UNDERSTANDING FACTORS THAT INFLUENCE TEACHERS' ACCEPTANCE OF TECHNOLOGY AND ACTUAL COMPUTER USE FOR TEACHING: THE CASE OF GREECE

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Abstract – *During the past few decades, governments worldwide have been actively promoting the use of information and communication technologies in schools because of their potential to enhance teaching and learning. Despite several policies undertaken towards this end, the adoption of new technologies by teachers remains controversial. Teachers' attitudes influence technology acceptance and actual usage in education. This paper introduces a new instrument that measures teachers' attitudes towards computer use. The instrument, named the Attitude Scale towards Computer Use for Teaching (ASCUT), was developed following the Technology Acceptance Model and it contains four subscales: perceived usefulness, perceived ease of use, satisfaction expected and teacher's image. It was completed by 450 Greek primary and secondary school teachers. Confirmatory factor analysis was used to validate it. Internal consistency reliability was found to be high. The role of demographic, end-user background and environmental variables on teachers' attitudes were examined as well as the effect of attitudes on actual usage.*

Introduction

*T*he move of contemporary societies to a new phase of technological development has been signalled in various ways in sociological literature. Three decades ago Bell (1973) announced the arrival of what he called 'post-industrial societies'. Later, scholars such as Manuel Castells and Anthony Giddens spoke of 'information societies' (see Webster, 2003). The popular term nowadays has become 'knowledge societies' (Cartelli, 2006). All these terms refer, in some way or another, to computer-linked technologies that support information-based economies. Such a major development cannot leave education unaffected: many facets of education systems—such as curricula, infrastructure and organizational modalities—have been transformed in unprecedented ways to bring the school classroom in line with developments in other areas of social activity.

This would have been the ideal development had schools and teachers not exhibited a kind of institutional conservatism towards change, which has been well described by Slater & Tashakkori (1991). Specifically, these authors indicate that observers of school reform typically point to teachers in explaining the slowness of educational reform. According to Hu, Clark & Ma (2003), despite the fact that the role of information technology in education has significantly increased, resistance to technology by public school teachers worldwide remains high. Similarly Ma, Anderson & Streith (2005) recognize that the use of computer technology in schools has made slow progress since the mid-1980s even though governments had been generous in funding their introduction both in terms of infrastructure and training of teaching personnel.

In Europe the integration of ICT in education has been central in policies drawn by many countries (Eurydice, 2001), and after the realization of the slow impact of these policies, more detailed data began to be collected regarding the particularities of ICT use in education (Eurydice, 2004). Research points to the fact that teachers not only fail to effectively integrate information and communication technologies (ICTs) in their teaching, but they tend to stick to traditional methods of delivering lessons (Aldullah, Abidin, Su Luan, Majid & Atan, 2006; Dawes, 1999; Seyal, Rahman & Rahim, 2000; Underwood, 1997). Addressing teacher's attitudes towards ICTs becomes a pressing issue in view of the fact that younger generations are often more susceptible to their introduction and usage and it is only when teachers have share similar attitudes with their students that the integration of the new technologies in the classroom becomes feasible.

The introduction of ICTs in the Greek educational system has been one of the major innovations during the past few years. However, as Kiridis, Drossos & Tsakaridou (2006) remark, this introduction has been spasmodic. During this period schools have been equipped with ICT hardware and large scale teacher in-service training programmes have been implemented (Markakis, 1997; Papanikolaou & Tzimoyiannis, 2005; Roussos, Karmanis, Tsaousis & Politis, 2000) whose quality and effectiveness though, have been questioned (Kiridis *et al.*, 2006). In this framework and despite the latter comment, one might have expected that the use of ICTs in the Greek schools would be a growing feature of everyday pedagogy.

The reality, however, as argued by a number of researchers and academics, is that computer use is limited and in some cases non-existent (e.g., Koustourakis & Panayiotakopoulos, 2008, Paraskeva *et al.*, 2008). In order to examine ICT usage, the investigation of the role of teachers' attitudes towards ICTs for teaching was thought to be vital. In fact, studies in Greece and elsewhere have pointed to the fact that positive attitudes towards ICTs appear to be generally a good predictor of

whether teachers will eventually use these new technologies (Mitra, 1998; Rozell & Gardner, 2000; Paraskeva *et al.*, 2008; Roussos, 2007; Kotsambasaki & Ioannides, 2004; Tzimoyiannis & Komis, 2004).

Accepting technology in schools

The theoretical framework of the present study is largely based on the Technology Acceptance Model (TAM). TAM (see Figure 1) was specifically designed to explain individual technology acceptance and use across a wide range of organizational contexts, computer technologies, and user populations (e.g., Davis, 1989; Venkatesh & Davis, 2000). TAM postulates that two particular beliefs, perceived usefulness and perceived ease of use, are of primary relevance for computer acceptance behaviours.

FIGURE 1: The Technology Acceptance Model (TAM)
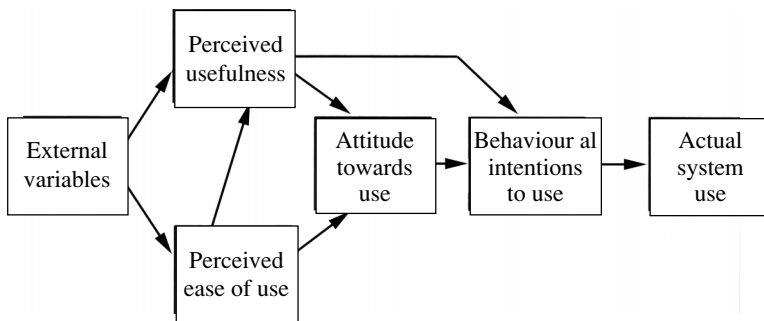
TAM provides a basis for tracing the impact of external factors on internal beliefs, attitudes and intentions. Several researchers have been using it to address computer acceptance behaviours in different contexts and have adapted it to suit these contexts. In addition, Harrisson & Rainer (1996), Al-Gahtani & King (1999), and Wixan & Todd (2005) have expanded the model combining the technology acceptance literature with the user satisfaction literature. Also more recently, Legris, Ingham & Collerette (2003) pointed to the fact that even though TAM has been a useful model to examine ICT usage, it needs to include other variables as well.

Following this suggestion and in an effort to extend the TAM model to provide deeper explanations for computer technology acceptance for teaching in Greece a new instrument was developed and examined. This new research instrument was constructed to assess teachers' attitudes towards computer use for teaching as part of a European Union and Greek government co-funded project (under the Pythagoras II initiative). The main objective of this paper is to present the

construction of this new instrument designed for measuring teachers' attitudes towards computer use for teaching within an extended TAM framework. At the same time it was important to investigate factors that contributed to the formation of teachers' attitudes and the role of attitudes on actual usage. More specifically the research questions for the present study were:

- What are teachers' attitudes towards computer use for teaching?
- What are the factors that influence teachers' attitudes towards computer use for teaching?
- To what extent do teachers' attitudes towards computer use for teaching affect their actual usage of computers in the classroom?

A number of hypotheses were then formulated taking into account possible characteristics of teachers/users that could lead to a diversified use of ICTs. These included the role of demographic variables (gender and age), end-user background variables (experience, ownership of computer, training), work-related variables (teaching experience), and environmental variables (availability of computers and access to computers in schools).

Research hypotheses

H1: Gender will have a significant effect on teachers' attitudes. We predict that men will have more positive attitudes than women.

H2: Age will be an important factor for predicting teachers' attitudes. We hypothesize that the older the teacher, the less positive his/her attitudes will be.

H3: Having a personal computer at home will be a determinant variable of teachers' attitudes. We hypothesize that teachers who own a personal computer will have more positive attitudes towards computer use for teaching.

H4: Experience in computer use will be an important factor for predicting teachers' attitudes. We predict that the more experienced in computer use a teacher is (measured in years of experience of computer use), the more positive his/her attitudes will be.

H5: Training in computers will have a significant influence on teachers' attitudes. We expect that trained teachers will have more positive attitudes.

H6: Teaching experience will be an important factor for predicting teachers' attitudes. We predict that novice and veteran teachers will not have very positive

attitudes towards using computers for teaching, but for different reasons; novice teachers have too many things to handle in their new profession, especially discipline, and veteran teachers have already an established teaching style and might be very reluctant to change.

H7: Computer availability at school will be a factor that shapes teachers' attitudes. We predict that teachers who work in schools that have computers which are easily accessed by them and their students, will have more positive attitudes towards computer use for teaching.

H8: Teachers' attitudes will have a significant effect on teachers' actual computer usage for teaching. We hypothesize that the more positive teachers' attitudes are, the more teachers will be using computers for teaching.

Research methodology

Participants

The sample consisted of 293 female teachers and 157 male teachers. 258 of these teachers taught in primary schools (90 male and 168 female teachers) and 192 taught in secondary schools (67 male and 125 female teachers). The schools were located in seventeen out of the 52 districts of Greece. The participants mean age was 41.47 years (SD= 7.28). Their teaching experience ranged from 1 to 34 years (mean 14.58 years, SD= 8.17) and their computer experience ranged from 0 to 23 years (mean 5.66 years, SD= 5.12). The majority of the participants (373 of them) had their own personal computer and had training in computer use (353). Regarding computer availability, 385 teachers indicated that there was a computer lab at their school. Of those teachers who reported that there was a computer lab, 275 of them noted that they had easy access to the computer laboratory while 121 of them noted that the computer laboratory was not easily accessed to anyone who might want to use it. In addition, 70 teachers (35 from primary education and 35 from secondary education) noted that there were computer(s) in their regular classrooms whereas 367 teachers noted that there were not any computers in their regular classroom.

Research instruments

Demographic sheet: One page with demographic data was used to elicit personal information regarding demographic variables (gender and age), end-user background variables (computer ownership, training in computers and experience

in computer use), work-related variables (teaching experience and level of education), and environmental variables (computer availability and access at school).

ASCUT: The Attitude Scale towards Computer Use for Teaching (ASCUT) has a 5-point Likert-type response scale ranging from 'disagree a lot' to 'agree a lot'. It has seventeen positively worded items towards computer usage for teaching, which are scored from 1 to 5, and eleven negatively worded items towards computer usage, which are scored from 5 to 1. Thus high scores are indicators of positive views towards computer usage for teaching. The ASCUT has four subscales:

[a] The perceived usefulness subscale includes thirteen items that measure teachers' perceptions about the usefulness (or not) of computer use in teaching.

[b] The perceived ease of use subscale which includes six items that measure teachers' perceptions about how easy (or difficult) it is to use computers for teaching purposes.

[c] The satisfaction expected subscale (six items) that measures the level of enjoyment teachers believe they would gain from using computers for teaching.

[d] The teacher' image subscale which includes three items that measure how teachers perceive learners' appreciation of their teaching when it includes computer usage.

CUST: The Computer Use Scale for Teaching is a uni-dimensional scale developed specifically for Greek primary and secondary school teachers. It contains five items, one for each potential area of computer usage identified by several researchers (Becker, 2000; Hu, & Kuh, 2001; O'Dwyer, Russell, Bebell & Tucker-Seeley, 2005; Whitrow, 1999; Williams, Wilson, Richardson, Tuson & Coles, 1998). In particular the five items refer to computer usage by the teacher for lesson preparation and for preparation of educational materials (items 1 and 2), to computer usage in the classroom by teachers and learners (items 3 and 4) and to computer usage by learners at home based on teacher instructions (item 5). The CUST has a 7-point response scale ranging from 'almost never' to 'almost daily'. High scores are indicative of frequent computer usage whereas low scores are indicative of limited or no computer usage. For more information about the CUST, see Pavlou (2007).

The development of the Attitude Scale towards Computer Use for Teaching (ASCUT) underwent four steps. The first step in the construction of this new instrument was to determine clearly the concept under investigation. Therefore it was important to define precisely what was meant by 'attitudes towards computer use for teaching'. As it was elaborated in the introduction section ideas about how to conceptualise attitudes were sought from the technology acceptance model (Davis, 1989; Venkatesh & Davis, 2000) and from the area of user satisfaction literacy (Harrison &Rainer, 1996; Wixon & Todd, 2005). Thus, initially teachers' attitudes towards computer use for teaching were conceptualised in terms of *perceived usefulness*, *perceived ease of use* and *satisfaction expected*.

The second step was to construct a pilot scale. A pool of positive and negative statements about computer use for teaching purposes was gathered using both new items derived by two in-depth group interviews with primary and secondary school teachers and from existing well documented instruments, and in particular from instruments that adopted the technology acceptance model (TAM; Davies, 1986, Davis, Bagozzi & Warshaw, 1989; Hu *et al.*, 2003; Gefen & Straub, 1997; Ma *et al.*, 2005). Items that were adopted from other instruments were translated in Greek and adapted to the specific context of this study, that is, to teaching and learning situations. In this way 70 items were developed covering three domains: perceptions about the usefulness of computer use for teaching, perceptions about ease of use of computers for teaching, and satisfaction expected to be received by the teachers when using computers for teaching.

The third step was to test the pilot scale. The pilot scale was administered to 158 primary and secondary school teachers. In order to initially validate it, an empirical appraising of its underlying factor structure was performed using exploratory factor analysis. Several issues were examined, including the factorability of the correlation matrix. The Bartlett's test of sphericity was significant providing evidence for scale factorability. The principal components method of analysis was selected to examine the underlying dimensionality of the item set. Several factors were obtained as a result of this exploratory factor analysis. According to the scree test criteria the first four factors were retained. The eigen values of these factors were: 22.02, 5.98, 4.40 and 3.57. These values implied a four-factor structure for the pilot scale, explaining 47.23% of the total variance. Items with factor loadings less than .40 and items that simultaneously loaded high in multiple factors were deleted from the scale. Thus the items were reduced to twenty-eight. Because a fourth factor was not expected, the items included to this factor were given to an expert for external interpretation. The fourth factor was named, by the expert, as *teacher's image* and it included items

that reflected how teachers thought that their students perceived them according to computer usage. The expert also labelled the other three subscales. His labelling matched the initial labelling.

The fourth step was to validate the revised scale using a confirmatory analysis technique. The results of this procedure are the main focus of this paper and are presented in the results section.

Procedure

The snowball technique was used to gather the data. In particular 70 schools were selected and one teacher from each school was asked to act as a mediator between the authors and the schools for the collection and posting of the questionnaires. 45 schools/teachers responded to our call and participated in the study. The questionnaires were then sent by mail to the 'mediator' teachers who were responsible for distributing and collecting them. An average of ten teachers in each school completed the questionnaires on a voluntary basis. A total of 450 questionnaires were returned in closed envelopes to the 'mediator' teachers who forwarded them to the authors after the data collection period had expired.

Reliability

Cronbach's alpha coefficient was used to assess the reliability of ASCUT. The Cronbach's alpha score were: 0.86 for the perceived usefulness subscale, 0.70 for the perceived ease of use subscale, 0.80 for the satisfaction expected subscale, 0.74 for the teacher's image subscale and 0.89 for the total score.

Validity

The Amos 7 (Analysis of Moment Structures) software was used to perform a Confirmatory Factor Analysis in order to test whether the four-factor structure of the attitude scale was appropriate. In a Confirmatory Factor Analysis an a priori model is fitted on to the data. The model fit is evaluated by means of a Chi-square statistical test. The null hypothesis underlying the test statistic is model fit, thus significance implies misfit of the model (Jöreskog & Sörbom, 1989). There are several fit indices that describe the fit of a model. Model fit is a multifaceted concept and no fit indices in isolation should be considered. Instead it is suggested that in order to build an overall understanding of the fit to the measurement model, one should use at least four fit indices. In evaluating our model we examined the Goodness-of-Fit Index (GFI; Raykov & Marcoulides, 2006) and the Comparative Fit Index (CFI; Bentler, 1990), in which values higher than 0.90 indicate a model

FIGURE 2: Path diagram of the model
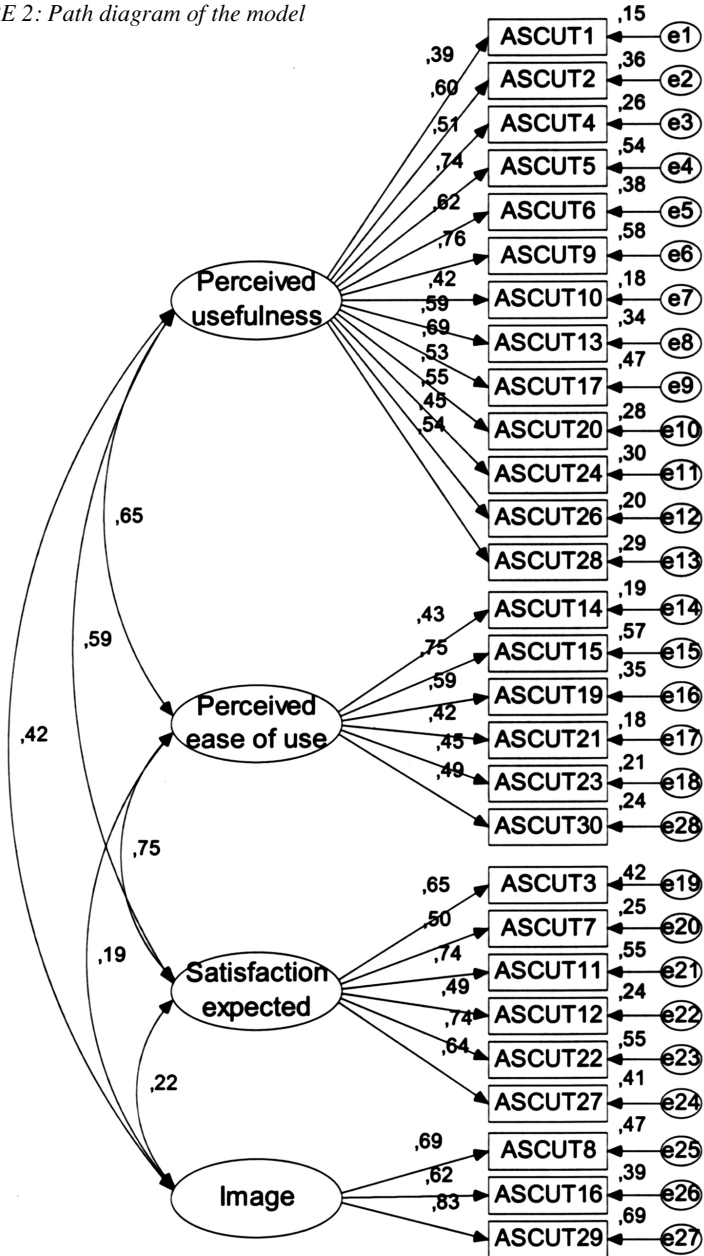
with a good fit, and the Root Mean Square Error of Approximation (RMSEA; Hu & Betler, 1999), in which values less than 0.06 indicate a model with a good fit. In addition, the chi-square/degrees of freedom ($\chi 2$/df) indicator was examined. Generally a χ^2/df less than 3.0 is considered good.

The results indicate that there was a good fit with the theoretical framework of the four-factor model. More specifically, the factor structure of the applicant sample fitted the data well according to the chi-square/degrees of freedom and to the Root Mean Square Error of Approximation indices ($\chi^2(318, N = 450) = 802.829$; χ^2/df = 2.33; RMSEA = 0.05). Moreover, the values of the Goodness-of-Fit Index and the Comparative Fit Index were very close to the cut off point of 0.90 (CFI = 0.88; GFI = 0.88). These results lead us to accept the model. This decision was supported by the modification indexes; if any covariance terms were to be added to the model, these would not result in an improvement of the fit indices.

The path diagram of the model is presented in Figure 2. In the diagram the correlations between the latent variables (subscales) are given. Standardized regression coefficients link the observed variables with the latent variables on the diagram. Twenty of them indicate a 'large' effect (values above 0.50) and eight have a 'medium' effect (values above 0.30). The R^2 value for the observed variables (items in the subscales) appears on the left side of their rectangle shape on the diagram. The R^2 value summarizes the proportion of variance in the manifested indicator that is accounted for by the latent variable. The R^2 values of the observed variables range from 0.15 to 0.58 for the perceived usefulness subscale, 0.18 to 0.57 for the perceived ease of use subscale, 0.24 to 0.55 for the satisfaction expected subscale, and 0.39 to 0.69 for the teacher's image needed subscale. The R^2 values further justify the validity of the instrument; that ASCUT measures what it supposes to measure.

TABLE 1: Means and standard deviations for ASCUT by gender

	Men (N=157)		Women (N=1293)		Range of scores
	M	SD	M	SD	
Perceived usefulness	51.25	6.98	49.81	7.19	13-65*
Perceived ease of use	19.20	3.93	18.12	3.73	6-30*
Satisfaction expected	21.07	4.79	18.73	4.69	6-30*
Teacher's image	9.97	2.58	9.96	2.41	3-15*
ASCUT total	101.50	13.83	96.62	13.91	28-140*

Note: * The higher the scores, the more positive are the views of the respondents towards computer use for teaching.

Research results

Descriptive statistics

The means and standard deviation of the ASCUT (total and subscales scores) are reported in Table 1. *What factors influence teachers' attitudes towards computer use for teaching?*

Several variables (demographic, end-user background, work-related and environmental variables) were tested to examine if they were influencing in a significant manner the scores of the ASCUT. This examination followed the hypotheses that were formulated in the introduction section and are presented in the same order below.

H1: Gender will have a significant effect on teachers' attitudes towards computer use for teaching

We hypothesized that men would have more positive attitudes than women. The results from the analysis provided support to our prediction. Particularly, t-tests showed that men believed more strongly than women that using computers for teaching was useful ($t = 2.058$, df= 448, p= .040), that computers were easy to use for teaching purposes (t= 2.858, df= 448, p= .004) and they also expected to derive more satisfaction from using them (t= 5.006, df= 448, p=0.000) than women. No differences were found for the teacher's image subscale (t= .063, df= 448, ns). A statistical significant difference was also reported for the total score of ASUCT with men receiving higher score indicating that they had more positive attitudes towards computer use for teaching ($t = 3,553$, df= 448, p=.000).

H2: Age will be related with teachers' attitudes.

We hypothesized that the older a teacher was, the less likely s/he would be to endorse computer use for teaching. Our hypothesis was partially confirmed. There was a significant, negative albeit weak correlation between teachers' age and their scores on the perceived usefulness subscale (Pearson correlation= -.149, p= .002), on the satisfaction expected subscale (Pearson correlation= -.179, p= .000) and on the total scores (Pearson correlation= -.155, p= .001).

H3: Having a personal computer at home will be a determinant variable on teachers' attitudes.

We predicted that teachers who owned a personal computer would have more positive attitudes towards computer use for teaching. This hypothesis was also

confirmed. Teachers who owned a personal computer believed more about its usefulness (t= 5.74, df= 440, p= .000), about its ease of use (t= 4.34, df= 440, p= .000), expected to be more satisfied from a forthcoming use (t= 5.28, df= 440, p= .000) and felt that computer use was important for teachers' image (t= 2.09, df=103, equal variance is not assumed, p= .39). Consequently there was a significant difference between those teachers who owned a computer and those who did not own a personal computer for the total scores of ASCUT (t = 6,357, df= 440, p=.000).

H4: Experience in computer use will be related with teachers' attitudes.

Computer experience was measured in years of computer use. We hypothesized that the more experienced in computer use teachers were, that is the more years of experience of computer use they had, the more positive their attitudes would be. That proved to be the case for the perceived usefulness subscale (Pearson correlation= .334, p= .000), for the perceived ease of use subscale (Pearson correlation= .255, p= .000), for the satisfaction expected subscale (Pearson correlation= .530, p= .000) and for the total score (Pearson correlation= .483, p= .000). No significant differences were noted for the teacher's image subscale (Pearson correlation= .088, ns).

H5: Training in computers will have a significant influence on teachers' attitudes.

We expected that teachers who received computer training would have more positive attitudes towards computer use for teaching. Our hypothesis was confirmed for the perceived ease of use subscale (t= 2.92, df= 440, p= .004), for the satisfaction expected subscale (t= 3.19, df= 440, p= .002) and for the total score (t= 2.57, df= 440, p= .01).

H6: Teaching experience will be an important factor for predicting teachers' attitudes.

We predicted that there would be a cullivear relationship between teachers' attitudes and years of teaching experience, that is novice and veteran teachers will have less positive attitudes towards using computers for teaching than other teachers. In order to analyze the effect of teaching experience on attitudes toward computer use for teaching a curve estimation regression analysis was performed for each of the subscales and for the total ASCUT score. Subscale scores and the total score represented the dependent variables, and teaching experience measured

in years (range 1–34) represented the independent variable. In total, 5 single curve estimation regression analyses were performed (4 subscales + 1 total). Within each analysis, the data were tested for linear and quadratic regression models (which had been indicated by scatterplots of the data). The analysis indicated that both the linear and the quadratic model of regression result in significant relationships between teaching experience and attitudes (see Table 2) for the two subscales (perceived usefulness and satisfaction expected) and for the total score. In particular the results showed a quadratic relationship in the perceived usefulness subscale, the satisfaction expected subscale and in the total score between attitudes and teaching experience thus partially confirming our hypothesis; teachers with 'middle' teaching experience showed the most positive attitudes.

TABLE 2: Results of the curve estimation regression analysis

Scale	Regression model	$R2$	*df*	*F*-value
Perceived usefulness	Linear	.029	442	13.12***
	Quadratic	.044	221	10.06***
Perceived ease of use	Linear	.004	442	1.71
	Quadratic	.004	221	.92
Satisfaction expected	Linear	.026	442	11.81**
	Quadratic	.026	221	5.89**
Teacher's image	Linear	.007	442	3.01
	Quadratic	.012	221	2.68
Total ASCUT score	Linear	0.30	442	13.67***
	Quadratic	0.36	221	8.25***

Note: * $p < .05$, ** $p < .01$, *** $p < .001$

H7: Computer availability at school will be a significant factor that shapes teachers' attitudes.

Three questions were asked in order to examine computer availability at school: a) whether there were computers in regular classrooms, b) whether there were computer labs in schools and c) whether there was easy access to the computer lab whenever teachers wished to use it. T-tests showed that teachers who had computer(s) in their regular classrooms had more positive attitudes towards computer use than those who did not have computer(s) in their classrooms (Perceived usefulness: *t*= 4,732, df=435, p= .000; Perceived ease of use: *t*= 5,266,

TABLE 3: Regression analysis for Computer Use Scale for Teaching' scores

Predictors	Model I		Model II		Model III		Model IV		Model V	
	Beta	Sig.	Beta	Sig.	Beta	Sig.	Beta	Sig.	Beta	Sig.
Age	-.258	.000	-.174	.000	-.247	.004	-.182	.025	-.208	.006
Gender	-.211	.000	-.050	.279	-.055	.239	-.026	.550	-.014	.738
Training			-.032	.467	-.034	.432	-.030	.465	-.021	.581
Ownership			-.176	.000	-.174	.000	-.176	.000	-.121	.003
Experience			.455	.000	.451	.000	.356	.000	.258	.000
Teaching experience					.078	.347	.052	.509	.116	.114
Computers in classrooms							-.291	.000	-.226	.000
Computer lab							-.036	.401	-.041	.300
Ease of access to computer lab							-.070	.101	-.044	.263
Attitudes towards Computer Use for Teaching									.341	.000
R^2	.088		.354		.356		.442		.527	

df= 435, p= .000; Satisfaction expected: $t=$ 9,338, p= .000; Teacher's image: $t=$ 2,859, df= 435, p= .004; Total: $t=$ 7,597, df= 435, p= .000). The existence or not of a computer laboratory was not a determinant factor for teachers' attitudes; no significant differences were found between teachers' attitudes whose schools had a computer lab and those whose schools did not have a computer lab. However, statistically significant findings were noted between the teachers who had easy access to the computer lab and the teachers who did not have easy access to the computer lab. As predicted, those who had easy access had more positive attitudes towards computer use for teaching (Perceived usefulness: $t=$ 2,322, df=394, p= .021; Satisfaction: $t=$ 2,500, df=394, p= .013; Total: $t=$ 2,596, df= 394, p= .010).

H8: Teachers' attitudes will have a significant effect on teachers' actual computer usage for teaching.

A regression analysis was carried out in order to investigate the extent to which teachers' attitudes as well as other variables (demographic, end-user background,

work-related, and environmental) affect teachers' actual computer usage for teaching purposes. The hierarchical regression analysis technique was used and variables were grouped in five blocks. They were then entered consecutively to the model to get to a final stage where all variables appeared in the model (see Table 3). Model I includes only the demographic variables. Model II includes demographic and end-user background variables. In Model III the work-related variables are introduced. In Model IV the environmental variables are added. The attitudinal variables (teachers' attitudes towards computer use for teaching) are introduced in the last stage. Model V includes all variables. In Model V the variables accounted for the 53 percent of the total variance of the scores of the Computer Use Scale for Teaching. In particular the attitudinal variables increase the amount of variance explained from 44.2% to 52.8%. In the last step (Model V), five variables exert a significant effect on computer use; the attitudinal variable (as measured with ASCUT) (β = 0.341, p<0.001), the computer in classrooms variable (β = -0.226, p<0.001), the experience variable (β = 0.258, p<0.001), followed by age (β = -0.208, p=0.006) and the ownership variable (β = -0.121, p=0.003).

Discussion

Results indicate that the scale developed to assess computer attitudes (ASCUT) in the Greek schools is a reliable and valid instrument that can be applied in research projects both in the Greek educational contexts and possibly in other social and educational contexts. The instrument has acceptable levels of reliability and validity and therefore can be used to build a database for teachers' attitudes towards computer use for teaching. The reliability of the four subscales is demonstrated at a high level on the basis of internal consistency as determined by Cronbach's Alpha. The Confirmatory Factor Analysis indicates that there is a good fit of the model and that the four key dimensions (subscales) identified are supported by the data. Importantly, teachers' attitudes, as measured by ASCUT, appear to be the most influential predictor of actual usage in the classroom thus providing a powerful means to explain the limited usage of computers in Greek schools today.

As hypothesized, gender does relate to attitudes towards computer use. This is in line with a large body of literature that points to the fact the new technologies are gendered (see Green, 2001 and Whitley, 1997) and with recent research conducted in Greece examining Greek teachers' attitudes towards computers (Roussos, 2007). Male teachers more than their female colleagues appear to regard computers as a more useful tool for teaching, as a tool which is easy to use and

from which they can expect to gain satisfaction when they use it. In view of the fact that the teaching profession in Greece, as elsewhere, is becoming a female dominated profession the need to target the stereotypical perception of men being more able to interact with this tool becomes paramount for successfully integrating ICTs in schools. And this is probably something that needs to start not just from teachers' initial training programs but also from children's education at the early stages of their socialization processes.

Even though the relationship between age and attitudes towards computer use was weak the fact that such relationship exists was to some degree expected and can be straightforwardly interpreted along two interconnected lines of explanation. One being that older teachers are less susceptible to innovations and change and the other which points to the fact that older age groups appear to be less integrated in the information society as cross national surveys point time after time (see for example the latest European Social Survey, 2006). Older teachers in this study believed less in computers' usefulness for teaching and did not expect to be as satisfied as younger teachers from a forthcoming use of computers. It is frequently noted that older teachers value innovations less positively than their younger colleagues (Huberman, 1988). However, this finding contradicts the results from a research conducted in Greece during the last few years (Roussos, 2007) which did not support the hypothesis that younger people had more positive attitudes than older people towards computers. Although teaching experience and age are highly interrelated, we cannot automatically deduce that the relationship between teaching experience and attitudes is similar to the relationship between age and attitudes. In fact, as shown by our analysis, a cullivear relationship exists between teachers' attitudes and years of teaching experience indicating that not only teachers with many years of teaching experience but also novice teachers did not have very positive attitudes towards computer use for teaching. Teaching experience can be connected with teachers' vision about teaching and learning strategies but because teaching and learning are complex concepts one cannot detect a linear relationship between these two. For example, one would expect that young teachers will be more familiar with current learning theories, such as teaching children 'how to learn', have a broad vision on 'learning to learn' and embrace innovations towards this end, including the use of new technologies. However, this is not always the case as Waeytens, Lens & Vandenberghe have shown (2002). Often, young teachers are preoccupied by other issues such as discipline issues and time needed for preparation.

Having a personal computer and using it for a long time is bound to have positive effects on attitudes towards computer use. For one, regular and long term interaction would more likely disprove myths that denote that one needs to have

specialized knowledge and abilities to use these new technologies. Moreover, it would make teachers view the availability of these new technologies in schools in a favourable way regardless of whether they actually exist in a school or not. Positive effects on attitudes towards computer use also exist in teachers who received training as part of specialized programs organized by the Greek government. In that respect, even though as was commented earlier, there are doubts as to the quality of these programs, they appear to at least contribute in shaping positive attitudes to the use of computers. Of course as it turned out training was not an important direct factor that predicted actual computer use for teaching purposes. This is particularly interesting and to some degree verifies the arguments of Kiridis *et al*. (2006). Besides, computer availability was important in shaping teachers' attitudes. The results indicated that having computer labs was not the crucial issue. Having access to the labs was more important as having computers in regular access. This result suggests that probably it is not the best policy to install large labs in schools and it concurs with the study of Reynolds, Treharne & Trip (2003).

So, in view of the above, how can one provide broader explanations about the limited use of ICTs in the Greek schools for teaching and learning? Certainly positive attitudes do help but as widely acknowledged changing people's attitudes is a long term process and involves the cultivation of a certain kind of professional ethos that includes for examples the integration of ICTs in schools which at the moment seems to be absent. In the meantime short to medium term initiatives could be introduced with regard to shaping a different environment in schools among teachers and administrators that could pave the way for better integration of ICTs in schools. Such initiatives could include further investment in technical support, production of relevant material and importantly constant mentoring of in-service teachers in order to overcome cultural, psychological and other barriers and to offer them the kind of practical expertise needed to make ICT an everyday reality of the Greek school.

Conclusion

Overall the expanded model of TAM has been a valuable starting point to evaluate the current state of ICT integration in the Greek educational system. There are important policy implications that emerge from our research pointing to possible action that should be taken by policy makers to actively encourage ICTs for teaching learning purposes. It appears that initial funding to create basic infrastructure and training programs alone cannot facilitate the successful transition of the Greek educational system to the knowledge age. Teachers'

attitudes need to change, a task which is neither straightforward nor easy to be achieved. A combination of initiatives and policies such as constant support and quality in-service training programs which would primarily aim to convey the value of bringing schools and teaching in the 21st century should be introduced. For example, flexible programs and curricula should be introduced that incorporate the innovations of modern technologies in a speedy and timely fashion taking into account the knowledge and expertise that students acquire by themselves.

From a macro-level perspective, there is a need for radical reforms to be introduced in relation to organizational cultures and the professional ethos among Greek teachers, and especially so among the younger generation. It is common knowledge that in the Greek social setting, many university graduates see the teaching profession as a safe employment route in the civil service. For many working class and lower middle class families in Greece, this constitutes a lifelong aspiration for securing the future of their children in a very tight labour market. Thus, one might speculate that if this is one of the primary reasons why many teachers eventually enter the profession, the prospects for ground breaking changes in the professional ethos of Greek public school teachers are grim. And this is so, because if they regard their job more as a position which primarily offers a secure income and steady working conditions rather than a challenging career which offers rewards (material and intrinsic) to those who actually wish to be in line with the developments of the modern era, how can policy makers' envisioned policies in relation to ICT integration in the educational system be implemented?

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