Available online at www.sciencedirect.com
ScienceDirect
Computers in Human Behavior 23 (2007) 578–590
Computers in Human Behavior
www.elsevier.com/locate/comphumbeh

The Greek computer attitudes scale: construction and assessment of psychometric properties

Petros Roussos

Department of Primary Education, University of the Aegean, 851 00 Rhodes, Greece

Available online 18 November 2004

Abstract

The purpose of this paper was to develop and test the psychometric properties of a computer attitudes scale for the Greek population. Through both adapting items from other scales and writing new items, this study developed a Greek Computer Attitudes Scale of 30 items, with three subscales: confidence, affection, and cognitive. This study also explored sex differences on the GCAS, and the relationship between age, computer experience, and confidence with computers and participants' responses on the scale. Questionnaire data from four Greek samples, which included participants from the general population (185 and 354 individuals, respectively), 222 teachers and 99 undergraduate students, were analyzed. Results indicated that: (1) both the reliability (internal consistency and test–retest) and validity (concurrent) of the GCAS were adequate; (2) the relationship between age and GCAS was not significant, whereas sex did not have a significant effect on GCAS scores; and (3) perceived computer experience and confidence with computers were strongly related to favorable attitudes toward computers.

Keywords: Attitudes toward computers; Computer experience; Greece

E-mail address: peroussos@hol.gr.

doi:10.1016/j.chb.2004.10.027

1. Introduction

For the last 20 years, information and communication technologies (ICT) have assumed a critically important role in almost every facet of our society. More recently, competence in using computers has become not only an advantage, but also often a necessity. This is reflected in society's attitude that computers are now a fundamental element in the education of students (LaMont Johnson, 1997) and that students should learn how to appropriately and competently use them. Computer competence and literacy relate "not only to knowledge of the capability, limitations, applications, and implications of computers, but also to individuals' attitudes and perceptions regarding computers" (Levine & Donitsa-Schmidt, 1998, p. 126). Bear, Richards, and Lancaster (1987) argue that promoting a positive attitude toward computers is of critical importance because if students develop favorable attitudes, the other objectives of computer literacy will become secondary.

The 'familiarization' and 'acquisition' phases of computers in the Greek secondary education were completed in 2002 whereas in primary education they are expected to be completed by the year 2006 (Greek Ministry of National Education & Religious Affairs, 2003). The Greek government and the European Union have provided funds to invest in large numbers of computers, the connection of all educational institutions to the Internet, the development of Information Technology (IT) curriculum subjects, the training of teaching staff, the strengthening of the production and diffusion of educational software, the implementation of many ICT research projects and the diffusion of research results. In addition, large-scale programs to enhance computer-related skills and attitudes now play an important part in the initial and in-service education of Greek teachers.

However, despite the increased availability of computers in Greek schools, many teachers are still hesitant to include the use of computers in their instruction (Roussos, 2002; Vryzas & Tsitouridou, 2002). Although many teachers believe computers are an important component of a student's education (Bikos, 1995), their lack of knowledge and experience lead to a lack of confidence to attempt to introduce them into their instruction. This lack of confidence then leads to anxiety and reluctance to use technology (Rosen & Weil, 1995). Attitudes toward computers are thought to influence not only the acceptance of computers, but also future behaviors, such as using a computer as a professional tool or introducing computer applications into the classroom. Awareness of student and teacher attitudes toward computers is also a critical criterion in the evaluation of ICT projects implemented in education; a link between negative attitudes toward computers and the failure of a number of ICT projects has been suggested by many authors (e.g., Roussos, Tsaousis, Karamanis, & Politis, 2000).

Attitudes, beliefs and intentions have long played a role in the social psychology literature as predictors of behavior (Ajzen & Fishbein, 1980). Consistent with Ajzen and Fishbein's (1977, 1980) theoretical position, the concept of attitudes toward computers has gained recognition as a critical determinant in the use and acceptance of ICT (Smith, Caputi, & Rawstorne, 2000).

Since the mid 60s, when the earliest attempts to measure computer attitudes were made (e.g., Lee, 1970), a large number of instruments have been developed and utilized to operationalize computer attitudes (Francis, Katz, & Jones, 2000). Kay (1993) noted that researchers have measured more than 15 different constructs with respect to computer attitudes, often without theoretical justification. The plethora of instruments and constructs has made it difficult to interpret, compare, and integrate across multiple studies. In addition, the instruments are often limited in that they are designed for specific populations or specific intentions (Nickell & Pinto, 1986).

While there are plenty of instruments that may be appropriate for use in assessing computer-related attitudes among students and educators, several studies have now drawn attention to the way in which different instruments purporting to assess computer-related attitudes may in fact be measuring somewhat different constructs (Francis, 1995; Gardner, Discenza, & Dukes, 1993; Woodrow, 1991). While all these instruments may be useful, some of them are also limited by the fact that they were designed for specific populations or specific intentions (e.g., the measurement of computer anxiety) or they are considerably dated (Rainer & Miller, 1996).

Central to this paper is the concern that Greek researchers have overlooked this area. Relatively little empirical research has been conducted during recent years in order to increase understanding of computer attitudes. In order to encourage high quality research, enable integration and consistency across research studies, and increase understanding of computer attitudes, there is a need for valid and reliable multiple-item measures for the computer attitude construct. A fast, effective measure of computer attitudes is crucial to the study of the extent and the manner in which students and educators use computers. Ideally, this instrument should also be short, efficient and easy to administer to a wide range of people.

The purpose of this paper was to develop a Greek measure of computer-related attitudes (eventually titled the Greek Computer Attitudes Scale – GCAS) – one that will be useful with members of the general population.

The GCAS was developed within the framework for assessing attitudes towards computers set out by Kay (1993). This framework draws on both the tripartite model of attitudes (Breckler, 1984; Breckler & Wiggins, 1989; Eagley & Chaiken, 1993; Katz & Stotland, 1959; Nesdale & Durkin, 1998; Rosenberg & Hovland, 1960) and Ajzen's (1988) Theory of Planned Behavior. The tripartite model proposes that attitudes are comprised of three components: affective, cognitive, and behavioral. In general, the affective component represents one's feelings toward computers (e.g., fear, pleasure), the cognitive component represents the perceptions of and information about computers (e.g., stereotypical knowledge) and the behavioral component represents behaviors consistent with the attitude (e.g., avoidance of computers). Recently, Ajzen (1988) added *perceived behavioral control* to the tripartite model (this reflects the perceived ease or difficulty of using computers).

The second objective of the present paper was to rigorously examine the psychometric properties of the GCAS. In the process of test validation, the present study also undertook a thorough exploration of the relationships of computer attitudes toward computer experience and use, and belief in own ability when working with computers. Finally, the present study set out to investigate the relationships between computer attitudes and the selected variables of age and gender.

2. Method

2.1. Participants

Four different samples were used in this study to develop (Sample 1) and later evaluate the psychometric properties (Samples 2, 3 and 4) of the GCAS.

Sample 1 consisted of 185 participants (99 females, 86 males) ranging in age from 18 to 82 years (mean = 31.1, SD = 12.4 years). They were randomly selected from various areas in Athens and they were administered a 79-item questionnaire that was used for the development of the GCAS.

Sample 2 included 354 participants (207 females, 124 males) ranging in age from 18 to 57 years (mean = 25.3, SD = 7.3 years) selected randomly from various areas in Greece. Most of these individuals (245 participants) owned a computer or had access to one at home.

Sample 3 was a convenience sample and consisted of 222 teachers (125 females, 95 males) ranging in age from 24 to 62 years (mean = 39.0, SD = 7.6 years). They were selected from a large number of schools in many different parts of Greece (78% came from schools in and around Athens, 9% from schools in the Aegean, 4% from Northern Greece, and 9% from the Thessaly-Sporades-Evoia). Of the 222 teachers 204 were teaching in state schools and 17 in private schools. Also, 98 of them were teaching in primary education and the rest 124 in secondary education. Almost two thirds (68% of males and 54% of females) of all teachers owned a computer.

Finally, Sample 4 was made up of 99 students from a Technical Institute in Athens (63 females, 36 males) ranging in age from 18 to 23 years (mean = 19.1, SD = 1.2 years). Seventy-one of them owned a computer. This sample was used in order to test the internal consistency of the cognitive subscale of the GCAS (see Internal consistency and test–retest reliability).

Samples 2, 3 and 4 were administered the GCAS and the collected data were used for the evaluation of its psychometric properties.

2.2. Instrument development

A pool of positive and negative statements about computers was developed using both new items written for the particular instrument and items from existing well documented instruments (e.g., Bear et al., 1987; Charlton & Birkett, 1995; Francis, 1993; Igbaria & Chakrabarti, 1990; Jones & Clarke, 1994; Kay, 1989; Nickell & Pinto, 1986; Popovich, Hyde, Zakrajsek, & Blumer, 1987; Richter, Naumann, & Groeben, 2000; Selwyn, 1997; Rawstorne et al., 1998 in Smith et al., 2000). These items were then translated in Greek, reviewed, revised, and edited. In this way 79 items were developed covering: affective responses and cognitive attitudes toward using computers; perceived usefulness; perceived control and behavioral attitudes toward using computers. Subsequently, Sample 1 used a 5-point Likert response scale that ranged from 1 "strongly disagree" to 5 "strongly agree" to indicate their level of agreement or disagreement with each of these items.

Items were screened for their tendency to elicit extreme responses, items being discarded if they produced mean responses of more than four or less than two on the 5-point Likert-type scale employed; three items were discarded on these grounds. In addition, three more items that demonstrated non-significant item-total correlations were discarded (Likert, 1932).

A principal components factor analysis with varimax rotation was used on the data for item analysis. Three factors were retained in the final version of the scale and they accounted for 40.5% of the systematic covariation among the items. An item was retained only when it loaded greater than 0.40 on the relevant factor and less than 0.40 on non-relevant factor(s). A detailed description of the three subscales follows:

1. The confidence subscale: measuring participants' confidence with computers; some of these items concerned degree of engagement with computing.
2. The affection subscale: these aimed at assessing computer anxiety and feelings such as unease, threat, irritation, and incompetence with respect to computers.
3. The cognitive subscale: these items mainly addressed participants' perceptions about computing and computers.

Thus, the initial 79 items were reduced to 30 items. The retained items, the corresponding subscales and factor loadings are displayed in Table 1.

The nature of the selected items was largely describable in terms of the three-component model of attitudes conceived by social psychologists such as Rosenberg and Hovland (1960).

2.3. Procedure

All participants were administered paper-and-pencil questionnaires.

Participants in Sample 1 only responded to the questionnaire with the initial 79 items and the data collected from these administrations were used for item analysis only.

Participants in Samples 2, 3 and 4 were administered the 30-item GCAS. Demographic information for these samples included age, sex, level of education, occupation, computer experience and confidence with computers. The variable of computer experience was divided into three measurable components, namely, opportunity/access to a computer at home (yes/no), frequency of computer usage (1 = never, 2 = rarely, 3 = once a week, 4 = 2–3 times a week, 5 = everyday) and diversity of computer experience (Smith et al., 2000). The last component was measured through questions pertaining to participants' experience with a number of different activities on the computer. Specifically, participants in Samples 2 and 4 were also administered two short scales asking them to rate: (a) how experienced they were in eight computing activities (word-processing, database/spreadsheet, email, Internet, music/drawing/design, programming, games/simulations, and data analysis), and (b) how confident they felt in performing five tasks on the computer (download a file from the Internet, learn a new software, install a printer, search

Table 1
Retained items of the Greek computer attitudes scale

Item no.	GCAS items	Factor 1: confidence	Factor 2: affection	Factor 3: cognitive
1	Computers do not scare me at all	**0.48**		
9	I can do advanced computer work	**0.70**		
11	I am not the type to do well with computers[a]	**0.54**		
12	I am sure I could learn to use any computer software	**0.57**		
15	I have a lot of self-confidence when it comes to using a computer	**0.69**		
29	I could probably teach myself most of the things I need to know about computers	**0.62**		
31	I hesitate to use a computer in case I look fool[a]	**0.45**		
35	I could get good grades in computer courses	**0.60**		
38	I need an experienced person nearby when I use a computer[a]	**0.71**		
42	When I have a problem with the computer, I will usually solve it on my own	**0.62**		
43	I hesitate to use a computer for fear of making mistakes I cannot correct[a]	**0.64**		
53	Computers are difficult to understand[a]	**0.42**		
64	If someone gives me a new computer to look at, I am sure I could get some programs to run	**0.55**		
76	I feel comfortable when I have to use a computer	**0.60**	0.48	
78	I am no good with computers[a]	**0.65**		
2	I feel hostile toward computers[a]		**0.50**	0.43
6	I get a sinking feeling when I think of using a computer[a]		**0.44**	
19	I enjoy working with computers		**0.64**	
26	I do not enjoy talking with others about computers[a]		**0.72**	
40	I avoid using computers whenever I can[a]		**0.62**	
47	Computers are boring[a]		**0.68**	
63	I like to spend a lot of time using a computer		**0.64**	
73	The challenge of using a computer is very appealing to me		**0.67**	
74	I hope I will never reach the point of having to use computers[a]		**0.68**	
75	Computers are enjoyable		**0.66**	
54	You have to be a "brain" to work with computers[a]			**0.65**
62	Not many people can use computers[a]			**0.56**
69	You have to be young to learn how to use a computer[a]			**0.58**
72	Computers fail very frequently[a]			**0.40**
79	Anyone can use a computer			**0.54**

[a] Scoring is reversed for these items.

the web for information, and deal with problems on the system of the computer). Perceived computer experience and confidence were measured on an 11-point scale from 0 to 10 and in this way participants' experience could be calculated on a scale with a range of 0–80 whereas confidence could be calculated on a scale with a range of 0–50.

Two to three weeks after initial testing, the participants in Sample 2 retook the GCAS.

3. Results

Descriptive statistics of the GCAS scores for Samples 2, 3 and 4 are reported in Table 2. As can be seen, the results across samples were quite consistent and generally revealed positive attitudes toward computers.

3.1. Internal consistency and test–retest reliability

Analyses of the GCAS data collected from all samples indicated internal consistency (coefficient α) reliability coefficients between 0.90 and 0.94. As Table 3 shows, the α coefficients were also high for the first two sub-scales suggesting that the internal consistency of the constructs was satisfactory. However, answers to the five items of the third subscale (cognitive) did not form an internally consistent scale (α coefficients were 0.52, 0.53 and 0.09 for Samples 2, 3 and 4, respectively).

At this point, it was hypothesized that the very nature of the items of the cognitive subscale (stereotypical views regarding computer usage) produced inconsistent responses, which were independent of computer attitudes. For this reason, Sample 4 was used; participants were young students at a technical university in Athens, who were presumably exposed to computers very early in their life, most of them owned a computer and they were using computers very frequently. The results seemed to support this hypothesis: correlations between the cognitive subscale and the other two subscales were non-significant [$r = .26$ and $r = .19$ for the confidence and affection subscales, respectively], whereas internal consistency was $\alpha = 0.09$ for this sample.

The test–retest data collected from Sample 2 yielded a statistically significant, positive correlation [$r = .83$, $p < 0.001$].

α Coefficients for the short scales which were used for the measurement of perceived computer experience and confidence with computers are presented in Table 4. Results suggest that both scales provided internally consistent, self-report measures of experience and confidence with computers.

Table 2
Descriptive statistics for the Greek computer attitudes scale

Statistic	Sample 2	Sample 3	Sample 4
N	354	222	99
Mean	110.42	106.77	111.08
SD	20.0	19.6	14.7
Minimum	42	51	72
Maximum	150	148	145

Table 3
Means, standard deviations and reliability coefficients for the GCAS and its subscales

Construct	Items	Sample 2			Sample 3			Sample 4		
		Mean	SD	α	Mean	SD	α	Mean	SD	α
Confidence	15	54.84	11.3	0.91	51.59	11.0	0.91	52.82	8.4	0.84
Affective	10	36.95	8.8	0.91	35.70	8.6	0.92	39.03	6.7	0.88
Cognitive	5	18.77	3.2	0.52	18.93	3.0	0.53	18.89	2.2	0.09
GCAS	30	110.42	20.0	0.93	106.77	19.6	0.94	111.08	14.7	0.90

Table 4
Means, standard deviations and reliability coefficients for the perceived computer experience and confidence with computers scales

Scale	Items	Sample 2			Sample 4		
		Mean	SD	α	Mean	SD	α
Perceived experience	8	40.99	19.0	0.86	37.96	16.4	0.84
Confidence	5	29.80	14.4	0.90	27.03	13.6	0.90

3.2. Validating measures

The concurrent validity of the scale was calculated by correlating the scores on the scale to the participants' previous computer experience (independent criterion measure). To this end, GCAS was administered to Samples 2 and 4 with the short scale that measured perceived computer experience. Pearson's correlation was performed on the GCAS and computer experience data and a significant correlation was found on both cases ($r(294) = 0.66$, $p < 0.001$ and $r(87) = 0.57$, $p < 0.001$ for samples 2 and 4, respectively).

3.3. Supplemental analyses

GCAS scores from Samples 2, 3 and 4 were analyzed to assess whether men held more favorable attitudes than women toward computers. The means, the standard deviations and the results of t-tests are presented in Table 5. Although the differences between men and women were all in the predicted direction, only the results from Sample 3 (the teachers) were supportive of this conclusion.

Table 5
Gender comparisons on total scores of the GCAS

Sample	Gender	*N*	Mean	SD	*t* Test
Sample 2	Males	117	112.71	19.7	$t(299) = 1.75$, ns
	Females	184	108.58	20.0	
Sample 3	Males	80	111.46	20.2	$t(172) = 2.96$, $p = 0.003$
	Females	94	102.79	18.4	
Sample 4	Males	35	114.17	15.8	$t(86) = 1.62$, ns
	Females	53	109.04	13.6	

The second hypothesis that was tested was that younger people have more positive attitudes than older persons towards computers. This hypothesis was not supported by the data gathered from the three samples [Sample 2: $r(302) = 0.08$, ns; Sample 3: $r(198) = -0.15$, ns; Sample 4: $r(87) = 0.02$, ns]. However, it should be noted that Sample 4 had a very narrow age range (18–23 years); this is a common problem of many studies that have used typical student samples (for a review, see Maurer, 1994). Also, when the relationship between age and computer attitudes is tested, participants' experience with computers should be considered. In the present study, computer experience scores from Sample 2 (data concerning participants' computer experience were not gathered from Sample 3, whereas data from Sample 4 were meaningless due to the narrow age range) were found to have a significant negative correlation with age ($r(324) = -0.19$, $p = 0.001$).

The present study, moreover, analyzed the relationships between participants' computer attitudes and their computer experience and confidence with computers. The assessment of computer experience was approached in three different ways. Specifically, participants were asked (a) whether they owned a computer, (b) how frequently they were using a computer, and (c) how experienced they were in eight computing activities (see Section 2.3).

Data from the short scale that was used for the measurement of perceived computer experience have already been presented (see Section 3.2). Table 6 demonstrates that computer ownership had a significant effect on the participants' GCAS scores for all three samples. In particular, significant differences were evident for those who owned a computer in terms of positive computer attitudes.

Table 7 shows an analysis between frequency of computer usage and participants' scores on the GCAS. The one-way ANOVA tests that were performed on the data collected from the three samples revealed a highly significant effect of frequency of usage on computer attitudes. Through a series of Scheffe post hoc tests, it was found that participants who used a computer rarely or never tended to have significantly lower scores on the GCAS. Post hoc tests were not performed on the data collected from Sample 4 because one group ("Never") had fewer than two cases.

Finally, data from Samples 2 and 4 revealed highly significant correlations between GCAS scores and participants' self-ratings of their confidence with computers [Sample 2: $r(302) = 0.70$, $p < 0.001$; Sample 4: $r(87) = 0.64$, $p < 0.001$].

Table 6
Effects of owing a computer on total scores of the GCAS

Sample	Computer ownership	*N*	Mean	SD	*t* Test
Sample 2	Yes	223	114.60	18.4	$t(299) = 7.02$, $p < 0.001$
	No	78	97.45	19.1	
Sample 3	Yes	107	110.96	19.3	$t(173) = 3.68$, $p < 0.001$
	No	68	100.16	18.4	
Sample 4	Yes	64	113.36	15.2	$t(86) = 2.44$, $p = 0.017$
	No	24	105.00	11.5	

Table 7
Analysis of frequency of computer usage and GCAS scores

Frequency	N	Mean	SD	F (ANOVA)	Scheffe test
Sample 2					
Everyday	160	120.38	14.6	48.25***	(1) > (2) > (4)
2–3 Times a week	68	107.22	17.1		(1) > (2) > (5)
Once a week	25	96.96	15.1		(1) > (3)
Rarely	39	88.56	13.0		
Never	10	82.80	29.3		
Sample 3					
Everyday	45	122.38	15.0	25.40***	(1) > (4), (1) > (5)
2–3 Times a week	33	111.79	11.0		(2) > (5)
Once a week	10	108.90	13.3		(3) > (5)
Rarely	34	104.77	17.1		(4) > (5)
Never	46	90.30	17.8		
Sample 4					
Everyday	31	120.58	13.7	8.09***	
2–3 Times a week	21	109.90	12.2		
Once a week	28	105.25	11.8		
Rarely	7	98.86	13.7		
Never	1	90.00	0.0		

*** $p < 0.001$.

3.4. Administration and scoring

The GCAS can be administered in 10 min. The scale is presented as a list of 30 items, alongside a 5-point Likert scale (worded "Strongly Disagree", "Disagree", "Neutral", "Agree" and "Strongly Agree"). Participants are advised that the scale is not a test and that there are no correct or wrong answers. They are asked to indicate the level of their agreement with each statement and to answer as honestly as possible.

Scores are obtained by allocating numerical values to responses: "Strongly Disagree" is scored 1, "Disagree" is scored 2, "Neutral" is scored 3, "Agree" is scored 4, and "Strongly Agree" is scored 5. Scoring is reversed for those items identified in Table 1. The 30 items are summed to provide a total score representing the participant's overall attitude toward computers (ranging from 30 to 150), whereas scores from items on each subscale are summed to provide individual scores on each attitude construct.

As a guide to interpretation, the scores obtained on Sample 2 yielded cut off scores: at the 25th percentile of 97; at the 50th percentile of 113; and at the 75th percentile of 125.2. Thus, a score below the 25th percentile can be interpreted as a relatively negative attitude toward computers, whereas a score above the 75th percentile can be interpreted as a relatively positive attitude toward computers.

4. Discussion

The GCAS is a Likert scale devised to measure attitudes toward computers in the Greek population. Overall, the GCAS appears to be a reliable and valid research instrument. However, the α reliability estimates obtained for each of the empirically derived factors were quite high for the first two factors only (confidence and affection), indicating that the third factor (cognitive) was not internally reliable. Although the cognitive component of attitudes was assessed using five items which clearly reflected perceptions of and information about computers, it seems that (a) the small number of items of this subscale, and (b) the nature of the items (representing mainly stereotypical views regarding computer usage) could explain the moderate internal reliabilities for Samples 2 and 3. The data collected from Sample 4 seemed to support this argument, and the picture emerging from this finding seems encouraging, since it could well reflect a reduction of the degree of computer stereotypes within younger people who have been sufficiently exposed to computers.

The findings of this study also support those of several prior researchers in other cultures. Likewise, consistent with prior studies (Honeyman & White, 1987; Kuhn, 1989; Loyd & Gressard, 1984a, 1984b; Mackowiak, 1988; Wallace, 1988 in Maurer, 1994; Sievert, Albritton, Roper, & Clayton, 1988), data collected with the GCAS provided evidence that age and gender do not have an effect on attitudes toward computers.

A hotly contested statement in the area of educational computing is that ''Users' computer experience and training will reduce their computer anxiety''. Although the present study has found a relationship between perceived computer experience and attitudes toward computers (though this was a correlation, which does not demonstrate a cause and effect relationship), this approach to testing the aforementioned statement is probably insufficient, since it may be that negative computer attitudes would be more a cause of greater computer experience than the other way around. However, even in the cases where researchers have manipulated the experience variable by looking at computer anxiety before and after some sort of computer course, mixed results have been reported (see Maurer, 1994, for a review). Based on the finding that scores on the GCAS were related to actual performance with computers, the instrument might have useful applications in school and industrial settings.

The next step of this study should work on providing more strong evidence about the validity of the GCAS and further studying the cognitive construct. It is clear that the GCAS needs to be further assessed to conclude that these three measures are in fact independent, and are all needed to measure computer attitudes.

As noted earlier in the paper, this study and its findings may have important implications as the Greek society becomes increasingly permeated by ICT. For instance, the GCAS could be useful to Greek researchers as they pursue further research in the area of general attitudes and general behaviors toward computers. Greek researchers are encouraged to use the GCAS to further examine its reliability and validity. Future research should continue to test the possible relationships between computer attitudes and computer experience and confidence, investigate the stability of negative attitudes toward computers over time, and develop normative data for different occupational, educational, and socioeconomic groups. Also, the relationships between computer attitudes and the user behavior in a true work environment are of interest.

Acknowledgments

The author thanks Dr. Ioannis Tsaousis for the enlightening discussions and his valuable comments on some of the topics addressed in this paper and Prof. John Dumont for reviewing the final version of the manuscript.

References

Ajzen, I. (1988). *Attitudes, personality, and behavior*. Chicago: Dorsey Press.

Ajzen, I., & Fishbein, M. (1977). Attitude-behavior relations: a theoretical analysis and review of empirical research. *Psychological Bulletin, 84*, 888–918.

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Englewood Cliffs, NJ: Prentice-Hall.

Bear, G. G., Richards, H. C., & Lancaster, P. (1987). Attitudes toward computers: validation of a computer attitudes scale. *Journal of Educational Computing Research, 3*, 207–218.

Bikos, K. (1995). *Teachers and computers (in Greek)*. Thessalonica, Greece: Kyriakidi Brothers.

Breckler, S. J. (1984). Empirical validation of affect, behavior, and cognition as distinct components of attitude. *Journal of Personality and Social Psychology, 47*, 1191–1205.

Breckler, S. J., & Wiggins, E. C. (1989). Affect versus evaluation in the structure of attitudes. *Journal of Experimental Social Psychology, 25*, 253–271.

Charlton, J. P., & Birkett, P. E. (1995). The development and validation of the Computer Apathy and Anxiety Scale. *Journal of Educational Computing Research, 13*, 41–59.

Eagley, A. H., & Chaiken, S. (1993). *The psychology of attitudes*. Orlando: Harcourt Brace Jovanovich.

Francis, L. (1993). Measuring attitudes toward computers among undergraduate college students; the affective domain. *Computers and Education, 20*, 251–255.

Francis, L. J. (1995). The measurement of attitudes toward computers among undergraduate students in Wales: the comparison of four scales in relationship to sex, age, personality and religion. In Y. J. Katz (Ed.), *Computers in education: Pedagogical and psychological implications* (pp. 85–112). Sofia: Bulgarian Academy of Science.

Francis, L. J., Katz, Y. J., & Jones, S. H. (2000). The reliability and validity of the Hebrew version of the Computer Attitude Scale. *Computers and Education, 35*, 149–159.

Gardner, D. G., Discenza, R., & Dukes, R. L. (1993). The measurement of computer attitudes: an empirical comparison of available scales. *Journal of Educational Computing Research, 9*, 487–507.

Greek Ministry of National Education and Religious Affairs. (2003). Facilities and Infrastructure. Retrieved on Feb. 6, 2003 from http://www.ypepth.gr/el_ec_page2084.htm.

Honeyman, D. S., & White, W. J. (1987). Computer anxiety in educators learning to use the computer: a preliminary report. *Journal of Research on Computing in Education*, 129–138.

Igbaria, M., & Chakrabarti, A. (1990). Computer anxiety and attitudes towards microcomputer use. *Behaviour and Information Technology, 9*, 229–241.

Jones, T., & Clarke, V. A. (1994). A computer attitude scale for secondary students. *Computers and Education, 22*, 315–318.

Katz, D., & Stotland, E. (1959). A preliminary statement to a theory of attitude structure and change. In S. Koch (Ed.). *Psychology: A study of a science* (Vol. 3, pp. 423–475). New York: McGraw-Hill.

Kay, R. H. (1989). A practical and theoretical approach to assessing computer attitudes: the computer attitude measure. *Journal of Research on Computing in Education, 21*, 456–463.

Kay, R. H. (1993). An exploration of theoretical and practical foundations for accessing attitudes toward computers: the Computer Attitude Measure (CAM). *Computers in Human Behavior, 9*, 371–386.

Kuhn, D. J. (1989). A study of the attitudes of female adults toward computers. *Community/Junior College Quarterly of Research and Practice, 13*, 181–189.

LaMont Johnson, D. (1997). Integrating technology in the classroom: the time has come. *Computers in the Schools, 13*(1–2), 1–5.

Lee, R. S. (1970). Social attitudes and the computer revolution. *Public Opinion Quarterly, 34*, 53–59.

Levine, T., & Donitsa-Schmidt, S. (1998). Computer use, confidence, attitudes, and knowledge: a causal analysis. *Computers in Human Behavior, 14*, 125–146.

Likert, R. (1932). A technique for the measurement of attitudes. *Archives of Psychology*(140).

Loyd, B. H., & Gressard, C. P. (1984a). The effects of sex, age, and computer experience on computer attitudes. *AEDS Journal*, 67–77.

Loyd, B. H., & Gressard, C. P. (1984b). Reliability and factorial validity of computer attitude scales. *Educational and Psychological Measurement, 44*, 501–505.

Mackowiak, K. (1988). Deaf college students and computers: the beneficial effect of experience on attitudes. *Journal of Educational Technology Systems, 17*, 219–229.

Maurer, M. M. (1994). Computer anxiety correlates and what they tell us: a literature review. *Computers in Human Behavior, 10*, 369–376.

Nickell, G. S., & Pinto, J. N. (1986). The computer attitude scale. *Computers in Human Behavior, 2*, 301–306.

Nesdale, D., & Durkin, K. (1998). Stereotypes and attitudes: implicit and explicit processes. In K. Kirsner & C. Speelman (Eds.), *Implicit and explicit mental processes* (pp. 219–232). Mahwah, NJ: Lawrence Erlbaum.

Popovich, P., Hyde, K., Zakrajsek, T., & Blumer, C. (1987). The development of the attitude towards computer usage scale. *Educational and Psychological Measurement, 47*, 261–269.

Rainer, R. K., & Miller, M. D. (1996). An assessment of the psychometric properties of the computer attitude scale. *Computers in Human Behavior, 12*, 93–105.

Richter, T., Naumann, J., & Groeben, N. (2000). Attitudes toward the computer: construct validation of an instrument with scales differentiated by content. *Computers in Human Behavior, 16*, 473–491.

Rosen, L. D., & Weil, M. M. (1995). Computer availability, computer experience and technophobia among public school teachers. *Computers in Human Behavior, 11*, 9–31.

Rosenberg, M. J., & Hovland, C. I. (1960). Cognitive, affective, and behavioral components of attitudes. In C. I. Hovland & M. J. Rosenberg (Eds.), *Attitude organization and change: An analysis of consistency among attitude components* (pp. 1–14). New Haven: Yale University Press.

Roussos, P. L. (2002). Computer attitude correlates: do they tell us anything new?. In K. Fernstrom (Ed.). *Proceedings of 3rd international conference on information communication technologies in education* (pp. 525–532). Samos, Greece: Research & Training Institute of East Aegean (Greece) and University College of the Fraser Valley (Canada).

Roussos, P., Tsaousis, J., Karamanis, M., & Politis, P. (2000). Educational evaluation of the ODYSSEAS project (in Greek). In G. Bagakis (Ed.), *Evaluation of educational programs and schools*. Athens: Metechmio.

Selwyn, N. (1997). Students' attitudes toward computers: validation of a computer attitude scale for 16–19 education. *Computers and Education, 28*, 35–41.

Sievert, M. E., Albritton, R. L., Roper, P., & Clayton, N. (1988). Investigating computer anxiety in an academic library. *Information Technology and Libraries*, 243–252.

Smith, B., Caputi, P., & Rawstorne, P. (2000). Differentiating computer experience and attitudes toward computers: an empirical investigation. *Computers in Human Behavior, 16*, 59–81.

Vryzas, K., & Tsitouridou, M. (2002). Teachers' attitudes to information and communication technologies. In K. Fernstrom (Ed.). *Proceedings of 3rd international conference on information communication technologies in education* (pp. 515–523). Samos, Greece: Research & Training Institute of East Aegean (Greece) and University College of the Fraser Valley (Canada).

Woodrow, J. E. J. (1991). A comparison of four computer attitude scales. *Journal of Educational Computing Research, 7*, 165–187.