

Original Article

# The Discourse for the Integration of ICT in STEM Education: Attitudes Expressed in Texts on Education in Greece (1984-2006)

Katerina Nikolakopoulou, Gerasimos Koustourakis, Vassilis Komis and Konstantinos Ravanis\*

*Department of Educational Sciences and Early Childhood Education, University of Patras, Greece*

\*Email: ravanis@upatras.gr

## Abstract

In this article an attempt is made to study the attitudes in the “discourse” on the integration of Information and Communication Technologies (ICT) in Science, Technology, Engineering, and Mathematics (STEM) education in Greece during the critical period 1984-2006, the period when the most important programme related to this integration was completed. The approach to the discourse was carried out using quality analysis of texts in the journal “Contemporary Education” through the use of a specialized methodological tool. The results of the analysis revealed that until the middle of the period being examined, there was a strong tendency to adopt attitudes that claimed that the integration of ICTs would bring about and/or should bring about minimal change, while in recent years attitudes which adopt the perspective of real influence of ICTs in the change in teaching practices have started to increase.

**Keywords:** *attitudes towards ICT; discourse analysis; ICT in STEM Education*

## Theoretical framework

The concept of discourse from Foucault’s theoretical framework is suitable for the analysis of various meanings and perceptions which are expressed on a particular issue by the social subjects, like the integration of ICTs into teaching action (Whisnant, 2012). Discourse comprises a culturally constructed reproduction of reality at a specific historical period which is created, maintained, put forward and promoted by the socially powerful, who use the available means of communication for this purpose (Foucault, 1972; Pitsoe & Letseka, 2013). So, discourse appears as a political good promoted by bodies who exercise power, aimed at the predominance of a dominant view which is passed off as “truth” (Jones & Ball, 1994, p. 171). Such a version of the truth may constitute a demonstration of the need for the utilization of ICTs in the teaching of curriculum subjects in education. More precisely, Foucault mentions that every society, at a particular moment in time aims through discourse at the shaping of its own regime of truth, which is linked to policies that promote “*the establishment of domains in which the practice of true and*

*false can be made at once ordered and pertinent*" (Foucault, 1991b, p. 79). In other words, talking about a regime of truth is an attempt to maintain that form of discourse, which is promoted as truth, with the aim of controlling the regulation of the language, thought and desire of the social subjects (Foucault, 1978). And this is because discourse appears simultaneously as text, in written and oral forms, and action as it is noted in people's everyday practices (Foucault, 1977). However, discourse does not remain static but "*undergoes constant changes as new utterances are added to it*" (Foucault, 1991a, p. 54). Consequently, as far as the shaping of discourse on ICTs is concerned, it is important to trace the varied and as a result different versions of it, as they are expressed in the pages of scientific journals with wide resonance in educational circles.

The discourse which relates to the utilization of ICTs in greek compulsory education was shaped by the action of the Official Recontextualizing Field (ORF), in other words, the ministry of education (Bernstein, 2000), and is linked to the implementation of a new interdisciplinary curriculum which was established, applying the decisions of European leaders in Lisbon in 2000 for the integration of ICTs in the educational process (Koustourakis, 2007). Here the international element proves to be dominant in the shaping of greek education policy in the area of school knowledge which contains ICTs as a basic element of the educational action. What's more, for the shaping of the particular contemporary greek educational policy for ICTs faculty members from the greek universities who belong to the Pedagogical Recontextualizing Field (PRF) were activated within the framework of the ORF, and they were activated in the sector of the new technologies and pedagogy (Koustourakis & Panagiotakopoulos, 2008). Indeed, the PRF, which is made up of the universities, the teachers, who can act either autonomously or through their trade union organizations, scientific journals, the publishing houses and the press that occupies itself with educational issues (Bernstein, 2000), play a decisive role in the shaping of the attitudes and actions of the teachers concerning the integration of the ICTs in Greek STEM education.

Foucault perceived discourse on a particular issue, such as the discourse on ICTs, as a magnetic field which concentrates "*the totality of all effective statements (whether spoken or written)*" which is expressed following a particular set of rules "*in their dispersion as events*" (Foucault, 1972, p. 27). In this case, the written statements of the members of the PRF, which set out in a clear way, following the rules of publication for scientific articles in the pages of scientific journals through which "their attitudes", related to the integration of ICTs in STEM Greek education, can be traced, are important. Indeed, the integration of ICTs into education brings about significant changes in the educational process and the approach to school knowledge, which is why it is to be expected that it would be picked up on by members of the PRF with the expression of differing and often opposing attitudes.

Fishbein & Ajzen (1975, p. 6), described attitude as the "learned pre-disposition to respond in a consistently favourable and unfavourable manner with respect to a given object", while for Capan (2012) attitudes represent the intellectual evaluations of an issue based on one's proximity or distance from it.

Over the past two decades, with the spread of technology in schools, a significant number of studies have been conducted related to the attitudes of teachers towards the integration of ICTs into the schools (Jimoyiannis & Komis, 2007; Wen & Shih, 2008). Some research has been concerned with the way in which attitudes on teaching are influenced by the need to use ICTs in the teaching act (Ertmer, 2005; Goos, Galbraith, Renshaw, & Geiger, 2003), other research focuses on the particularly positive attitudes of

teachers towards computers and the acceptance of their utilization for teaching (Kara-giorgi & Charalambous, 2006; Cure & Ozdener, 2008; Foley & Ojeda, 2008) and finally, there is research that is concerned with the tracing of negative attitudes of teachers who are called on to use ICTs, and which range from “*mild discomfort to extreme avoidance*” (Todman, 2000, p. 27).

Many studies also mention the factors which influence the teachers’ attitudes to ICTs. The teachers generally have positive attitudes towards the training programmes they attended, the general role that ICT can play in education and the integration of ICT in the educational process (Jimoyiannis & Komis, 2006, 2007). On occasions, the attitudes are linked to technical parameters (Morris, 2010) and it is seen that when the teachers do not use the available equipment often, this happens either because they don’t possess the necessary knowledge to prepare the students to approach the new social challenges (Kocak Usluel, Kuskaya Mumcu & Demiraslan, 2007) or because the teachers’ technical knowledge cannot guarantee the effective teaching of ICT (Schoepp, 2005). Pelgrum studied the influence of the head teachers’ attitudes on ICT and concluded that “*there is a clear association between the attitudes of school principals and the emphasis on computer integrated learning within the school*” (1993, p. 209). Trigwell, Prosser & Waterhouse (2009) highlighted the existence of a concatenation of relationships, which starts from the teachers’ way of thinking about teaching, the pupils’ approaches to learning and technology, the quality of learning and the learning outcomes. A number of researchers (Baylor & Ritchie, 2002; Albirini, 2006) highlighted from the findings of their studies the existence of a strong relationship between the attitude of the teachers and the successful use of ICT. Any change in teaching methodology should meet the needs of learners and educators in the digital age (Sharma, 2011, p. 390) and more specifically contain understanding of ‘why I’m using ICT’ and not simply ‘how do I use ICT’ (Towndrow & Vallance, 2004). The “*persistent digital disconnect between the tech-intensive lives of students outside of school, and the unsatisfactory experiences provided by many schools to use technology meaningfully*” (Project Tomorrow, 2011, p. 3) is highlighted. Kay (2006) noted that the shift from computer training to the focus on “informed pedagogy” proved to be of especial significance. From Ertmer et al.’s (2012) research it emerged that educators who hold ‘student-centred beliefs undergird student-centred practices (authenticity, student choice, collaboration). *Moreover tended...to enact student-centred curricula despite technological, administrative, or assessment barriers*”. In addition, from their findings it became clear that “*most teachers indicated that internal factors (e.g., passion for technology, having a problem-solving mentality) and support from others (administrators and personal learning networks) played key roles in shaping their practices. Teachers noted that the strongest barriers preventing other teachers from using technology were their existing attitudes and beliefs towards technology, as well as their current levels of knowledge and skills*” (Ertmer et al., 2012, p. 423).

Then, various observation scales have been created for the evaluation of the attitudes towards ICT of the pupils, the teachers and the heads of the school units (Rosen & Weil, 1995; Korukonda & Finn, 2003). These scales are made up of subscales which can be summarised in four general categories: a) Anxiety – Avoidance – Aversion to do with the prospect of the use of computers, b) Self-efficacy/Trust, c) Enthusiasm/Pleasure/Amusement from the use of ICTs, and d) Usefulness of ICT/Negative impact on personal and social life.

Rogers (1995) attempts to approach the spread of innovation and explain why some individuals adopt innovation and others don’t. In addition, he attempts to categorize these

people based on the moment in time during which they adopted them.

Siorenta & Jimoyiannis (2008), studying the attitudes of teachers of the Natural Sciences in Greece, ascertained the existence of three groups of teachers: a) the traditionalists, who were possessed by the attitudes of strict adherence to the presentation of the knowledge content of physics through the use of the school textbooks and who are unwilling to incorporate teaching laboratories and activities based on the use of ICT in their classroom, b) the non-traditionalists, who have a learner-centred orientation and positive attitude towards the adoption of laboratories and the teaching of Physics through the use of ICT and c) the undecided, who waver between the traditional and the non-traditional approaches in the teaching of Natural Sciences and likewise in the role of the laboratory and teaching which utilizes ICT (Siorenta & Jimoyiannis, 2008, p. 198).

Macleod (2005) notes the existence of two extreme teacher attitudes regarding the use of ICT in teaching. Some teachers are strong supporters of technological innovation, while others are unwilling to accept ICTs as necessary in the learning process. In the first case we find attitudes that simply see the learning of ICTs as an autonomous teaching goal, and restricted only in the value of the endeavour simply at a technical level. In the other case we come across the attitude that ICTs constitute a tool with consequences not only simply at the level of technology but at the level of social changes and reforms. These extreme positions create a continuous spectrum in which various intermediary attitudes to technology are shaped (Juniu, 2005).

Aviram & Tami (2004) recognise as attitude the discourse for the integration of ICTs into education, the attitude which is expressed concerning the extent and level of change to which the integration will or should lead. Changes are understood as simple technical shifts in administrative or educational functions, important shifts in teaching practices, radical change in all the educational processes or even ending up at complete de-schooling. Analysing attitudes to ICT in education, they distinguish five categories:

1. Agnostic attitudes, expressed by those who aren't interested in or don't know what any changes are or should be.
2. Conservative, is the attitude of those who claim that schools need to survive with minimal change and that ICTs simply constitute an additional tool.
3. Moderate attitudes are supported by those who believe that with the integration of ICT, schools will be lead to extensive change in teaching practices.
4. Radical attitude, which is founded on the belief that schools are to change radically in all educational or administrative processes.
5. Extreme radical attitude which marks de-schooling and the end of the form of today's school.

Since the incorporation of ICT nowadays continues internationally to constitute a stake for education, the systematic recording of multiple, varied gradated attitudes on the introduction of ICT in STEM education, the recording of the prevailing trends and their interpretation offer important information which can be expected to influence the development of public discourse. Aviram & Tami (2004) note that it is important for us to investigate the issue of the integration of technologies into education below the surface and "*encourage the development of a theoretical discussion, based on empirical data*", which will provide information on any shift and/or progress in the sector, contributing to the enrichment of the desired dialogue.

The present research aims at the investigation of the attitudes of the authors of re-

search and theoretical texts, which come from the PRF and formulate their attitudes in the greek university scientific press between 1984 – 2006, relating to the extent and level of the suspected changes which the integration of ICT may lead to in Greek STEM education.

### Methodology and Research Questions

In this research we will be occupied with the approach to the following research questions:

- How is the discourse on the incorporation of ICT in STEM education, which is expressed through the pages of the greek scientific journal press, shaped?
- Are there any changes in the formulation of the particular discourse on the integration of ICT in Greek STEM Education during the time period we focus our interest on?

The research focusses on the content study of the scientific journal “Contemporary Education” which belongs to the PRF (Bernstein, 2000) and which had wide distribution and acceptance in educational circles from the 1980s and on, contributing to the circulation of the discourse on the incorporation of ICTs in Greek STEM education. This is because this journal publishes articles which present a variety of attitudes on the part of the authors, who belong to the PRF, on the issue in question, and constitute effective statements for the acceptance, or not, of “truth” (Foucault, 1972), which is promoted by the dominant discourse, which was shaped by the action of ORF (education ministry) and requests the utilization of ICTs in the teaching process, in this way implementing the related decisions of European Union leaders on education (Koustourakis, 2007).

This research focusses on texts published in the pages of the journal *Contemporary Education* between 1984 and 2006 and which focus on the integration of ICT into education. The year 1984 marks the start of the introduction of experimental teaching of Information Science in Greek secondary education (Panagiotakopoulos & Koustourakis, 2005) and 2006 is the year of publication of teaching material implementing the new curriculum for compulsory education which was established in 2002 and includes educational software for all the subjects (Koustourakis, 2007). During this time a wide programme was implemented in Greece which concerns the attempt to introduce ICT into education, which took place with funding from the European Union’s Community Support Framework. Precisely due to the attempt to implement this venture, intense discussion on ICT developed and many researchers as well as educators presented research as well as theoretical texts on the issue that occupies us.

Consequently, our research material is made up of articles which were published in the journal *Contemporary Education* and which refer to ICT and their utilization in education. Qualitative Content Analysis was performed on these articles, during which since we defined the ‘theme’ as basic unit for data recording and the ‘article’ as context unit, and the attitudes of the authors towards ICT were sought in the whole article (Krippendorff, 2004). We also attempted the quantification of some data in order to record trends. The articles were analysed with the digital software Nvivo 8.

The units of analysis that were noted were assigned to one of the following five analysis categories, which emerge from the work of Aviram & Tami (2004) and reveal authors’ attitudes towards ICT:

1. Agnostic attitude
2. Conservative attitude

3. Moderate attitude
4. Radical attitude
5. Extreme radical attitude

The five particular analysis categories were used in the study of the research material as the attitudes of the authors of the articles analysed were sought with the aim of describing the extent and level of the changes proposed by the authors themselves during the integration of ICT into the educational framework and their utilization in STEM teaching in Greece.

## Results

From study of the contents of the journal *Contemporary Education* 97 articles which approach the relationship between ICT and education were identified and analysed. It should be noted that this journal was versatile and representative of all the possible trends and attitudes from any potential author on the issue being researched during the period studied. In our analysis we distinguished 3 categories of authors, who all come from the PRF and focus their interest on ICT. They are Faculty Members in Greek Universities, who chiefly approach the issue through research, and teachers as much those specialised in STEM Education as those from the Social Sciences and Humanities.

Next we will present the results of the content analysis on the attitudes towards ICT as they are expressed in the articles, as much from a quantitative as from a qualitative perspective.

### *The quantitative perspective*

The analysis of the ninety-seven articles revealed the trends which appear in the authors' attitudes concerning the extent of changes brought about by the integration of ICT in Greek STEM Education. In the specific articles pinpointed 349 references on authors' attitudes towards ICT. As Table 1 shows, the majority of authors adopt a conservative attitude (46.4%), while those who hold agnostic attitudes follow with a high percentage too (36.1%). A satisfactory number of authors (12.4%) have moderate attitudes towards the integration of ICT in STEM education, while the adoption of radical attitudes is a fairly rare choice (5.1%). It is interesting that there is an absence of extreme radical attitudes and related references to strong doubting of the existing educational system, something which is to be expected, as we will discuss next.

Table 1. Scientific articles and references by attitude to ICTs category

	ATTIDUTES IN THE AUTHORS' DISCOURSE					
	Agnostic	Conservative	Moderate	Radical	Extreme radical	
Articles	35	45	12	5	0	97
	36,08%	46,39%	12,37%	5,15%	0,00%	100,00%
References (themes)	123	161	54	11	0	349
	35,24%	46,13%	15,47%	3,15%	0,00%	100,00%

In Table 2 an attempt is made at correlation between the scientific specialization and the attitudes of the authors, as they are expressed through the content of the scientific journal *Contemporary Education*, on the integration of ICTs into the teaching process. It appears that independent of the category to which the authors belong, they chiefly adopt conservative attitudes and secondly agnostic attitudes while almost 4/5 of the radical attitudes are expressed by university faculty members.

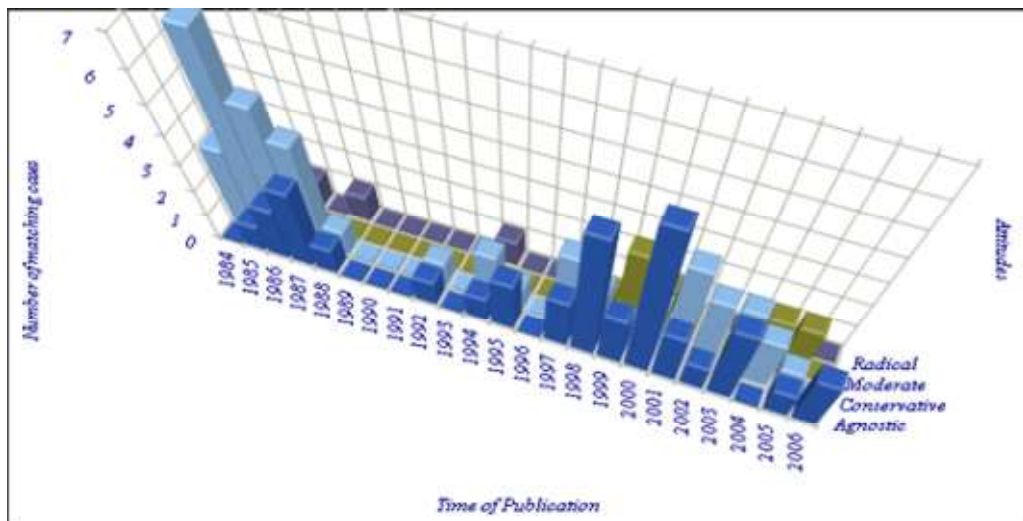
Table 2. Correlation between attitudes and scientific specialization of authors in their writings on the integration of ICTs in STEM education

Attitudes in the authors' articles	Authors' specialisation			F
	University Member	Teacher in STEM education	Teacher in Social Sciences and Humanities	
Agnostic	8	23	4	35
Conservative	13	26	6	45
Moderate	2	6	4	12
Radical	4	1	0	5
Extreme radical	0	0	0	0
Total	27	56	14	97

An analysis of the proposals which are expressed in the articles, leads to the ascertainment that a large percentage of the authors who adopt agnostic attitudes (34%) don't propose the integration of ICT into the teaching of particular objects of learning but almost the same percentage (31%) propose their integration into the Information Science lesson. Similarly, the authors with conservative (52%) or radical attitudes (60%) don't discuss the integration of ICT into some particular teaching object. In contrast, moderate attitudes are accompanied primarily by proposals for the integration of ICTs into the Natural Sciences. The authors, the majority of whom are primary or secondary school teachers, tend to follow the 'obvious' long-established practices, without tending to utilise the dynamism of the new means and their possible contribution to educational practice and learning (Miller & Olson, 1995), following conservative forms of thought and practices (Jimoyiannis & Siorenta, 2001).

From a study of the data in Graph 1 the dominance of two forms of discourse on the incorporation of ICTs in Greek STEM Education between 1984 and 2006 emerge. Hence, in this case the effective statements, which shape the dominant attitudes of truth towards the integration of ICTs into the teaching practice in greek schools (Foucault, 1992; Jones & Ball, 1994) on the part of the PRF authors whose articles were analysed, focus on cases of agnostic or conservative attitudes. More specifically, the conservative attitude appears to be the prevailing form of truth for the teaching use of ICTs at the beginning of the 1980s when the teaching of information science was introduced into greek secondary education, as at the beginning of the 21<sup>st</sup> century when we saw the reform of the curriculum in greek compulsory education which was aimed at the implementation of the decisions of the European leaders at the Treaty of Lisbon in 2000 for the integration of ICTs

Graph 1. The development of attitudes in discourse on the integration of ICTs in Greek STEM Education between 1984 and 2006



into teaching practice (Koustourakis, 2007). Small changes in the development of the discourse on ICTs, between the two predominant attitudes, can be observed at the end of the 1990s where the version of agnostic attitudes prevails, as at the beginning of the 21<sup>st</sup> century where the agnostic co-exists with the conservative attitude while these two constitute the two dominant forms of expression of discourse on ICTs. The moderate attitude is noted to a small extent in the authors' discourse in the mid 1980s. Finally, moderate attitudes appear to a very small extent in published discourse after 1997. It is the moderate attitude which reappears, and the radical attitude which is noted for the first time. In essence, this is when the discussion started in Greece on the reformative perspective of the integration of ICTs in the educational process.

### ***The qualitative perspective***

The qualitative approach to the articles led to the search for their fundamental assumptions, on the basis of which they were assigned to various attitude categories.

The articles in which the **conservative attitude** was dominant were based on three main assumptions:

1. The computer is accepted as an additional tool, a *“dynamic teaching aid which helps children develop fundamental skills”* (Michaelides, 1997, p. 73) a supplement that contributes to the improvement of the teaching process and offers a *“new form to the traditional way of teaching”* (Bairaktaris, 1984, p. 113) *“many opportunities in order to present a concept better”* (Papadaki, 1998, p. 67) without nevertheless the communicative teaching environment differentiating especially as compared with the traditional.

2. Concern is expressed over the instrumental way in which the integration of ICTs in education is perceived, for example over the fact that *“it is restricted to its objective of providing some manner of education for all the population”* (Milios, 1985, p. 68). This concern often leads to the refusal to incorporate ICTs, while concerns, such as *“the neglect of ideals and lack of socio-political sensitivity”* predominate (Gabriel & Tzepoglou, 1985, p. 77).



3. To this context of rejection and disapproval of technocratic approaches to education is added the necessity of ensuring a broader education for the pupils, “*ensuring the student of a more general background of education, so that preparation of scientists who are the equivalent of ‘specialist fools’ can be avoided*” (Sofios, 1985, p. 21), and the formation of critically thinking individuals. A position of ‘resistance’ to technocracy is often expressed strongly, for example “*students and progressive teachers to oppose the technocratic dehumanization*” (Eleftheriou, 1985, p. 62).

The emphasis on **agnostic attitude** is based on the following three fundamental assumptions:

1. Conventional teaching material and chiefly the school textbook are seen simply as tools on the same level as ICTs, since the computer will become established as “*the intellectual tool that the pupils will use as spontaneously as a pen or a pencil...*” (Bairaktaris, 1985, p. 93) “*...it will be able to supplement or even replace, the traditional textbook*” (Gasparakis, 1987, p. 101).

2. The employment of the introduction of computers as progress and development, despite the intense debate which points to the scepticism and critical mood (Csikszentmihalyi, 2000; Burgess, 2001). Hence, the introduction of ICTs is seen as an ‘a priori’ process of progress, development, improvement and upgrading of the learning process, which should be sought in order for the opportunity for the “*modernisation of education*” not to be missed (Bairaktaris, 1985, p. 95), “*upgrading of primary and secondary education and the demands of the times*” (Tsolakidis, 1998, p. 98). A deterministically identified course is then expressed for incorporation, which “*constitutes an urgent need*” (Jimoyiannis & Theodorou, 2000, p. 40) and which should be made use of “*for the benefit of the pupils and teachers of the future*” (Jimoyiannis, 2002, p. 65).

3. Remaining with given and particular existing attitudes on learning and the teacher, the utilization of new means as tools, “*users must resort to a variety of mechanisms and make use of the search possibilities that are offered*” (Nikolaou & Karagiorgi, 2003, p.75), without any prospect of the change they may bring about being noted.

The debate on the adoption of **moderate attitudes** for the integration of ICTs in the teaching of STEM is based on:

1. Expectations of change in teaching methodology which would facilitate the activation of the pupil, investigation, experimentation and discovery since he would “*participate actively in a cycle of feeling-action-thought and through investigation...to the discovery and construction of knowledge*” (Vahtsevanou-Stamouli, 2005, p. 170), provide “*effective supervision of the system and...intervention and modification of the properties of the objects in the environment*” (Bakas, 2005, p. 157) and establish the new profile of the teacher “*intermediator*” (Karaminas, 2001, p. 84).

2. Within this context, organizational changes, like the conversion of the classroom into a computer laboratory, the establishment of new rates of access to knowledge and the transition from the serial<sup>1</sup> to the hypertext<sup>2</sup> mode of learning are discussed, so that the pupil can “*develop self activated learning*” (Jorjakakis & Polakis, 1999, p. 91), as is the change in the organization of the classroom, so as to permit a combination of individual and group learning.

<sup>1</sup> School knowledge is presented serially, placing one topic after the other. The attempt to present knowledge takes place with the creation of a linear text in a course with a clear beginning and end (Chevallard, 1985; Ravanis, 2003, 2010).

<sup>2</sup> The hypertext means of learning refers to “computer-based texts that are read in a nonlinear fashion and that are organized on multiple dimensions...capable of being explored in different ways, with the different exploration paths producing what are essentially multiple texts for the same topic” (Spiro & Jehng, 1990, p. 166).

3. Innovative attitudes and expected changes, flexible and adapted to the needs and interests of the pupils, founded on the “*active self-education of the individuals themselves*” (Kapodistria, 2000, p. 45), as well as the creation of open, innovative, flexible applications for “*construction of worlds*” where “*the user can walk, fly, produce objects and make them disappear, be transformed...*” (Tsolakidis & Fokidis, 2004, p. 126).

In the thinking of the authors who express **radical attitudes**, the following fundamental arguments prevail:

1. The computer transforms the social terms of the conduct of teaching, “*in the conditions of the teacher-pupil communication of the cognitive object*” (Filippou, 1986, p. 85). Moreover, a “*trend towards the gradual replacement of the teacher*” is predicted and obviously a new, differentiated role for the educator since he “*will be a kind of intermediary, heading towards his own ultimate elimination*” (Filippou, 1986, p. 86).

2. The change in the means of social organization and orientation towards a “*society which is dominated by perhaps a significant technical innovation, rather than by political conflicts*” (Ziamos, 1988, p. 104), in the “*relationships of social reality and political plans*” (Chasapis, 2002, p. 54), towards a cultural reality of “*interpenetration and osmosis*” (Kaitatzi-Whitlock, 2003, p. 376).

3. The need for the deconstruction and criticism of the understood reality is evident, since “*significance comes from differences and not similarities, which are highlighted by the removal of rationalism*” (Self, 1997, p. 303), while the non-neutrality of the incorporation of ICT is revealed very early on, that is to say that the computer “*isn't such a simple, colourless, neutral and apolitical hypothesis...*” (Raptis, 1994, p. 14).

### Discussion and conclusions

In this paper we focussed our interest on the approach to and analysis of texts which refer to ICTs and were expressed in the framework of the PRF and more specifically in the scientific journal Contemporary Education, which due its circulation among the members of the PRF, in other words primary and secondary school teachers, postgraduate students and faculty members at greek universities (Bernstein, 2000), contributes to the broader expression and diffusion of ideas on the issue in question. In addition, the authors of the articles come from the PRF since they are faculty members and teachers, as much from the sciences as from the humanities.

From the analysis of the research material it emerged that through the attitudes of the authors towards ICTs not one version of discourse on their utilization in the educational process appeared, but four, revealing the existence of a discontinuity between the specific discourses (Foucault, 1978). Moreover, the findings of this research demonstrate the predominance in the official written discourse of the authors throughout the time period we studied, of the conservative attitude (46.39%) and the agnostic attitude (36.08%). More specifically, the conservative attitude expresses a tendency to persevere with the given educational system. It is in the direction of a structural-functional position which aims at the maintenance of the teaching approaches that are applied within the context of the school classrooms and the development of mechanisms that will exclude or place controls on potentially unforeseen situations arising from the introduction of new teaching methods. The conservative comprises the dominant choice for the incorporation of ICTs for all categories of authors. Hence, in the dominant discourse in the articles, an interest can be discerned in a renewal of teaching practice, utilization of new technologies in the same way as the traditional technologies (board, school book, various teaching aids for the Natural Sciences and so on), for the use of ICTs as a tool that will reinforce the ex-

isting learning environment and bring about the activation of the pupils' interests. However beyond these choices recorded in the conservative framework of ideas, there doesn't appear to be anything else of interest.

The fact that a large part of the authors concur in their attitudes, and the encouragement of the development of conservative thought and discourse, show a tendency for good adaptation in this context and for this reason the ICTs are perceived as a means that *"has not brought about a widespread revolution in methods of teaching or in school structure or organizations"* (Hativa & Lesgold, 1996, p. 134) but in their greater part *"they generally provide either an add-on activity or simply technological versions of the work-book approaches that are already prevalent in the nation's classrooms"* (Hadley & Sheingold, 1993, p. 265). The modification of long-established teaching methods, the integration of innovative attitudes in teaching practice, such as for example the utilization of ICTs in teaching, which have the potential to modify the working environment is neither obvious, nor easy.

Also significant is the adoption – to a great extent – of an agnostic position by the authors of the articles studied. The authors with agnostic attitudes adopt positions of parallelism between the book and the computer, they see it as yet another tool in the existing variety of tools for the children. At the same time, they developed a rhetoric which functions as symbolic pressure for the integration of ICT and contributes as expected to a determinist acceptance and incorporation of ICTs. The mere existence of computers is considered progress and development and their incorporation in administration and educational process constitutes a necessity, without reference being made to further prospects for change. In fact it constitutes a process of neutral and determinist significance for education. And a fundamental admission for them: technology exists, constitutes progress, is at the disposal of education and should be made use of to its advantage.

The agnostic attitude which appears in a large number of articles and references reveals a change in the discourse on ICTs due to the influence of the actual circumstances in the specific time period (Foucault, 1991a) which were created for the teachers and that came from a series of factors such as: the abrupt, mass and pressing introduction of computers into the schools, the inadequate prior training of the teachers, the lack of preparation of the bodies involved, the enthusiasm and the vague but excessive optimism regarding the variety of possibilities their integration could potentially bring about in the educational framework of STEM teaching, pressure from the markets and the parents, the emphasis placed on the development of educational software. In addition, another strong factor, which leads to an agnostic attitude is perhaps a rhetoric in the institutional texts which is without grounds or a relationship with reality, concerning the direct necessity for the digital literacy of all within the framework of the society of knowledge. Computers exist and the contextual framework exerts pressure for their incorporation, which should be realized with no thought for change and their use.

The circulation of the discourse of ICT within society as we approach and enter the 21<sup>st</sup> century, with the gradually increasing familiarity of teachers, pupils as well as a large part of society and especially the young, with the computer contributes to the transformation of the corresponding attitudes on the necessity and usefulness of its utilization in everyday life (Foucault, 1977, 1991a). So, of particular interest is the appearance after 1997 of a moderate attitude for the incorporation of ICTs, a reformative utilization of them for the shaping of new constructivist, collaborative, inquiry based learning environments, whose supporters are chiefly authors who are STEM teachers. The dynamically devel-

oping potential, brought about through technology, for the regulation of more effective access to the 'gap' which is created between the pupils' every day spontaneous knowledge and scientific knowledge is highlighted, with the supplementing of the pupils' inadequate direct experience and the creation of environments of direct experience (e.g. virtual reality, simulator). In addition, here we meet too the demand for the 'construction' of the 'actively self-educating' flexible pupil, of the life-long learner. The integration of technology aims at the solution of practical problems, in some changes within the framework and more innovative attitudes and perspectives on teaching methodologies.

In these articles, which appear after 1997, the change from teacher-centred to pupil-centred relations is described as well as the change to environments where with the use of ICT the activation of the pupils, investigation, experimentation, discovery and the establishment of the teacher 'intermediator' are facilitated, and also some changes within the framework towards individualised learning rates of access to knowledge.

A small portion of authors adopts a radical, critical and sceptical position towards computers, revealing 'ideologies' that are dispersed across society, exercise 'symbolic control' and exert pressure in the direction of misguided acceptance of the incorporation of ICTs in schools. University authors, while the majority of them held conservative attitudes, as we have already mentioned, to a small degree, although proportionally the biggest of all the categories, support radical attitudes.

Some focus on revealing the "internal conflicts" of the topic studied, with the aim of maintaining the 'other' rarer 'eye' in the discourse on the integration of ICT and certain alternative proposals. The authors highlight the radical transformation of the communicative learning relationship and the gradual replacement of the 'teacher' with the computer, and the transfer to 'disintermediation' and the creation of a new 'hybrid' form of educational communicative relationship.

Moreover, the complete absence of extreme radical positions in the authors of the articles studied is noted, which is to be absolutely expected since some extreme expressions of opinion – like extreme radicalism or deschooling – are not imaginable and do not represent feasible choices for greek society and the educational reality and by extension for the developing dialogue.

This research revealed the attitudes of university and school teachers regarding the integration of ICT into education as they were expressed in their articles between 1984 and 2006. This expression allows the study of the potential influence of similar attitudes on the political-educational choices that were made as much during this period as well as over the following years and until today. It also provides an opportunity to study today potential changes in related articles and so assess the weight of experience of the applications in the attitudes of today's researchers and teachers. Finally, the study of approaches, as Aviram & Tami's (2004) framework foresees, in other words, of the attitudes towards the objectives of the integration of ICTs in education, would give a complete understanding of the general trends in the attitudes expressed by groups whose thinking and action influence educational applications.

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## Appendix

### Primary source material: Articles from the journal "Contemporary Education"

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