www.ejmste.com

Eurasia Journal of Mathematics, Science and Technology Education

Volume 2, Number 3, December 2006

COMPUTER ATTITUDE, USE, EXPERIENCE, SOFTWARE FAMILIARITY AND PERCEIVED PEDAGOGICAL USEFULNESS: THE CASE OF MATHEMATICS PROFESSORS

Balarabe Yushau

ABSTRACT. As the pedagogical-effectiveness of information technology (IT) in mathematics education is carefully established the topic of discourse among mathematicians and mathematics educators is no longer a dispute about whether or not to use IT in the teaching and learning of mathematics but a shift to some debate about the when and how of its usage. Under this dispensation, both researchers and educators have emphasized the role that teachers' attitudes toward information technology play as a crucial factor in the successful use of computers in the teaching and learning of mathematics. In this paper, we seek to study and examine the attitude of mathematics professors toward computers. In addition, the paper also investigates the effects of age and computer experience on computer attitude, usage, software familiarity, and perceived pedagogical usefulness. The broader perspective of the paper has drawn its input from more than fifty five percent (55%) of the mathematical sciences faculty of King Fahd University of Petroleum & Minerals who participated in a survey conducted as feedback for the paper. Measurement tools deployed in this regard were a slightly modified Computer Attitude Scale (CAS) by Loyd and Gressard (1984), and the Pedagogical Use (PU) unit of the Computer Attitude Scale for Teachers (CAST) by Yuen and Ma (2001). The acquired data was analyzed using an analysis of variance (ANOVA). Although both ANOVA and Duncan multiple comparison revealed that Age and computer experience did not affect attitudes towards computers and their pedagogical usefulness, the raw data nonetheless does show some trend towards that. From the result, one can conclude that mathematics professors not only have positive attitude towards computers, but seems convinced of the positive role that computers can play in the teaching and learning of mathematics. The only aggravating factor is the technical know-how and concomitant experience that are essential in guiding pedagogical activities towards effective and proper utilization of these technologies.

KEYWORDS. Computer Attitudes, Computer Use, Computer Experience, Computer Usefulness, Mathematics, Software Familiarity, Mathematics Professors.

INTRODUCTION

> In the industrial and consumer societies of the world, micro-chip technology is rapidly becoming all-pervasive; wherever one looks one finds more and more examples of its applications. In daily life microtechnology is something one uses, it is a tool for achieving ones objectives more quickly, more cheaply or more efficiently. It even facilitates things which, ten years ago, would have been considered impossible. Such developments must be reflected in our schools (Blease, 1986:3).

ISSN: 1305-8223

Computers have been used in education for more than four decades, and they have now been accepted "unconditionally" as an integral part of our entire educational system. The increase in computer use is rapid and has also generated new challenges. Perhaps more than other fields, mathematics as a subject is thought to have benefited and established a stronger intrinsic link with the development of computers in recent times. Nonetheless, Kadijevich (2002) has identified four issues as critical to proper and effective use of computer technologies in the mathematics classroom. Top among them is computer attitude, followed by software selection, a proper utilization direction, and Web-based professional development of mathematics teachers. Similarly, in his meta-analysis of the factors that are instrumental in promoting the use of computer aided learning, Griffin (1988) found that teacher attitude towards computers is an important factor related to the teacher's role towards the effective use of computers in education. Indeed, previous correlation studies have long forecasted that the use of computers in education would very much depend on how well teachers integrate them in everyday activities. And therefore, the question of teacher attitude toward computers is central to any successful use of computers in education (Loyd & Loyd, 1985; Kluever, Lam, Hoffman, Green, & Swearingen, 1994; Yuen & Ma, 2001). However, despite the attitudinal factor identified above, Yuen & Ma (2001) have noted that very little attention has been given to this factor in actual teaching practice. Not unlike any other innovation, teachers initially resisted the use of computers in education. As a matter of fact, the term "computerphobia" and "computer anxiety" were coined and entered in the literature vocabulary due to teacher (not student) resistance to computer use. The causes of this resistance according to Nickerson (1981) are not unconnected with feelings of stupidity, fear of obsolescence, fear of the unfamiliar, and the thought that computers have a dehumanizing effect.

Studies have shown that computer anxiety, lack of confidence, and lack of enjoyment influence both the acceptance of computers and their use as a teaching and learning tool (Gressard & Loyd, 1986; Smith & Kotrlik, 1990; Woodrow, 1991; Fletcher & Deeds, 1994). The need to therefore disabuse the minds of teachers from such fears and replace these misconceptions with confidence building measures is ever more paramount. In this regard, computer ownership and computer experience are two very important and interrelated factors that can help in mitigating fear and anxiety about computers from the minds of mathematics teachers and help to develop their confidence. With computer ownership, the teacher is guaranteed total access and freedom to experiment with the use of a computer as the machine tool that it is. With ownership, there then comes the reciprocal relationship of computer experience that provides the technical-know-how and the intellectual ability to manipulate and discover the pedagogical power of the machine. The importance of these two facts has been echoed and reiterated in many studies that encapsulate the argument about the effectiveness of computer use in teaching. Loyd and Gressard (1984b) have put it more succinctly:

> it is becoming increasingly evident that familiarity with computers and the ability to use them effectively will be of critical importance to success in many different fields. Computer experience is therefore gaining wide recognition as crucial component of the educational process (Loyd and Gressard,1984b, p.67).

It has been noted that, due to the lack of training and experience, "even when computers are available, mathematics teachers rarely use them in their educational practice" (Kadijevich, 2002). Limited computer experience has been found to be a factor that influences anxiety (Gressard & Loyd, 1986). Lack of training and experience is also believed to be, in part, the reason why many teachers have not been well-disposed to computers and consequently deprived of their usefulness in the classroom (c.f. Collins, 1996). Once computer-trained, teachers with computer experience will be less inclined to doubt the usefulness of the computer in their classroom. Thus the perceived usefulness of computers does clearly influence attitudes toward computers, and the amount of confidence a teacher possesses in using computers also influences the implementation of acquired skills in the classroom (Bandura, 1977; Gressard & Loyd, 1986; Yuen & Ma, 2001). The forgoing underlines the calls often made for personal education in computer technology, and promoting computer literacy for both learners and instructors within educational institutions (Jay, 1981). Some studies have investigated the relationships between computer attitude, age and experience but findings have been contradictory (Gressard & Loyd, 1984b; Loyd & Loyd, 1985; Pope-Davis & Twing, 1991). However, there has been little information related to mathematics professors, especially with regard to their computer experience, frequency of computer use, software familiarity, and perceived pedagogical usefulness of the computers in mathematics teaching and learning. This study aims at providing insight in that direction. The paper is divided into four parts. After the introduction in the first part, the second part discusses the research methodology, while the third part will carry an analysis of the results followed by some discussion and, finally, the concluding remarks together with the summary and recommendations.

METHODOLOGY

Sample

The data of this study was collected from 41 of 72 faculty members of the Mathematics Department at King Fahd University of Petroleum & Minerals. The age ranges of the participants are summarized in the following table:

Table 1. Age Ranges of the Participants

Age Ranges	Frequency
23 -30	5
31 – 40	7
41 – 50	11
51 -55	16
More than 55	2
Total	**41**

Instruments

The two instruments used in this study were Computer Attitude Scale (CAS) by Loyd and Gressard (1984a), and the modification of the pedagogical usefulness (PU) unit of the Computer Attitude Scale for Teachers (CAST) by Yuen and Ma (2001). The former aimed at assessing general attitude towards computers, and the later aimed at assessing teachers' perception of the usefulness of computers particularly in the teaching and learning processes (Yuen & Ma, 2001).

CAS consists of four subscales: Computer Anxiety, Computer Confidence, Computer Usefulness, and Computer Liking. The aim of the *computer anxiety* subscale is to asses the fear while dealing with computers, while that of *computer confidence* is to asses the confidence in the ability of dealing with computers. *Computer liking* subscale assesses the enjoyment of dealing with computers, and *computer usefulness* assesses the perception of the proliferation of computers on future jobs. All the questions present statements of attitude towards computers and their use. The reliability coefficient for these subscales was found to be .90, .89, .89, and .82 for Computer Anxiety, Computer Confidence, Computer Liking, and Computer Usefulness subscales, while the total score was estimated as .95 (Loyd & Loyd, 1985). Subsequent studies have yielded similarly high internal consistency scores (Nash & Moroz, 1997).

On the other hand, Computer Attitude Scale for Teachers (CAST) by Yuen & Ma (2001) was partially adopted from Selweyn (1997). The scale consists of four factors: Affective Attitude (AA), Behavioral Control (BC), General Usefulness (GU), and Pedagogical Use (PU). However, in this study only the Pedagogical Usefulness subscale was used, even that, most of the questions were modified and some localized to mathematics. According to Yuen and Ma (2001) the "standardized coefficient beta is 0.044 and was not alone statistically significant directly to the overall usage".

Apart from the above two scales, other questions included in this study are that of:

1. *Computer Experience*. The participants were asked about their experience with

learning about or working with computers with five ranges: 1 year or less, 2 – 3 years, 3 – 4 years, 4 – 5 years, and more than five years.

2. *The frequency of computer use*. Here the choices are: everyday, a few times a week, a few times a month, a few times a year, and not at all.

3. *The purpose of computer use*: Here the choices are: e-mail, Internet, word processing and spreadsheets, programming, and other research purposes.

4. *Frequency of computer use in teaching*. The question is how often they use computers in preparing for their lessons, and how often they give their students homework/assignments that will require the use of computers. The ranges are: every week, a few times in each semester, sometimes in some semesters, and never.

5. *Familiarity with frequently used software such as*: word processors (e.g. MS word, LaTEX, etc), spreadsheet and statistical packages (e.g. MS Excel), Presentation programs (e.g. PowerPoint), computer algebra systems (e.g. Mathematica, Matlab, Maple etc), programming languages (Fortran, C, C++, Java etc.), and Internet design software (e.g. FrontPage). The ranges here were: excellent, good, average, poor, and very poor. Also, the respondents were asked to indicate for which of these programs they would like to have more training for the enhancement of their research.

Procedures

Participants in the present study were given the questionnaire at the beginning of the semester, and were given two weeks to return. After collection, the data was analyzed using the statistical packages SAS and SPSS. The level of statistical significance (alpha level) was set at .05.

RESULTS AND DISCUSSION

The results of this study are summarized below followed by some discussion:

1. Summary of the Attitude Results

Both the Computer Attitude Scale (CAS) and Pedagogical Use (PU) subscale are Likert - type instruments. The former consists of forty items with each subscale consisting of ten questions, while the later consists of six items. The participants indicate the degree to which they agree with the statement on a four-point scale, with “agree strongly” on one end and “disagree strongly” on the other. Each response is given a value of 1 to 4, with 4 indicating a more positive attitude towards computers.

Table 2. Summary of the means and standard deviation of the subscales

Subscale	Mean	Standard Deviation
Computer Anxiety	35.39	4.15
Computer Confidence	34.93	4.89
Computer Liking	31.63	4.76
Computer Usefulness	33.41	4.05
Pedagogical Usefulness	19.17	3.85

It is worth noting that the participant that answered all the questions has a maximum score of 40 and a minimum of 10 score for each subscale and maximum of 24 and minimum of 6 for PU subscale. Participant with attitude score of 25 and above in each subscale of CAS and 15 and above in PU are considered to have positive attitude. Therefore, in general, the results of this study suggest that mathematics professors at King Fahd University of Petroleum & Minerals (KFUPM) have fairly positive attitudes toward computers (see Table 2). This is consistent with the results of other similar studies carried out with teachers and educators (see Loyd & Loyd, 1985; Gressard & Loyd, 1986; Park & Gamon, 1995; Robb, 1996; Nash & Moroz, 1997; Yuen & Ma, 2001).

In particular, the attitude of the teachers towards the pedagogical usefulness of computers is far above average with a mean more than 19 out of 24. This is an indication that the perception of the professor toward computer is more of a positive tool that can enhance teaching and learning process. However, as the results below indicate, the professors have difficulty in putting this positive perception into practice (See Table 6 and 8).

2. Computer Experience

In terms of years of use and working experience with computers, the results show that most of the mathematics faculty at KFUPM (over 80% of the respondents) has been using computers for more than five years. No participant indicated having computer experience of less than 3 years (see Table 3). Contrast this with Loyd and Gressard (1986) who derived experience values as: (a) none, (b) less than six months, (c) six months to one year, and (d) more than one year. With this range, Loyd and Gressard found a link between experience and computer anxiety. That is to say, teachers with more than one year of experience were significantly less anxious than those with less experience.

Table 3. Number of years of working with computers

Year of Experience	Number	Percentage
1 year or less	0	0%
2 – 3 years	0	0%
3 – 4 years	3	7%
4 – 5 years	4	10%
More than 5 years	34	83%
Total	41	100%

Therefore, the lack of computer anxiety shown by the mathematics faculty in this study may be associated with their years of experience in working with computers. More than 80% of the participants indicated having more than five years of experience in working with computers.

3. Frequency of Computer Use

The frequency of computer use, Table 4, shows that 99% of the faculty use computers every day in one way or another. This shows how pervasive the use of computer has become in our daily, personal, and professional life and, therefore, "such developments must be reflected in our schools" (Blease, 1986:3). This is more so if we take the cognizance that our students will soon graduate and join the workforce.

Table 4. Frequency of computer use

Frequency of computer use	Number	Percentage
Everyday	40	99%
A Few times a week	1	1%
A Few times a months	0	0%
A Few times a year	0	0%
Not at all	0	0%
Total	41	100%

4. The Purpose of Computer Use

Here respondents were allowed to make more than one choice.

Table 5 shows how intensively the faculty use computers for e-mail communication and Internet surfing. More than 95% of the faculty use computers for e-mail or Internet purposes. More than 60% use computers for word-processing and other research purposes. Programming takes the smallest factor with 46%, and this is understandable since only a few faculty members, who work in the area of numerical analysis and applied mathematics, use some programming in their work.

Table 5. The Purpose of Computer Use

Area of computer use	Number	Percentage
E-mails	41	100%
Internet	39	95%
Word processing & spreadsheet	32	78%
Other research purposes	25	61%
Programming	19	46%

5. Frequency of the Use of Computers in Teaching

In terms of computer use in teaching, the results in Tables 6 show that less than 40% of the faculty use computers in teaching on a weekly basis. It is important to note that this result includes the instructors of Math 001 and 002 and Stat 319, in which the weekly computer lab period is almost compulsory. This means that in the bulk of other courses that most of the engineering students are required to take, such as the calculus series, very few faculty use computers in teaching. This seems to be a common phenomenon (see, for example, Manoucherhri, 1999).

Table 6. Frequency of Computer Use in Teaching

Every week	16	39%
Few times each semester	8	20%
Sometimes in some semester	13	32%
Not at all	2	5%
Total	**39**	**96%**

As noted earlier, the result of this study coincides with the Kadijevich's (2002) observation that "even when computers are available, mathematics teachers rarely use them in their educational practice". The reason for this lukewarm attitude according to Kadijevich is "because they do not have (enough) knowledge and skills related to what and how can be achieved by using these tools (Manoucherhri, 1999)". Therefore, to change the present practice, we need to innovate, promptly yet thoughtfully, both pre-service and in-service professional development for mathematics teachers (Kadijevich, 2002). Some other factors identified as the major reasons for the reluctance of teachers to integrate computers into their teaching include: teacher perception of the computer as an efficacy of the change, lack of a curricular imperative for this (Heywood & Norman, 1988) i.e. teachers need to see the reason behind any changes in their teaching methods (Robb, 1996, Fullan, 1982). Other reasons include: lack of time, tight schedules, too much material to be covered, a rigid syllabus to be followed, lack of knowledge of how to use computers in teaching, and possibly faculty perception of computers as being a tool for communication, information, and research only, and not as a teaching and learning tool. The data in Table 6 shows how intensively the mathematics faculty use computers on a daily basis. In fact, the trend is indicating that our students today will live and work in an era dominated by computers, by worldwide communication, and by a global economy. Therefore, to have students adequately prepared for these challenges, computer-based technology should be routinely used at schools and universities (Steen, 1989; Pelton & Pelton, 1998), especially in mathematics classes.

6. Frequency of Use of Computers in Preparation for Teaching

Table 7. Frequency of Computer Use in Preparing for Teaching

Every week	22	54%
A few times each semester	10	24%
Sometimes in some semester	9	22%
Not at all	0	0%
Total	**41**	**100%**

This also shows how useful computers are in helping the preparation and organization of lectures in one way or another.

7. Frequency of Work Assigned to Students Requiring Computer Usage

Table 8. Frequency of Work Assigned to Students Requiring Computer Usage

Every week	3	7%
A Few times each semester	8	17%
Sometimes in some semesters	15	37%
Not at all	12	32%
Total	**39**	**93%**

Although only 50% of the faculty use computers a few times each semester in their teaching (Table 6), more than 60% of faculty members do not give students any assignment or homework that will require the use of computers in **most** of the semesters. Contrast this with the fact that 100% of the faculty use computers almost daily for their personal and professional work (see Table 6). Even for teaching preparation, whatever that means, almost 80% of the faculty use computers a few times each semester. One could not agree more with Blease (1986) in that “such developments must be reflected in our school" (p.3).

8. Software Familiarity

In the area of software familiarity, Table 9 indicates that more than 80% of the mathematics faculty is at least good in word-processing, which is the most commonly used software for writing memos, exams, and most journal publications. Similarly, more than 60% indicate that they are at least good at spreadsheet & statistical packages, 50% at computer algebra system, and 40% with programming languages such as Fortran, C, C++, Java, etc.

Table 9. Familiarity with frequently used Software

Software	Level of familiarity					Number of people that need further training in:
	Excellent	Good	Average	Poor	Very Poor	
Word processors (MS word, Tex, Scientific Work place, LaTEX, etc.)	14 (34%)	22 (54%)	4 (10%)	1 (2%)	0 (0%)	15 (37%)
Spreadsheet & Statistical packages (MS Excel, Statistica, SPSS, etc.)	11 (27%)	15 (37%)	9 (22%)	4 (10%)	2 (5%)	12 (29%)
Presentation programs (PowerPoint, etc.)	8 (20%)	13 (32%)	5 (12%)	7 (17%)	8 (20%)	21 (51%)
Internet design programs (FrontPage, etc.)	1 (2%)	10 (24%)	13 (32%)	5 (12%)	12 (29%)	25 (61%)
Computer Algebra System (Mathematica, Maple, Matlab, MathCAD, etc.)	5 (12%)	17 (41%)	9 (22%)	7 (17%)	2 (5%)	22 (54%)
Programing Language (Fortran, C, C++, Java, etc.)	5 (12%)	15 (37%)	8 (20%)	9 (22%)	4 (10%)	15 (37%)

However, only 20% indicated that they are good at Internet design programs (e.g. FrontPage, etc.), while 60% indicated that they are familiar, on average, with presentation programs like PowerPoint. The results also show that mathematics professors have shown interest in undergoing more training in almost all software areas in order to update their knowledge. Internet design software carried the highest number of volunteers with 60%, followed by computer algebra systems 54%, presentation programs (PowerPoint, etc.) 51%, programming and word processing with 37%, and spreadsheet & statistical packages with 29%.

9. The effect of Age and Experience on Computer Anxiety

Many studies have shown the significant effect of age and computer experience on attitudes towards computers (Loyd & Gressard, 1984; Pope-Davis & Twing, 1991). To replicate the findings in these studies, ANOVA analyses where done with age and experience as factors and subscales as criteria. However, age and computer experience did not show any significant influence of attitudes in any of the subscales (see Appendix I for the ANOVA Tables 10 - 14). Nevertheless, there is some trend in the raw data that indicates that the younger faculty seems to have higher means, indicating a more positive attitude. Similarly, the raw data also indicates some trend in all the subscales showing that the more the experience the higher the mean, except in computer usefulness subscale. The data in the pedagogical usefulness, though not statistically significant also, indicates a reverse role: the more the experience, the less the mean. This result is indeed surprising as we anticipated that the more the experience with computer the higher the perceived usefulness in classroom. A further study is required in this direction. However, as expected, the younger the years, the higher the mean, which seems to show that the younger ones are more optimistic on the pedagogical usefulness of computers.

CONCLUSION AND RECOMMENDATIONS

We have in this study investigated the computer attitude, use, experience, software familiarity, and perceived pedagogical usefulness among mathematics professors. In summary, the findings in this study are:

1. Mathematics professors at KFUPM have positive attitudes toward computers and towards the use of computers in their academic activities. This is encouraging as it has been realized that computer attitudes influence not only the acceptance of computers, but also their use as professional tools or as teaching/learning aids (Kadijevich, 2002). Therefore, to have computers widely used in mathematics classrooms, we should first help teachers develop positive attitudes toward the machine.

2. It was found that the number of years of working experience with computers by the mathematics professors at KFUPM was high. This might have influence their positive attitude towards the machine. It should be noted that the experience range used in this study is more than those considered in the previous studies in the literature.

3. Although mathematics professors at KFUPM were found to be intensive computer users in many of their academic activities, the rate at which they use computers in the classroom is low compared to the faculty computer usage in research and other purposes. This is the most appealing finding in this study. It shows that having positive attitude toward technology is not enough indicator that the tool will automatically be used in classroom. The result appears to show that teachers need to be shown the road to its utilization in the classroom. Therefore, it should be noted that computer ownership and free access to Internet facilities, though are good step, are not enough to trigger changes in our mathematics classroom practices. A concerted effort to enlighten and develop the confidence of the mathematics faculty on the use and

potential of computers in the mathematics classroom is necessary. This can be achieved by organizing periodic training or workshops for faculty on two fronts: (a) on recent development on various software items especially the ones relevant to their professional development, for instance, various CAS programs, word processing, spreadsheets, and possibly Internet authoring software, etc. and (b) on instructional technology, whereby the pedagogical usefulness of the various information technologies will be unveiled.

4. It was also found that Mathematics professors, despite their differences in age and experience did not differ significantly (in statistical sense) in their attitudes, knowledge, and use of computers. However, the younger ones appear to be more optimistic.

5. Mathematics professors at KFUPM were found to be familiar with most of the software needed in their professional development; however, they seem to be most knowledgeable in the area of word-processing software. The area in which they seem most deficient is in Internet design software where 61% registered their willingness to undergo more training in the area.

It is worth noting here that is one very important factor that has not been considered in this study, which is the issue of computer ownership. Computer ownership is one of the variables that many researchers have intensively investigated and found to be a statistically significant factor that influences attitude toward computers (see Nash & Moroz, 1997). However, at King Fahd University of Petroleum & Minerals there is a policy in which all faculty of the University are provided a personal computer in their offices that is upgradeable or changeable after every two years. Similarly, Internet access and e-mail facilities are free. Furthermore, the Information Technology Center (ITC) of the University provides most of the needed software and services free of charge. In view of this, computer ownership was isolated in this study since all mathematics professors have personal computers in their offices. This information should help in interpreting the level of computer use by the faculty. It is our belief that this policy is an excellent initiative that might have positively contributed in the professors' computer attitude, usage, computer experience, and software familiarity.

Limitations: This study is limited on the numbers of faculty members that participated, the way the faculty were categorized in terms of age, and the length of the questionnaire. Had these issues been examined differently, a different result may have been obtained.

Acknowledgement: The author acknowledges with thanks the excellent research facilities at KFUPM.

REFERENCES

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavior change. *Psychological Review*, 84, 191-215.

Blease, D. (1986). *Evaluating Educational software*. Croom Helm, 51 Washinton Street, Dover, New Hampshire 03820, USA.

Collins, T. Jr. (1996). *The effects of computer-assisted algebra instruction on achievement, mathematics anxiety levels and attitudes toward personal use of computers of students in an historically black University*. PhD Thesis, University of South Florida.

Fletcher, W. E. & Deeds, J. P. (1994). Computer anxiety and other factors preventing computer use among United States secondary agricultural educators. *Journal of Agricultural Education*, 35(2), 16-21.

Fullan, M. (1982). *The new meaning of educational change*. Toronto: OISE Press.

Griffin, J. (1988). CAL Innovation as Viewed by Purchasers of Computer Software in Secondary Schools. *Journal of Computer Assisted Learning*, Vol. 4, No 3, pp. 150-161.

Gressard, C. P., & Loyd, B. H. (1986). Validation studies of a new computer attitude scale. *Association for Educational Data Systems Journal*, 18(4), 295-301.

Heywood, G. & Norman, P. (1988). Problems of educational innovation: the primary teacher's response to using the microcomputer. *Journal of Computer Assisted Learning*, Vol. 4, No 1, pp. 34-43.

Jay, T.B. (1981). Computerphobia: What to do about it. *Educational Technology*, 21, 47-48.

Kadijevich, D. J. (2002). *Four Critical Issues of Applying Educational Technology Standards to Professional Development of Mathematics Teachers*. Proceedings of the 2nd International Conference on the Teaching of Mathematics at the undergraduate level. University of Crete.

Kluever, R., Lam, T., Hoffman, E., Green, K. and Swearingen, D. (1994). The Computer Attitude Scale: Assessing Changes in Teachers' Attitudes toward Computers. *Journal of Educational Computing Research*, Vol. 11, No 3, pp. 251-61.

Loyd, B. H., & Gressard, C. (1984a). Reliability and factorial validity of Computer Attitude Scales. *Educational and Psychological Measurement*, 44, 501-505.

Loyd, B. H., & Gressard, C. (1984b). The effects of sex, age, and computer experience on computer attitudes. A*EDS Journal*, 18(2), 67 77.

Loyd, B. H. & Loyd, E. L. (1985). The Reliability and Validity of an Instrument for the Assessment of Computer Attitudes. *Educational and Psychological Measurement*, 45, 903 909.

Manoucherhri, A. (1999). Computers and School Mathematics Reform: Implications for Mathematics Teacher Education. *Journal of Computers in Mathematics and Science Teaching*, 18, 1, 31-48.

Nash, J. B. & Moroz, P. (1997). *Computer Attitudes Among Professional Educators: The Role of Gender and Experience*. Annual meeting of the Southwest Educational Research Association, Austin, TX, January 23-25.

Nickerson, R. S. (1981): Why Interactive Computer Systems are Sometimes Not Used by People Who Might Benefit from Them. *In International Journal of Man-Machine Studie*s, 15 (4) p. 469-483

Pelton, L.F. & Pelton, T.W. (1998). Using WWW, Usenets, and E-mail to manage a mathematics pre-service technology course. *Computers in the Schools*, 14, 3-4, 79-93.

Pope-Davis, D. B. & Twing, J. S. (1991). The Effects of the Age, Gender, and Experience on Measure of Attitude Regarding Computers. *Computer in Human Behavior*, 7, 333-339.

Park, S-Y. & Gamon, J. (1995). *Computer use, Experience, Knowledge, and Attitudes of Extension Personnel: Implication for Designing Educational Programs*. National Agricultural. Education Research Meeting, December 1, 1995, Denver, Colorado.

Robb, D. A. (1996). Survey of Teachers' Attitudes to Computers. http://www.egss.demon.co.uk/dr_www/drnofram/resrch/introrqs.htm#Introduction

Selwyn, N. (1997) ‘Students’ attitudes toward computers: validation of a computer attitude scale for 16-19 education’ *Computers and Education*, 28, 1, pp.35-42

Smith, M. N. & Kotrlik, J. W. (1990). Computer Anxiety Levels of Southern Region Cooperative Extension Agents. *Journal of Agricultural Education*, 31(1), 12-17.

Steen, L. A. (1989). Teaching Mathematics for Tomorrow’s World. *Educational Leadership*, 47:1 (September),18-22.

Yuen, A. H. K. & Ma, W. K. (2001). *Teachers' Computer Attitudes: Factors influencing the Instructional Use of Computers*. Proceedings of the International Conference on Computers in Education, November 2001, Korea, 7p.

Woodrow, J. E. J. (1991). A Comparison of Four Computer Attitude Scales. *Journal of Educational Computing Research*, 7 (2), 165-187.

APPENDIX I

Table 10. Age and Experience Differences in Computer Anxiety

Independent Variable	ANOVA STATISTICS F - Value	p	E DESCRIPTIVES	N	Mean	S.D.
Age	F (4, 36) = 2.58	0.09	23 - 30 years	5	36.40	2.966
			31 - 40 years	7	36.00	2.582
			41 - 50 years	11	34.27	5.479
			51 - 55 years	16	36.13	3.384
			More than 55 years	2	31.00	8.485
			Total	**41**	**35.39**	**4.147**
Computer Experience			3 - 4	3	34.33	6.93
			4 - 5	4	35.5	3.70
			More than 5 years	34	35.5	4.06
			Total	**41**	**35.5**	**4.06**

Table 11. Age and Experience Differences in Computer Confidence

Independent Variable	ANOVA STATISTICS F - Value	p	DESCRIPTIVES	N	Mean	S.D.
Age	F (4, 36) = 0.78	0.63	23 - 30 years	5	37.2	2.95
			31 - 40 years	7	36.71	3.30
			41 - 50 years	11	33.9	4.95
			51 - 55 years	16	34.63	5.88
			More than 55 years	2	31	1.41
			Total	**41**	**34.93**	**4.89**
Computer Experience			3 - 4	3	30	7.21
			4 - 5	4	33	5.94
			More than 5 years	34	35.6	4.42
			Total	**41**	**34.93**	**4.89**

Table 12. Age and Experience Differences in Computer Liking

Independent Variable	ANOVA STATISTICS F - Value	p	DESCRIPTIVES	N	Mean	S.D.
Age	F (4, 36) = 0.89	0.54	23 - 30 years	5	31	4.64
			31 - 40 years	7	33.86	3.18
			41 - 50 years	11	31.55	3.42
			51 - 55 years	16	31.63	6.00
			More than 55 years	2	26	1.41
			Total	**41**	**31.63**	**4.76**
Computer Experience			3 - 4	3	28	4.58
			4 - 5	4	31.5	5.45
			More than 5 years	34	31.97	4.71
			Total	**41**	**31.63**	**4.76**

Table 13. Age and Experience Differences in Computer Usefulness

Independent Variable	ANOVA STATISTICS F - Value	p	DESCRIPTIVES	N	Mean	S.D.
Age	F (4, 36) = 1.09	0.40	23 - 30 years	5	34.6	1.52
			31 - 40 years	7	32.71	3.86
			41 - 50 years	11	33.36	5.80
			51 - 55 years	16	33.75	3.53
			More than 55 years	2	30.50	2.12
			Total	**41**	**33.41**	**4.05**
Computer Experience			3 - 4	3	33.33	2.52
			4 - 5	4	34.25	3.862
			More than 5 years	34	33.32	4.25
			Total	**41**	**33.41**	**4.05**

Table 14. Age and Experience Differences in Pedagogical Usefulness of Computer

	ANOVA STATISTICS		DESCRIPTIVES			
Independent Variable	**F - Value**	**p**				
				N	**Mean**	**S.D.**
Age	F (4, 36) = 0.95	0.50	23 - 30 years	5	21.2	2.95
			31 - 40 years	7	21.14	2.73
			41 - 50 years	11	19.18	3.31
			51 - 55 years	16	17.75	4.63
			More than 55 years	2	18.50	0.71
			Total	**41**	**19.17**	**3.85**
Computer Experience			3 - 4	3	21.67	1.53
			4 - 5	4	19.5	1.73
			More than 5 years	34	18.91	4.11
			Total	**41**	**19.17**	**3.85**

B. Yushau

Department of Mathematical Sciences
King Fahd University of Petroleum and Mineral.
P. O. Box 1154
KFUPM, Dhahran, 31261,
Saudi Arabia
e-mail: byushau@kfupm.edu.sa
Fax: 966-03-860 2979
Tel: 966-03-860-1081/5023