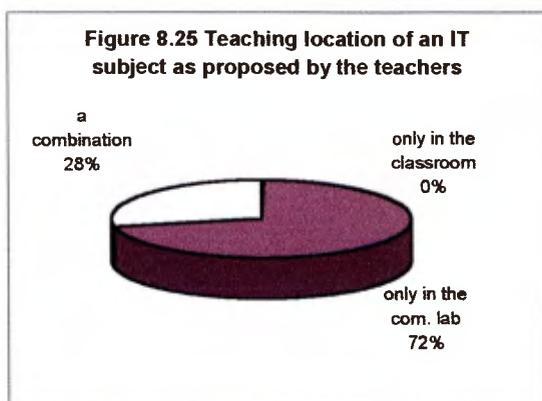


objectives should be. Data showed that they wish for the IT to have a more multidimensional

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role than the one proposed in the IT curriculum. Nearly half of the teachers promoted all the Computer Awareness, the Computer Competence, the Pedagogical and the Computer Science objectives, while one fifth of the teachers proposed the first three. Looking at how often the above objectives appeared in the teachers' answers, it is shown that the Computer Awareness and the Computer Competence objectives dominated their answers. Specifically, all teachers proposed the Computer Awareness objective, since they mentioned that the IT subject should aim at familiarising students with basic notions of IT and of computer operation, as well as with computer applications. This was however expected, since Greek students had their first contact with the computer in the first grade of gymnasium.

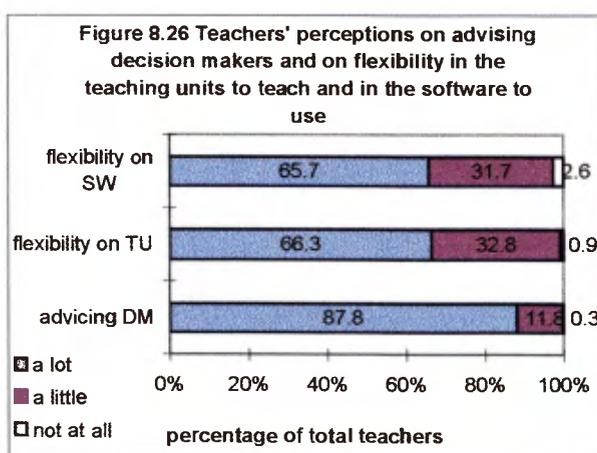
In parallel, the large majority of teachers (81,4%) proposed the Computer Competence



objective, since they believed that their students needed to acquire competence on using computer applications. Interestingly, the majority of the teachers (78%) proposed the Pedagogical objective, since they mentioned that the IT subject should aim at the enrichment of teaching in general. Finally, more than half of the teachers (61,5%) suggested the Computer Science objective, since they believed that the IT subject should aim also to familiarise students with programming, or to cultivate future programmers and computer scientists (Figure 8.23).

Although IT teachers agreed with the current teaching location of IT in the computer

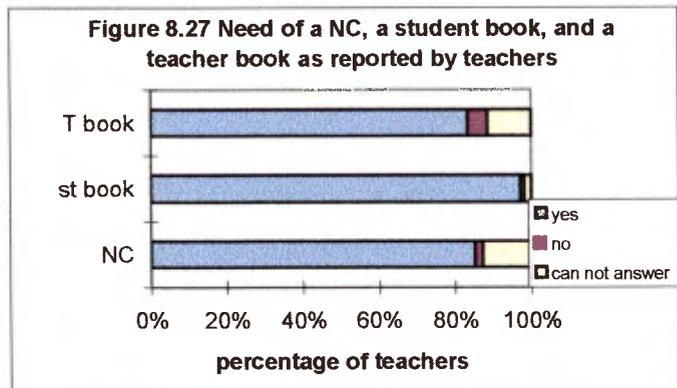
labs (Figure 8.25), more than half of them proposed a more flexible organisation of the teaching of IT. These teachers argued that IT should be taught as a separate subject as well as within sessions of other curriculum subjects (Figure 8.24). IT teachers also argued for a more flexible schema for the implementation of IT in schools. As presented below, they welcomed co-operation with decision-makers and second, they argued for flexibility in the teaching units and in the



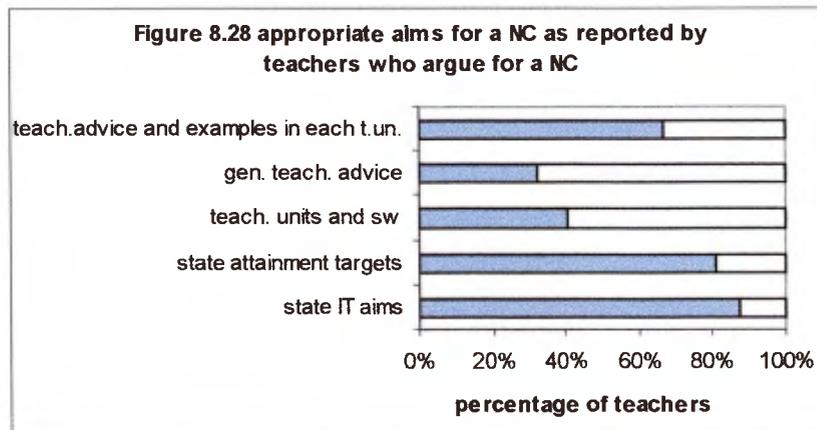
software to be used. Specifically, a large majority of the teachers (88%) reported that the

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decision-makers should consult teachers on issues related to the subject. In parallel, teachers welcomed flexibility in their practice. Two thirds of the teachers (66%) mentioned that they wished to have a lot of flexibility in choosing the teaching units of IT to be taught and the software to be used (Figure 8.26).



As far as the triangle of IT curriculum-student textbook-teacher book is concerned, the majority of the sample teachers considered an IT Curriculum necessary, while nearly all argued



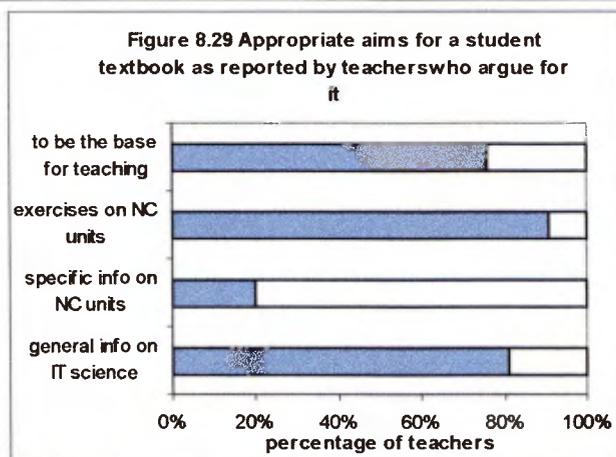
for the existence of a student book. Moreover, the majority of teachers wished to have a teacher's book (Figure 8.27).

However, when it comes to the IT teachers' views on

the role of the above resources, a paradox is revealed in the data. On the one hand, they reported that they wanted flexibility on choosing the specific teaching units to be taught, the books and the software to be used. On the other hand, they asked for advice and guidance on specific teaching units and specific examples to work with. Specifically, as for the role of the IT Curriculum, on the one hand, the majority of teachers wanted a generalised IT Curriculum without detailed information and teaching guidance. Most of the teachers (87,2%) would like the aims and the attainment targets of the subject to be stated, while initiative for the specific teaching units to be taught, should be left to them (80,8%). On the other hand, however, more than half of the teachers (66,6%) argued that an IT Curriculum should provide teaching advice and examples for each teaching unit of the subject. (Figure 8.28)

Similarly, on the one hand, the majority of the teachers favoured an authorised list of books, and argued for a student textbook as a reference book for students which would provide general information on Computer Science. On the other hand, the large majority of the teachers viewed the book as an everyday teaching aid for the teachers, since they argued that a student textbook needed to provide exercises for each teaching unit of the IT Curriculum. In parallel the majority of the teachers viewed the student textbook as a medium that helped them organise their teaching throughout the year (Figure 8.29)

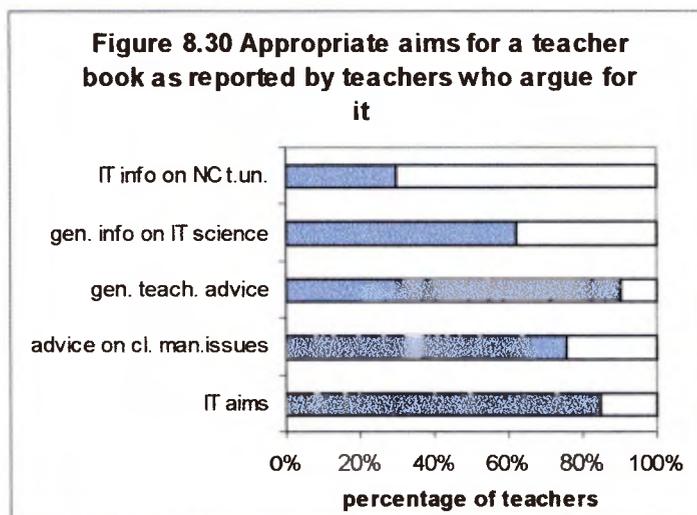
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Finally, IT teachers argued for a teacher's book as a medium for general teaching help and guidance. The majority of those teachers who argued that a teacher book is needed, argued that it needed to state the aims and attainment targets of the IT subject (85%), as well as teaching guidance (90,2) and help on classroom management issues (75,6%). In parallel, more than half the

teachers (62,1%) viewed the book as an information resource, since they asked for general information on Computer Science (Figure 8.30).

As indicated from the above, although IT teachers argue for more flexibility, they can not easily escape from the strong tradition of the prescriptive centralised educational system. On the one hand they accepted the authority of the Ministry of Education to decide on the objectives of IT at a general level, and argued for a more flexible schema of initiation and implementation of IT. On the other hand, they asked for guidance and help on specific teaching units, as well as specific examples to work with in their teaching. This could be explained as an indirect way for teachers to ask for educational support that they did not have, or even as a difficulty to escape from the familiar practice.



8.5 Summary

As discussed in this chapter, IT teachers seemed to accept the centralised organisation of the educational system, and their priority was to cover the IT Curriculum. Although they argued for more flexibility, they could not easily escape from the strong tradition of the prescriptive centralised educational system. On the one hand they accepted the authority of the Ministry of Education to decide on the objectives of IT at a general level, and argued for a more flexible schema of initiation and implementation of IT. On the other hand, they asked for guidance and help on specific teaching units, as well as specific examples to work with in their teaching.

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Looking at the way IT teachers perceived IT, their main aim was to familiarise their students with computers and technology (Computer Awareness objective) and with computer applications (Computer Competence objective). They wanted their students to enter the modern society (Social rationale). Educational rationale that was promoted as the main aim by the working group for the IT curriculum was lost in the transition from policy to implementation, due to ambiguities and contradictions found in the policy documents (Chapter Seven).

Looking at the way IT teachers perceived the objectives of the teaching units of IT curriculum, their perceptions about the objectives of IT were in congruency with those promoted in the IT curriculum and in the student textbook (Chapter Seven). They aimed to realise the Computer Awareness and the Computer Competence objectives (teaching units one and two) through the familiarisation of students with computers and their applications. Educational rationale that was proposed by the working group were not promoted in the IT curriculum. As for the teaching unit three (Investigations with Symbolic expression through programming environment), IT teachers perceived its aims differently, since Computer Science, Pedagogic or Catalytic objectives were traced in teachers' views. It is indicated that contradictions found in the IT curriculum itself about the objectives of the third teaching unit (Chapter Seven) left space for interpretations on behalf of the IT teachers, who perceived differently the objective of this unit.

In their every day practice, IT teachers covered the IT curriculum and used the distributed resources: hardware, software and student textbook. This way, the Ministry of Education, intentionally or unintentionally, controlled the implementation of IT. At the same time though, one third of IT teachers extended the IT curriculum along an IT track by elaborating on teaching units related to computers' operation (components, DOS commands, File Manager) and the latest evolution of technology (multimedia, computer applications, Internet, networks). This initiative was influenced by their perception about IT, their background and by the available resources. Teachers who held an IT degree were more inclined to extend the IT curriculum. Teachers who worked in old computer labs were less inclined to extend the IT curriculum. It is indicated that teachers elaborated on these topics because they believed that the main aim of IT was the familiarisation of students with technology and computer applications.

Additionally, interview data revealed an interest of IT teachers to extend the IT curriculum along an ITE track by using computers within other curriculum subjects. The subject organisation though that kept IT unrelated to other curriculum subjects, in combination with the overloaded IT curriculum, hindered teachers to implement such initiatives. The majority of those teachers argued that they did not manage to realise their goals due to lack of time within the IT teaching sessions and lack of their colleagues interest. A minority of those teachers who implemented these initiatives, they organised them outside IT sessions.

Going further, it seems that teachers were used to work alone. Nearly half of the IT teachers reported that they did not face problems. More than half of them mentioned technical problems, mainly referring to lack of up to date equipment. A minority of them reported that they

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faced problems related to educational issues (classroom management or teaching) and subject organisation (lack of time).

At the same time IT teachers felt that they did not receive adequate support on educational issues. Teachers' perceptions about the educational support they had from the PLINET differed. As indicated from the interview data, it was a matter of the PLINETs' commitment and persistence to overcome the problems in his/her area and reach teachers. In parallel, IT teachers found the IT curriculum of little help on teaching issues. They found it useful though as a guideline on what to teach. Finally, they found the student textbook useful as a ready-made material to use in their teaching.

As for every day technical problems, IT teachers tried to fix them on their own or in co-operation with their colleagues. They felt that they would be able to do so, as specialist IT teachers. In those cases when they did not manage to do so, they tried to exploit whatever help was available. There did not seem to be much help from the PLINET. In case of damages on the equipment, they addressed the Computer Company. The process though was time consuming, creating problems in the running of the computer labs.

Finally, the majority of teachers asked for training, while less than half of them asked for help. Although teachers who faced problems were found more inclined to ask for training and help, many of those who did not face problems also asked for training. This can be explained by the need of IT teachers to be up to date with the field of Technology that evolves continuously. Teachers were found to prefer training on educational issues, and help on technical issues. Finally, teachers in the visited isolated islands were found having more training opportunities from their colleagues in the capital. This could be explained by the personal motivation of a specific PLINET. More information from other regions is needed to safely explain this issue.

Chapter 9

Discussion and Conclusions

In this chapter I pull together all the issues discussed earlier concerning the introduction of computers into education as an educational innovation and I proceed to the conclusions of the thesis.

According to the educational innovation studies (Chapter Two), the characteristics of an innovation influence the process of the innovation. Thus, before discussing the process of the introduction of computers into education, I discuss the characteristics of the computer use. In the first section of this chapter, I present the two categories of computer use elaborated in the current thesis: IT and ITE. These categories are based on two main issues that according to educational innovation studies influence the process of the innovation: the value the innovation promotes and the complexity it involves for its introduction into education.

In the next two sections I discuss the process of the introduction of computers into education. In the second section of the chapter I discuss the initiation of computer use into education and explore different factors that influenced the promotion of a category of computer use. In the third section of the chapter I discuss the implementation of computer use. I focus on IT, I explore the way it was transformed in the transition from policy to implementation in schools and I identify the factors that influenced how it was shaped.

In each of the two sections, I bring together some major issues that have come up in educational innovation studies and experience accumulated over the use and introduction of computers into education as documented in the relevant literature. I illustrate the computer use and its introduction in education in the early efforts of England and Germany to introduce computers into education. Finally, I discuss the findings of the empirical research documented earlier (chapters six, seven and eight), concerning the introduction of computers into Greek general education.

In the final part of the chapter, I discuss implications for the introduction of computers as an educational innovation, I consider the contribution but also the limitations of the present study and I suggest further research in this area.

9.1 The use of computers in education: the distinction between IT and ITE

The thesis distinguished the computer use in two fundamental categories, “Education in Information Technology” (IT) and “Information Technology in Education” (ITE), based on two main issues, that according to educational innovation studies influence the process of innovation: the value an innovation promises with respect to its aims, and the complexity the innovation involves in its introduction. There is no clear demarcation between these two categories, and in practice, they will be inevitably interrelated. However, it is suggested that these two categories of computer use present different implications for both the initiation of the innovation as well as its implementation, due do the difference on its characteristics.

As it was argued in Chapter Three, the computer use in IT and ITE represent different values. The introduction of IT into schools aims to satisfy mainly the social and economic needs of a country. It aims to prepare students to participate in the modern technologically oriented society and the modern market and industry. It focuses on teaching *about* the computer and its technology, and aims to familiarise students with the use of computers and of computer applications. It may also aim to familiarise students with programming and Computer Science. By contrast, in ITE, the introduction of computers into schools is expected to improve education (Chapter Three). It might aim to improve teaching methods and practices; it might also aim to change the aims of education, or it might aim at both. Therefore, computer use is not only related to technology or to computer skills, but also to general educational aims, such as the cultivation of problem solving.

In addition to their different value with respect to aims, it is suggested that the two categories of computer use represent different levels of complexity for their introduction into schools. As an educational innovation, the introduction of computers into education raises educational complexities in terms of possible incompatibility of the proposed program with existing educational aims and structures. The more dimensions of education (materials, methods, beliefs and structures) are influenced by the introduction of a new program, however, the more complex the process of change (Chapter Two). In this sense, -taking into consideration the aims of the two computer categories, it is suggested that the implementation of ITE involves higher level of educational complexity than - IT. The implementation of IT influences the content of the school curriculum, but it may not disturb the school structures. The proposed aims of IT are not specifically related to other educational objectives, learning of history for example, so, teaching methods and school structures might not be affected considerably. In this sense, introduction of IT is related more to organisational and technical issues rather than educational ones.

By contrast, the implementation of ITE into schools aims to improve teaching and learning processes, and to realise educational aims which are not related to technology. In this sense, the introduction of ITE influences by definition the school curriculum, since it is intimately related to existing curriculum subjects and educational goals. Methods of teaching and school

structures maybe influenced, as teachers need to be involved and change their existing practices and routines. For example, in the case of England, English teachers were encouraged to use computers within their teaching, in order to enrich and extend learning, to support collaborative learning, independent study and students' reflection. They were encouraged to change not only the teaching tools and materials they used, but also their methods of teaching and classroom organisation, as well as to reflect on their own beliefs and on their pedagogy. Research evidence from England indicated that, as in other educational innovations, in cases where practices and beliefs were questioned, the relevance of the proposed computer use to teachers becomes of critical importance. In this sense, the implementation of ITE is more difficult, since its introduction is related not only to organisational and technical issues, but also to educational ones. In this case, as suggested by the educational innovation studies, more attention needs to be paid to the meaning of the computer use and the way it is perceived by all participants in the innovation.

Going further, unlike other educational innovations, the introduction of computers into education presents an additional complexity, on a technical level. It demands the provision and maintenance of hardware and software in schools. Moreover, technology evolves very fast, thus increasing the complexity of computer use in schools. This does not only demand considerable funds on behalf of the school, but also stresses the need for teachers to be familiarised with new aspects of technology and software (be able to evaluate and choose it) as well as assess its potential for teaching and learning.

Extending this argument, this task becomes still more complex in the case of ITE. First, smaller computer/student ratios have to be achieved, as computer use becomes diffused into more curriculum subjects, and more teachers and students need access to computer hardware and software. Second, high quality educational software need- to be developed or translated. Third, teachers who are expected to use computers within their everyday practice need technical hardware support and help with software, at least in their early efforts, since they are neither IT specialists nor necessarily familiarised with computer applications. Finally, they need pedagogic support as to how to integrate ITE into their everyday classroom practice (chapter three).

Summing up, IT and ITE promote different values and involve different levels of complexity for their introduction into schools, and thus have different implications for their initiation and implementation into schools, which are discussed next.

9.2 The initiation of computer use into education

As reviewed in chapter three, different countries have followed different routes introducing computers into their educational systems. As indicated by reviewing the early efforts of England and Germany to introduce computers into their schools, the initiation of computer use was influenced by the characteristics of IT and ITE as codified in the specific context of the country.

Each country prioritised introduction of either IT or ITE or both depending on whether the value of these categories was in congruency with that country's priorities and needs: economic, societal or educational. In addition, the promotion of IT and ITE was influenced by the complexity they involved in relation to the particular educational system, its pedagogical orientations and school organisation, the available infrastructure of the country as well as its innovation policy.

Germany followed a top-down approach focusing only on the introduction of IT. In the case of Germany, according to the innovation policy, the main actors of the initiation were the top educational administrators at the state and country level. Educational authorities prioritised economic development and, thus, saw the need for the introduction of IT, which was promoted centrally, at the level of the country. It is likely that the introduction of ITE was rejected in these first steps due to its complexity, since the necessary infrastructure was not available. Moreover, as indicated in the literature, the German educational authorities were not convinced about the educational value of ITE. They were not convinced that ITE would improve the teaching and learning of school subjects and believed time was needed to explore the potential of computer use to realise educational goals other than simply computer familiarisation. Thus, in this first phase of computer introduction into German schools, a small space for the exploration of ITE was left within the framework of the implementation of IT, at the level of the state. It was expected that the implementation of IT and the experience from this first exploration of ITE would facilitate the introduction of ITE, which remained a next step after the introduction of IT. As discussed later (section 9.1.3), this space that was left for the exploration of ITE, in combination with the federal organisation of the country, allowed variation in the implementation of IT. Consequently, it seems that the variation in the implementation of IT among German states created variation in the initiation of ITE (section 9.1.3).

Turning to the case of England, both IT and ITE were introduced simultaneously. England started computing in schools within a decentralised educational system that allowed initiatives to flourish at the school level and the potential of computer use in schools to be explored by individual teachers and schools. As appeared in literature, even before large-scale national projects were launched, schools chose to participate in examinations on computer studies and enthusiastic teachers were experimenting on the use of computers within their teaching. When the first large-scale national project (MEP) was launched, the government encouraged the introduction of both IT and ITE. It is suggested that, similarly to other countries, England valued the introduction of IT because of its links to the economic development of the country and the satisfaction of social needs. In parallel, it can be suggested that the experience (even if small) of some English teachers with the use of computers as tools for learning, in combination with the decentralised educational system, encouraged further exploration of ITE at that time. It seems that the government could only encourage and support, but not impose - at least, up until the mid-eighties - innovative programs. After the introduction of the National Curriculum, it seems that schools and teachers have lost some of their flexibility to innovate, in

the sense that the content of their teaching was more closely prescribed. However, it seems that teachers have kept the right to decide, at least to some extent, how to teach their subject, and both IT and ITE are still apparent in the National curriculum.

The cases of England and Germany indicated that different countries followed different routes for the initiation of computers into their schools, according to the priorities, the particular educational system and the available infrastructure of each country. At the same time, they highlighted the specificity of the context within which an innovation is initiated. This thesis, in order to capture the process of the innovation as shaped by the characteristics of computer use and by the specific context within which it was introduced, proceeded to an empirical in depth study of the effort of Greece to introduce computers into education. The Greek case study provided both the historical and the empirical information needed to discuss the indications that arose from the theoretical research and from the cases of the two countries.

9.2.1 The initiation of computer use into Greek general education

The empirical study looked at how computers were to be introduced into Greek schools at different points of time, and explored the way the value and complexity of computer use, according to the specific characteristics of the country, influenced the initiation of computer use.

The initiation of computers into Greek schools was influenced by the specific educational system. The process of computer introduction into Greek education appeared to be related to the technological paradigm of the innovation. It has been argued that in spite of the shift in the focus of educational innovation studies to the school context and collaborative models of innovation (Fullan 1993; Hargreaves 1994; Rudduck 1990; Sarason 1996), the technological paradigm appeals to government officials. In the case of Greece, decisions were taken centrally by the Ministry of Education being advised by specially appointed committees, while teachers are expected to implement the authorised curriculum (chapter four).

As shown in the case study, the introduction of the computer use into Greek education followed this traditional top-down innovation policy. The Ministry of Education launched three major projects for the introduction of computers into general education at different times: in the mid-eighties, early nineties and mid-nineties. Each time, the Minister of Education appointed a special committee, consisting of academics and other specialists on the subject and asked- to submit a proposal for the introduction of computers into education. Decisions were taken at the country level, with the main actors being the Ministry of Education and its advisory committees, while schools remained marginal to the policy-making process.

In the second phase of the innovation, however, a decentralisation of initiatives was attempted. The advisory proposal submitted to the Ministry of Education emphasised the importance of the level of Prefecture which was to become the centre of activities related to the implementation and expansion of computer use into schools, and the new position for PLINETs was established to co-ordinate these activities. It seems that these persons would play the role

of change facilitator interacting with school and district personnel, helping teachers and informing the Ministry for needed action (Fullan 1991).

As reviewed in literature (Hall, Putnam and Hord 1985), in the Greek case too, the role of the facilitators was not clear. The PLINETs reported problems with the enactment of their position and confusion about their role (chapter seven). At the same time, as discussed in chapter eight, teachers had different views about the role of the PLINETs as well as about the sufficiency of their support. This confusion was due to the change of government between the second (1991-93) and third (1994-1997) phase of innovation. The position of PLINETs was established in the second phase aiming to support the expansion of computer use in general (IT and ITE). Since ITE was separated from IT at the third phase (1994-97), and new support structures were set up to support ITE, the PLINETs' role was limited to the support of IT. As a result the Ministry regarded the PLINETs as the ones whose responsibility was to support IT teachers only. The PLINETs seem to have taken up this role, since they reported personal contact with the teachers in their effort to help them on both technical and educational issues. As discussed in chapter eight, however, it was a matter of the PLINET's commitment and persistence to overcome the problems in his/her area and reach teachers, and it was a matter of PLINETs to organise training seminars for IT teachers.

This lack of clarity about their role of the PLINETs between the policy makers, the PLINETs themselves and the teachers, seems that - did not allow them to fulfil their role. As Fullan (1991) has argued, if facilitators work without a co-ordinated plan for managing change, it is extremely difficult for them to set up activities involving assistance to support and change. Effective facilitators need to have access and balance expertise in both the content of change and the process of change, and develop working relationships with other change leaders. This did not seem to happen in the case of the PLINETs. The role of the PLINETs in the implementation of IT as shaped within this support framework developed by the Ministry of Education, - is discussed in more detail in section 9.3.1.2.

Additionally, the case study showed that a grid of interrelated factors influenced the process within the same educational system. These factors weighed differently on the process at particular times, rather than being static. The case study showed how the country's priorities were perceived differently at different times, namely from economic priorities in the mid-eighties to educational priorities in the mid-nineties. It also showed how the available infrastructure was different at different times, namely from non-existent in the mid-eighties to the availability of necessary human and technical resources for the IT subject in the majority of gymnasiums across Greece, in the mid-nineties. Moreover, external factors at certain times, namely the European Support Framework, as well as a political turnover, also influenced the route of the innovation. The way that these factors were interrelated at particular times is discussed below.

Phase one (1985-1990): At this first phase of the computer introduction into education, discussions at the policy level began. As it is evident in policy documents and also revealed in the interviews with policy makers, the Ministry of Education declared that the introduction of

both IT and ITE would be valuable for Greek education. The first (IT) would satisfy the social needs and economic development of the country, while the latter (ITE) would improve education in Greek schools. However, the Ministry of Education decided to introduce only IT at that time. As shown in chapter six, there were several reasons for this decision. First, it is likely that the Ministry of Education embraced the argument of the advisory committee, as available in the advisory proposal, recommending that introducing both IT and ITE would be impossible, because of the complexity of the effort. As the committee had suggested, the available infrastructure was not in place to accommodate the effort at that time: Schools did not use computers at all, while human resources were also in short supply. There was also a minimal number of teachers who could teach the subject of IT and even fewer able to use computers in their classrooms. Hardware was expensive, since it had to be imported, there was limited office automation software in Greek, and no educational software at all in Greek. Moreover, the committee pointed to the educational complexity associated with the introduction of ITE. Although not explicitly stated in the proposal, but revealed in the interviews with policy makers, and supported by literature, Greek schools offered many separate subjects within an academic classical National Curriculum that focused on product-oriented learning and assessment needs (OECD 1997, Ifanti 1992, Massialas, Flouris & Kassotakis 1988). The committee argued that research was important to explore the potential of computer use within curriculum subjects in the Greek context, before its introduction into schools. Second, it appears that the Ministry of Education prioritised the satisfaction of social and economic needs, following the international tendency of cultivating computer-literate citizens ready to participate in the international society and market, able to raise standards and compete in the European and international arena (Guthrie and & Pierce 1990). Third, as presented in chapter four, the Ministry of Education traditionally followed a systemic approach when a new curriculum subject, method or resources would be introduced throughout the school system, so that all Greek students would have the same opportunities in education (OECD 1997, Law 1566/86). In conclusion, it is suggested that the Ministry fulfilled its traditional role. The argument for IT for all Greek students was clear, satisfying at the same time both the need for the economic development of the country, and the policy for equal opportunities in education, dominant in Greece at least at that time. ITE was not abandoned, at least in the policy papers, but due to its complexity (technical and educational), was left for a later stage.

However, at the end of this first stage, the Ministry of Education managed to diffuse IT only into a small number of schools, an estimated 15%. It appears that the intentions of the Ministry of Education were too complex to be realised, since the introduction of computers into education demands huge amounts of technical and human resources. Additionally, the top-down bureaucratic Greek policy (Samatas 1995) delayed the process: the National Curriculum was only published after the first two pilot years, and student textbooks did not reach schools until 1990. Hardware and software was also to be provided centrally by the State, a fact that again imposed a slow pace for diffusion. Moreover, the necessary supply of specialist teachers

who could teach the new subject was not available, and the Ministry had to transfer teachers from other subjects to teach IT. The argument that innovation in the Greek centralised system can be easily diffused (OECD 1997) apparently was not supported in the case of computers. The Ministry of Education could not diffuse the subject into all schools, due to its inability to provide the necessary resources. This issue points out the specificity of the introduction of computers into education, where funds are one of the main factors that influence the process (Plomp, Anderson & Polydorides 1996; Brummelhuis & Plomp 1993; Pelgrum & Plomp 1993).

Phase two (1991-93): A second project related to the introduction of computers into education was launched in the early nineties. As shown in chapter six, the same tendencies to seek satisfying social and economic needs, and to ensure equal opportunities as declared at that time, again dominated the planning of this second project. The main aim of the project was to introduce ITE across a number of subjects of the curriculum (Greek language, History, Geography, Mathematics, Science, Foreign languages, Information Technology, Career guidance) aiming at a Pedagogic objective. However, before the introduction of ITE, IT was to be expanded into all gymnasiums. In fact, the aims of this new initiative were influenced by the following factors. First, as revealed in policy documents and interviews, the government viewed this second project as a continuation of the previous one. The expansion of IT into all gymnasiums was still a priority in order to satisfy the social and economic needs of the country, since this had not been achieved by the previous project. Second, the expansion of IT had a dual purpose. In addition to satisfying social and economic needs through the familiarisation of students with computers, IT was also expected to provide a first step towards the introduction of ITE across Greece. The equipment distributed to support the IT subject would also be used for the ITE. According to the dominant policy for equal opportunities as declared at that time, ITE was again to be introduced on a systemic scale, that is, into all gymnasiums. Thus, an educational change was attempted through the introduction of ITE aiming at a Pedagogic objective. This objective despite its high level of technical complexity, involved less educational complexity as compared to introducing ITE aiming at a Catalytic objective. Use of computers would improve the teaching of other curriculum subjects in all Greek schools, while at the same time, it would not disturb school structures and pedagogic beliefs. Third, funds from European Union were obtained to support the effort (1st European Community Support Framework). In conclusion, during this period too, social and economic needs were prioritised and were to be satisfied through the diffusion of IT. At the same time, an educational rationale was to be satisfied through the introduction of ITE. Finally, the policy for equal opportunities was also met, since the effort was planned on a systemic scale.

At the end of the second phase, IT had been diffused in the majority of gymnasiums, while ITE had not yet been introduced in schools. The intentions of the policy-makers, again, were not realised. This time, although funds were available, bureaucratic procedures within the centralised educational system considerably delayed the project, and the new government found the project unfinished. Although the first part of the project was realised, namely the

expansion of IT into the majority of Greek schools, the introduction of ITE was left nearly untouched. Specifically, hardware was provided to the majority of gymnasiums, the IT subject was diffused across Greece, and Plinets were appointed at the level of Prefectures to support IT and the introduction of ITE. Although the procedure for software development had started, it was cancelled, and the training of teachers did not take place.

Phase three (1994-1997): In the mid-nineties, the route of the introduction of computers in schools changed. A political change, together with the fact that a new proposal had to be submitted to the European Union (2nd European Community Support Framework) one year after the government took over, encouraged the abandonment of the previous project and the planning of a new project. Policy documents and interviews indicate that there was a chronological gap between the previous project, which had been inactive since 1993, and the planning of the new project, which was not approved before the summer of 1996. The new project was very different from the previous one that was abandoned, with respect not only to its aims but also to its implementation strategy.

As for the aims of the project, it proposed the introduction of ITE with the catalytic objective in mind, to develop new educational practices, to create new learning environments, a dynamic approach to knowledge, and to upgrade the role of the teacher. The integration of computers into school subjects aimed not to improve the realisation of existing educational objectives, but rather to change the existing practices and pedagogical orientation. An educational change was proposed this time, which involved high levels of educational complexity. IT was no longer an issue of discussion at the policy level, since it was considered as an established subject under the authority of the Pedagogical Institute, as any other curriculum subject.

Interestingly, the infrastructure that had been put in place (hardware, Plinets) from the previous project to support the introduction of IT and the introduction of ITE, was marginalised and left simply for the implementation of IT. In 1996, when the project was accepted, the computer labs created in the previous phase had already been out of date due to the fast evolution of technology in combination with the bureaucratic educational system. New labs were to be created for the introduction of ITE. Moreover, the proposed teachers' training, which had not taken place in the previous phase, was abandoned and a new organisation for teachers' training was developed. This time, the short training courses that had been planned in the previous phase were considered inappropriate. By contrast, long-term training and in-action support for teachers were proposed, abandoning the previous plans. For the first time, a small-scale implementation strategy was proposed, due to the technical as well as the educational complexity of the project.

As is evident in policy documents and interviews with the policy makers (chapter six), two main reasons influenced the change of direction of the introduction of the computer innovation. First, the declared need to modernise teaching and learning in Greek schools and the idea that this could be fostered by the introduction of ITE. As revealed in the documents

collected and the interviews with the policy makers, the European Community did not affect the specific aims of the project. This was a matter for policy makers and the way they perceived the educational needs of Greek schools. It is not suggested that the Ministry of Education lost its interest in the diffusion of IT to all schools in Greece. It seems though that since IT had been diffused to the majority of gymnasiums, the aim of the Ministry for the familiarisation of Greek students with technology and computer applications was considered as having been essentially achieved at a satisfactory level. Second, funds from the European Community for curriculum development and support for human resources were made available and provided the resources needed for such a huge effort. As explicitly argued by those responsible for IT in the Ministry of Education at that time, the availability of funds through the European Community encouraged the Ministry to prioritise the introduction of ITE, a target that had been set since the mid-eighties.

Looking at the initiation of computers into Greek schools over these three periods, it is shown that as in England and Germany, the value and complexity of the computer use were two main factors that influenced its initiation, as these were codified in the Greek context. In the case of Greece, the initiation of computer use was a matter of the policy makers in the high levels of the educational hierarchy. The satisfaction of social and economic needs, as they were prioritised by the policy makers in the first and second phase of the innovation, encouraged the prioritisation of IT, while the need for modernisation of teaching and learning as this was prioritised in the third phase, encouraged the introduction of ITE. Additionally, as shown from the case study, the complexity that the computer use involves for its introduction into schools was also a strong factor that influenced its initiation, since it demands huge funds for the provision of human and technical resources. This task was more difficult in a centralised educational system, where the state is the only one responsible for the provision of funds. In this case, external support from the EC facilitated the diffusion of IT across Greece, and gave a stimulus for the introduction of ITE in the third phase. Internal factors also influenced the course of the innovation. The political change that occurred between the second and third phase encouraged the development of a new project, abandoning the previous one, thus changing the route of the innovation. However, these factors cannot be considered separately. As shown from the Greek case study, it is more the way that these factors were interrelated at particular times that shaped the process of the innovation.

Another important issue that the case study pointed out is that the highly centralised bureaucratic educational system hindered the progress of the computer innovation during all the phases. It is indicated that the highly centralised bureaucratic educational system can not easily cope with the specificity of the introduction of computers in the educational system. The use of computers in schools does not only demand huge funds for the initial provision of resources for each school, but also continuous maintenance and technical support. Both tasks were found to be problematic within the Greek educational system. The Greek educational system has to develop other, more decentralised mechanisms for such tasks, since it is impossible for one

central authority to provide for all schools. Moreover, technology and its applications continuously evolve, and the bureaucratic system cannot follow his progress, as shown from the advancement of the second phase. The Greek educational system has to find more flexible plans and procedures. Extending this argument, it can be said that bottom-up initiatives can face the same problem, especially as far as the teachers' professional development is concerned, which cannot always be organised within the school or on a local level. It can be hypothesised that local investments in combination with national support would provide a better framework to tackle the technical complexity of computer introduction in education.

Additionally, the case study revealed a paradox considering the nature of computer introduction in education. On the one hand, the fast evolution of technology and of computer applications needs flexible procedures to keep up with change. On the other hand, the change of Greek government, as related to the progress of the computer introduction, caused a gap between the second and the third phases of the innovation, highlighting the importance of the issue of continuity. Frequent change of orientation allows neither for the time for experience to build, nor for supportive mechanisms to develop. Furthermore, it confuses teachers and leads them to abandon their efforts. So, it seems that flexible management structures need to co-exist with long-term plans. A longitudinal study could question the issue of continuity and the way it influences the diffusion as well as the institutionalisation of computer use within schools.

Finally, as shown in the Greek case study, the introduction and diffusion of IT was not a catalyst for the introduction of ITE. This was due to the fact that IT was introduced within a narrow approach. So, IT was introduced as a separate curriculum subject, keeping its own entity in the school curriculum. Thus, it remained unrelated to other curriculum subjects, while teachers from other subjects remained uninvolved. As discussed previously (section 9.1) IT and ITE are very different not only in relation to the aims they promote, but also in relation to the kinds of issues that need to be taken into consideration in their introduction into schools. IT is more closely related to technical and managerial issues, while the introduction of ITE is more closely related to educational issues, such as the professional development of teachers. Thus, the development of a technical infrastructure in schools such as computer labs, and the use of computers by a specific group of teachers, do not ensure computer use by other subject teachers in their every day teaching.

9.3 The shaping of meanings in the transition from policy to implementation

In the previous section I discussed the initiation of computer use in education and the factors that influence the promotion of a specific category of computer use. In this section, I turn to the implementation of computer use in schools, and I discuss the way it is shaped in the transition from policy to implementation.

As argued in chapter two, educational innovation studies suggest that the meaning of an innovation is shaped in the transition from policy to implementation. This was evident in the

cases of the two countries (England and Germany) in respect to the implementation of IT in schools. The importance of the meaning of computer use as perceived by policy makers and teachers was highlighted, since a shaping of initial policies was noted at different levels of education, and among different schools and teachers.

The two countries, in their early steps of introducing computers into schools, introduced IT following different implementation strategies, reflecting different perspectives of IT. As I discuss below, these strategies were decided at different educational levels (the state, the school, the teacher) with respect to the decision-making process in the specific educational system and innovation policy of the country. These different implementation strategies for IT developed different implemented subjects in schools.

In the case of England, there was considerable variation in practice among schools, suggesting that the traditionally decentralised educational system allowed teachers to be more involved and to influence the innovation process. Although, since the Educational Reform Act 1988 the educational system became more centralised, English teachers (at least up until the mid-nineties) still had an active role in the initiation process. During that period, the teachers' role continued to be crucial for the computer innovation, since they decided if and how to participate or developed their own computer projects in their schools. The government, within the framework of rather loose objectives, supported many different school projects. IT became a compulsory element of school education with the introduction of the National Curriculum, although, again, variation was encouraged. Although the National Curriculum prescribed an IT capability, it did not describe how it was to be delivered. Four different approaches were developed in schools for the delivery of IT (chapter three). Some schools introduced IT within a narrow approach, and the cultivation of IT skills was to be achieved through a clearly defined taught program, focusing more on the cultivation of IT skills. Other schools adopted more outspread approaches and diffused IT through many, if not all, curriculum subjects, focusing on the educational value of computer use, too. It seems that the national policy (at least, until the mid-nineties) still respected the professionalism and autonomy of teachers, and encouraged schools to develop their own meanings of any innovation. Even though they had to deliver IT following the National Curriculum, they were the ones to decide the best way of doing it, according to their assessment of the value and complexity of the innovation. For example, they were in the position to choose an implementation approach of IT, according to their beliefs about IT and the available resources.

Turning to the case of Germany, the federal organisation of the country allowed for a differentiation among the states of the country. As presented below, the common objectives agreed at the country level were transformed at the level of the state, since the different German states followed different implementation strategies for the introduction of IT, resulting in different actually implemented subjects in schools. Some states, such as Baden-Wurtemberg, introduced IT adopting a "narrow" approach, namely focusing on knowledge about computer technology and introducing additional teaching units only into the main curriculum subjects. In one of the states, cultivation of computer skills was spread across all curriculum subjects. By

contrast, other states, such as North Rhine-Westphalia introduced IT adopting an "outsread" approach, namely, they cultivating computer knowledge and skills through interdisciplinary projects. Thus, it appears that the initial aims of the introduction of computers that were agreed at the country level were shaped according to the different needs and perspectives of disparate states. Although not enough information was collected to be certain as to how IT was implemented in schools, it is indicated from literature that all states achieved the familiarisation of their students with computers and their applications. However, it is indicated that the implementation of IT did not mean the same thing for all states. In the first group of states, where an "outsread" implementation approach was introduced, students were not only familiarised with computer applications, but also viewed the use of computers as an organic tool for their school activities. The opposite happened in the states that followed a narrow implementation approach. In these states, students had a more isolated view of the role of IT in relation to curriculum subjects. This does not suggest that one or the other approach was successful, in terms of the realisation of the initial aim for the students' familiarisation with computers, but to point out that the meaning and the role of computer use was shaped, creating intentionally or unintentionally different perspectives on computer use. There is no information though, for the reasons that this happened, nor is there any information at the level of the teacher, in order to explore whether the teachers further shaped the meaning of computer use.

As presented above, variation on the implementation of IT existed in both countries. It is indicated that in some schools, IT was implemented within a narrow approach. In these schools IT was introduced by adding teaching units related to technology and to computer applications, focusing more on the cultivation of IT skills. In other schools, IT was introduced within outsread approaches, by spreading the computer use into more curriculum subjects or by introducing interdisciplinary project work, focusing more on the educational potential of computer use.

In this study, however, no empirical data was available to analyse the complexities of the implementation process in the two countries. I have not investigated how IT was implemented or how much differentiation existed and for what reasons. Moreover, important information is missing to understand the intentions of the policy makers and the reasons for differentiation between schools. The Greek case study that I conducted attempts to capture some of these complexities.

9.3.1 The shaping of meanings in the transition from policy to implementation in the Greek situation

In this section I focus on a specific phase of computer innovation in Greece (1994-97). At that time, IT had already been established as a new subject within the school curriculum, and it had been diffused through all grades of gymnasium and across the majority of the Greek gymnasiums. Looking at this specific phase, I explore the way IT was shaped in the transition from policy to implementation. I look at how IT was perceived by the policy makers and discuss

the infrastructure they developed to support its implementation. Next, I focus on the teachers, and the way they perceived the implementation of IT and the reasons behind their perceptions.

As it will be shown below, the implementation of the promoted IT, as this was shaped in the Greek classrooms, was influenced by three interrelated factors: the way teachers perceived their role, the way they perceived IT, and the infrastructure put in place. These factors were influenced by the specificity of the Greek educational system in terms of its implementation policy.

9.3.1.1 The intentions of the policy makers

The introduction of IT into the Greek system seems to be related to the technological paradigm of the innovation. The Ministry of Education appointed a special committee to develop the IT Curriculum for the new subject, presenting the aims of the subject as well as the teaching units to be covered. In parallel, the Ministry of Education set in motion a huge mechanism to provide the infrastructure to support implementation of the specific published IT curriculum: subject organisation, technical resources (hardware and software), human resources (teachers, PLINETs, training and support) and other teaching resources (student's textbook, teacher's book). The way the meaning of IT is promoted in the developed IT curriculum as well as in the developed infrastructure is discussed below.

The meaning of the IT subject: the IT Curriculum

As pointed out by educational innovation studies (chapter two), not only is the meaning of any innovation perceived differently among people at the same level, but it is also shaped through the different levels of education, from policy to implementation. Although the literature originated from research in decentralised educational systems such as the English (Hargreaves 1994, Osborn 1997), the above argument was confirmed in the case study of Greece too, promoting a highly centralised system.

In the case of Greece (chapter seven), it was shown that policy makers in the high levels of hierarchy perceived the aims of IT differently depending on their personal background, position, biographies and agendas. The Pedagogical Institute, under the authority of the Ministry of Education, appointed a working group of specialists to develop the IT Curriculum. As revealed in the interviews with the members of the NC working group, there were different views among them, with respect to the aims of the subject. Specifically, as revealed from this interview, the representative of the Ministry promoted mainly Social and Vocational rationales. It is suggested that his view of IT reflected the political agenda for the reform and modernisation of the country. The representative of the Pedagogical Institute however, promoted Social and Educational rationales, reflecting both the policy for reform and the pedagogical perspective for improvement in the classroom. The University scholar proposed an Educational rationale, reflecting his interest in teaching and learning in the field of educational technology.

Additionally, as the case study showed, the argument that policy texts are often contradictory to each other as found in literature (Baw & Ball 1992) was also supported by the Greek case study (chapters seven). As shown in chapter seven, the perceptions of the members of the working group for the National Curriculum were apparent in the introductory section of the Draft Curriculum, with the Educational rationale appeared as the main aim of the subject. However, a transformation of the objectives and rationales was found in the transition from the first (including the aims of IT and subject areas to be covered) to the second part of the Draft Curriculum (including the teaching units and attainment targets). In the first part both the Social and the Educational rationales were proposed. In the second part, the Educational rationale was not promoted at all, and the teaching units reflected only the Social or the Vocational rationales, proposing the Computer Awareness, Computer Competence and Computer Science objectives¹. For example, in the introductory section, the "reformation of the educational process" is mentioned as one of the aims of the IT. Focusing on the use of Logo within the IT Curriculum, in the first part, "problem solving" appeared, which was to be cultivated through "investigations with symbolic expression through programming environment", aiming further to "develop generalisation and the deductive skills" of students. In the second part of the Draft Curriculum, "problem solving" appeared again. Students needed to "expand their knowledge in programming" in order to develop "a higher ability to investigate through symbolic expression", while in the end, they needed to "be able to develop software related to their school subjects". The distortion of the initial objective became still clearer in the teaching units, where, for example, recursion represented a separate teaching unit. Students were expected to use mathematical functions and their formulas in order to explore programming functions, and not the opposite. The Draft Curriculum was thus denuded of its philosophy and this denudation continued even after its publication. The published IT Curriculum included only the introductory section and the second part of the Draft Curriculum. Thus, the Educational rationale was promoted only in the introductory section, while the Social and (implicitly) the Vocational rationales were proposed throughout.

Summing up, in the effort to develop a "teachable" IT curriculum for teachers to follow, the curriculum became divested of its initial philosophy. The broad view of IT that was proposed in the introductory sections, for linking IT to other school activities was transformed into the development of IT skills in isolation from other subjects or school activities. Additionally, the proposal that IT would aim at the cultivation of problem-solving skills turned into the development of programming skills. This way the initial objectives promoted by the working group for IT were distorted. This can be explained by reference to the process of

¹ Specifically, the Educational rationale, reflected within the second teaching unit "Basic Computer Applications", was limited to the Computer Awareness objective. Catalytic objective reflected within the last teaching unit "Investigations through symbolic expression within programming environment", was transformed into the Computer Science objective. Moreover, the interdisciplinary projects proposed as the

"compartmentalisation" of the computer use in the National Curriculum in order to be teachable and to meet the dominant culture (Hoyles 1992).

The same transformations were identified in the student textbooks and the teacher's book (chapter seven). While the Educational rationale was promoted in their introductions, the organisation and the structure of the books clearly promoted the Social and (implicitly) the Vocational rationales proposing the Computer Awareness and Computer Competence objectives.

In parallel, teachers, focusing on the main parts of the documents that were more directly related to their teaching practice, concentrated on the cultivation of IT skills. Moreover, contradictions between different parts of the documents about, for example, investigations through Logo, created confusion referring to its meaning. So, discrepancies among the teachers about the meaning of the use of Logo were created in this case because of the following: the lack of clarity in the documents, the fact that investigations were not a usual practice in Greek schools, and the focus of teachers' training on issues other than investigations.

Thus, the case study showed that, in decentralised educational systems too, the meaning of an innovation is transformed from the policy to the implementation level even in centralised prescriptive educational systems, such as that in Greece. In the Greek case, personal interpretations and most importantly, lack of consistency within and between documents transformed the aims of IT. Moreover, contradictions within documents, lack of information and the inadequate professional development of teachers, created discrepancies between teachers' views about the aims of the use of Logo.

The development of the infrastructure to support the implementation of the subject

The Ministry of Education, within the framework of a top-down, centralised educational system after the development of the IT Curriculum, tried to ensure that an infrastructure (technical, human and teaching resources) for the implementation of the specific published IT curriculum was put in place. I discuss all aspects of the infrastructure separately, although I by no means suggest that they are in fact fragmented in reality. By contrast, they appear to be interrelated and represent a unified context within which IT was implemented.

First, the Pedagogical Institute defined the subject organisation and a time schedule for its teaching. As is evident in policy documents, a "narrow" implementation approach was followed. IT was introduced as a separate subject within the school curriculum. This organisation gave a separate entity to IT and leaving it unrelated to other subjects. This way, educational rationale was rather ignored, while Social and Vocational rationales were more emphasised. Students were to attend sessions specifically devoted to technology and computer applications. Limited teaching hours (IT was to be taught once a week) in combination with the

methodology to be used for the familiarisation of students with basic computer applications, was separated from the teaching unit "Basic Computer Applications" and presented another teaching unit.

rich material of the IT Curriculum, left little time within the Greek school year for any input from teachers or any flexibility in their teaching. For example, an IT teacher in the first grade had to cover the theoretical section, familiarise his students with Windows and a file manager and introduce them to word processing and drawing. In the second grade, teachers had, again, to cover the theoretical section, familiarise their students with spreadsheets and engage them in an investigation using Logo. Considering that most Greek students had no prior contact with computing, it is clear that they did not have enough time to go in depth into any of the applications, and could only obtain a first contact with them. The limited time for IT was acknowledged by both the Pedagogical Institute and the Ministry of Education (interviews), but no more space could be found within an already overloaded Greek National Curriculum (OCED 1997).

Second, the student textbooks as well as the teacher book promoted the Social and implicitly the Vocational rationales, proposing the Computer Awareness and Computer Competence objectives, and thus, mirroring the specific published IT curriculum. Editing and distribution, however, of the above mentioned books was a time consuming process within the bureaucratic centralised educational system. The Ministry under the advise of the Pedagogical Institute appointed a working group for this task. Books needed to be evaluated from the Pedagogical Institute, edited, printed and then distributed to all using-schools. All three books for the three grades of gymnasiums were not distributed before 1998, that is three years after the IT curriculum had been published. Only the teacher book for the first grade was edited and distributed into schools, which as revealed from questionnaires, reached only a small minority of teachers. Teacher books for the second and third grades were not edited, since the evolution of technology was faster than the editing of a book. Instead, printed guidance was edited by the Pedagogical Institution and was sent into the schools.

Third, the Ministry of Education is responsible for providing all necessary resources for schools. So, according to the IT Curriculum and under the guidance of specialists, it distributed hardware to all schools offering IT. Provision of up-to-date hardware though was a difficult task considering, on the one hand, that the Ministry of Education had the total responsibility for hardware provision, and on the other, the fast evolution of technology. As revealed in the Teacher-questionnaire, the computer labs developed in 1994 were already out of date. Moreover, the centralised provision of technical support, although adequate for the first five years of IT provision under the signed contract, had already expired leaving schools without technical support.

The Ministry also distributed the specific software that was prescribed in the IT curriculum and was included in the student textbooks: that is, automation office software (MS WORKS), and Logo. Interested teachers could also be provided with a tutorial software for teaching basic theoretical concepts of IT (ORION), provided by the Ministry, however, not mentioned anywhere in the student textbook. It was difficult for schools to use other software, since they had to buy it using other means, such as parents' associations. As Plinet data

revealed though, only in few of the regions parents were involved in these initiatives, providing the authorised software according to the IT curriculum to be introduced into the school curriculum, or other software to be used in supplementary evening classes on Information Technology. Thus, the majority of teachers only had the distributed software at their disposal in order to teach IT. In this way the Ministry of Education controlled –intentionally or unintentionally- the software to be used in schools.

Fourth, the development of human resources was also the responsibility of the Ministry of Education, which needed to appoint teachers to teach the subject. This task was difficult at first, when IT specialists were not available. Moreover, the necessary funds needed to be ensured, and a legislation process developed. In 1992, the Ministry of Education legislated for new positions for IT specialist teachers (Law 2009/92) following the advice of the Pedagogical Institute on the necessary qualifications. However, the appointment of specialist teachers, marginalised IT from the other school subjects. Moreover, the initial lack of availability of IT graduates created a group of IT teachers simply to fill the gap. They had a range of distinctive characteristics and they would most likely shape the fledgling subject in unpredicted ways. As revealed in teacher-questionnaires, nearly half of the teachers were on temporary contracts, and less than half held a first degree in Computer Science. As discussed in literature (Acker 1997, Hargreaves 1994, Osborn et al 1997), teachers perceive their subject differently depending on their own biographies, background, and as well as the school context within which they work. This issue though is discussed in the next section.

Finally, the Ministry of Education legislated for a new position in each Prefecture of Greece, that of the persons responsible for "Informatics and New Technology" (PLINETs). As discussed before (section 9.2.1) their role was unclear. As Plinets argued, they encountered problems with the enactment and equipment of their offices and there was confusion concerning their role in their Regional Office. For example, few of them had a desktop computer to work with, and many were expected to help their Regional Office on statistical processing or data processing, in addition to helping IT teachers. However, as revealed in Plinet- questionnaire, PLINETs had personal contact with IT teachers and helped as they could, whenever asked.

In conclusion, according to the highly-centralised policy, the Greek state provided an IT curriculum, and developed an infrastructure to ensure the implementation of this specific curriculum; that is a student textbook, a teacher book, teachers, hardware and software. As in decentralised educational systems, in the Greek centralised educational system too, the objectives of IT were perceived differently by the participants of the initiation of IT, reflecting their different background and priorities (Osborn 1997, Hargreaves 1994). Additionally, the published documents proved to be contradictory to each other, but also to include contradictions among different parts of the documents themselves (Baw &Ball 1992). As a result, the objectives of IT were transformed at this first educational level, in the transition from the initial objectives promoted by the advisory working group to the published IT curriculum books.

Moreover, within a top-down highly-centralised bureaucratic educational system, the provision of resources for the implementation of IT was problematic, while the infrastructure developed confirmed the authoritarian Greek educational system. Hardware demanded huge funds, and many labs were already out-of-date, while the provision of books to schools was rather slow. Additionally, the overloaded IT Curriculum, in combination with the limited time offered for the teaching of the subject, left little space for teachers to deviate from the prescriptions laid down, while the specific hardware and software distributed to schools, and the student textbook, constrained teachers to cover this specific curriculum. Next, the "narrow" approach that was adopted for the implementation of IT, namely the organisation as a separate subject and the appointment of specialist teachers, left IT unrelated to other curriculum subjects, and other teachers uninvolved. Finally, the political turnover at mid-nineties and the gap between the second and the third governmental projects, created confusion around the role of the Plinets who had mainly technical as opposed to educational expertise.

9.3.1.2 The implementation of the IT subject

The analysis of the implementation of IT in the Greek case study reinforced the argument put forth in the theoretical considerations that an innovation is not implemented in the way its initiators envisage. As mentioned before, the implementation of IT, was influenced by three interrelated factors: the way teachers perceived their role, the way they perceived IT, and the developed infrastructure.

Looking first at the way teachers perceived their role, it appeared that Greek IT teachers accept the authority of the State that had appointed them to implement an IT curriculum, and they felt that their professional duty was to cover this curriculum. All teachers interviewed, argued that their main priority was to cover the IT Curriculum. In parallel, questionnaire data showed that the vast majority used the IT Curriculum and the student textbook. This was expected, given the strong tradition of the student textbook in all subjects, which is distributed gratis to all Greek students (OECD 1997). However, although more than half of the teachers reported that they used the student textbook a lot, nearly half of the IT teachers reported that they used the student textbook rather rarely. This can be explained by the interview data. On the one hand, all teachers interviewed argued that they used the student textbook to organise their teaching, trying to be in line with the prescriptions of the IT Curriculum. On the other, they complained that the books became fast out of date. This is true, considering the bureaucratic procedure necessary to write a new student textbook. The IT Curriculum was voted in 1995, and the student textbooks did not reach schools before 1996 (textbook for the first grade), 1997 (for the second grade) and 1998 (for the third grade). It is easy, therefore, to assume that in the case of Information Technology, the traditional procedures are found inadequate considering the fast evolution of technology, where books become quickly out of date. This explains why many teachers reported that they gave additional notes to their students. Interestingly enough,

the two of the teachers interviewed, who had installed Windows 95 on the computers in their lab, actually taught under Windows 3.11 in order to be in line with the book, an action that was proposed in the teacher book. This fact confirms the mentality of the civil servant among Greek teachers (OECD 1997). It appears that on the one hand, teachers tried to follow the official guidelines within the tradition of the civil servant appointed to serve the system. At the same time, they tried to provide their students with the latest advances on the subject, which is an issue that is further discussed below.

Looking at the way IT teachers perceived the IT, as questionnaire data showed, the majority of the teachers proposed the Computer Awareness objective as one of the most important objectives of IT, while nearly half of them suggested the Computer Competence objective. Only a minority of teachers put forward the Computer Science objective, and the Educational or Vocational rationales, and those who did, they proposed them additionally to the Computer Awareness objective. This issue was revealed also in the interviews with teachers, who argued that their main priority was to familiarise their students with the basic concepts of computer science and with computer applications. More than half of them emphasised the familiarisation of their students with computer applications in their teaching, since they believed this to be the most important aim of the IT Curriculum. Investigating the relationship between the background of teachers and the proposal of the Computer Science objective as one of the important aims of IT, the statistical test showed (chapter eight) that teachers who did not hold an IT degree tended to propose the Computer Science objective. It could be suggested that these teachers who hold an IT degree had a deeper knowledge and a wider view of Information Technology and its potential, compared to the teachers who did not hold an IT degree. Therefore, they did not focus that much on programming. This conjecture, though, needs to be investigated further in another project.

Looking in more detail, interview data revealed that teachers proposed for each teaching unit of IT the objective that the IT curriculum promoted. The most of the teachers proposed Computer Awareness objective for the first teaching unit (Communication with the computer) and the Computer Competence objective for the second teaching unit (Basic Computer Applications). Discrepancies were found among them on the aim of the use of Logo (third teaching unit: Investigations with symbolic expression in a programming environment). Some teachers suggested the aim of programming (Vocational rationale, Computer Science objective) and others mentioned the aim of cultivating a problem-solving ability (Educational rationale, Catalytic objective). This was expected for the following reasons. First, discrepancies and contradictions within the IT Curriculum and student textbooks had already created a lack of clarity in the aims of the use of Logo, an issue highlighted in literature (Baw & Ball 1992, Fullan 1991). Secondly, IT teachers in Greece, as all other secondary teachers, had no pedagogical training at that time, and investigations are not a usual practice in the Greek classrooms (MNER 1994). Third, the in-service training that the Ministry of Education provided for teachers was not related to investigations with programming but to training in programming and familiarisation

with the distributed software (chapter seven). Thus, the IT teachers had to make sense on their own and interpret the IT Curriculum based on their understanding and personal background.

As shown above, teachers perceived their duty to be the implementation of the IT Curriculum, and saw as its main aims to familiarise students with technology and computer applications. At the same time though, questionnaire data showed that the majority of IT teachers believed that IT should have a multidimensional role. The majority of the teachers believed that IT should aim, in addition to the above, to enrich teaching in general and that it should also be taught within other curriculum subjects. At the same time, teachers wished to extend the IT subject in two ways. First, they wished to extend the IT curriculum along an IT track elaborating on teaching units related to Computer Science, and second, to extend IT along an ITE track by relating IT with the teaching of other subjects. Interestingly, they tried to realise the first within the teaching of IT, whereas, they attempted to implement the second through activities isolated from the IT structure.

Looking at the first teacher initiative, more than half of the teachers reported in the questionnaire that they wished to teach topics related to computer operation beyond the National Curriculum, such as networks, the Internet and multimedia. Since the above topics were included in the National Curriculum, it is assumed that IT teachers wanted to provide additional information on the above topics to that included in the student book, and to provide more opportunities for their students to work on computer applications. For example, they might expand more on the topic of multimedia, or they might provide practical experience of the Internet. Teachers interviewed also reported these initiatives.

However, questionnaire data showed that only one third of the teachers reported that they managed to realise any of these initiatives on their own. Moreover, these ideas remained on a theoretical level, since no teacher actually used multimedia software, and only a small minority used software to demonstrate Internet facilities to their students. Questionnaire data suggested two reasons for this. First, teachers did not have the necessary resources to realise their ideas. The lack of up-to-date equipment, coupled with maintenance problems in the computer labs were the most important problems mentioned by the IT teachers. Second, teachers did not have adequate time to realise them. Interview data gave a better insight into this situation. As explained by the interviewees, teachers felt free to realise their initiatives provided they had covered the IT Curriculum. However, the real available teaching time in the classroom was even less than the time set by the IT Curriculum, since many teaching sessions were lost when a school participated in extra-curricular activities (for example, visit to a museum). Moreover, the majority of teachers interviewed, mentioned a lack of technical support for hardware problems and delays that hindered the realisation of even the IT Curriculum itself. The provider Computer Company, although successfully supporting most schools in the capital, created frustration in the schools of the islands, where communication and transportation was a time-consuming process. Therefore, given this situation in schools, teachers could squeeze some additional information at a theoretical level within IT sessions. For example, they could

provide their students with more information on computer internal operation and the latest advances in IT. By contrast, they couldn't realise their initiatives related to practical experience for their students, since the hardware and software necessary were not available. For example, teachers could not involve their students with activities related to the World Wide Web since they did not have access to the Internet or the appropriate software needed.

Turning now to the initiative of the teachers concerning the diffusion of IT across the school curriculum, no teacher in the questionnaires mentioned that he/she wished to relate IT with other curriculum subjects. This issue came up only in the interview data, where teachers had the opportunity to answer in more detail. Half of the teachers interviewed, expressed the wish to use computers for interdisciplinary work or within other curriculum subjects. As teachers argued in the interviews, their initiatives remained unrealised in most cases, due to the fact that they had neither the time nor the co-operation of their colleagues. Interestingly, when computers were used for other school activities, the school infrastructure kept these activities isolated from the IT subject. In the three schools where such activities were reported, students worked with computers outside the IT. Therefore, IT teachers considered these initiatives unrelated to IT. This can explain the fact that when teachers reported their initiatives on IT, they did not include activities related to the other curriculum subjects. Indeed, looking at the questionnaire results more carefully, a small minority of the IT teachers reported that computers were used outside IT sessions by their students for other school activities. Thus, activities relating IT to other subjects or school activities were marginalised and kept outside the IT framework. Two reasons seemed to justify the isolation of these activities. First, IT teachers had very limited time within IT sessions to cover the IT Curriculum. Therefore, they did not have time for further explorations within IT sessions. Second, the lack of interest of the other teachers did not allow experimentation within sessions devoted to the teaching of other subjects.

So, the context within which IT was to be implemented not only did not encourage teachers' initiatives, but was also inadequate to support the implementation of IT in all schools. The highly centralised bureaucratic educational system did not manage to provide up-to-date resources to all gymnasiums, teachers were provided with out-of-date books and limited support on educational and technical issues, while there was a lack of clarity about the role of the Plinets. This points again to the inability of the centralised top-down implementation policy to cope with an innovation such as the introduction of computers into education, as mentioned in the previous section.

Leaving the issue of teachers' initiatives, I turn to the way teachers perceived their role. Looking at the way the teachers themselves viewed their role within the implementation of IT, a paradox was revealed. On the one hand, teachers argue for more flexibility claiming their participation in the decision-making process in relation to IT. On the other hand, teachers welcome the existence of a National Curriculum, a student textbook and a teacher book. Although the majority of the teachers wanted a general National Curriculum as a basis for the teaching units they had to cover, they wanted a student textbook to organise their teaching and

to provide practical exercises for use in their teaching. Finally, teachers viewed the teacher book as the replacement for the educational support they did not have. Interview data indicated that teachers were not ready to break free from the authoritarian educational system, although more information is needed to explain their attitude. As I mentioned above, teachers felt as their duty to cover the IT Curriculum. Interestingly, they felt self-sufficient in this role. Questionnaire data showed that half of them reported no problems at all, and less than half of them reported that they needed help. It seemed teachers accepted the role of the IT specialist, and felt able to handle everyday problems. In parallel, they did not ask for help on educational issues. As for direct help, teachers received that from the Plinets. As revealed in interview data, Plinets operated differently in different areas. It seems that discrepancies concerning their role (see previous section) gave them the flexibility to act but also resulted in confusion about their responsibilities. Interestingly, teachers in the Cyclades, despite all the problems they faced in terms of transportation and isolation, felt the Plinet to be more active than those in Athens. This is an interesting indication that might point to the personality of the PLINET, or it might point to specific characteristics in their area other than adequacy of communication. This conjecture would be interesting to be researched further. Finally, teachers did ask indirectly for support, since the majority asked for training in educational issues. At the same time, they reported lack of opportunities for training. This can be explained by the fact that technology evolves very quickly and they felt the need for continuous training and updating of their skills.

Thus, it seems that the system survived. On the one hand, teachers reported that they had limited help and support, but on the other hand they perceived their role as professionals who should be able to control their classroom, both in respect to technical as well as educational aspects. Teachers only asked for help on hardware damages that a “specialist teacher” could not fix, and for training, as a professional development process that any teacher should participate in.

In conclusion, the implementation of IT was shaped in the classrooms by the interrelation of three factors. First, the way the teachers perceived the main aims of the subject itself, as proposed in the IT Curriculum and as they believed IT should be taught in schools. Second, it was influenced by the infrastructure that had been put in place to support its implementation. Third, it was influenced by the way the teachers perceived their role within the process of implementation.

Greek IT teachers accepted their role as implementers of a given National Curriculum, having a different mentality in comparison to the one that teachers in decentralised systems such as the English one have (Acker 1997, Steven & Hassell 1994, Olson 1988). This does not mean that teachers did not feel as professionals in their classrooms, but that they perceived professionalism in a different way, highlighting the difference between the culture of teaching and of education in different countries (Fullan & Hargreaves 1998). On the one hand, Greek IT teachers seemed to accept the authority of the State that had appointed them to implement an imposed National curriculum, and their professional duty was to cover it. At the same time, they

perceived their role as professionals who should provide their students with the latest information about IT, as well as being able to control their classroom, both in technical and educational aspects.

In this line of argument, teachers realised their initiatives only conditioning they had covered the IT curriculum. This way, their initiatives were perceived as an add-on to the prescribed actions.

Thus, the Greek case study reinforced the argument found in literature that the meaning of computer use is shaped during the transition from the policy to the implementation level. In parallel, it suggested that the reasons for discrepancies between the two levels may differ among educational systems. Discrepancies found between policy and implementation in Greek schools were not due to the teachers' resistance as in decentralised systems. Greek IT teachers resisted neither the system, nor the IT curriculum. By contrast, they accepted the system and the authority of the Ministry of Education to impose a National Curriculum. Discrepancies between policy and practice were due to a lack of clarity in meaning, as well as to a lack of resources. Moreover, the infrastructure provided by the Greek prescriptive educational system to support the implementation of IT, did not encourage initiatives on behalf of the teachers. So, teachers' initiatives related to IT were realised as an add-on to the IT curriculum, while teachers' initiatives unrelated to IT were realised outside the school schedule.

9.4 Implications for the introduction of computers in education

The present study explored the process of the introduction of computers into education as an educational innovation. It reviewed educational innovation studies and international experience related to the computer use, it explored the introduction of computers into schools as attempted in the early efforts of England and Germany and investigated in-depth the way computers were introduced in Greece. By pulling all these issues together, the study raises some specific issues but also suggests some general implications on the introduction of computers into education that are presented below.

The thesis showed that the introduction of computers into education is a distinct educational innovation, in the sense that unlike other educational innovations, it presents a technical complexity, since it demands considerable funds for hardware and software provision and maintenance. Moreover, it demands additional lifelong funds to update resources, since technology evolves very fast. This specificity of computer innovation needs to be considered in such projects. It seems that centralised strategies can not provide adequate technical infrastructure, since funds can not be easily ensured for all schools. Bottom-up strategies can neither provide for adequate technical infrastructure, especially as far as it concerns software development and teachers' training. It is indicated that a combination of national support and local initiative might work better.

As an educational innovation, the introduction of computers raises issues of educational complexity, in terms of possible incompatibility of the proposed programme with the existing

educational aims and structures. This perspective needs to be taken in consideration by initiators and policy makers in the effort to introduce computers into education. As discussed in the thesis, the way participants perceive the meaning of the computer use is a very important factor in the implementation of the innovation. The study, showed that whatever the system is, centralised or decentralised, the meaning of computer use, as the meaning of other educational innovations, is perceived differently among participants not only at the same but also at different levels of education. Additionally, the meaning of the computer use is distorted in policy documents. Lack of clarity and contradictions between documents or even more, between different parts of the same document, create a lack of clarity about the meaning of the attempted computer use, especially when this is contradictory to traditional practices. Next, the study showed that the proposed computer use is shaped through the transition from policy to classroom implementation. Reasons though for discrepancies between policy and implementation differ among different educational systems. This issue is discussed later in this section.

The study showed that the process of the computer innovation is influenced not only by the specificity of the computer innovation, but also by the characteristics of the proposed computer use. The thesis distinguished two broad categories of computer use (IT and ITE) that promote different values and involve different levels of complexity for their introduction and have different implications for their initiation and implementation into schools. IT aims to satisfy socio-economic needs of a country. Thus, all countries promoted IT following the international tendency for familiarising future citizens with computer applications and facilitating technological development. As indicated in the study, mainly technical and organisational issues need to be considered for its introduction into education. By contrast, ITE aims to improve or even alter education. It is more complex than the introduction of IT. Due to its complexity, ITE remains as a parallel or even second step in governmental plans. Although no empirical evidence was available in the Greek case study, the theoretical considerations indicated that not only technical and organisational, but also educational issues need to be considered for its introduction into schools. More resources need to be ensured, while development of high quality educational software is a time consuming and high cost endeavour. Moreover, professional development of teachers is an issue that needs to be taken into consideration.

Additionally, introduction of IT is not a catalyst for introduction of ITE. That is due to the different nature of IT and ITE. The two categories of computer use, not only promote different values but also involve different kind of complexities for their introduction into schools. Initiators need to emphasise on different aspects in the process of introduction of IT and ITE, and thus, successful introduction and diffusion of IT does not ensure introduction of ITE.

As also shown in the study, the specific context of the country plays a crucial role for the initiation and implementation of computer use in schools. In centralised educational systems, policy makers decide to promote IT or ITE depending on whether the value promoted by IT and ITE is in congruency with the country's priorities. Moreover they consider the complexity that IT

and ITE involve for their introduction into schools, according to a country's available infrastructure, educational aims and structures. Other external and internal factors may influence decisions, however, that needs to be investigated in depth in each country.

Additionally, implementation of computer use is influenced by the way teachers perceive their role, the meaning of computer use, as well as by the available infrastructure. However, the above factors are codified by the subjective realities in each country. Teachers perceive their role differently in centralised and decentralised educational systems. Teachers in decentralised systems are encouraged to develop their own meanings of innovation, while they are the ones to decide the best way of realising the curriculum that usually promotes loose objectives. By contrast, it was shown that in centralised educational systems, teachers feel professionals in a different way. They feel their duty is to cover the given National curriculum in the best way possible. Any initiative comes as an add-on to the prescribed actions. Moreover, in centralised prescriptive educational systems such as Greece, infrastructure is developed in such a way to support the specific proposed computer use. This infrastructure, although it does not forbid initiative on behalf of the teachers, it does not encourage it.

Extending this point, one can question the level of variation accepted by different educational systems and policies. For example, within the technological paradigm of innovation, implementation of the proposed innovation is expected, at least as it concerns the main aims and features of the innovation. In this case, the research issue would be to find a way to achieve implementation of the proposed model, by developing clarity of the meaning of the innovation and the teachers' mastery of it. An innovation within the political paradigm of innovation would target the implementation -which all participants conform. In this case, the research issue would focus on finding a way to achieve consensus among the participants about the meaning of the innovation, through negotiation. Finally, an innovation within the cultural perspective allows variation in its implementation, since it acknowledges that teachers and schools may not be in complete agreement, as they represent different sub-cultures.

9.5 Limitations of the study and suggestions for further research

The study explored the process of the introduction of computers into education as a nationally directed innovation, in the sense that the study was concerned mainly with national projects launched related to computer use in schools. The theoretical considerations of the thesis were concerned with the way national projects were launched and the way teachers reacted to their introduction. Although in the theoretical considerations of the study I referred to decentralised initiatives in England, I focused more on the way the national projects supported them, than on the way local initiatives developed and flourished.

Next, the thesis does not explore the use of computers in school administration. Not because its importance is not acknowledged, but rather computer use in school administration

is very limited internationally and especially in the case of Greece. It would be, however, interesting for another research to investigate this issue.

Additionally, the thesis does not explore the way students may react to a proposed innovation, and thus, the way in which an innovation might be presented to them. That is because the current thesis explores the way the proposed innovation is perceived in the policy and in the implementation by the teachers. In order to have a complete picture of the implementation of the innovation, students' attitudes and perceptions is definitely of interest. Such an inquiry, however, goes beyond the scope of the current research. It presents a challenge though for future investigation.

Turning to the cases of England and Germany, it has to be noted that discussion was based only on literature found related to the efforts of these countries to introduce computers into their education system. Primary data is missing to analyse the complexities of the process of the introduction of computers in the two countries. For example, information on the way policy makers actually perceived rationales for the introduction of computers into schools would throw light on the phase of initiation. Moreover, adequate information is missing on the way the German educational system promotes the loose objectives decided at the country level, to the state and school levels. This does not allow us to understand better how different IT subjects were implemented in schools. Similarly, primary data is missing to analyse the way English teachers actually interfered with the initiation of computers in their schools, as well as the way they perceived its objectives. Such an in-depth research, however, was not under the scope of the current study. A comparative study would bring out very interesting issues, illustrating the way specificity of the different educational systems influence the process of the computer innovation.

Additionally, the empirical study in Greece was influenced by the innovation policy of the country, that is, a top-down prescriptive policy. Greece was, by no means, chosen to stand as a representative case. Its uniqueness is acknowledged in terms of its priorities, innovation policy, educational structure, pedagogical orientations and infrastructure. Rather the case study was conducted in order to explore in depth the process of the introduction of computers in the particular setting of the Greek educational system. As other case studies of this kind, it offered in-depth information about the investigated issue, raising the specificity of the context, as well as common issues with other countries.

So, the present study is concerned with computer initiation in schools as a result of policy-making at the high levels of the educational hierarchy. In such context, intermediaries are not influential since they can not challenge decision-making in the high hierarchy. Moreover, teachers do not participate in decision-making in the initiation phase. Different factors may influence the initiation of computers in schools, in cases where the initiators are not the policy-makers, but the school policy or the teacher. It may be the case that the value and complexity of computer use, as codified in the specific school by school initiators, may represent two main

factors that influence the decisions for the initiation of computer use. This issue though remains to be investigated in another research.

Turning to the Greek case study, the findings of the research may be limited in certain ways. First, the Minister of Education who was the main decision-maker, in the sense that he is the one who signs for the introduction of any educational innovation, was not interviewed, since it was difficult to trace him. However, the person responsible for the introduction of computers in the Ministry of Education was interviewed and there was no reason to doubt his statements on the reasons that influenced the initiation of computers in education. At the same time, members from the advisory committees were interviewed giving a rounded understanding of the above issue.

Next, the response of teachers to the questionnaires sent to them can be considered to be low, since only a little over half of the distributed questionnaires were returned. However, it has to be taken into consideration that the collected questionnaires still represent more than half of the IT teachers in Greece, since questionnaires were distributed to all Greek IT teachers. Additionally, there is no reason to suggest that specific groups of teachers did not respond to the questionnaire. By contrast, low response might be explained by the specific conditions at that particular time in schools. Specifically, at the time that the questionnaire was distributed to schools, teachers participated in the most long-lasting strike ever. The absence of teachers from schools for a period longer than one month in combination with a two-week Easter holiday, created problems in the distribution of questionnaires as well as in their receipt by teachers. Moreover, when teachers came back to schools, they were too busy covering the lost teaching sessions through an extended school schedule.

One of the main concerns that came up was the validity of some of the answers obtained by the questionnaires. More specifically, some questions in the questionnaire used a four-point scale, while it would be more appropriate for the purposes of the research to use a five point Likert-type scale. Moreover, the proposed answers such as, "some", "many", "a little", "a lot" may have created problems of interpretation by the responders. The meaning of expressions such as the above could vary enormously between one respondent and another and that was realised during the interpretation of the results. Arguably, statistical analysis for such questions maybe of limited reliability. The above limitations, however, do not restrict us from formulating an accurate picture on the issues raised by the questionnaires.

Additionally, teachers' perceptions about IT were explored through questionnaires and interviews, while classroom observations were not conducted, since it was not possible under the time limits of the present study. Another research may extend the findings, exploring the classroom dynamics, as well as the role of the students in the implementation of IT. Next, teacher interviews were conducted in a central and an isolated area of Greece, but not in a semi-peripheral area. Moreover, schools were not distinguished according to the characteristics of the area (urban, rural etc). These factors were excluded due to the time limits of the present

study. Another research could throw more light on the above issues and extend the findings of the research.

Finally, the implementation of computer introduction in Greek schools in the third phase was not investigated, since at the time the empirical research was conducted, ITE had not yet been implemented in schools. Another research project would provide valuable information, since this phase presented a change in the orientation of the project.

9.6 Concluding remarks

The present study attempted a conceptualisation of the process of computer introduction in education as an educational innovation. It drew up some major theoretical considerations by pulling together educational innovation studies, international experience related to computer use in education and some experience of the efforts of England and Germany to introduce computers in their educational systems. The Greek case study illuminated and enriched the theoretical considerations, giving a detailed insight into the process of computer introduction in Greek education, both as this was shaped at different times and at the different educational levels at particular points in time. It raised issues drawn from the specificity of the Greek context, and concluded with the implications for the introduction of computers in education, irrespectively to the context within which computer introduction is attempted. More case studies in other educational systems with other characteristics and innovation policies are needed to enlighten and give a more spherical understanding of the complexity of the introduction of computers in education.

REFERENCES

- Acker, S.** 1997 'Primary School Teachers' Work: The Response to Educational Reform', in G. Helsby and G. McCulloh (eds) *Teachers and the National Curriculum*, London: Cassell.
- Adamopoulos, et.al** 1985 'Introduction of Information Technology in Education', Athens: Pedagogical Institution. (in Greek)
- Adamopoulos, L. et.al** 1986 'Report of the working group for the introduction of Information Technology into gymnasiums" Report submitted to the Ministry of Education'. (in Greek)
- Alexandris, N.** 1982 'Participation to the Workspop for educational research in new technologies on education, Report to the Ministry of Education'. (in Greek)
- Alexandris, N.** 1995 'The new student textbooks for Informatics: grades A, B and C of gymnasium'. *Meeting: Information Technology and Education*, MNER and Economics University, Athens, Greece (in Greek)
- Anastasi, A.** 1990 *Psychological Testing*, New York: Macmillan Publishing Company.
- Andreou, A. and Papakonstantinou, G.** 1994 'Authority and Organisation - Administration of educational system', *Nea Synora, Athens*. (in Greek)
- Ball, S. J.** 1993 'Education policy, power relations and teachers' work', *British Journal of Educational Studies* 41(2, June 1993): 106-121.
- Ball, S. J.** 1998 'Big Policies/Small World: an introduction to international perspectives in education policy', *Comparative Education* 34(2): 119-130.
- Benekos, A. P.** 1991 'National Curriculum in Greece), *Pedagogical Psychological Encyclopedia* 7: 4054-4058.
- Bowe, R. and Ball, S.** 1992 *Reforming Education & Changing Schools*, London: Routledge.
- Boyd-Barrett, O.** 1990 'Schools Computing Policy as State-Directed Innovation', in O. Boyd-Barrett (ed) *Computers and Learning*: Addison Wesley.

- Brennan, M. and Noffke, S.** 2000 'Social change and the individual: changing patterns of community and the challenge for schooling', in H. Altrichter and J. Elliott (eds) *Images of Educational Change*, Buckingham: Open University Press.
- Brown, J., Coupland, J. and Davies, M.** 1993 'New Information Technology in Education in United Kingdom', Brussel, Luxembourg: Task Force Human Resources, Office for Official Publications of the European Communities.
- Brummelhuis, A. and Plomp, T.** 1993 'Lessons from two Dutch Projects for the Introduction of Computers in Schools', *Computers and Education* 20(4): 333-340.
- Brummelhuis, A. and Plomp, T.** 1993 'The Relation between Problem areas and Stages of Computer Implementation', *Studies in Educational Evaluation* 19: pp. 185-198.
- Brummelhuis, A. and Plomp, T.** 1994 'Computers in Primary and Secondary Education: The Interest of an Individual Teacher or a School Policy?', *Computers in Education* 22(4): 291-299.
- Brummelhuis ten, A.** 1995 'Lessons from a decade of policies for stimulating computer use in the Netherlands' *6th World Conference on Computers in Education: liberating the learner*.
- Carmichael, H. W. et.al** 1985 'Computers, Children and Classrooms: a Multicidic Evaluation of the Creative Use of Microcomputers by Elementary School Children': Ministry of Education, Ontario.
- Chatzopoulos, M. and al., e.** 1992 'Working group's proposal for the IT curriculum in Gymnasium and in Dimotico: Report submitted to the Ministry of Education', Athens. (in Greek)
- Cohen, L. and Manion, L.** 1994 *Research Methods in Education*, 4th Edition, London: Routledge.
- Collis, B.** 1989 'Using Information Technology to Create New Educational Situations', *Higher Educational Policy* 2(4): 63-70.
- Collis, B. A.** 1996a 'Computers in Education', in T. Plomp and D. Ely (eds) *International Encyclopedia of Educational Technology*, Oxford, UK: Pergamon.
- Duguet, P.** 1989 'National Strategies and their Extension to the International Level', *Higher Education Policy* 2(4): 46-49.
- Duguet, P.** 1990 'Computers in Schools: National Strategies and their Extension to the International Level', *Prospects* 20(2): 165-172.

- Elliott, J.** 2000 'Towards a synoptic vision of educational change in advanced industrial societies', in H. Altrichter and J. Elliott (eds) *Images of educational change*, Buckingham: Open University Press.
- Finnan, C. and Levin, H. M.** 2000 'Changing school cultures', in H. Altrichter and J. Elliott (eds) *Images of educational change*, Buckingham: Open University Press.
- Forthergill, R.** 1988a 'It's a Small World', *NUT Education Review* 2(1): 69-72.
- Forthergill, R.** 1988b 'The Problems of Innovation: The British Experience', *European Journal of Education* 23(4).
- Francis, L. J., Katz, Y. J. and Jones, S. H.** 2000 'The reliability and validity of the Hebrew version of the Computer Attitude Scale', *Computers & Education* 35: 149-159.
- Fraser, R. et.al** 1988 'Learning Activities and Classroom Roles', in A. S. Jones, P. (ed) *Computers in Education 5-13*: Open University Press.
- Fullan, M.** 1986 'The Management of Change', in E. Hoyle and A. McMahon (eds) *World Yearbook of Education 1986: The Management of Schools*, London: Kogan Page.
- Fullan, M., Miles, M., Anderson, S.** 1988 'Strategies for Implementing Microcomputers in Schools: The Ontario Case': Ministry of Education.
- Fullan, M.** 1991 *The New Meaning of Educational Change*: Cassell.
- Fullan, M.** 1992 'We do not have the choice of avoiding change just because it is messy' *Times Educational Supplement*, London.
- Fullan, M.** 1993 *Change Forces: Probing the Depths of Educational Reform*, London: The Falmer Press.
- Fullan, M.** 1999 *Change forces: the sequel*, London: Falmer Press.
- Fullan, M. and Hargreaves, A.** 1998 *What's worth fighting for in your school? Working together for improvement*: Open University Press.
- Fung, A. and Visscher, A.** 1996 'Conclusion and agenda for ITEM research', *International Journal of Educational Research* 25(4): 373-380.

- Geertz, C.** 1973 'Thick Description: Toward an interpretive theory of culture', in C. Geertz (ed) *The Interpretation of Cultures*, New York: Basic Books.
- Gorny, P.** 1982 'New Information Technologies in Education in the Federal Republic of Germany', *European Journal of Education* 17(4): 339-353.
- Gorny, P.** 1991 'Fundamental Informatics in Teacher Education in West Germany', *Computers Education* 16(1): 37-42.
- Guthrie, J. W. and Pierce, L.** 1990 'The International Economy and National Educational Reform: a Comparison of educational reforms in the United States and Great Britain', *Oxford Review of Education* 16(2): 179-204.
- Gwyn, R.** 1982a 'England and Wales: Main Lessons learned', in L. Cerych (ed) *Computer Education in Six Countries: policy problems and issues*, Hague: Ministry of Education and Science, The Hague.
- Gwyn, R.** 1982b 'Information Technology and Education: the Approach to Policy in England, Wales and Northern Ireland'.
- Gwyn, R.** 1988a 'Editorial: The New Information Technologies and Educational Policy: lessons learned, lessons unthinkable', *European Journal of Education* 23(4): 299-303.
- Gwyn, R.** 1988b 'Teacher Education and Change: the first Decade'.
- Hargreaves, A.** 1994 *Changing Teachers, Changing Time: Teachers' work and culture in the postmodern age*, London: Cassell.
- Hargreaves, A. and Evans, R.** 1997 *Beyond Educational Reform: bringing Teachers Back In*, Buckingham: Open University Press.
- Hawkrige** 1996 'Educational Technology in Developing Nations', in T. Plomp and D. Ely (eds) *International Encyclopedia of Educational Technology*, Oxford, UK: Pergamon.
- House, E.** 1978 'Technology versus Craft: A Ten Year Perspective on Innovation', in P. Taylor (ed) *New Directions in Curriculum Studies*, Sussex: The Falmer Press.

- House, E.** 2000 'Economic change, educational policy formation and the role of the state', in H. Altrichter and J. Elliott (eds) *Images of educational change*, Buckingham: Open University Press.
- House, E. R.** 1974 *The Politics of Educational Innovation*, United States of America: McCutchan Publishing Cooperation.
- Hoyles, C.** 1993 'Computer-based Microworlds: a Radical Vision or a Trojan Mouse?' *ICME 7*, University Laval, Quebec, Canada.
- Hoyles, C., Noss, R. and Sutherland, R.** 1991 *Final Report of the Microworlds Projects: 1986-1989*, London: Department of Mathematics, Statistics and Computing, Institute of Education, University of London.
- Huberman, A. and Miles, M.** 1984 *Innovation Up Close: How Schools Improvement Works*, New York and London.
- Hurst, P.** 1983 *Implementing Educational Change - A Critical Review of the Literature*, London: Department of Education in Developing Countries, University of London, Institute of Education.
- Ifanti, A.** 1992 'The politics of the secondary school curriculum in Greece', London: Institute of Education, University of London.
- Jones, R.** 1991 'Shaping Educational Technology: Ontario's Educational Computing Initiative', *Educational and Training Technology International* 28(2): 129-134.
- Kanellopoulos N. et al** 1986 'Report to the Minister of Education for the introduction of Information Technology in secondary education'. (in Greek)
- Kazamias, A.** 1993 'The curse of Sisyphus in Greek educational reform; a socio-political and cultural interpretation', in S. Bouzakis (ed) *Comparative Education III*, Athens: Gutrenberg. (in Greek)
- Kemmis, S.** 1987 'How Computing is Changing Education, in Coming to Terms with Computers in Schools': Report of the School Studies of the National Evaluation Study of the Commonwealth Schools Commission's Study of the Commonwealth Schools Commission's National Computer Program.

- Kontogiannopoulou-Polydorides, G., Georgakakos, S. and Zavoudakis, A.** 1996 'Greek Schools and Computer Education: Socio-Cultural Interpretations', in T. Plomp, R. Anderson and G. Kontogiannopoulou-Polydorides (eds) *Cross National Policies and Practices on Computers in Education*, London: Kluwer Academic Publishers.
- Kontogiannopoulou-Polydorides, G., Mylonas, T., Solomon, J. and Vergidis, D.** 1995 'Greece', in T. P. Neville, T.N. (ed) *The international encyclopedia of national systems of education*, Oxford: Pergamon.
- Koutouzis, M.** 1999 'Educational organisations and the Greek educational system', in M. Koutouzis, A. Athanasoula-Reppas, G. Mavrogiorgos, D. Chalkiotis and V. Nitsopoulos (eds) *Management of educational organisations: Educational administration and policy*, Patras: Greek Open University. (in Greek)
- Lawton, D. and Gordon, P.** 1996 'Education and educational theory' *Dictionary of Education*, London: Hodder and Stoughton.
- Lehmann** 1994 'Germany: System of Education', in T. Husen and T. N. Postlethwaite (eds) *The International Encyclopedia of Education*, Oxford: Pergamon.
- MacDonald, B. and Walker, R.** 1975 'Case Study and the social philosophy of educational research', *Cambridge Journal of Education* 2(11).
- Maguire, M. and Ball, S. J.** 1994 'Discourses of Educational Reform in the United Kingdom and the USA and the work of teachers', *British Journal of In-service education* 20(1): 5-16.
- Maritsas, D. et.al** 1985 'Education on Information Technology and Information Technology in Education, Report to the Ministry of Education', Athens. (in Greek)
- Maritsas, D. et.al** 1992 'Astrolavos: Study for the exploitation of Information Technologies in Greek Gymnasiums, Report to the Ministry of Education', Patra, Greece: Computer Technology Institute. (in Greek)
- Massialas, B., Flouris, G. and Kassotakis, M.** 1988 'The educational system of Greece', in G. T. Kurian (ed) *World Educational Encyclopedia*, New York: Files and Fact Publications.
- McGrath, F.** 1992 'Educational Infrastructure (Informatics): Assessment of Capacity to Accelerate an Information Programme within the Educational Structure in Greece', Brussels: Local and Regional Development Planning, Managers of EC Technical Assistance Projects.

McKinsey and Company 1997 'The Future of Information Technology in UK Schools', London.

Metaxaki - Kossionides, C. 1993 'New Information Technology in Education in Greece', Brussel, Luxembourg: Task Force Human Resources, Office for Official Publications of the European Communities.

Michalopoulos, G. 1987b 'The Beauraucratic Character of the Greek School System and the Pedagogical Educational Process', *Pedagogiki Epitheorisi* 7: 169. (in Greek)

Ministry of Education 1985 'Law 1566/85'. (in Greek)

Ministry of Education 1987 ',Feasibility Report' Athens, Greece: MNER. (in Greek)

Ministry of Education 1992 'Project for the Expansion of Information Technology in Primary and Secondary Education', Athens, Greece: MNER. (in Greek)

Ministry of Education 1994 'European Community Support Framework'. (in Greek)

Molenda, M. 1996 'Educational Technology in Elementary and Secondary Education', in T. Plomp and D. Ely (eds) *International Encyclopedia of Educational Technology*, Oxford, UK: Pergamon.

Morris, J. 1982a 'The use of New Information Technologies in Scottish Education'.

Morris, J. G. 1982b 'Scotland: Comments on Problems in Initiating a Microelectronics Programme', in L. Cerych (ed) *Computer Education in Six Countries: Policy Problems and Issues*, Hague: Ministry of Education and Science.

National Technical University of Athens (NTUA) 1999 'Ploutarchos: Research for the harmonisation of the use of teaching aids in the educational process and for the definition of pedagogical and teaching prototypes for their development.', Athens, Greece: National Technical University of Athens.

Noss, R. and Hoyles, C. 1996 *Windows on Mathematical Meanings*, The Netherlands.

OECD 1997 *Reviews of National Policies for Education: Greece*, Paris: OECD.

Olson, J. 1988 *Schoolworlds-Microworlds: Computers and the Culture of the Classroom*, London: Pergamon Press.

- Osborn, M. et.al** 1997 'Policy into Practice and Practice into Policy: Creative Mediation in the Primary Classroom' *Teachers and the National Curriculum*.
- Panoutsopoulos, A. and Potari, D.** 1993 'A Report on the Use and Evaluation of Software for Teaching Mathematics to Primary School Children', *Journal of Computer Assisted Learning* 9: 184-186.
- Papas, G.** 1989 *Information Technology in Education*, Athens: Symeon. (in Greek)
- Pelgrum, Anderson and Polidorydis** (eds) 1996 *Cross National Policies and Practices on Computers in Education*, London: Kluwer Academic Publishers.
- Pelgrum, W.** 1993a 'Attitudes of school Principals and Teachers towards Computers: Does it matter what they think?'
- Pelgrum, W. and Plomp, T.** 1993a *The IEA Study of Computers in Education: Implementation of an Innovation in 21 Educational Systems*, Oxford: Pergamon Press.
- Pelgrum, W. and Plomp, T.** 1993b 'The Worldwide Use of Computers: A Description of the Main Trends', *Computers and Education* 20(4): 323-332.
- Pelgrum, W. J.** 1994 'New Information Technologies in the Education Systems of EC Member States: Synthesis Report', Brussel, Luxembourg: Task Force Human Resources, Office for Official Publications of the European Communities.
- Pelgrum, W. J. and Plomp, T.** 1991 *The Use of Computers Worldwide: Results from the IEA "Computers in Education Survey in 19 Education Systems"*.
- Pelgrum, W. J. and Plomp, T.** 1993c 'The use of computers in education in 18 countries', *Studies in Educational Evaluation* 19: 101-125.
- Plomp, T., Anderson, R. and Kontogiannopoulou, G.** (eds) 1996a *Cross National Policies and Practices on Computers in Education*, London: Kluwer Academic Publishers.
- Posch, P.** 2000 'Community, school change and strategic networking', in H. Altrichter and J. Elliott (eds) *Images of educational change*, Buckingham: Open University Press.
- Robson** 1993 *Real World Research*, London: Blackwell Publishers.

- Rogan, G. M. and MacDonald, M. A.** 1985 'The in-service teachers education component of an innovation: a case study in an African setting', *Journal of Curriculum Studies* 1: 63-85.
- Rommel, H. G.** 1992 'New Information Technology in Education in Germany', Brussel, Luxembourg: Task Force Human Resources, Office for Official Publications of the European Communities.
- Rommel, H. G. and Lang, M.** 1996 'Computers and Education in the Federal Republic of Germany', in T. Plomp, R. Anderson and G. Kontogiannopoulou-Polydorides (eds) *Cross National Policies and Practices on Computers in Education*, London: Kluwer Academic Publishers.
- Rudduck, J.** 1991 *Innovation and change*, Philadelphia: Open University Press.
- Russell, P.** 1987 'Computer Education and the Microelectronics Education Programme', *British Journal of Educational Technology* 18(3): 256-265.
- Samatas, M.** 1995 'The Greek educational beauraucracy: a socio-political perspective of the beauraucratic Greek education', in A. Kazamias and M. Kassotakis (eds) *The Greek Education: Potential of reconstruction and modernisation*, Athens: Sirios. (in Greek)
- Sarason, S.** 1971 *The Culture of the School and the Problem of Change*, Boston: Allyn and Bacon.
- Sarason, S.** 1982 *The Culture of the School and the Problem of Change*, Boston: Allyn and Bacon.
- Sarason, S.** 1990 *The predictable failure of educational reform*, San Francisco: Jossey-Bass Publishers.
- Sarason, S.** 1996 *Revisiting: The Culture of the School and the Problem of Change*, Boston: Allyn and Bacon.
- Sarason, S.** 1998 *Political leadership and educational failure*, California: Jossey-Bass Inc., Publishers.
- Schostack, J.** 2000 'Developing under developing circumstances: the personal and social development of students and the process of schooling', in H. Altrichter and J. Elliott (eds) *Images of educational change*, Buckingham: Open University Press.
- Shaeffer, S.** 1991 *A Framework for Collaborating for Educational Change*: UNESCO.

- Simons, H.** 1995 'Case Study in Policy and Programme Evaluation', Southampton: University of Southampton.
- Slenning, K.** 2000 'The future school manager: information and communication technology aspects', *Educational Media International* 37(4: Dec 2000): 243-249.
- Smith, L. M. and Geoffrey, W.** 1968 *The Complexities of an Urban Classroom*, New York: Holt, Rinehart and Winston.
- Souflias, G.** 1993 'Minutes of first meeting of NCSINTE', Athens. (in Greek)
- Spirakis P. et al.** 1994 'Information Technology in public secondary Education: 1994-1999, Report to the Ministry of Education', Athens.
- Stake, R. E.** 1995 *The Art of Case Study Research*, California: Sage Publications.
- Stenhouse, L.** 1978 'Case Study and case records: towards a contemporary history of education', *British Research Journal* 2: 21-39.
- Stevenson, I. and Hassell, D.** 1994 'Modelling and Teacher Change', in H. Mellar, J. Bliss, J. Ogborn and C. Tompsett (eds) *Learning with Artificial Worlds: Computer-Based Modelling in the Curriculum*, London: Falmer Press.
- Stronach, I. and Morris, B.** 1994 'Polemical Notes on Educational Evaluation in the age of "Policy Hysteria"', *Evaluation and Research in Education* 8(1 and 2): 5-19.
- Tagg, B.** 1995 'The impact of government initiatives on IT education in UK schools', *Computer Education* 81(Nov 95): 5-9.
- Underwood, J. D. M. and Underwood, G.** 1990 *Computers and learning: helping children acquire thinking skills*, Oxford: Basil Blackwell.
- Vavaleskos, E. and al., e.** 1990 'Working group for the expansion and the implementation of IT into secondary education', Athens.
- Vavouraki, A.** 1993 'A longterm evaluation of the Microworlds Course: Implications for Teacher Training in Computers in Education', London: Institute of Education, University of London.
- Visscher, A.** 1996a 'The implications of how school staff handle information for the usage of school information systems', *International Journal of Educational Research* 25(4): 323-334.

- Visscher, A.** 1996b 'Information Technology in educational management', *International Journal of Educational Research* 25(4): 289-380.
- Visscher, A. and Wild, P.** 1997 'The potential of technology in support of teachers and educational managers managing their work environment', *Education and Information Technologies* 2(4: Dec 97): 263-274.
- Walker, D. F.** 1996 'New Information Technology in the Curriculum', in T. Plomp and D. Ely (eds) *International Encyclopedia of Educational Technology*, Oxford, UK: Pergamon.
- Watson, D., (ed)** 1992 'The Impact Report: an Evaluation of the Impact of Information Technology on Children's achievements in Primary and Secondary Schools': King's College, London.
- Watson, D.** 1997 'A dichotomy of purpose: the effect on teachers of government initiatives in information technology', in D. S. B. Passey (ed) *IFIP TC3 WG3.1/3.5 Joint Working Conference on Information Technology: Supporting change through teacher education*, 30th June - 5th July 1996, Kiryat Anavim, Israel: Chapman & Hall.
- Yin, R. K.** 1994 *Case Study Research. Design and Methods*, London: Sage Publications.
- Zucker, A. A.** 1982b 'USA: Main Lessons drawn from the Experience Regarding New Technologies in Education', in L. Cerych (ed) *Computer Education in Six Countries: Policy Problems and Issues*, Hague: Ministry of Education and Science.

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Questionnaire
for PLINETs

②

Part A

This part refers to your personal information, which is going to be **strictly confidential** and only for **academic use**. Please tick (✓) the boxes that represent you and give full answers where it needs

Age: _____ Sex: male female

Number of PLINET officers in your region _____

Number of IT teachers in your region _____

Years in your current position _____ (excluding this year)

Years in teaching IT (if so): _____

Other teaching experience (if so): subject _____ years _____

Other experience in educational sector (if so): _____ years _____

First degree on Information Technology: Yes No

Other degree: _____

Please, state the modules you have attended concerning IT (if so)

module	number of semesters

Attended in-service training courses on Information Technology

course	institute		duration		content <small>(give the main aim of the course)</small>
			days	hours per day	

Name: _____

Region: _____

Contact number: _____

Part B

This part is concerned with gymnasiums of your region in which **Information Technology has been introduced**. Please tick (✓) the appropriate boxes and fill in the spaces where it needs.

	none	some	many	all	insufficient evidence to judge
1. How many schools of your region where the IT subject is introduced have computer labs ?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>
2. How many schools of your region are provided with new equipment ?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>
3. How many schools of your region face problems in relation with computer resources?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>
4. How many schools of your region face problems in relation with space for the computer lab?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>
5. In how many schools of your region parents' associations did help the organisation of schools lab?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>
6. How many teachers of your region face technical problems in the lab ?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>
7. How many teachers of your region face problems on their teaching?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>
8. With how many teachers of your region you have discussed the aims of the National Curriculum?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>
9. With how many teachers of your region you have discussed technical problems?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>
10. With how many teachers of your region you have discussed issues concerning the teaching of the IT?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>
11. Do you have a copy of the National Curriculum? Yes <input type="checkbox"/> No <input type="checkbox"/>					

12. With which of the following bodies/persons you exchange information about issues concerning the Information Technology subject in gymnasiums?

Other PLINETS	<input type="checkbox"/>	Pedagogical Institute	<input type="checkbox"/>
IT teachers	<input type="checkbox"/>	IT committee	<input type="checkbox"/>
Teacher trainers	<input type="checkbox"/>	School board	<input type="checkbox"/>
parents' associations	<input type="checkbox"/>	Office of IT in the Directorate of Ministry of Education	<input type="checkbox"/>
none of the above	<input type="checkbox"/>		

13. Do you have personal contact with IT teachers in schools? Yes No
 If yes, how often?
 less than once a month once a month more than once a month

14. Have you met teachers who use other software apart those prescribed by the National Curriculum?
 Yes No
 If yes what? _____

15. Have you met teachers who, despite their wish to use other software apart the prescribed by the National Curriculum they didn't?
 Yes No
 If yes, what? _____
 what was the reason? _____

16. Which do you think is the most important problem that schools face in relation with the Information Technology subject? (please state)

17. Which do you think is the most important problem that IT teachers face? (please state)

18 What are the most important problem/s you face in your work?

19 What is the reason that in some of the schools of your region IT has not been introduced?

20 Did you organise in-service training courses for teachers of your region?

Yes No

What was the main aim of the courses?

Part C.

This section of the questionnaire is concerned with your views about Information Technology in gymnasiums. Please tick (✓) the boxes that best represent your views. It would be of great help if you could feel in the blank spaces.

21. Which of the following do you think should be the aims of IT in gymnasiums? (please, tick for yes of no)

	yes	no
<i>for students to understand basic notions of computer operation</i>		
<i>for students to be familiar with computers</i>		
<i>to develop qualified citizens to enter the future work force</i>		
<i>to give students the basic knowledge needed to pursue an academic course on IT</i>		
<i>for students to be aware of the nature and potential of computers</i>		
<i>for students to be able to use application programmes</i>		
<i>to develop future programmers</i>		
<i>for students to learn how to programme</i>		
<i>to enrich teaching in general</i>		
<i>other</i>		

22. Do you think that a National Curriculum has to exist?

Yes No

Please justify

23. Do you think that a student book has to exist?

Yes No

Please justify

24. Do you think that a teacher book has to exist?

Yes No

Please justify

25. Which of the following you think they should be advised by the Ministry of Education about issues concerning with the Information Technology subject? (please tick as apply)

- Pinet officers IT teachers academics
- school boards parents associations
- none of the above other _____

Part D.

This part concerns YOUR views about Information Technology in gymnasiums. Please, tick (✓) answers best represent your views. There is empty space to add something in case you think it needs.

42. Which of the following should be the aims of IT in gymnasiums? (please, tick for yes or no)

	yes	no
<i>for students to understand basic notions of computer operation</i>		
<i>for students to be familiar with computers</i>		
<i>to develop qualified citizens to enter the future work force</i>		
<i>to give students the basic knowledge needed to pursue an academic course on IT</i>		
<i>for students to be aware of the nature and potential of computers</i>		
<i>for students to be able to use application programmes</i>		
<i>to develop future programmers</i>		
<i>for students to learn how to programme</i>		
<i>to enrich teaching in general</i>		

other _____

43. Do you think that a National Curriculum has to exist?

Yes No not enough evidence to judge

If yes, please note which of the following should be the aims of a National Curriculum by ticking (✓) for yes or no

44. a National Curriculum

	yes	no
<i>has to state clearly the aims of the IT subject</i>		
<i>has to provide pedagogical guidance</i>		
<i>has to be analytical, providing specific teaching units in combination with propositions of possible actions by teacher</i>		
<i>has to be general, allowing for teacher initiatives has to be general allowing for teacher initiatives</i>		

other _____

45. Do you think that a student book has to exist?

Yes No not enough evidence to judge

If yes, please continue. If no, please go to question 48

46. Please note which form a student book has to have

one authorised student book to be used in all gymnasiums

an authorised list of proposed student books from which IT teacher can choose with to use

47. Tick with (✓) which of the following should be the aims of a student book

A student book has to:

	yes	no
<i>provide exercises on the NC teaching units</i>		
<i>give general information about IT</i>		
<i>give information on the teaching units of National Curriculum</i>		
<i>be consulted by IT teachers for the organisation of teaching</i>		

other _____

48. Do you think that a teacher's book has to exist?

Yes No not enough evidence to judge

If yes, please tick (✓) which of the following should be the aims of the teacher's book

49. a teacher's book has to:

	yes	no
<i>state the aims of IT</i>		
<i>provide guidance for classroom organisation</i>		
<i>provide guidance in teaching</i>		
<i>provide general information on the subject of IT</i>		
<i>provide information on the IT National Curriculum teaching units</i>		

other _____

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**Questionnaire
 for IT Teachers**

Name: _____
 School: _____
 Contact number: _____

Part A

This part refers to your personal information, which is going to be strictly confidential, and only for academic use. Please tick (✓) the boxes that represent you and give full answers where it needs

Age: _____ Sex: male female
 Position in school: permanent temporary other _____
 Grades I taught in 1996-97 school year: 1st 2nd 3rd grade _____
 Years of teaching IT _____
 Other teaching experience (if so): subject _____ number of years _____
 First degree on Information Technology Yes No
 Other degree (if so): _____

Please, state the modules you studied in IT (if so):

module	number of semesters

Attended In-service training courses on IT

course	institute	year	duration		content
			days	hours per day	

Part B

This part is concerned with information about your gymnasium. Please tick (✓) the boxes you feel describe the situation in your school.

- 1 How many classes does your gymnasium have in total?
3 6 9 other _____
- 2 How many teachers of IT are there in your gymnasium?
1 2 other _____
- 3 Does your school have a lab? No If No, please go to question number 10
Yes If Yes, please continue.
- 4 Do you share it with another school? Yes No
- 5 Is your lab equipped with (please, tick as appropriate)
8pcs 8088, one of them with hard disk, one printer
1 server 80486SX/25MHz/4MB 210MB Hard disk and 7 Pcs 80386SX/33MHz/2MB
Other _____
- 6 Is Windows installed in your computers? Yes No
- 7 Are the computers networked? Yes No
- 8 Which software is installed? (please, tick as appropriate)
Basic Logo word processing databases spreadsheet
MSWORKS ORION other _____
- 9 Are there any optional classes for students in IT outside National Curriculum hours?
Yes No
If yes, for students independent of their grade
separately for each grade
how many hours per week? _____

Part C

This part is concerned with your experiences concerning the teaching of IT. Please tick (✓) the boxes that you feel best represent you, and fill in the spaces where requested.

- 10 Which of the current aims of the IT national curriculum for gymnasiums you can recall?

- 11 Do you have any problems when teaching IT? Yes No
If yes, what kind of problems?
students' attitudes classroom management content of IT
teaching issues technical problems other _____
- 12 Are you or your students using materials in your classroom other than the student-book?
Yes No
If yes, please state what _____
- 13 Do you or have you received any kind of help in IT from PLINET? Yes No
If yes, please state what kind _____
- 14 Do you or have you had any other support in IT? Yes No
If yes, please state what _____
- 15 Do you have a copy of the National Curriculum? Yes No
- 16 Are you teaching IT teaching units not prescribed by the National Curriculum?
Yes No
If yes, which? _____

17. Would you like to offer a unit in IT that you do not at present teach? Yes No
If yes, which one? _____
why you do not offer it? _____

If your school does not have a lab, please proceed to question 22

18. Under which environment do you teach? DOS Windows both
 19. Which software do you use in your teaching? (tick as appropriate)
 Basic Logo word processing databases spreadsheet
 MSWORKS ORION other _____

20. Do you want to use a software for IT, that you do not at present use?

Yes No

If yes, which one? _____

21. Are computers used by students outside IT classes? Yes No

If yes, which software? _____
 for what purpose? _____

Please tick the box you feel best represents you

22. I use the National Curriculum not at all a little a lot

23. The National Curriculum provides me with teaching guidance

24. The National Curriculum leaves space for teacher initiatives in terms of teaching units or software used

25. My students use the student book

26. The student book gives me information on IT

27. The student book helps me to plan my teaching

28. I use the teacher's book not at all a little a lot

29. The teacher's book gives me teaching guidance

30. The teacher's book provides me with information about IT

31. I am given technical support by PLINET

32. I am given technical support by the software company

33. I am given teaching advice by PLINET

34. I am given teaching advice by other than PLINET

35. I have opportunities for in-service training

36. I need in-service training

37. Students like working in the lab

38. Students like theoretical sessions

39. Teaching in the lab is easier for me than teaching in the classroom

40. Looking back over your experience of teaching IT, pick up the best experience you can remember, and describe it _____

41. Looking back over your experience of teaching IT, pick up the worst experience you can remember, and briefly describe it _____

Part D.

This part concerns YOUR views about Information Technology in gymnasiums. Please, tick (✓) answers best represent your views. There is empty space to add something in case you think it needs.

42 Which of the following should be the aims of IT in gymnasiums? (please, tick for yes or no)

	yes	no
<i>for students to understand basic notions of computer operation for students to be familiar with computers</i>		
<i>to develop qualified citizens to enter the future work force</i>		
<i>to give students the basic knowledge needed to pursue an academic course on IT</i>		
<i>for students to be aware of the nature and potential of computers</i>		
<i>for students to be able to use application programmes</i>		
<i>to develop future programmers</i>		
<i>for students to learn how to programme</i>		
<i>to enrich teaching in general</i>		
<i>other</i>		

43 Do you think that a National Curriculum has to exist?

Yes No not enough evidence to judge

If yes, please note which of the following should be the aims of a National Curriculum by ticking (✓) for yes or no

44 a National Curriculum

	yes	no
<i>has to state clearly the aims of the IT subject</i>		
<i>has to provide pedagogical guidance</i>		
<i>has to be analytical, providing specific teaching units in combination with propositions of possible actions by teacher</i>		
<i>has to be general, allowing for teacher initiations has to be general allowing for teacher initiations</i>		
<i>other</i>		

45 Do you think that a student book has to exist?

Yes No not enough evidence to judge

If yes, please continue. If no, please go to question 48

46. Please note which form a student book has to have

one authorised student book to be used in all gymnasiums

an authorised list of proposed student books from which IT teacher can choose which to use

47. Tick with (✓) which of the following should be the aims of a student book

A student book has to:

	yes	no
<i>provide exercises on the NC teaching units</i>		
<i>give general information about IT</i>		
<i>give information on the teaching units of National Curriculum</i>		
<i>be consulted by IT teachers for the organisation of teaching</i>		
<i>other</i>		

48. Do you think that a teacher's book has to exist?

Yes No not enough evidence to judge

If yes, please tick (✓) which of the following should be the aims of the teacher's book

49 a teacher's book has to

	yes	no
<i>state the aims of IT</i>		
<i>provide guidance for classroom organisation</i>		
<i>provide guidance in teaching</i>		
<i>provide general information on the subject of IT</i>		
<i>provide information on the IT National Curriculum teaching units</i>		
<i>other</i>		

60 IT teachers need support in classroom management

Part E.

This part is concerned with YOUR views about the intended integration of computers within existing curriculum subjects. Please, tick (✓) the appropriate boxes. It would be of great help if you could fill in the blank spaces.

61. Do you know about the intention of the government to introduce computers into existing curriculum subjects?
 yes no
 if yes, where from? _____

62. Do you know about the way this will happen?
 no vaguely yes

63. Do you support the move to integrate computers into existing curriculum subjects ?
 yes no
 please state why

64. Do you think that the integration of computers into existing curriculum subjects is possible?
 yes no
 please state why

50. I believe that IT is best taught as a separate curriculum subject
 within existing curriculum subjects
 combination of lab sessions and teaching within existing curriculum subjects
 other _____

51. I believe that IT is best taught in the classroom
 in the lab
 combination of lab and classroom
 other _____

52. I need in-service training on (tick as appropriate)
 teaching issues
 classroom management issues
 computer applications
 subject of IT
 other _____

Please tick (✓) the boxes that best represent your views

	no	a little	a lot	not enough evidence to judge
53. IT teachers need training in teaching issues	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
54. IT teachers need training in its subject	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
55. IT teachers need to be allowed to decide about which teaching units to teach	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
56. IT teachers should be allowed to decide which software to use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
57. IT teachers should be asked by decision makers about issues concerning IT	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
58. IT teachers need technical support	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
59. IT teachers need support on teaching issues	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

65. Do you think that you could have a role in this effort? yes no

please state why

Appendix 5.3 Alterations in the Teacher-Questionnaire

Part A.

Since it was revealed that some of the IT teachers although they had no IT degree, had postgraduate studies on IT, it was decided for a question referring to postgraduate studies to be included. Second, as in PLINET's questionnaire, since it was revealed that most of in-service training courses were measured in hours, it was decided for the duration of in-service training courses to be measured only in hours instead of days and hours per day. Finally, it was decided for the title of the course to be excluded from the main questionnaire, since it was revealed that the title and the aim of the course was considered from the respondents overlapping, and moreover the respondents did not remember the title of the course.

Part B.

Since MSWORKS is a software package that includes word processor, database and spreadsheet, it was decided for this option to be put as a third one after Basic and Logo. However, options «word processing», «database» and «spreadsheet» was decided to remain since some schools might not had installed Windows. Moreover, the option «paintbrush» was decided to be included. Thus question eight was rephrased as follows:

«8. Which software is installed? (please, tick as appropriate)

Basic	<input type="checkbox"/>	Logo	<input type="checkbox"/>	MSWORKS	<input type="checkbox"/>
word processing	<input type="checkbox"/>	databases	<input type="checkbox"/>	spreadsheet	<input type="checkbox"/>
paintbrush	<input type="checkbox"/>	ORION	<input type="checkbox"/>	other _____»	

Part C.

Although IT teachers did not mention any problems concerning question ten, it was found in the analysis of the questionnaires that answers seemed to be confusing. Thus, it was decided for the question to be rephrased as follows:

«10. Which of the current aims of the IT national curriculum for gymnasiums you believe are the two most important?»

Since it was revealed that were teachers that never had asked for help from PLINET, and since questions number 31, 33 and 34 were also referred to the help that teachers actually received from PLINET officers, question number thirteen, was decided to be rephrased as follows:

«13. Do you or did you ever need any kind of help in the teaching of IT ?

Yes No

If yes, please state what kind of help you needed _____»

In this way, based also on questions number 31, 33 and 34, information could be revealed about the actual help IT teachers not only had, but also had asked for.

Similarly with the question number eight in part B, question number nineteen was rephrased as follows:

«19. Which software do you use in your teaching? (tick as appropriate)

Basic Logo MSWORKS
 word processing databases spreadsheet
 paintbrush ORION other _____»

Part D.

Although IT teachers did not argue for misunderstandings in question forty-four, from the analysis of the questionnaires, it was revealed that there were conflicting answers. Thus it was decided for the question to be rephrased using more detailed sentences minimising misunderstandings, as follows:

44. a National Curriculum

has to state clearly the aims of the IT subject
 has to provide the attainment targets leaving initiative to the teacher to organise teaching units and to decide for the software to be used
 has to organise the teaching units and propose the software to be used
 has to provide teaching guidance in general
 has to provide teaching guidance for every teaching unit with teaching examples
 other _____

yes	no

For the same reasons question number forty seven was rephrased as follows:

A student book has to:

give general information about IT not only on National Curriculum teaching units
 give information only on the teaching units of National Curriculum
 provide questions and exercises on every teaching unit of the National Curriculum
 consist the base on which IT teachers would organise their teaching
 other _____

yes	no

On question number forty six, it was revealed that IT teachers did not understand clearly the two options about the student textbook, since the authorised list of student textbooks was not used in Greece, it was decided for alterations to be made in the sentences as follows:

«one and only authorised student textbook to be used by all gymnasiums» and «an authorised list of proposed student textbooks from which IT teacher can choose which to use in his/her class».

No alterations have been decided for the last part of the questionnaire.

Appendix 5.4 Alterations in the PLINET-Questionnaire

Part A.

First, since it was revealed that a lot of Plinets had postgraduate studies in IT, it was decided for a question referring to postgraduate studies to be included. Second, as it was revealed that most of in-service training courses were measured in hours, it was decided for the duration of in-service training courses to be measured only in hours instead of days and hours per day. Finally, since it was revealed that the title and the aim of the course was considered from the respondents overlapping, and moreover, respondents did not remember the title of the course, it was decided for the title of the course to be excluded from the main questionnaire.

Part B.

First, the section «insufficient evidence to judge it was decided to be excluded since respondents argued that Plinets «should know this information».

In question two, the wording «new equipment» was to be further defined, since it was considered to be ambiguous. Thus, it was decided for the phrase «server 80486 and seven 80386, windows environment» to be added. This phrase was decided because based on official documents this kind of equipment was considered to be «new equipment».

Question three was excluded because Plinets argued that the question was ambiguous and the answer could not be subjective, unless there was space for further justification.

Since it was argued that there were cases that Communal authorities helped to the development of computer labs it was decided for another question to be added as follows: «In how many of gymnasiums in your region, Communal authorities did help the organisation of the school lab?»

For the questions number six and seven, it was decided the phrase «face ... problems» to be replaced with the phrase «asked you for ... help» since it was argued that this way it would be more clear to respondents.

In question number twelve, it was decided for «school boards» to be excluded, and «teacher trainers» to be replaced by «academics, since both options were not clear to the respondents.

Question number thirteen was rephrased, since respondents argued that they were not covered by given options. Thus, the question was rephrased as follows:

« Do you have personal contact with IT teachers in schools?

Yes No

If yes, how often you meet the average teacher?

less than once a month once a month more than once a month

what IT teachers you meet more often?

Next, since it was recalled that in one of the regions pilot programmes concerned with the integration of computers within existing subjects were running, it was decided for the following question to be added:

«Are there any schools in your region in which pilot programmes concerned with IT are run?

Yes No

If yes, which schools and what kind of programmes?

Part C.

In question twenty-one, it was decided for the option «for students to learn how to programme» to be replaced with the phrase «for students to be familiar with programming», since it was argued that phrasing was ambiguous.

In questions twenty two, twenty three and twenty four, the phrase «Please justify» was decided to be replaced with «Please state what the aim of a National Curriculum should be», «Please state what the aim of a student book should be» and «Please state what the aim of a teacher book should be» accordingly, since respondents seemed to answer the questions based on the existing National Curriculum, student book and teacher book, which was not the purpose of the question.

In question number twenty-five, the option «school boards» was excluded since respondents seemed to be confused. Moreover, it was decided for two more options to be included: «PEKAP» (Panhellenic union of IT teachers) and «EPI» (Hellenic Society of scientists of Computer and IT), since both options were added from respondents.

Part D.

Question number twenty nine, «Do you think that the integration of computers within existing curriculum subjects is possible?» was decided to be rephrased as follows: «Do you think that the integration of computers within existing curriculum subjects as mediums for discovery learning is possible?», since respondents argued that it was ambiguous.

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Questionnaire
for IT Teachers

Name: _____
 School: _____
 Contact number: _____

Part A

This part refers to your personal information, which is going to be **strictly confidential**, and only for **academic use**. Please tick (✓) the boxes that represent you and give full answers where it needs

Age : _____ Sex : male female
 Position in school : permanent temporary paid by hour
 Grades I teach in 1996-97 school year : 1st 2nd 3rd grade
 Years of teaching IT _____
 Other teaching experience (if so) : subject _____ number of years _____
 First degree on Information Technology (if so) _____
 Postgraduate degree on IT (if so) _____

Other university degree (if so) : _____
 modules you studied in IT (if so)

module	number of semesters

Attended In-service training courses on IT

institute	year	duration hours	content of the course

Part B

This part is concerned with information about your gymnasium. Please tick (✓) the boxes you feel describe the situation in your school.

1. How many classes does your gymnasium have in total?
 3 6 9 other
2. How many teachers of IT are there in your gymnasium?
 1 2 other
3. Does your school have a lab? No *If No, please go to question number 10*
 Yes *If Yes, please continue.*
4. Do you share it with another school? Yes No
5. Is your lab equipped with (please, tick as appropriate)
 8pcs 8088, one of them with hard disk, one printer
 1 server 80486SX/25MHz/4MB 210MB Hard disk and 7 Pcs 80386SX/33MHz/2MB
 Other _____
6. Is Windows installed in your computers? Yes No
7. Are the computers networked? Yes No
8. Which software is installed? (please, tick as appropriate)
 Basic Logo MSWORKS
 word processing databases spreadsheet
 paintbrush ORION other _____

9. Are there any optional classes for students in IT outside National Curriculum hours?

- Yes No
 If yes, for students independent of their grade
 separately for each grade
 how many hours per week? _____

Part C

This part is concerned with your experiences concerning the teaching of IT. Please tick (✓) the boxes that you feel best represent you, and fill in the spaces where requested

10. Which of the current aims of the IT national curriculum for gymnasiums you believe are the two most important?

11. Do you face any problems when teaching IT? Yes No
 If yes, what kind of problems?
 students' attitudes classroom management content of IT
 teaching issues technical problems other _____
12. Are you or your students using materials in your classroom other than the student-book?
 Yes No
If yes, please state what _____
13. Do you or did you need any kind of help in teaching of IT? Yes No
 If yes, please state what kind _____
14. Do you or have you had any other support in IT other than from PLINET? Yes No
 If yes, please state what _____

- 15 Do you have a copy of the National Curriculum? Yes No
- 16 Do you have the teacher book? Yes No

17 Are you teaching IT teaching units not prescribed by the National Curriculum?

Yes No

If yes, which?

18 Would you like to offer a unit in IT that you do not at present teach? Yes No

If yes, which one?

why you do not offer it?

If your school does not have a lab, please proceed to question 22

19 Under which environment do you teach? DOS Windows both

20 Which software do you use in your teaching? (tick as appropriate)

- Basic Logo MSWORKS
 word processing databases spreadsheet
 paintbrush ORION other _____

21 Do you want to use a software for IT, that you do not at present use?

Yes No

If yes, which one? _____

22 Are computers used by students outside IT classes? Yes No

If yes, which software?

for what purpose? _____

- 23 I need in-service training on (tick as appropriate)
- teaching issues computer applications
 classroom management issues IT science
 other _____

Please tick the box you feel best represents your views

- | | not at all | a little | a lot |
|---|--------------------------|--------------------------|--------------------------|
| 24 I use the National Curriculum | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 25 The National Curriculum provides me with teaching guidance | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 26 The National Curriculum leaves space for teacher initiatives in terms of teaching units or software used | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 27 My students use the student book | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 28 The student book gives me information on IT | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 29 The student book helps me to plan my teaching | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 30 I use the teacher's book | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 31 The teacher's book gives me teaching guidance | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 32 The teacher's book provides me with information about IT | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 33 I am given technical support by PLINET | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 34 I am given technical support by the computer company | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 35 I am given teaching advice by PLINET | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 36 I am given teaching advice by other than PLINET | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 37 I have opportunities for in-service training | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 38 Students like working in the lab | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 39 Students like theoretical sessions | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 40 Teaching in the lab is easier for me than teaching in the classroom | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

51. I believe that IT is best taught as a separate curriculum subject
 within existing curriculum subjects
 combination of lab sessions and teaching within existing curriculum subjects
 other _____

52. I believe that IT is best taught in the classroom
 in the lab
 combination of lab and classroom
 other _____

Please tick (✓) the boxes that best represent your views

53. I wish to have the flexibility to allowed to decide which teaching units to teach no a little a lot
54. I wish to have the flexibility to decide which software to use
55. IT teachers should be asked by decision makers about issues concerning IT

Part E.

This part is concerned with YOUR views about the intended integration of computers within existing curriculum subjects. Please, tick (✓) the appropriate boxes. It would be of great help if you could fill in the blank spaces

56. Do you know about the intention of the government to introduce computers into existing curriculum subjects?
 yes no
 if yes, where from? _____

57. Do you know about the way this will happen?
 no vaguely yes

46. Do you think that a student book has to exist?
 Yes No not enough evidence to judge
 If yes, please continue. If no, please go to question 48

47. Please note which form a student book has to have one and only authorised student book to be used in all gymnastiums
 an authorised list of proposed student books from which IT teacher can choose wish to use in his/her class

48. Tick with (✓) which of the following should be the aims of a student book
 A student book has to:

	yes	no
give general information about IT not only on NC teaching units		
give information only on the teaching units of National Curriculum		
provide questions and exercises on every teaching unit of the NC		
consist the base on which IT teachers would organise their teaching		
other _____		

49. Do you think that a teacher's book has to exist?
 Yes No not enough evidence to judge

- If yes, please tick (✓) which of the following should be the aims of the teacher's book
 50. a teacher's book has to:

	yes	no
state the aims of IT		
provide guidance for classroom organisation		
provide guidance in teaching		
provide general information on the subject of IT		
provide information on the IT National Curriculum teaching units		
other _____		

58 Do you support the integration of computers into existing curriculum subjects in gymnasium?

yes no

please discuss

59 Do you think that the integration of computers into existing curriculum subjects is possible?

yes no

please discuss

60 Do you think that you could have a role in this effort?

please discuss

Agapi Vavouraki
Research Student in
Educational Technology
Institute of Education, University of London
e-mail: temsav@ioe.ac.uk

Questionnaire
for PLINET Officers

Name: _____
Directorate: _____
Contact number: _____

Part A.

This part refers to information about your region and about your personal information, which is going to be **strictly confidential** and only for **academic use**. Please tick (✓) the boxes that represent you and give full answers where represent you.

Age: _____ Sex: male female

Number of PLINET officers in your region: _____

Number of IT teachers in your region: _____

Years in your current position: _____ (excluding this year)

Years of teaching IT (if so): _____

Other teaching experience (if so): subject: _____ years: _____

Other experience in educational sector (if so): _____ years: _____

First degree on Information Technology (if so): _____

Postgraduate degree (if so): _____

Other degree: _____ Please, state the modules you have attended concerning IT (if so)

<i>module</i>	<i>number of semesters</i>

Attended in-service training courses on Information Technology

<i>institute</i>	<i>year</i>	<i>duration (in hours)</i>	<i>aim of the course</i>

Part B.

This part is concerned with **gymnasiums of your region** in which **Information Technology has been introduced**. Please tick (✓) the appropriate boxes and fill in the spaces where it needs.

1. How many schools of your region where the IT subject is introduced have computer labs ?
- | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| | none | some | many | all |
| <input type="checkbox"/> |
2. How many schools of your region are provided with new equipment ? (server: 80486 seven pcs 80386 windows environment)
- | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
3. How many schools of your region face problems in relation with space for the computer lab?
- | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
4. In how many schools of your region parents' associations did help the organisation of schools lab?
- | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
5. In how many schools of your region Communal Authorities did help the organisation of schools lab?
- | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
6. How many teachers of your region asked for your help on technical problems in the lab ?
- | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
7. How many teachers of your region asked for your help on problems on their teaching?
- | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
8. With how many teachers of your region you have discussed the aims of the National Curriculum?
- | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
9. With how many teachers of your region you have discussed technical problems?
- | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
10. With how many teachers of your region you have discussed issues concerning the teaching of the IT?
- | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <input type="checkbox"/> |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
11. Do you have a copy of the National Curriculum? Yes No

12. With which of the following bodies/persons you exchange information about issues concerning the Information Technology subject in gymnasiums?

- Other PLINET Officers Pedagogical Institute IT teachers
- IT committee parents' associations academics
- Office of IT in the Directorate of Ministry of Education
- none of the above

13. Do you have personal contact with IT teachers in schools? Yes No

If yes, how often you meet the average teacher?

less than once a month once a month more than once a month

what IT teachers you meet more often? _____

14. Have you met teachers who use other software apart those prescribed by the National Curriculum?

Yes No

If yes, what software? _____

15. Have you met teachers who, despite their wish to use other software apart the prescribed by the National Curriculum they do not?

Yes No

If yes, what software? _____

what was the reason? _____

16. Are there any schools in your region in which pilot programmes concerned with Information Technology are run? Yes No

If yes, which schools and what kind of programmes? _____

17. Which do you think is the most important problem that gymnasiums face in relation with the Information Technology subject?

18 Which do you think is the most important problem that IT teachers face?

19 What are the most important problem/s you face as a PLINET Officer?

20 What is the reason that IT has not been introduced in some of the schools of your region? (if any)

21 Did you organise in-service training courses for teachers of your region?

Yes No

If yes, what was the main aim of the courses?

Part C.

This section of the questionnaire is concerned with your views about Information Technology in gymnasiums. Please tick (✓) the boxes that best represent your views. It would be of great help if you could feel in the blank spaces.

22 Which of the following should be the aims of IT in gymnasiums ? (please, tick for yes or no)

yes	no

for students to understand basic notions of computer operation

for students to be familiar with computers

to develop qualified citizens to enter the future work force

to give students the basic knowledge needed to pursue an academic

course on IT

for students to be aware of the nature and potential of computers

for students to be able to use application programmes

to develop future programmers

for students to be familiar with programming

to enrich teaching in general

other

23 Do you think that a National Curriculum has to exist?

Yes No

Please state what the aim of a National Curriculum should be

24 Do you think that a student book has to exist?

Yes No

Please state what the aim of a student book should be

25 Do you think that a teacher book has to exist?

Yes No

Please state what the aim of a teacher book should be

26 Which of the following you think they should be advised by the Ministry of Education about issues concerning with the Information Technology subject? (please tick as apply)

PLinet officers IT teachers academics

school board parents' associations PEKAP

EPI none of the above other _____

Part D.

This section of the questionnaire is concerned with **your** views about the recent discussion for the integration of computers within other curriculum subjects in gymnasiums. Please tick (✓) the boxes that best represent your views. It would be of great help if you could feel in the blank spaces.

27. Are you informed about the intention of the government to introduce computers within existing subjects? Yes No
If yes, where from? _____

28. Are you informed about the way this will happen?
Yes Yes, but vaguely No

29. Do you support the integration of computers within existing curriculum subjects?
Yes No
Please elaborate

30. Do you think that the integration of computers within existing curriculum subjects as mediums for discovery learning is possible?
Yes No
please elaborate

31. Do you think that you could have a role in the integration of computers within other curriculum subjects?
Yes No

Please elaborate

32. Do you think that IT teachers could have a role in this effort?
Yes No

Please elaborate

Appendix 5.7 Response and follow up process of the Teacher Questionnaire

ID	Region	questionnaires sent	returned questionnaires	traced through
1	Athens A	61	38	teachers
2	Athens B	46	16	teachers
3	Athens C	54	31	teachers
4	Athens D	47	21	teachers
5	East Attica	28	19	teachers
6	Pireaus	70	16	PLINETs
7	West Attica	17	11	teachers
8	Etoloakarnania	28	12	teachers
9	Argolida	13	10	teachers
10	Arkadia	8	3	PLINETs
11	Arta	15	12	teachers
12	Achaia	39	31	PLINETs
13	Voiotia	28	12	teachers
14	Grevena	5	2	teachers
15	Drama	12	8	teachers
16	Dodecanisa	18	11	PLINETs
17	Evros	20	13	teachers
18	Evoia	22	18	PLINETs
19	Evritania	3	1	teachers
20	Zakinthos	4	5	teachers
21	Ilia	16	11	teachers
22	Imathia	14	11	teachers
23	Heraclion	32	2	PLINETs
24	Thesprotia	6	2	teachers
25	Thessaloniki	96	19	PLINETs
26	Ioannina	14	11	teachers
27	Kavala	15	9	teachers
28	Karditsa	16	3	PLINETs
29	Kastoria	13	12	teachers
30	Corfu	18	15	PLINETs
31	Cefallonia	6	2	teachers
32	Cilcis	12	5	teachers
33	Cozani	21	11	PLINETs
34	Korinthos	25	21	PLINETs
35	Kyklades	22	22	PLINETs
36	Lakonia	11	6	local
37	Larisa		0	PLINETs
38	Lasithi	9	5	teachers
39	Lesvos	16	6	teachers
40	Lefkada	0	0	
41	Magnisia	16	10	teachers
42	Messinia	14	11	teachers
43	Xanthi	11	7	teachers
44	Pella	19	10	PLINETs
45	Pieria	16	12	teachers
46	Preveza	10	7	teachers
47	Rethymno	7	6	teachers
48	Rodopi	8	4	teachers
49	Samos	10	3	teachers
50	Serres	22	20	teachers
51	Trikala	8	2	PLINETs

52 Fthiotida	17	12	<i>teachers</i>
53 Florina	8	4	<i>teachers</i>
54 Fokida	4	1	<i>teachers</i>
55 Chalkidiki	12	9	<i>teachers</i>
56 Chania	16	6	<i>teachers</i>
57 Chios	5	4	<i>teachers</i>
	1103	591	
p.c. received		54	

Appendix 5.8 Covering letter for the Teacher Questionnaire

Agapi Vavouraki
Research Student,
Mathematical Sciences Department,
Institute of Education
University of London

Dear colleague,

As a PhD research student in the Institute of Education (University of London) I investigate the introduction of computers in Greek gymnasiums. The aim of the research is to study this innovation, giving emphasis on the perceptions of the Information Technology teachers and of the Plinets, as well as on the problems that face.

This questionnaire is addressed to all Information Technology teachers across the Regions of Greece and aims to record **your views** and **reflections** on the Information Technology subject in gymnasium, as well **your thoughts** about the integration of computers within other school subjects.

The questionnaire is for **academic use only** and I can guarantee **confidentiality**.

The current research can not be completed without your contribution. I would be grateful if you could devote some of your time to fill in this questionnaire. Please note that there are no right or wrong answers, but **only your answers**. Please use the stamped envelope I include, to return the questionnaire without any expense.

Thank you for your co-operation

Agapi Vavouraki

Appendix 5.9 Follow up letter for the Teacher Questionnaire

Agapi Vavouraki
Research Student,
Mathematical Sciences Department,
Institute of Education
University of London

Dear colleague,

First of all I would like to thank all of you that for all your workload, you spent some of your time to fill in the questionnaire I have sent.

In parallel, I would like to kindly ask those that haven't managed to fill in the questionnaire up till now, for your participation in this research.

My aim through this research is to explore the situation related to the Information Technology subject in the schools in our country, as well as the views of those who implement it. Hopefully, this will provide useful information about existed experience, but also information about necessary actions for its improvement and evolution. This questionnaire is addressed to all Information Technology teachers across the Regions of Greece and aims to record **your views** and **reflections** on the Information Technology subject in gymnasium, as well **your thoughts** about the integration of computers within other school subjects.

I would like to remind you that the questionnaire is for **academic use only** and I can guarantee **confidentiality**. Please use the stamped envelope I include, to return the questionnaire without any expense.

Thank you for your co-operation

Agapi Vavouraki

Appendix 5.10 Covering letter for the Plinet Questionnaire

Agapi Vavouraki
Research Student,
Mathematical Sciences Department,
Institute of Education
University of London

Dear colleague,

As a PhD research student in the Institute of Education (University of London), I investigate the introduction of computers in Greek gymnasiums. The aim of the research is to study this innovation, giving emphasis on the perceptions of the Information Technology teachers and of the Plinets, as well as on the problems that they face.

This questionnaire is addressed to all Plinets across the Regions of Greece and aims to record **your views** and **reflections** on the Information Technology subject in gymnasium, as well **your thoughts** about the integration of computers within other school subjects.

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The current research can not be completed without your contribution. I would be grateful if you could devote some of your time to fill in this questionnaire. Please note that there are no right or wrong answers, but **only your answers**. Please use the stamped envelope I include, to return the questionnaire without any expense.

Thank you for your co-operation

Agapi Vavouraki

Appendix 5.11 Follow up letter for the Plinet Questionnaire

Agapi Vavouraki
Research Student,
Mathematical Sciences Department,
Institute of Education
University of London

Dear colleague,

First of all I would like to thank all of you that for all your workload, you spent some of your time to fill in the questionnaire I have sent.

In parallel, I would like to kindly ask those that haven't managed to fill in the questionnaire up till now, for your participation in this research.

My aim through this research is to explore the situation related to the Information Technology subject in the schools in our country, as well as the views of those who implement it. Hopefully, this will provide useful information about existed experience, but also information about necessary actions for its improvement and evolution. This questionnaire is addressed to all Plinets across the Regions of Greece and aims to record **your views** and **reflections** on the Information Technology subject in gymnasium, as well **your thoughts** about the integration of computers within other school subjects.

I would like to remind you that the questionnaire is for **academic use only** and I can guarantee **confidentiality**. Please use the stamped envelope I include, to return the questionnaire without any expense.

Thank you for your co-operation

Agapi Vavouraki

Appendix 5. 12 Response of the Plinet-Questionnaire

ID Region	questionnaires sent	questionnaires received
1 Athens A	0	0
2 Athens B	2	2
3 Athens C	2	2
4 Athens D	2	2
5 East Attica	2	2
6 Pireaus	2	2
7 West Attica	0	0
8 Etoloakarnania	2	2
9 Argolida	1	1
10 Arkadia	1	1
11 Arta	1	1
12 Achaia	2	0
13 Voiotia	1	1
14 Grevena	1	1
15 Drama	1	1
16 Dodecanisa	2	0
17 Evros	1	1
18 Evoia	2	2
19 Evritania	0	0
20 Zakynthos	1	1
21 Ilia	1	1
22 Imathia	1	1
23 Heraclion	1	1
24 Thesprotia	1	1
25 Thessaloniki	3	0
26 Ioannina	1	1
27 Kavala	1	1
28 Karditsa	1	1
29 Kastoria	1	1
30 Corfu	1	1
31 Cefallonia	0	0
32 Cilcis	1	1
33 Cozani	1	1
34 Korinthos	1	1
35 Kyklades	1	1
36 Lakonia	1	1
37 Larisa	1	0
38 Lasithi	0	0
39 Lesvos	1	1
40 Lefkada	0	0
41 Magnisia	1	1
42 Messinia	1	1
43 Xanthi	1	1
44 Pella	1	1
45 Pieria	1	1
46 Preveza	1	1
47 Rethymno	1	1
48 Rodopi	1	1
49 Samos	1	0
50 Serres	1	1
51 Trikala	1	1
52 Fthiotida	1	1

53 Florina	0	0
54 Fokida	1	0
55 Chalkidiki	1	1
56 Chania	1	1
57 Chios	1	1
	61	51
percent received		84

**Appendix 5.13 Variables developed to code information from the Teacher-
Questionnaire**

PERSONAL INFORMATION

Question Variable

	a1	Questionnaire ID
	a2	Region
	a3	Age
	a4	Sex
	a5	Position
	a6	Grades T. teach
	grade1	Grade a
	grade2	Grade b
	grade3	Grade c
	a7	IT teaching experience (years)
	a8	Other Subject teaching experience (years)
	a8a	total teaching experience (years)
	a9	First Degree
	a9a	first degree Other than IT
	a10	IT modules in BA
	a10a	semesters attended
	a11	Postgraduate degree (what)
	a11sum	Postgraduate (Yes/no)
	a12	IT training seminars duration
	a12a	IT training seminars content
	a12_csc	Computer science
	a12_prog	Programming
	a12_appl	Com. Applications
	a12_ited	IT and education
	a12_netw	Networks
	a12_mult	Multimedia
	a12b	Seminars, teachers association
	a12c	Seminars, other Institute

SCHOOL INFORMATION

Question Variable

1	b1	Classes (number)
2	b2	N of teachers
3,4	b3	lab (existence & sharing)
5	b4	Hardware
6,7	b5	windows & network
	b5win	Windows
	b5netw	Network
8	b6a	Programming languages SW acquisition
	B6basic	Basic
	B6logo	Logo
8	b6b	Applications SW acquisition
	b6wpr	Word processing
	b6dbs	Databases
	b6spr	Spreadsheets
	b6draw	Drawing package
	b6mswork	MS WORKS
8	b6c	educational software SW acquisition
9	b7	IT classes outside NC

TEACHERS CURRENT PRACTICE

Question Variable

10	c1	Two most important aims of IT
11	c2	Problems encountered
	c2sum	Problems (yes/no)
	c2_stat	Student attitudes
	c2_clman	Classroom management
	c2_teach	Teaching
	c2_tech	Technical
	c2_sorg	subject organisation
	c2_equip	Old/lack equipment
	c2_it	Information Technology subject

12	c4sum	Other Teaching aid use (Yes/no)
	c4	Other Teaching aid use
13	c5sum	need of help (Yes/no)
	c5	need of what kind of help
	c5_aids	Teaching aids/books
	c5_teach	Teaching
	c5_tech	Technical
14	c6sum	Offered help other than PLINET (Yes/no)
	c6	Offered help other than PLINET (what)
15	c7	have NC
16	c8	have teacher book
17	c9sum	Teaching outside NC (Yes/no)
	c9	Teaching outside NC (what)
	c9_csc	Computer science
	c9_prog	Programming
	c9_appl	Computer applications
	c9_netmu	Network/multimedia
	c9_orion	Software Orion
18	c10sum	wish to teach outside NC but NOT (Yes/no)
	c10	wish to teach outside NC but NOT (what)
18	c10a	Why not, reason
	c10a_boo	Books
	c10a_hw	Equipment
	c10a_nc	National Curriculum
	c10a_tim	Time
19	c11	Environment
20	c12a	Programming languages SW use
	c12basic	Basic
	c12logo	Logo
20	c12b	Applications
20	c12bb	Applications SW use
	c12wpr	Word processing
	c12dbs	Databases
	c12spr	Spreadsheets
	c12draw	Drawing package
20	c12c	Educational SW use
21	c13sum	wish for SW use that do not use (Yes/no)
	c13	wish for SW use that do not use, (what)

22	c14sum	comp use outside class by students (Yes/no)
	c14	comp use outside class by students (what SW)
	c14a	Purpose of use
23	c15sum	need in-service training (Yes/no)
23	c15	need in-service training (what)
	c15_appl	Computer applications
	c15_clma	Classroom management
	c15_csc	Computer science
	c15_inne	Internet/networks
	c15_mul	Multimedia
	c15_nsw	New software
	c15_tec	Teaching
	c15_tech	Technical issues
24	c16	NC use
25	c17	NC teaching guidance
26	c18	NC flexibility
27	c19	school book use
28	c20	school book IT information
29	c21	school book teaching organisation
30	c22	teacher book use
31	c23	teacher book usefulness in teaching
32	c24	teacher book IT information
33	c25	PLINET technical support
34	c26	Computer company technical support
35	c27	PLINET teaching support
36	c28	other teaching support
37	c29	in-service training opportunities
38	c30	students attitudes in lab
39	c31	students attitudes theoretical sessions
40	c32	teaching lab vs. classroom
41	c33	best experience
42	c34	worst experience

TEACHERS PERCEPTIONS

Question Variable

43	d1	aims of IT (what)
	d1_cop	Computer operation
	d1_fam	Familiar with comp.
	d1_work	Work force
	d1_acad	Academic course
	d1_natu	Nature and potential of comp
	d1_appli	Applications familiarisation
	d1_progr	Future programmers
	d1_prfam	Learn how to program
	d1_teach	Teaching
44	d2	NC need (yes/no)
45	d2a	NC aims (what)
	d2_itaim	Aims of IT
	d2_targ	Attainment targets, Initiative to the teacher to decide for teach. Units and sw
	d2_units	Propose teaching units and sw
	d2_teach	General Teaching guidance
	d2_examp	Teaching guidance and examples in each teach. unit
46 47	d3	student book , need & form
48	d3a	student book, aim
	d3_genIT	General information on IT
	d3_Ncinf	Information on National Curriculum units
	d3_Ncexe	Exercises in each unit
	d3_base	To be the base of teaching
49	d4	teacher book , need
50	d4a	teacher book, aim
	d4_itaim	Aims of IT
	d4_clman	Classroom organisation
	d4_teach	Teaching guidance
	d4_itinf	General information on IT
	d4_NCinfo	Information on NC units
51	d5	teaching, sep subj vs. other subj (subj. organisation)
52	d5a	teaching, location (subj. organisation)

53	d6	teaching units <i>flexibility</i>
54	d7	sw choice flexibility
55	d8	advice to decision makers

COMPUTERS INTEGRATION

Question Variable

56	e1	information
	e1a	where from
57	e2	information about process
58	e3	support integration
	e3a	yes, because...
	e3b	no, because...
59	e4	feasibility
	e4a	yes, because...
	e4b	yes, but...
	e4c	no, because...
60	e5	teachers role
	e5a	yes, in...
	e5b	no, because...

*Appendix 5.14 Variables developed to code information from the PLINET-
Questionnaire*

Question Variable

PERSONAL INFORMATION

	a1	Questionnaire ID
	a2	Region
	a3	age
	a4	sex
	a5	N of PLINET
	a6	N of Teachers
	a7	experience PLINET
	a8	teaching experience IT
	a9	teaching experience other subject
	a10	experience education
	a10a	where
	a11	first degree
	a12	other degree
	a12a	modules
	a12b	semesters
	a13	postgraduate degree
	a14	seminars duration
	a14a	seminars content
	a14b	Teachers' association course
	a14c	Other Institute

IT PRACTICE (School, Teacher)

1	b1	IT - comp labs
2	b2	new equipment
3	b3	problems - space for comp lab
4	b4	help parents' associations
5	b5	help Com/Munic authorities
6	b6	teachers help - technical
7	b7	teachers help - teaching
8	b8	discuss NC
9	b9	discuss technical problems
10	b10	discuss teaching IT
11	b11	NC have
12	b12	exchange information (bodies)
13	b13	contact with teachers
	b13a	which teachers
14	b14	sw initiative
15	b15	sw initiative wish
	b15a	why
16	b16	pilot programs
17	b17	problem school
18	b18	problem teacher
19	b19	problem PLINETs
20	b20	reason for non-user schools
21	b21	seminars organised
	b21a	seminars organised content

Question Variable

PLINETS PERCEPTIONS

22	c1	IT aims
23	c2	NC need
	c2a	NC aim
24	c3	student book need
	c3a	student book aim
25	c4	teacher book need
	c4a	teacher book aim
26	c5	participation on decisions

COMPUTERS INTEGRATION

27	d1	information
	d1a	where from
28	d2	information about process
29	d3	support integration
	d3a	yes, because...
	d3b	no, because...
30	d4	feasibility
	d4a	yes, because...
	d4b	yes, but...
	d4c	no, because...
31	d5	plinet's role
	d5a	yes, in...
	d5b	no, because...
32	d6	teachers role
	d6a	yes, in...

Appendix 5.15 List of interviewees involved in the initiation phase of the introduction of computers into Greek schools

Interviewee A.

Permanent member of the Pedagogical Institute

*Participated in : Working group under Maritsas 1986,
pilot phase of Information Technology
Working group for IT curriculum 1989*

Interviewee B.

*Participated in : Working group under Maritsas 1986,
Working group for technical report 1987,
Working group for expansion 1990,
Working group for NC 1992,
Working group under Doukidis in the IT committee of 1994*

Interviewee C.

*Participated in: President of the IT committee in 1994
NCITE 93,
PCITE 94
Working group for IT curriculum 1995*

Interviewee D.

*Member of CTI (involved with ULYSSES)
Participated in: Working group for NC 92, 95
NCITE 93*

Interviewee E.

*Member of CTI
Responsible for ODYSSEY*

Interviewee F.

*MNER, responsible for Secondary Education Office 1993-97
Participated in PCITE 94*

Interviewee G.

MNER, responsible for Secondary Education Office 97-

Interviewee H.

Member of the Pedagogical Institute 94-

Appendix 5.16 Regions selected for the interviews to take place



■ Islands of Cyclades selected for interviews to be conducted

Appendix 5.17 Sample of interviewed IT teachers

Region	Contract	Degree	Experience of teaching IT or other subject
Cyclades/Syros (capital)			
	temporary	other	5 years IT
	temporary	IT degree (Degree in Computer Science)	first year IT
Cyclades/Paros			
	permanent	IT degree	4 years IT
	temporary	IT degree	2 years IT
Cyclades/Santorini			
	permanent	IT degree	2 years IT
	permanent	IT degree + other	5 years IT
Athens B			
	permanent	other	10 years IT
	permanent	IT degree	5 years IT
	permanent	other	2 years IT
	temporary	IT degree	first year IT
	temporary	other degree	5 years IT
	temporary	IT degree degree	4 years IT
Athens A			
	permanent	other degree	10 years IT + 2 years mathematics
	temporary	other degree	3 years IT
	permanent	other degree + master	11 years IT +2 years mathematics
	permanent	IT degree	5 years IT
	temporary	IT degree	2 years IT
	temporary	other degree + post	5 years IT + 2 years science

Appendix 5.18 A first insight to the teaching of IT: an exploratory study

The aim of the exploratory study was to gain a first insight to the teaching of IT in gymnasiums as well as a first insight to the views of IT teachers. Classroom observations were conducted in one gymnasium of Athens and an interview was taken from the IT teacher who taught IT.

Since it was very time consuming for the classroom observations to be programmed officially with the confirmation of the Pedagogical Institute, they were organised after one IT teacher unofficially volunteered to let the researcher observe her class. So, the choice of the school and teacher was based on the school's and on the teacher's availability, and it can not by any means stand as a representative case. Exploratory observations, however, were found to be very useful, providing a first insight to the every day school situation (staff, classrooms, lab, timetables, and organisation) and to the teaching of IT (curriculum, activities, teaching materials, teaching approaches). The interview was open-ended giving the opportunity to the teacher to express her views.

Background information

The school was a new built school. Not every classroom was still ready and students sometimes had to move from class to class (from the old one to the new). There were two IT teachers for the three grades of the gymnasium (1st- 2nd-3rd). The first was a permanent full-time teacher and the second was an assistant full-time teacher¹. Timetable followed the official guidelines.²

Students on the first (12-13 years old) and on the second (13-14 years old) grades were taught IT once a week. Students were divided in two groups. One group was taught Technology in the classroom and the other one was taught IT in the lab. Students on the third grade (14-15) was taught IT twice a week. Again, students were divided in two groups. One group was doing theoretical session in the classroom and the other one was doing practical session in the computer lab.

The classroom was the same as any other traditional Greek classroom. There was the teacher's desk next to the blackboard, which was facing to three rows of students' desks. The teacher traditionally teaches from his/her desk or blackboard, and students sit two in each desk, and they are not allowed to talk between them.

The lab was very small. It was a temporary one since the new lab was to be ready in a few days. Teacher had put on a lot of effort to organise the computer lab. In terms of hardware, there was one computer server, one printer and seven workstations for the students, as expected from the official guidelines. There was a blackboard on one side. There were no overhead projector or big screen for demonstrations.

Three teaching sessions were observed. The first session was a practical session of the first grade on word-processing, that took place in the lab. The second was a theoretical session of the third grade on programming, which took place in the classroom. The third was a practical session of the third grade on programming that took place in the lab. The three sessions are discussed below. Finally, teacher's views will be presented.

Practical session on word processing: first grade

Timetable and classroom organisation was as expected considering the official guidelines. The class was divided in two groups. One group was taught technology in the main classroom and the other one (the observed) was taught IT in the lab. Students were sitting in groups of two, and the teacher was walking around. The class was noisy, since children were talking to each other.

The teacher introduced me as a visiting colleague and asked from the students to "tell" me what they were doing in the class. Teacher guided the dialogue with

¹ Assistant teachers are teachers who are employed for the time period between October to June. They usually replace a teacher who is on leave. However, sometimes they are employed by the Ministry of Education to teach in schools where permanent positions have not been enacted.

² The observation took place on 1994, based on 1993 IT curriculum.

continuous questions. Students answered with loose definitions (what was they are working on, why it was useful, what applications they have used, what was "window"...)

It seemed that students had to "learn" "things" and needed to be able to reproduce them with loose definitions. It was not clear the extent to which students understood everything they said. It was interesting that they reproduced specific applications of the computer for society and man.

After the introduction, students started to work with "WRITE"³ under windows. The lesson was about fonts and different appearance and size of them. They were told to open their student textbook book on page seventy-two and write an invitation for a party using different styles of fonts. There was an example of an invitation in the book. It was interesting that most of the students copied the same invitation with the same fonts. Only two pairs of students out of seven developed their own invitation. One of them also inserted a picture from paintbrush.⁴ This was welcome from the teacher. After the students wrote their invitations they printed them and showed them to the teacher. The lesson lasted for forty-five minutes.

Although students' interactions were not systematically observed, it seemed that students were collaborating very well with each other. Moreover, although teacher was going near the students, it was not observed the way she was intervening with her students.

Theoretical session on programming: third grade

The class was divided again in two groups. The observed group was taught a theoretical session and the other one (the other half of the class) was doing a practical session in the lab. Students were sitting in their desks and the teacher was mainly standing in front of the blackboard. The class was quiet listening mainly the teacher responding to her questions. The timetable was again according to official guidelines and organisation of the class was the traditional one.

The teacher started the lesson by asking questions about the use and benefit of programming. Students were answering by raising their hands and the teacher had to pick someone to answer the question for the whole class. Students were complementing one another. Teacher was trying to prompt on things they "have said" in previous sessions.

- i.e. " why it is useful to learn programming?*
- to have an idea of how a PC operates*
 - to adjust a program to our specific needs*
 - for fun*

It seemed that questions had to be answered in a certain way. It seemed that the discussion was a previous taught lesson which students had to remember. That part of the lesson seemed to be a kind of reminding and linking process between already known things and new ones that teacher was going to talk about.

Teacher by traditional whole class teaching (exposure) explained on the blackboard the basic programming commands (LET, PRINT, INPUT) and gave some examples for each one of them. Students were sitting quietly on their desks and the only intervention was the confirmation to the teacher that they had understood the teacher's examples.

After that, teacher used the written questions and exercises in the schoolbook on page forty. The teacher solved the exercises on the blackboard helped by the students. Students were raising their hand -if they knew the answer or wanted to say it- and they were answering loudly guiding the teacher to write it on the blackboard.

The children solved more exercises from the schoolbook on their notebooks, chosen by the teacher. The same exercises were solved on the blackboard from one volunteer student in order for the rest of the students to check and correct them on their notebooks.

It seemed as any traditional lesson in the Greek school. Teacher presents what he/she has to say about the new unit explaining with examples. After that, he/she solves some exercises with the participation of willing students and at the end students solve

³ WRITE is a word processing software

⁴ They had already been taught how to use paintbrush

exercises themselves. They have understood the new unit, they have tried some exercises with the help of the teacher, and now they are able to solve similar exercises themselves. On the next lesson they have to remember what they have learned in order to proceed to the next unit which is usually in sequence.

It was clear that the teacher had the control of the classroom and she was organising all the activities. Students could go to the next stage if they had completed the previous one. Students were just following the rules of the game: teacher organises the activities, students have to be willing to participate in order to have a good grade. Moreover, students have to be quiet except the occasions of answering teacher's questions. However, students did not seem to be motivated.

Practical session on programming: third grade

The class was divided in two groups. The observed group was doing a practical session in the lab and the other one (the other half of the class) was doing a theoretical session in the classroom. Students were working in groups of two, with one computer, and the teacher was mainly walking around the class. The class was noisy and students were talking to each other. Again, timetable and organisation of the class was according to official guidelines.

The teacher started the lesson by asking students about the use and benefit of programming. Students were answering by raising their hands, complementing each other. It seemed that the students did not spontaneously give the answers, rather they had been discussed in the previous lesson. It seemed that students were trying to remember what the right answer was. It has to be noticed that the answer was the same that was given to the theoretical session by different students. That might suggest that the teacher guided the answer.

Next, the teacher reminded some basic programming commands on the blackboard (REM, PRINT, PRINT a+b, INPUT) and presented the problem. Students had to make a program for calculating the average grade of one curriculum subject at the end of the school year.⁵

The teacher gave an example to help the students: "INPUT "Give the grade of first term", a". Students were working in pairs. All students except one were working to write the program. Teacher did not interfere for the indifferent student. She ignored him. One student went too far. He used sound and colour. He was using QBASIC very fluently because he had a computer at home. Teacher saw his program and gave him more ideas and conditional situations. He managed to do it. Some students were interested in what he was doing and he was willing to help them do the same things, especially using sound.⁶ After that, teacher presented information on conditional situations and IF/THEN command.

Although it seemed that students were working alone, teacher was in control. Teacher decided which program they were going to work on, gave the basic command line "INPUT give the grade of the 1st term" a" which was written on the blackboard, thus,

⁵ The final grade was calculated by the sum of grades of the first, the second and the third term and the double of grade in the final written exam, divided by five : $(a+b+c+2d)/5$, where a=grade of first term, b=grade of second term, c=grade of third term and d=written exam grade

⁶ A simple program written by most of the students

REM Program for calculating the average grade of a school subject

CLS

PRINT "Calculating the average grade of a school subject"

INPUT "Give the grade of the first term",a

INPUT "Give the grade of the second term",b

INPUT "Give the grade of the third term",c

INPUT "Give the grade of the written exam",d

MO= (a+b+c+2d)/5

PRINT "The average grade for the academic year was ", MO

Enrichment

IF a > 20 THEN PRINT "It can not be. Try again!"

IF MO > 10 THEN PRINT "You can go to the next class"

IF 18<MO<20 THEN PRINT "You are an excellent student"

students used it just like the way it was written. Students were not that keen on working with programming. Moreover, they seemed to have a problem with changing the language from English (commands) to Greek (comments). Sometimes turning from comments to commands they kept writing in Greek characters and realising it when the characters were different (English INPUT- Greek INPYT).

Views of the teacher

The interview was an open ended discussion aiming to let the teacher discuss issues "she" was concerned with. Since there were no planned questions, and there was also time constraint, not many issues were discussed.

The teacher was a mathematics teacher who had attended seminars on IT and was appointed on the school as an IT teacher.

She argued that there was no problem with technical support, because the providing company has this responsibility and any problem arose was dealt within three days. She didn't seem to worry about every day problems "*we can try out different things and finally everything works*"

As for the flexibility of the teacher, she argued that although there were official guidelines from the Ministry of Education on what exactly they were going to teach, there was some flexibility. She was teaching QBASIC instead of BASIC and WRITE instead of DOS Editor. Moreover, she had printed some notes for students for the third grade on windows. She felt the need to do it since their students were working on WRITE that was not in their book.

She believed that programming was very useful for students in order for them to learn algorithms, and she argued that students did not like very much programming. They seemed to prefer to work under Windows applications.

Concerning students' attitudes, she argued that "*...students like very much the class it's the class they do not want to miss*".⁷ She argued that students "liked" IT for three reasons. First students felt that it was something different -the use of computer - from other curriculum subjects where they had only to learn from teacher's exposure and read to reproduce what it was learned. Second, they liked the co-operation and grouping while they were working in the lab, which was again a different way of "being a student". Third, they liked the fact that the classroom was not so quiet, since they were allowed to talk to each other, while on other subjects usually they could not even whisper or move. Moreover, she argued that students did collaborate creatively, although in the start they didn't know how⁸. Moreover, she claimed that students even developed friendships from IT classes by working together.

Finally, she pointed out that students sometimes work on the computer doing assignments (coursework) for other classes (home economics, technology) which was voluntary. They worked in intervals and teachers from other classes did not interfere with their work on the computer.

IT in the classroom

Although the exploratory research was taken place only in one school, in the classroom of one teacher, many interesting points can be highlighted. Although they can by no means be generalised, they do present a first insight to the teaching of IT at least in one school.

IT subject was following the official guidelines from Ministry of Education and IT Curriculum. Students were taught IT divided in two groups. While one group was having a theoretical session in the classroom, the other one was working in the lab. Timetable was also developed by law in IT Curriculum. At that time students of first and second grade were taught IT once a week, while students of the third grade were taught IT twice a week.⁹

Although IT Curriculum is considered to be very analytical in terms of the defined content (units of teaching) teacher argued that she felt enough flexibility to

⁷ Greek schools frequently organise educational visits. In this case students "miss" all classes which are programmed for that day

⁸ It has to be mentioned that Greek classes usually do not encourage collaboration between students

⁹ Now IT is taught once week in each grade

choose other software to use in her classroom (WRITE instead of DOS writer). It has to be considered though, that there were schools with new equipment that worked under windows. However, since student textbook did not included WRITER, the teacher by her one initiative printed some notes for students on Windows. Concerning technical support, teacher argued that it was adequate and no such problems complicated the situation.

Turning back to the teaching of IT, theoretical sessions in the classroom seemed to be similar with the teaching of any other subject of the curriculum. The classroom since it was the same used for every other subject was like any other traditional Greek classroom. Students were sitting in rows, two in each desk facing the teacher, while the teachers' desk was near the blackboard. Students were not allowed to talk, but to ask questions or answer to questions raised in the class by raising their hands. Teacher was in control, since she followed the traditional procedure of lesson. She asked some questions from previous units, she explained the new unit giving examples on the blackboard, and then students solved exercises from the student textbook. It seemed that students were not interested on the subject. They were just following teacher's questions and were solving the exercises from the student textbook.

On the other hand, the work in the lab was very different. Students were sitting in front of the computers, co-operating with each other on their work. They seemed to like the work on the computer and the group work. Although groupwork was not usual in Greek classrooms, and thus students were not used to it, the teacher argued that although students found it difficult at first, they enjoyed it at the end. Even more, they created new friendships through this collaboration.

The teacher was again in control. She asked some questions from the previous discussed session, she explained the new unit on the blackboard (commands) or windows by students. However, the teacher followed different approaches in her teaching. On the first case (word processing session) she encouraged children to create their own invitations. However, only two pairs of seven did, while the rest copied exactly the same invitation from the book. In the other case (programming session), teacher did not ask for students to use the learned commands to create their own programme, but a specific programme to write on the estimation of their grades in one subject. At the same time she gave the example on the blackboard. However, although the same programme can be created in different ways students followed the example of the teacher. Looking closer these two incidents, one can see that teacher used a mixed approach. On the first case, when she used an "open" approach giving the initiation to the students, most of them preferred to stay with the example of the student textbook. On the second case, she used a more "closed" approach giving the specific programme to be written by students and the example on the blackboard. Students again, followed teacher's steps to write the programme using the same symbols and input questions given by teacher. Because there is not enough evidence, it can not be explained why teacher took two different approaches in the two incidents. However, it would be interesting to investigate the extent to which teacher consciously took these approaches, and to what extent students tent to "follow the rules" giving the initiation to the teacher or the book. Moreover, it would be interesting to investigate the reason why although she encouraged and helped a student who was more familiar with computers to develop a more complicated programme, she did not do anything for a student who was totally indifferent to the lesson.

Finally, another interesting point was that students liked a lot the IT, and they were even spending their free time to develop coursework for other subjects.

Appendix 5.19 Interview questions for the policy makers

Since the interviewees participated in different working groups at different times, the questions were not the same. However, the interview schedule that was developed included three main issues for discussion: the objective of the proposed introduction of computer use into schools; the policy rationale for the introduction of computers into schools and the objectives of the IT subject in gymnasiums. The main questions that were developed around the above issues were as follows.

1. At what time did you participate in the effort for the introduction of computers into schools?
2. In which working groups did you participate for the introduction of computers into schools? What was your position?
3. What was the aim of the introduction of computers into gymnasiums at that time?

The interviewees were prompted to distinguish between using computers to learn about technology and computer applications (IT) and using computers within other curriculum subjects (ITE).

4. What was the aim of IT into gymnasiums at that time?
5. Why do you think this specific type of computer use was promoted at that time?
6. Why another computer use was not promoted?

The interviewees were prompted to discuss about

- ◆ the aims of the proposed and not proposed computer use in relation to educational and other priorities at that time.
- ◆ the complexity that the introduction of the proposed and not proposed computer use involved at that time.
- ◆ the influence by the European Community

7. Were there any problems on the implementation of the proposed computer use in schools? What were these problems?

In case that the interviewee participated in more than one working groups at different times, the questions 3-6 were repeated for each period of time.

Appendix 7.0 The Organisation of the IT Curriculum

General aims of the subject

Specific aims of the subject

Grade A.

Teaching Unit 1. Communication with the Computer

General Attainment Target

Specific Attainment Targets

Sub-Units

*Sub-Unit1.- Attainment Target – Teaching Content – Comments –
Activities*

Sub-Unit 2....

Teaching Unit 2. Drawing

General Attainment Target

Specific Attainment Targets

Sub-Units

*Sub-Unit1.- Attainment Target – Teaching Content – Comments –
Activities*

Sub-Unit 2....

Teaching Unit 3. Word Processing

General Attainment Target

Specific Attainment Targets

Sub-Units

*Sub-Unit1.- Attainment Target – Teaching Content – Comments –
Activities*

Sub-Unit 2....

Teaching Unit 4. Applications

General Attainment Target

Specific Attainment Targets

Grade B.

Teaching Unit1. Communication with the Computer

General Attainment Target

Specific Attainment Targets

Sub-Units

*Sub-Unit1.- Attainment Target – Teaching Content – Comments –
Activities*

Sub-Unit 2....

Teaching Unit 2. Spreadsheet

General Attainment Target

Specific Attainment Targets

Sub-Units

*Sub-Unit1.- Attainment Target – Teaching Content – Comments –
Activities*

Sub-Unit 2....

*Teaching Unit 3. Investigations through symbolic expression within programming
environment*

General Attainment Target

Specific Attainment Targets

Sub-Units

*Sub-Unit1.- Attainment Target – Teaching Content – Comments –
Activities*

Sub-Unit 2....

Teaching Unit 4. Applications

General Attainment Target

Specific Attainment Targets

Grade C.

Teaching Unit1. Communication with the Computer

General Attainment Target

Specific Attainment Targets

Sub-Units

*Sub-Unit1.- Attainment Target – Teaching Content – Comments –
Activities*

Sub-Unit 2....

Teaching Unit 2. Databases

General Attainment Target

Specific Attainment Targets

Sub-Units

*Sub-Unit1.- Attainment Target – Teaching Content – Comments –
Activities*

Sub-Unit 2....

*Teaching Unit 3. Investigations through symbolic expression within programming
environment*

General Attainment Target

Specific Attainment Targets

Sub-Units

*Sub-Unit1.- Attainment Target – Teaching Content – Comments –
Activities*

Sub-Unit 2....

Teaching Unit 4. Applications

General Attainment Target

Specific Attainment Targets

Appendix 7.1 Draft Proposal for the IT Curriculum

Introduction

New Technologies, and especially Information Technology (of which computer presents the main tool), contribute to the cultivation of a new pedagogical view, which facilitates dynamic acquisition of knowledge and develops methodological skills. For this purpose, Information Technology must contribute to the development of the context for the reformation of the educational process. This process should focus on an inductive approach of knowledge acquisition, in order for students to develop continuous skills for learning.

(EDUCATIONAL rationale, Catalytic objective)

GENERAL AIMS	RATIONALE according to theoretical framework	OBJECTIVE according to theoretical framework
1. For students to understand basic concepts related with the use of information technology and to develop a clear understanding of the nature and potential of information technology	SOCIAL	Computer Awareness
2. For students to acquire necessary skills in order to exploit the computer potential not only within their school life but also after their graduation, for their educational, professional and personal needs.	(Implicitly) SOCIAL VOCATIONAL	Computer Competence Pedagogic Catalytic
Specifically students:		
1. To be able to use a computer and the peripherals	SOCIAL	Computer Awareness
2. To explore and use computer application programs, in order to exploit them in various activities (written expression, drawing, search/collect/organise/deliver information)	EDUCATIONAL	Computer Competence Pedagogic
3. To discern the nature of a problem and possibility of its solution through programming (problem solving through programming environment)	EDUCATIONAL	Catalytic
4. To exploit computer potential in learning process	EDUCATIONAL	Unclear
5. To be in a position to follow up financial and social changes due to the evolution of science and technology	SOCIAL	Computer Awareness

Appendix 7.2 Draft Proposal for the IT Curriculum

SPECIFIC AIMS	RATIONALE According to theoretical framework	OBJECTIVE according to theoretical framework
<p><i>To be understood by students that previous teaching subjects consist a group of tools for learning and that they offer us potential for expression and exploration of ideas that facilitate knowledge acquisition within other curriculum subjects too.</i></p> <p><i>For students to exploit potential of computer environment for the development of</i></p> <p><i>Investigation and co-operation mentality through experimentation and exploration of mistakes</i></p> <p><i>Cognitive abilities (analytic – synthetic thinking/ abstraction)</i></p> <p><i>To be understood that computer consists a machine totally controlled by man</i></p>	<p>EDUCATIONAL</p>	<p>Pedagogic Catalytic</p>
<p><i>Specific aims for each axis of the National Curriculum</i></p>		
<p><i>1. Introduction to Information Technology Science</i></p> <p><i>Presentation of basic concepts of Information Technology</i></p> <p><i>Acquisition of basic technological knowledge for computer operation and peripherals</i></p> <p><i>Acquisition of basic knowledge and development of skills for human-computer communication under windows environment</i></p>	<p>SOCIAL</p>	<p>Computer Awareness</p>
<p><i>2. Basic Computer Applications</i></p> <p><i>Acquisition of some experience of exploitation of specific computer applications</i></p> <p><i>... for students to acquire skills to explore and use any other software package of the same kind.</i></p>	<p>Unclear</p>	<p>Computer Competence</p>
<p><i>3. Investigations with symbolic expression under programming environment</i></p> <p><i>Students trough this unit have the opportunity to develop experimental situations for problem solving, not necessarily computer problems, through a programming environment with the aim to</i></p> <p><i>Use symbols for expression and exploration of ideas</i></p> <p><i>Development of analytical and synthetic thinking</i></p> <p><i>Exploitation of mistake within the process of knowledge acquisition</i></p> <p><i>Understanding of basic computer operation (concept of data,</i></p>	<p>EDUCATIONAL</p>	<p>Catalytic</p>

<p><i>concept of input – process- output, ...)</i></p> <p><i>Exploitation of parametric environment for development of generalisation and abstraction abilities</i></p> <p><i>Exploitation of developmental programming for the gradual formulation and expression of complicated meanings</i></p>		
<p><i>4. Critical evaluation of technological evolution and connection with financial and social change</i></p> <p><i>The aim of this unit is to cultivate, through appropriate questioning and discussion, the critical mind of the students and their ability to sustain their views related to technology. In this way, the students will be able to assess any social or cultural phenomenon associated with technology, without unquestioned simplifications, indifference or dramatic exaggerations.</i></p>	<p>SOCIAL</p>	<p>Computer Awareness</p>

Appendix 7.3 Teaching Units and General Attainment Targets for Gymnasium

	GRADE A	GRADE B	GRADE C
Communication with the computer	TU 1. (teaching unit 1) GAT. for the student to acquire the basic knowledge on computer operation and to understand through communicating with it that the computer is a machine totally controlled by man (Computer Awareness)	TU 1. GAT. (general attainment target) for the student to expand his knowledge on basic concepts of computer science and on computer operation and communication (Computer Awareness)	TU 1. GAT. for the student to know new possibilities of Information Technology (networks, communication, multimedia) (Computer Awareness)
Basic computer applications	TU 2. Drawing GAT. For the student to have a first contact with "graphics" with the computer, through an application, "drawing", that can be exploited multidimensional (Computer Awareness)	TU 2. Spreadsheet GAT. For students to acquire the ability to handle and graphically present data through a spreadsheet (Computer Competence)	TU 2. Data Bases GAT. For students to develop ability to organise and handle information through a database system (Computer Competence)
	TU 3. Word processing GAT. For students to cultivate the habit and ability to organise writing and to aesthetically improve text (Computer Competence)		
Investigations with symbolic expression under programming environment		TU 3. GAT. For students to exercise in problem solving through a programming environment, to acquire fluency on use of tools for expression and exploration of ideas, and to develop analytical – synthetic thinking (Catalytic)	TU 3. GAT. For students to expand their knowledge on programming and Information Technology concepts, and to develop higher ability to explore in symbolic expression through a programming environment (Implicitly Computer Science)
Applications	TU 4. Students to discern that various application programs that they met, can co-operate and that the computer constitutes a tool for interdisciplinary approach of knowledge (Educational rationale, pedagogic or catalytic objective)		

Appendix 7.4 Word Processing in Grade A

General Attainment Target

For students to cultivate the habit and ability to organise writing and to aesthetically improve text (computer competence)

Specific Attainment Targets

- For students to acquire skilfulness on the use of a word processing program (computer competence)
- For students to understand through applications, contribution of such a program to organisation and aesthetic improvement of text (computer competence)

Teaching Unit 3: Word Processing

Sub-Unit	Attainment Target	Teaching Content	Comments-Activities
1.Familiarisation with word processing (computer awareness)	To understand that word processing is a tool for written expression and presentation of ideas and information. To understand basic principles of written expression as well as basic actions needed for text processing.	Actions through processing of text. Creation, saving, retrieval, printing of text.	Demonstration of text in different stages of processing, that without a word processing they should have been written again. Refer to interventions that gave the different forms of text. Analysis of actions.
	To understand indicative groups of actions. Groups of actions are not the same for all word processing packages.	Writing of text. Selection of part of text. Format of text. Layout of text. Insert graphics. Spell check. Thesaurus. Help.	Simple reference.
	To understand that commands that realise actions exists in the menus, in windows, in icons or Are realised with combination of keys in the keyboard.	Ways in which commands are realised in word-processing.	Demonstration of commands' organisation in word processor that is installed.
	For students to be familiar with the keyboard and its use in	Keys for printable and not printable characters. Capital	Use of keys, Alt-Ctrl, F1-F10, Caps Lock, Shift, Esc, Tab, Back Space

	<i>word processing.</i>	<i>letters, English-Greek, Bold, Combination of keys</i>	<i>etc.</i>
2. Creation of text (computer awareness)	<i>For students to have practical experience in text composition. Students to know basic actions- commands of word processing in the lab.</i>	<i>The concept of cursor-point of insertion, typing of text. Small changes/movement while inserting text. Movement of cursor in different positions of text, Ways of writing.</i>	<i>Open window/typing. Change of paragraph. Insert of blank lines. Use of keys Back Space, Space Bar. Move at a space of one character/word/line/screen. Movement to the start or end of line or text. Automatic or not insertion of characters.</i>
3. Saving, retrieval, correction, printing of text (computer awareness)	<i>For students to understand the importance of saving of document for future retrieval. Printing.</i>	<i>Saving of text in a magnetic medium. Retrieval of existing document. Printing of the whole of part of the document.</i>	<i>Naming of file and definition of disk. Set up printer, number of copies etc.</i>
	<i>For students to practice in selection of text. Possible actions – commands of word processor installed.</i>	<i>Selection of part of text.</i>	<i>Selection of character, word, lines, paragraph, text.</i>
	<i>For students to practice on correction of text. Possible actions – commands of word processor installed.</i>	<i>Copy – Delete – Paste of part of text. Search and possible replace of fonts.</i>	<i>Copy – Delete – Paste of selected text. Search – Replace,</i>
4. Format – Layout of text (computer competence)	<i>For students to understand potential of modern word processors for the esthetical improvement of text</i>	<i>Appearance/change of ruler. Page layout. Format paragraph. Format fonts.</i>	<i>Change of ruler, text width. Page size and margins. Hanging effect, alignment, line spacing. Bold, Italics, underlined characters. Selection of fonts and size of characters. Superscript, subscript.</i>

Appendix 7.5 Investigations through symbolic expression within a programming environment

General Attainment Target

- To expand their knowledge on programming and information technology concepts, and to develop higher ability to investigate with symbolic expression within a programming environment (computer science, catalytic)
- to be able by the end of the teaching unit to develop software related with their curriculum subjects: Mathematics, Science, Grammar etc. (computer science)

Specific Attainment Targets of the unit are:

- to discern (the students) statements, talking and syntax of programming environment that students use (computer science)
- expansion on the concept of variable to take place (global – local variable) (computer science)
- problems to be solved with recursions procedures in contrast to repeated structure (computer science)
- To learn to use the statements based on comparison (computer science)
- The return of an agreement from one routine and the passing of this argument to another routine to be understood (computer science)
- To conceptualise structure of the list and practice in processing the list (computer science)
- To learn how to use interactive programs (computer science)
- To learn to use Cartesian and polar co-ordinators on a 2-D (computer science)

Sub-Unit	Attainment Target	Teaching Content	Comments-Activities
6. Recursion (computer science)	To understand the concept and importance of recursion in programming	Connection between Information Technology perspective of the concept with the according meaning to the every day speech and in general to the definition of a phenomenon within the phenomenon itself. It has to be highlighted that simple recall before the end of a procedure, is also a recursion	Technicality of recursion can be elucidated with appropriate examples as those following in Logo: TO METRH1: X IF X>5 [STOP] PRINT: X METRH1: X+1 END TO METRH2: X IF X>5 [STOP] METRH2: X+1

			<i>PRINT:X END</i>
8. Mathematical Functions (computer science)	<i>To be familiar with existing mathematical function To know how to use recursion for the development of functions</i>	<i>Trigonometric functions, square root etc. and their exploitation on problem solving Solving of mathematical calculations such as sum of n</i>	<i>For mathematical functions to be used in appropriate examples. For example a procedure that calculates the roots of secondary Or Wherever possible it is suggested for the problems to be solved through repetition and recursion.</i>

Appendix 7.6 Applications

General Attainment Target

- *For the students to have the opportunity to develop initiative and to relate theory with practice*
- *To develop co-operation between students*
- *For the students to have opportunity to explore and discover additional practices and possibilities that environment of computer application offer*

Appendix 7.7 Contents of the student textbook for the chapter word processing

Chapter 4. Word Processing with Write

Introduction

What we can do with a word processor

Word Processor "Write"

The keyboard

Letters and numbers

English and Greek keyboard

Operational keys

How we write a text

How we save a document

How we exit "Write"

How we open a file from the diskette to the memory

How we print a document

How we edit

Change of insert point in editing point

Delete of text

Insert text

Selection of text

How we delete a part of text

How we replace text

How we copy text (Copy – Paste)

How we move text (Cut – Paste)

Format of document

How we format paragraphs

Page margins/indent

Alignment

Line spacing

Paragraph menu

Tab Key

How we format characters

Change format characters

Change size and fonts

Appendix 7.8 IT Curriculum for word-processing and correspondence with student textbook

Information Technology National Curriculum				Student Book
Sub-Unit	Attainment Target	Teaching Content	Comments-activities	
1. Familiarisation with word processing	To understand that word processing is a tool for written expression and presentation of ideas and information. To understand basic principles of written expression as well as basic actions needed for text processing.	Actions through processing of text. Creation, saving, retrieval, printing of text.	Demonstration of text in different stages of processing, that without a word processing they should have been written again. Refer to interventions that gave the different forms of text. Analysis of actions.	Introduction
	To understand indicative groups of actions. Groups of actions are not the same for all word processing packages.	Writing of text. Selection of part of text. Format of text. Layout of text. Insert graphics. Spell check. Thesaurus. Help.	Simple reference.	What we can do with a word processor
	To understand that commands that realise actions exist in the menus, in windows, in icons or Are realised with combination of keys in the keyboard.	Ways in which commands are realised in word-processing.	Demonstration of commands' organisation in word processor that is installed.	Word Processor "Write"
	For students to be familiar with the keyboard and its use in word processing.	Keys for printable and not printable characters. Capital letters, English-Greek, Bold, Combination of keys	Use of keys, Alt-Ctrl, F1-F10, Caps Lock, Shift, Esc, Tab, Back Space etc.	The keyboard Letters and numbers English and Greek keyboard Operational keys

<p>2. Creation of text</p>	<p>For students to have practical experience in text composition. Students to know basic actions- commands of word processing in the lab.</p>	<p>The concept of cursor-point of insertion, typing of text. Small changes/movement while inserting text. Movement of cursor in different positions of text. Ways of writing.</p>	<p>Open window/typing. Change of paragraph. Insert of blank lines. Use of keys Back Space, Space Bar. Move at a space of one character/word/line/s creen. Movement to the start or end of line or text. Automatic or not insertion of characters.</p>	<p>How we write a text</p>
<p>3. Saving, retrieval, correction, printing of text</p>	<p>For students to understand the importance of saving of document for future retrieval. Printing.</p> <p>For students to practice in selection of text. Possible actions – commands of word processor installed.</p> <p>For students to practice on correction of text. Possible actions – commands of word processor installed.</p>	<p>Saving of text in a magnetic medium. Retrieval of existing document. Printing of the whole of part of the document.</p> <p>Selection of part of text.</p> <p>Copy – Delete – Paste of part of text. Search and possible replace of fonts.</p>	<p>Naming of file and definition of disk. Set up printer, number of copies etc.</p> <p>Selection of character, word, lines, paragraph, text.</p> <p>Copy – Delete – Paste of selected text. Search – Replace,</p>	<p>How we save a document How we exit "Write" How we open a file from the diskette to the memory How we print a document</p> <p>How we edit Selection of text</p> <p>How we edit Change of insert point in editing point How we delete a part of text How we replace text How we copy text (Copy – Paste) How we move text (Cut – Paste)</p>

<p>4. Format – Layout of text</p>	<p>For students to understand potential of modern word processors for the esthetical improvement of text</p>	<p>Appearance/change of ruler. Page layout. Format paragraph. Format fonts.</p>	<p>Change of ruler, text width. Page size and margins. Hanging effect, alignment, line spacing. Bold, Italics, underlined characters. Selection of fonts and size of characters. Superscript, subscript.</p>	<p>Format of document How we format paragraphs Page margins/indent Alignment Line spacing Paragraph menu Tab Key How we format characters Change format characters Change size and fonts</p>
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Appendix 8.1 Cross-tabulation between covering teaching units beyond IT curriculum and acquisition of a first degree in Computer Science

		Covering teaching units beyond IT curriculum		
		No	Yes	Total
Degree in Computer Science	No	250 74.6%	85 25.4%	335 100.0%
	Yes	132 63.5%	76 36.5%	208 100.0%
Total		382 70.3%	161 29.7%	543 100.0%

Valid Cases 543

Total Cases 591

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	7.669	1	.006		
Continuity Correction	7.143	1	.008		
Likelihood Ratio	7.576	1	.006		
Fisher's Exact Test				.007	.004
Linear-by-Linear Association	7.655	1	.006		
N of Valid Cases	543				

a Computed only for a 2x2 table

b 0 cells (.0%) have expected count less than 5. The minimum expected count is 61.67.

Appendix 8.2 Cross-tabulation between covering teaching units beyond IT curriculum and equipment installed in the computer lab

	Equipment			Total
	8086	386-486	Pentiums	
Did not teach beyond the IT curriculum	103	267	15	385
	69.6%	73.0%	48.4%	70.6%
Taught beyond IT curriculum	45	99	16	160
	30.4%	27.0%	51.6%	29.4%
Total	148	366	31	545
	100.0%	100.0%	100.0%	100.0%

Valid Cases 545

Total Cases 591

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.422	2	.015
Likelihood Ratio	7.737	2	.021
Linear-by-Linear Association	.895	1	.344
N of Valid Cases	545		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 9.10.

Appendix 8.3 Coding of the question number 10 of the Teacher Questionnaire

Question 10. Which two of the aims of the National Curriculum do you think are the most important?

Teachers' answers were coded according to the objectives their words reflected as defined in chapter three. Some examples on the way that teachers' words were coded are given below.

Computer Awareness (1)

Under Computer Awareness objective were coded answers referring to students' first contact with the computer as well as to students' awareness on social issues related to computers.

"Demystification of the computer" as found in Teacher Questionnaire, number 1(TQ#1)

"To support students on their first contact with the computer and computer applications" (TQ#8)

Understand the nature of the computer and what it can do. (TQ#9)

Familiarise students with philosophy of windows. (TQ#2)

Support students in their first contact with the computer and software [TQ#8]

Inform students about Information Technology concepts that are discussed and become up to date [TQ#5]

Computer Science (2)

Under Computer Science objective were coded answers referring to students' familiarisation with basic programming as well as to basic concepts related to Computer Science or technical issues.

Programming in Pascal and not in Basic (TQ#24)

Learning Basic (TQ#27)

Introduction to programming (TQ#33)

Familiarise with programming [TQ#20]

Basic programming (TQ#53)

To familiarise them with computer science [TQ#4]

Computer Competence (3)

Under Computer Competence objective were coded answers referring to students' cultivation of IT skills.

Learning of word processing (TQ#1)

To be able to exploit the computer to other activities (TQ#3)

Fluency on the use of computer applications (TQ#22)

Familiarisation with a word processing, a database and a spreadsheet (TQ#20)

Use of a word processing (TQ#27)

To learn to use a word processing, a database and a spreadsheet in relation to their everyday life. (TQ#2]

Because the question was open ended, teachers' words were not always reflecting specific objectives, they were coded according to the rationales their words reflected as defined in chapter three. Examples are cited below.

Educational rationale (4)

Under Educational rationale were coded answers referring to the exploitation of the use of computers into school activities, or referring to learning in general.

New way of thinking (TQ#13)

Exploitation of educational potential of computers (TQ#28)

To discern the nature of a problem and solving with the computer (TQ#61)

Use the computer within school activities (TQ# 57).

Vocational rationale (5)

Under Educational rationale were coded answers referring to the exploitation of the use of computers in their students' future working life.

To be able to exploit the computer potential in future professional activities (TQ#3]

Teachers' answers most of the times reflected more than one objective. All reflected objectives were coded for each teacher, as shown in the following examples:

Answer	Coding
Familiarisation of the student with the computer, new way of thinking through the use of the computer (TQ#13)	14
Familiarisation of students with the use of the computer, development of skills on the use of computer applications	13

Appendix 8.4 Cross-tabulation between computer Science objective proposed by the IT teachers and acquisition of a first degree in Computer Science

		Degree in Computer Science		
		Held	Did not hold	Total
Computer Science objective	Not proposed	213 84.5%	131 92.3%	344 87.3%
	Proposed	39 15.5%	11 7.7%	50 12.7%
Total		252 100.0%	142 100.0%	394 100.0%

Valid cases 394

Total cases 591

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.898	1	.027		
Continuity Correction	4.225	1	.040		
Likelihood Ratio	5.237	1	.022		
Fisher's Exact Test				.028	.018
Linear-by-Linear Association	4.885	1	.027		
N of Valid Cases	394				

a Computed only for a 2x2 table

b 0 cells (.0%) have expected count less than 5. The minimum expected count is 18.02.

Appendix 8.5 Coding of the question number 11 on the Teacher Questionnaire

Question 11.

Do you have any problems when teaching IT? Yes No

 If yes, problems relating to what?

 Students' attitudes classroom management

 content of IT teaching issues

 technical problems other _____

One variable (Var. 1) was created to include information on whether IT teachers felt they faced problems (Yes/No).

A second variable (Var. 2) was created to capture information relating to what type of problems teachers faced. This variable included information collected from teachers' responses to the given type of problems, and information collected from teachers' responses to the open-ended alternative (other). For each given type of problem a code number was given as follows: Students' attitudes (1); classroom management (2); content of IT (3); teaching issues (4); technical problems (5). Three more code numbers were given reflecting different type of problems reflected in teachers' responses to the open-ended alternative. Firstly, a code (6) for problems relating to Subject Organisation was given. This code included teachers' responses relating to: problems relating to the IT National Curriculum; student textbooks; lack of teaching time. Secondly, a code (7) was given for problems relating to Equipment. This code included teachers' responses relating specifically to lack of equipment. Finally, a last variable (8) was given to include teachers' responses relating to all other type of problems that were mentioned by limited number of teachers, such as problems relating to students' understanding.

For example a teacher (TQ, case 28) responded as follows:

Do you have any problems when teaching IT? Yes No

 If yes, problems relating to what?

 Students' attitudes classroom management

 content of IT teaching issues

 technical problems other *lack of time*

His answer was coded as shown below.

Var.1	Var.2
1	236

Additionally, seven more variables were created to capture whether IT teachers checked (yes/no) each of the type of problems mentioned above. For example, the answer of the above teacher was coded as follows.

Var.1	Var.2	Var2a	Var.2b	Var.2c	Var.2d	Var.2e	Var.2f	Var.2g
1	236	0	1	1	0	0	1	0

Appendix 8.6 Coding of the question number 42 on the Teacher Questionnaire

42. Looking back over your experience of teaching IT, pick up the worst experience you can remember, and describe it.

A variable was created to capture information relating to what type of problems teachers faced. For each type of problem a code number was given as follows:

Lack of infrastructure (1)

In my first school, I had to teach Information Technology on 8086 PCs. I had to teach MS word processing that was in the student textbook, just on the blackboard, it was terrible (TQ #3)

Technical Problems (2)

Experience with viruses and non-working screens (TQ#13)

Students' attitudes (3)

I told to all students to get out of the lab. They behaved like being in the schoolyard. (TQ #16)

Colleagues' attitude (4)

Narrow-mindedness of teachers (TQ #26)

Subject organisation (5)

I try to teach Information Technology within a tight National Curriculum to students that ignore the Latin alphabet (TQ #50)

Support provided by the Ministry of Education (6)

When we tried to establish the computer lab in my new school, the Ministry of Education said "the appointed IT teachers to be transferred to other schools" (TQ #134)

Students' learning (7)

When after many hours of using the computer lab, many students can not start or load something on the computer (TQ #32)

Other (8)

When I first realised the advantage that students had because they had a PC at home or went to a cramming school (TQ #257)

In case that the teachers' answer reflected more than one type of problems, all of them were coded, as shown in the following examples:

Answer	Coding
The computer lab had 8088 PCs from which only one had a hard disk. Once, it was infected by a virus, which erased all programs of the one and only hard disk. (TQ#11)	12
To try to start up out of date machines and students to be noisy (TQ#51)	13

Appendix 8.7 Cross-tabulation between hardware acquisition and problems related to technical issues

Hardware Acquisition	Problems		Total
	No technical problems reported	Technical problems reported	
8086	65 48.9%	68 51.1%	133 100.0%
At least one 386	9 52.9%	8 47.1%	17 100.0%
At least one 486	286 77.7%	82 22.3%	368 100.0%
At least one Pentium	25 78.1%	7 21.9%	32 100.0%
Total	385 70.0%	165 30.0%	550 100.0%

Total cases 591

Valid cases 550

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	42.070	3	.000
Likelihood Ratio	40.093	3	.000
Linear-by-Linear Association	38.793	1	.000
N of Valid Cases	550		

0 cells (.0%) have expected count less than 5. The minimum expected count is 5.10.

Appendix 8.8 Cross-tabulation between problems reported and need for help

	No help needed	Needed help	Total
No problems reported	181	51	232
	78.0%	22.0%	100.0%
Problems reported	171	158	329
	52.0%	48.0%	100.0%
Total	352	209	561
	62.7%	37.3%	100.0%

Total cases 591

Valid cases 561

Chi Square tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	39.472	1	.000		
Continuity Correction	38.366	1	.000		
Likelihood Ratio	40.894	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	39.402	1	.000		
N of Valid Cases	561				

a Computed only for a 2x2 table

b 0 cells (.0%) have expected count less than 5. The minimum expected count is 86.43.

Appendix 8.9 Cross-tabulation between problems reported and need for training

	No training needs	Training needs	Total
No problems reported	55 23.4%	180 76.6%	235 100.0%
Problems reported	30 8.9%	306 91.1%	336 100.0%
Total	85 14.9%	486 85.1%	571 100.0%

Total cases 591

Valid cases 571

Chi Square tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2- sided)	Exact Sig. (1-sided)
Pearson Chi-Square	22.870	1	.000		
Continuity Correction	21.742	1	.000		
Likelihood Ratio	22.546	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	22.830	1	.000		
N of Valid Cases	571				

a Computed only for a 2x2 table

b 0 cells (.0%) have expected count less than 5. The minimum expected count is 34.98.

Appendix 8.10 Reliability Analysis – Scale (ALPHA)

1. C17 = The National Curriculum is useful on teaching issues
2. C21 = The Student textbook help me organise my teaching
3. C27 = Plinet helps me on teaching issues

Reliability Coefficients

N of Cases = 523.0

N of Items = 3

Alpha = .2804

Appendix 8.11 Reliability Analysis – Scale (ALPHA)

1. C25 = I am supported on technical problems by the Computer Company
2. C26 = Plinet helps me on technical problems

Reliability Coefficients

N of Cases = 536.0

N of Items = 2

Alpha = .2720

Appendix 8.12 Cross-tabulation between problems reported relating to educational issues and the usefulness of the National Curriculum on such issues

		Level of help			Total
		None	Some	A lot	
Problems reported	No	97 21.5%	253 56.1%	101 22.4%	451 100.0%
	Yes	35 32.7%	55 51.4%	17 15.9%	107 100.0%
	Total	132 23.7%	308 55.2%	118 21.1%	558 100.0%

Total cases 591

Valid cases 558

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.665	2	.036
Likelihood Ratio	6.427	2	.040
Linear-by-Linear Association	6.051	1	.014
N of Valid Cases	558		

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 22.63.

Appendix 8.13 Cross-tabulation between problems reported relating to educational issues and help by the student textbook on the organisation of teaching

		Level of help			Total
		None	Some	A lot	
Problems reported	No	42 9.2%	209 45.5%	208 45.3%	459 100.0%
	Yes	17 15.7%	53 49.1%	38 35.2%	108 100.0%
Total		59 10.4%	262 46.2%	246 43.4%	567 100.0%

				Chi-Square Tests		
		Value	df	Asymp.	Sig.	
		(2-sided)				
Pearson Chi-Square		5.955	2		.051	
Likelihood Ratio		5.687	2		.058	
Linear-by-Linear		5.686	1		.017	
Association						
N of Valid Cases		567				

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 11.24.

Appendix 8.14 Cross-tabulation between problems reported relating to educational issues and help provided by the Plinet

		Level of help			Total
		None	Some	A lot	
Problems reported	No	135 31.0%	136 31.3%	164 37.7%	435 100.0%
	Yes	6 35.0%	41 39.8%	26 25.2%	103 100.0%
	Total	171 31.8%	177 32.9%	190 35.3%	538 100.0%

Total Cases 591

Valid Cases 538

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5.909	2	.052
Likelihood Ratio	6.125	2	.047
Linear-by-Linear Association	3.328	1	.068
N of Valid Cases	538		

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 32.74.

Appendix 8.15 Cross-tabulation between problems reported relating to technical issues and help provided by the Computer Company

		Level of help			Total
		Not at all	some	A lot	
Problems reported	No	92 24.2%	87 22.9%	201 52.9%	380 100.0%
	Yes	51 30.4%	53 31.5%	64 38.1%	168 100.0%
	Total	143 26.1%	140 25.5%	265 48.4%	548 100.0%

Total Cases 591

Valid Cases 548

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	10.377	2	.006
Likelihood Ratio	10.445	2	.005
Linear-by-Linear Association	7.341	1	.007
N of Valid Cases	548		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 42.92.

Appendix 8.16 Cross-tabulation between problems reported relating to technical issues and help provided by the PLINET

		Level of help			Total
		none	some	A lot	
Problems reported	No	77 20.2%	131 34.4%	173 45.4%	381 100.0%
	Yes	73 44.5%	49 29.9%	42 25.6%	164 100.0%
	Total	150 27.5%	180 33.0%	215 39.4%	545 100.0%

Total Cases 591

Valid Cases 545

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	36.697	2	.000
Likelihood Ratio	35.714	2	.000
Linear-by-Linear Association	33.952	1	.000
N of Valid Cases	545		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 45.14.