

Individual characteristics and computer self-efficacy in secondary education teachers to integrate technology in educational practice

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Abstract

The development of modern technologies and their extension to every domain of our daily life nowadays is an indisputable fact. The widespread use of computers renders training in these technologies necessary. Consequently, computers were soon introduced into the Greek educational system. Factors related to the nature of the teacher's personality, such as computer self-efficacy, self-concept, attitudes, motivation and needs are considered crucial to the integration and development of modern technologies in education. This study examines the relationship between individual characteristics of secondary school teachers and computer self-efficacy as well as teacher prospects with regard to modern technologies.

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1. Introduction

In recent years, a concerted effort has been made to introduce modern technologies into the school curriculum. Part of this effort includes courses of training teachers in modern technologies (computers, internet, multimedia, communication technologies) as well as the creation of suitable educational software. Research has shown that teachers' attitudes towards modern technologies considerably influence the effective use of these technologies at school learning. Moreover, individual factors related to the teacher's personality, such as computer self-efficacy, self-concept, motivation, needs, etc., seem to affect the integration and development of modern technologies in educational practice (Benson, 2004; Hsiung, 2002; Roussos, 2002).

Teachers with a strong sense of self-efficacy are more open to new ideas and they are more willing to experiment with new methods at the same time offering students new and different learning opportunities

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or experiences (Tschannen-Moran & Woolfolk Hoy, 2001). Consequently, teacher computer self-efficacy might determine to a considerable extent the ability to develop such technologies as an important educational tool. This also depends on the teacher's self-image (self-perception, self-esteem), but also on other individual characteristics such as gender, age, prior experience and subject areas.

By this study, it is aimed to investigate the relationship between individual characteristics of Greek secondary education school teachers which determine the use and development of computers in education. More specifically, the purpose of the study was to identify the relationship between:

- general self-efficacy and computer self-efficacy of secondary school teachers;
- self-esteem and computer self-efficacy;
- demographic characteristics of the teachers, such as subject, prior experience in computer use and training, and computer self-efficacy.

2. Theoretical background

The efficacy beliefs of teachers are related to their instructional practices and to their students' achievement (Tschannen-Moran, Woolfolk Hoy, & Hoy, 1998). A strong sense of computer self-efficacy of school teachers can affect the extent as well as the way technology can be used in everyday instructional practice, significantly changing both the teacher's and the student's roles. Studies suggest that technology has the potential to revise and change teachers' roles. Technology can foster a shift in the teacher's role from a traditional one to that of facilitator in the classroom. Additionally, technology also can impact students to become more active learners during the learning practices (OTA, 1995).

Self-efficacy is defined as the personal judgement about one's capability to adopt certain behaviours and actions in order to accomplish certain objectives and expected outcomes (Bandura, 1997; Hoy & Miskel, 2001). The degree of self-efficacy which individuals assign to themselves constitutes a valid predictor of the expected behaviour that the individuals will demonstrate in performing a task (Koliadis, 1997). Compeau and Higgins (1995) defined computer self-efficacy as "judgment of one's capability to use a computer". Computer self-efficacy is based on an already formed sense of self-efficacy and represents its fundamental elements applied in the fields of use and mastery of computers. Thus, a strong sense of self-efficacy enriches human achievement and personal life in many ways (Karsten & Roth, 1998).

In a study by Looney, Valacich, and Akbulut (2004) it is pointed out that general self-efficacy reflects considerable positive influence regarding computer self-efficacy, which, in turn, seems to predict, to a considerable degree, self-efficacy in the use and development of online research. Thus, researchers with a greater sense of computer self-efficacy tend to prefer technologies based on the worldwide web as a vehicle for research, whereas researchers with lower computer self-efficacy prefer more traditional methods such as library research, or traditional lectures.

Research shows that computer self-efficacy influences expectations (Compeau & Higgins, 1995) and emotional reactions regarding the effective use of modern technologies (Looney et al., 2004). Thus, individuals who do not regard themselves as competent computer users are less likely to use them. Attitudes towards information technology are linked to computer self-efficacy since they are deemed to be a significant factor in the interpretation of the frequency and success with which individuals use computers (Compeau & Higgins, 1995; Khorrami-Arani, 2001). Research also corroborates that beliefs regarding teacher self-efficacy are related to teaching practices (Ashton & Webb, 1986). Therefore, if teachers are to integrate technology into their teaching practice, they have to consider themselves to be self-efficacious at its use (Ropp, 1999). Consequently, a positive attitude towards computers and a strong sense of computer self-efficacy are basic preconditions for positive self-efficacy in computer-aided teaching (Albion, 1999).

In this academic area current interest in self-beliefs has also been characterized by self-concept, including the terms of self-perception, and self-esteem. Self-perception defines how individuals think about themselves, which expresses the cognitive part of one's self (self-knowledge). Self-esteem generally expresses the emotional part as the evaluation component of self-concept. As a component of emotional attitude it determines how individuals feel about themselves. As an evaluation component it represents whether individuals view them-

selves as good or bad, competent or incompetent (Scholl, Beauvais, & Leonard, 1995). Research has generally demonstrated that self-efficacy is related to achievement and goal setting in specific cognitive objectives rather than measurements regarding global self-concept or self-esteem in which moderate or weak correlations are found in connection with subject domains (Pajares & Schunk, 2001; Sommerfeld & Watson, 2000). Self-esteem is a critical factor, because it indicates the extent to which the individual believes him/herself to be competent, intelligent, successful and special. However, it is worth pointing out that self-concept and its relation to other variables cannot be adequately interpreted if we disregard sub constructs of self-concept (Bong & Skaalvik, 2003; Pajares & Schunk, 2001).

Researchers (Sommerfeld & Watson, 2000) have generally demonstrated that self-efficacy is a better predictor of task-specific goals and performance than more global evaluations such as self-concept and self-esteem. Studies in which general or global self-concept was compared to specific achievements reported weak correlations (Pajares & Schunk, 2001). The relation between self-concept and achievement in a particular domain is very specific. Thus, the more global the self-concept under examination is, the less it correlates with achievement in a specific domain (Huitt, 1998). Research by Gage and Berliner (Huitt, 1998), has also reached the same conclusion, as well as research by Bong and Skaalvik (2003), which reports that: “generalized self-concept diminishes the ability to explain behavior, but we must examine self-concept as a more multidimensional concept in specific domains”. Marsh (Pajares & Schunk, 2001) warned that “research clearly proves that self-concept and its relationship with other variables cannot be sufficiently understood if we ignore its multidimensional domain-specific nature”. In many cases, self-esteem is linked to background, previous experience and impacted by teachers’ perception and school situation. Thus, self-esteem reflects years of experience and self-evaluation by reflected appraisals of significant others, via realistic expectations in the behaviour or academic capabilities. Consequently, the examination of self-concept components in specific domains of the teachers’ academic role is a critical factor in order to integrate modern technologies in educational practice.

Another characteristic that can affect an individual’s computer self-efficacy is prior experience in their use. Prior experience is interpreted according to the amount of time an individual has spent working with computers and the different applications they have learnt to use. It is also linked to emotional attitudes to technology (Ropp, 1999). Teachers’ prior experience in the use of technology influences their view of their own efficacy, that is their self-efficacy. This experience in turn greatly affects teachers’ self-confidence concerning the integration of technology in the teaching process (Hsiung, 2002). Slough and Chamblee report that teachers with positive prior experience in the use of technology as an aid to teaching tend to use it in the classroom (Hsiung, 2002). In a report by Software and Information Industry Association (2000), which sums up research into educational technology over the last 20 years, it is mentioned that teachers are more effective after receiving extensive training for integrating technology into the school curriculum. In the same publication it is also reported that teachers who have successfully used communication technologies such as e-mail, newsgroups and mailing lists in order to exchange ideas on educational matters, demonstrate greater progress in self-efficacy and confidence in their teaching abilities compared to teachers lacking access to such tools. Undoubtedly, the benefits of educational tutorials constitute a significant means for the increase of computer self-efficacy (Gist, Schwoerer, & Rosen, 1989). A recent study conducted by Wallace (1999 quoted in Khorrami-Arani, 2001) on education and computer students (subject-specific), investigated the correlation between the computer self-efficacy of a 3-item measure (basic, advanced skills and file-software) with main factors such as computer anxiety, computer confidence and computer knowledge, in order to describe the influence and the development of computer self-efficacy. Comparisons reported that computer students expressed low levels of computer anxiety, and higher levels of computer knowledge and computer confidence in comparison with education students (Khorrami-Arani, 2001).

Bandura (1995) argues that teacher efficacy is subject-specific oriented. For example, a teacher’s self-efficacy may be low while teaching science, but high while teaching language or arts, so they would devote more time to language or arts than to science and could develop more personal interest in participating in activities related to language or arts. Supporting the aforementioned findings in international bibliography it is evident that individuals with prior experience in computers are likely to demonstrate higher levels of computer self-efficacy compared to individuals without such experience (Karsten & Roth, 1998).

3. Research methodology

The present study is part of a broader research approach concerning the investigation of individual characteristics of secondary education teachers, during seminar training in the areas of technology, learning and instruction and how these characteristics affect the integration of modern technologies in teaching.

The participants were 286 secondary education teachers, in subject areas such as: (i) 145 from classical or social studies (50, 6%) (ii) 87 from sciences (30, 5%) and (iii) 54 from technological subjects, such as internet, computers, multimedia (18, 9%). The participants attended a training program about learning and instruction. They were selected via the simple random sampling method in order to complete the questionnaire regarding the demographic questions and self-evaluation questionnaires.

The purpose of the study was to investigate the relationship between general self-efficacy, self-esteem and computer self-efficacy (CSE). In addition, this study investigated the relationships of teachers' subject area, prior experience, software use (as educational tools), previous computer training and CSE.

Specifically the study investigated the following questions:

1. The relationship between general self-efficacy and computer self-efficacy. The relationship between general self-efficacy and basic computer skills. The relationship between general self-efficacy and advanced computer skills. The relationship between general self-efficacy and files and software skills.
2. The relationship between self-esteem and computer self-efficacy.
3. The relationship between teachers' subject areas, prior experience in using computers and software (as an educational tool), previous computer training and computer self-efficacy.

The research instruments for the data collection were:

- (i) The demographic questionnaire regarding teachers' subject areas, prior experience, software used (as educational tools), previous computer training.
- (ii) The General Perceived Self-Efficacy Scale first developed by Matthias Jerusalem and Ralf Schwarzer in 1981. The scale is a ten item, Likert-type scale that purports to measure a belief in personal competence (Schwarzer & Jerusalem, 2000).
- (iii) The Rosenberg Self-Esteem Scale. Rosenberg's scale was developed to measure global feelings of self-worth or self-acceptance. It includes 10 items that are usually scored using a four-point response ranging from strongly disagree to strongly agree (Blascovich & Tomaka, 1991).
- (iv) Computer Self-Efficacy Scale by Murphy, Coover, and Owen (1989). This scale was developed to measure individuals' perceptions of their capabilities regarding specific computer knowledge and skills. Items represent beginner skills, advanced skills, file and software. The Likert-scale items ranged from "1" (Strongly Disagree) to "5" (Strongly Agree).

4. Findings and discussion

4.1. Research question 1: The relation between general self-efficacy and computer self-efficacy

For the analysis of general self-efficacy (GSE) and computer self-efficacy (CSE) as well as of the three variables that determine skill level in computer self-efficacy (basic skills, advanced skills, files, and software skills), we used Multiple-Variable Analysis. To investigate the relationship between general self-efficacy and computer self-efficacy – both general and specific levels – we used the Spearman Rank Correlations Method. In Table 1 are presented the mean, the standard deviation and the statistical significance (*p*-value) of each variable, as well as the correlation coefficient between general self-efficacy and computer self-efficacy.

4.2. Research question 2: The relationship between self-esteem and computer self-efficacy

The results of the correlation between general self-efficacy and self-esteem in connection with computer self-efficacy appear in Table 2. Multiple-Variable Analysis was also used in analyzing self-esteem with computer

Table 1

Average, mean difference of individual characteristics and general self-efficacy in relation to computer self-efficacy

Variable	n	Scale maximum	Mean	s.d.	GSE	
					r	p
GSE	286	4	2.99	0.39		
CSE	286	5	3.62	0.98	0.2720	0.0000
Basic skills	286	5	4	0.94	0.2359	0.0001
Advanced skills	286	5	3.32	1.03	0.2930	0.0000
Files and software skills	286	5	3.64	1.09	0.2506	0.0000

n = sample size; GSE = general self-efficacy; CSE = computer self-efficacy; r = correlation co-efficient; p = statistical significance of correlation; $p < 0.05$.

Table 2

Correlation between self-esteem and computer self-efficacy

Variable	n	Scale maximum	Mean	s.d.	r	
					r	p
Self-esteem	286	4	3.58	1.73		
CSE	286	5	3.63	0.97	0.1033	0.0921
Basic skills	286	5	4.01	0.93	0.1179	0.0545
Advanced skills	286	5	3.33	1.03	0.0861	0.1604
Files and software skills	286	5	3.66	1.08	0.1159	0.0588

n = sample size; GSE = general self-efficacy; CSE = computer self-efficacy; r = correlation co-efficient; p = statistical significance of correlation; $p < 0.05$.

self-efficacy and its three skill levels (basic, advanced and files and software). To investigate the relationship between self-esteem and computer self-efficacy at every skill level, we used again the Spearman Rank Correlations method.

4.3. Research question 3: The relationship between teachers' subject area, prior experience in using computers and software (as an educational tool), previous computer training and computer self-efficacy

The correlation between the individual characteristics of secondary school teachers and computer self-efficacy is presented in Table 3. For the analysis of teaching subjects, prior experience in computer and software use, previous computer training and computer self-efficacy we used again Multiple-Variable Analysis. To investigate the relationship between teaching subjects, prior experience in computer and software use, previous computer training and computer self-efficacy we used the Spearman Rank Correlations method.

The findings of the research testify the majority of research questions we postulated and prove positive correlations between most of the characteristics of secondary school teachers we investigated.

The first research question concerned the relationship between general self-efficacy and computer self-efficacy. We ascertained that there is significant positive correlation between the two variables ($p = 0.000$). The same also happens in the case of the relation between general self-efficacy and the three skill levels of computer

Table 3

Correlation between secondary school teachers' individual characteristics and computer self-efficacy

Variable	n	Scale maximum	Mean	s.d.	CSE	
					r	p
Teachers' subject	286	3	1.54	0.92	0.4732	0.0000
Prior experience	286	5	3.77	0.98	0.7662	0.0000
Software use as educational tools	286	1	0.87	0.34	0.3363	0.0000
Previous computer training	286	1	0.83	0.38	-0.05	0.45
CSE	286	5	3.65	0.97		

CSE = computer self-efficacy; n = sample size; r = correlation co-efficient; p = statistical significance of correlation; $p < 0.05$.

self-efficacy (basic, advanced and files and software). This means that the higher a teacher's general self-efficacy is, the higher their computer self-efficacy is. This is also the conclusion reached in the study by Looney et al. (2004), who ascertained a significant positive influence of general self-efficacy on computer self-efficacy. In general, several surveys have demonstrated that general self-efficacy plays a significant role when an individual interacts with information technologies (Compeau & Higgins, 1995; Looney et al., 2004).

According to Koliadis (1997), "individuals confident of their capabilities and generally of themselves, expect favourable outcomes of their actions, demonstrate better performance in various domains and achieve pursued goals effectively". As a result, these individuals develop optimistic attitudes, increased self-confidence and motivation for creative actions. Pajares and Schunk (2001) refer to several surveys which prove that general self-efficacy influences the success of an individual's endeavours in various domains, as well as their persistence in the endeavour. Teachers with high general self-efficacy are more open to new ideas and more willing to experiment with new methods. Thus, it is much more likely that teachers with high general self-efficacy will be motivated to learn to use modern technologies and that their efforts will be crowned with success.

All the above demonstrated by the results of our survey, are traits that Greek teachers have. Consequently, they also possess the ability and the inclination within increased general self-efficacy, towards developing high computer self-efficacy (Ropp, 1999). Thus, the first working premise we postulated regarding a direct relation between general self-efficacy and computer self-efficacy is corroborated on the basis of our survey results.

The second research question concerned the relationship between self-concept and computer self-efficacy. We ascertained that between the two variables there is no significant correlation ($p = 0.0921$). We also obtain the same result if we examine the relationship between self-esteem and advanced computer skills ($p = 0.1604$), whereas the investigation of the correlation between self-esteem and the other two skill levels of computer self-efficacy did not appear to be significant, although very marginally ($p = 0.0545$ for basic skills, $p = 0.0588$ for files and software skills).

In an analysis of 128 studies by Hansford and Hattie cited in Pajares and Schunk (2001), where general or global self-concept was compared to specific attainments, correlations were reported to fluctuate from moderate to weak. Besides, the correlation between self-esteem and attainments in a given domain is very specific. Thus, the more general the self-esteem under examination is, the less it correlates with attainments in a specific domain, whereas particular measurements of a domain-specific self-esteem correlate significantly with performance in the relevant domain.

Our working premise in this case was not corroborated by the findings. It is possible that the evaluation of teachers' general self-esteem we made in our survey and its comparison with computer self-efficacy has led to the statistical relation between the two variables being diminished.

The third research question concerns the relationship between teachers' subject area, prior experience in computer and software use and computer self-efficacy. All three variables were also found to be strongly and positively correlated with computer self-efficacy.

From the findings it appears that the strongest correlation of the three mentioned above is that of prior experience in computer use ($r = 0.7662$). This result is consistent with a study by Phillips (1997), which demonstrates that positive prior experience in computer use is the greatest factor in forming a positive attitude towards computers. The level of experience in using technology influences, to a considerable extent, an individual's attitude to computers and, consequently, their computer self-efficacy.

The positive correlation between teachers' subject area and computer self-efficacy found in our survey agrees with the result of the survey by Coffland (Hsioung, 2002). Therefore, teachers of science and technological subjects also have richer prior experience in computer use. However, this result was expected, since our sample included several Computer Studies teachers, who, given their field, have substantial prior experience.

Moreover, it is proved that using software for educational purposes contributes substantially to an increase in computer self-efficacy. The teachers in our sample use mainly word-processing programs, while database programs, statistical software packages, presentation software packages or other more complex programs are used by specific subject teachers mainly in Computer Studies (Gist et al., 1989).

The same research question concerns the relation between previous training in computer use and computer self-efficacy. We ascertained that between these two variables there is no correlation ($p = 0.45$). Therefore, in this case also, the working premise we postulated was not corroborated. This result of our survey, of course,

contrasts with findings of other surveys such as those by Fazio and Polsgrove (Hsioung, 2002), Ertmer and Hruskocy (Hsioung, 2002) and Woodrow (Phillips, 1997). However, there are many factors the interpretation of which could account for that result. For example, the way Greek teachers are trained in modern technologies is often not the appropriate one. Teachers are often invited to attend training courses in order to familiarize themselves with computer use, while they feel restrained regarding the usefulness of the new technology in their educational work. In other studies it was also found that the inadequate training of teachers in computer use impedes the increase of their computer self-efficacy and the use of information technologies in teaching (Albion, 1999, 2001). Another important issue is, of course, that of the lack of equipment in schools, both in terms of hardware and software.

Another factor which may have an effect on teacher training in computer use is their characteristics as adult trainees. Alan Rogers (1999) referring to these characteristics stresses that: secondary school teachers who are called upon to train in modern technologies already are in an evolving process of development and not at its beginning. They bring with them a sum of experiences, values and attitudes that cannot be ignored.

All the above factors render the training of Greek teachers in computer use a peculiar undertaking, since it occurs under different, more adverse conditions compared to colleagues abroad, but also due to the teachers' particular characteristics resulting in the occurrence, in our survey, of no relation between previous training in computer use and computer self-efficacy.

5. Conclusions

Greek teachers demonstrate a high level of general self-efficacy. The high ratings in the evaluation scale of this variable are influenced by individual characteristics, such as prior experience and training and characteristics related to the nature of the teaching profession.

The Greek teachers' technology use profile indicates that they have moderate experience. A considerable percentage owns personal computers, thus having access to computers outside the workplace. Software use, however, comprises mainly word-processing programs towards lesson preparation and only in a few cases are more complex applications used (lesson plan, tutorials, concept maps, cognitive tools). A significant number of teachers have attended training courses the content of which is often confined to technological literacy goals. Teachers attempt to come into contact with technology but their efforts are not supported by improvements in the schools' material and technical infrastructure.

The Greek teachers' sense of computer self-efficacy is moderate to high, as a result of their high sense of general self-efficacy and confidence in their capabilities, combined with their desire to master and use modern technologies. All the above findings of our survey argue that Greek secondary school teachers have the abilities, necessary attitudes and desire to integrate technology into their teaching. Nevertheless, it is pointed out by statistical evaluations that important steps towards training teachers must be taken, in order to render them competent at using computers as an educational tool in the classroom. It is also worth emphasizing individual factors (self-concept, motivation, professional values, internal/external locus of control, cognitive learning style.), which compose the teacher's personality, in order that they can develop their range of potential regarding their professional prospects and development, but also the effective integration of modern technologies into everyday teaching practice.

Teacher training in technology as an educational tool can change teachers' attitudes toward and confidence with technology and can also provide them with skills that they did not previously have. Teachers could acquire many technological skills and use them specifically to support their current teaching practices. Furthermore, teachers who have more experience in technology-aided teaching, especially in practice, are more likely to integrate technology in their classrooms. More importantly, teachers need to have specific subject needs during their technology learning, overcoming their reticence towards using technology in the classrooms, in order to help students gain lifelong high-tech skills. Teachers' confidence in this area should be enhanced by a curriculum that strongly emphasises the technological element and problem solving techniques by means of project-based activities. Teachers in specific subject areas such as mathematics, science or social studies should build on previously gained skills (prior experience), to ensure an effective learning experience, and confidence to integrate modern technologies in educational practice.

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