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ABSTRACT

In order to investigate how attitudes among preservice teachers are influenced by participation in a computer literacy course and to test the utility of an attitude questionnaire, a study was conducted with 75 college preservice teachers (56 females and 19 males). The course was developed to teach the use and understanding of computer technologies in an educational setting. Seventy-three students completed the Computer Literacy Attitude Survey, developed for this study, at the beginning of the course, and 65 completed it at the end of the course. Participation in the course appeared to improve student attitudes toward computers and their use. After completing the course, students had less anxiety and more confidence, and they generally valued computers more. Students also evaluated the course favorably, commenting on its clarity and utility. Three tables present study findings. (Contains 26 references.) (SLD)

Title:

Measuring Teacher Attitudes Toward Interactive Computer Technologies

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Measuring Teacher Attitudes Toward Interactive Computer Technologies

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Ours is an information-technology oriented society. Attitudes toward computer technology have therefore been of interest to researchers in the social sciences in recent years, based on the belief that attitudes toward technologies may influence their effective and innovative use. As early as 1976, Ahl administered a survey to American adults to determine their perceptions and understanding of computers. He found for example, that 85% of the Americans he surveyed felt that computers would improve education. Researchers interested in education have carried out similar studies with teachers and students. Lichtman found, for example, that in 1979 teachers were somewhat apprehensive about computers and their impact on schools.

Several researchers have sought to influence teacher attitudes toward computers using interventions, based on findings that experience with computers influences teacher attitudes (Koohang, 1987, 1989; Loyd & Gressard, 1986). For example, Madsen and Sebastiani (1987) and Berger and Carlson (1988) found that participation in computer courses influenced attitudes of inservice teachers. Similarly, Savenye, Davidson, and Orr (1992) found that participation in a semester-long computer applications course positively influenced preservice teachers' attitudes, however this study was limited in the attitudinal factors analysed, as it represented part of the evaluation of an ongoing course. There have been few comprehensive studies of the effects of such computer courses on the attitudes of preservice teachers. Such studies appear to be necessary. Although preservice teachers are entering computer literacy courses with increased prior experience in computers (Bitter & Davis, 1985), some say such experience can produce more negative attitudes than were previously held. For instance, in a recent study Mahmood and Medewitz (1989) found that for undergraduate business students, thus preservice practitioners, participation in a computer literacy course did not improve student attitudes, which in that case were already negative.

Elements of attitudes toward computers have been studied in a somewhat piecemeal fashion. For instance, some studies have investigated simple liking of computers, while others have focused on anxiety about using computers (Cambre & Cook, 1985, 1987). Computer anxiety itself has been variously defined by researchers as including elements of confidence, fear and comfort (Cambre & Cook, 1987), whereas others (Koohang, 1989) have analyzed elements of anxiety and confidence as separate factors. Koohang has also studied the factor of perceptions of usefulness, an extension of early work done on perceptions of value of computers to society. In his and other such comprehensive studies recently researchers have based their initial questionnaire development on thorough reviews of the literature,

administered many attitudinal items, and have subsequently subjected their items to factor analysis to sort through the actual elements of computer attitudes (cf. Abdel-Gaid, Trueblood & Shrigley, 1986).

The present study was conducted with several purposes in mind: 1) to investigate in depth how attitudes among preservice teachers are influenced by participation in a computer literacy course, and 2) to test the utility of an extensive attitude questionnaire, based on several recent comprehensive studies.

Method

The subjects were 75 college preservice teachers, 56 females and 19 males, enrolled in two five-week summer sessions of a required course on computer applications in education at a major university in the southwest.

The computer literacy course was systematically developed to teach the use and understanding of computer technologies in an educational setting. The course is taught by many instructors, in a multi-section format, but content, activities, projects and exams are the same for all sections. All students thus received the same instruction.

As a normal procedure in the computer literacy course, students every semester complete pre-and-post course surveys to help instructors maintain and improve the quality of the course. During one summer, an additional questionnaire, the Computer Literacy Attitude Survey (described below), was specifically developed to study in depth the effects of the course on attitudes. This Attitude Survey was administered at the same time as the regular course surveys.

Data Sources

Seventy-three students completed the Computer Literacy Attitude Survey after the first class. Sixty-five students completed the Survey again on the next-to-last class day. The Survey consisted of fifty Likert-scale type items derived from several sources (Abdel, et al., 1986; Bannon, Marshall, & Fluegal, 1985; Ellsworth & Bowman; 1982; Smith, 1987; and Violato, Marini & Hunter, 1989). The survey contained items related to the factors of liking of computers, valuing computers for society and for education; anxiety about using computers; confidence with regard to learning about computers; and perceptions of gender appropriateness of computers. Students were asked to rate the items from strongly agree to strongly disagree.

Students also completed a brief questionnaire regarding their demographic characteristics and previous computer experience.

Data Analysis

First, several types of descriptive data were collected and analyzed. Students were asked several questions about their background, and frequencies were calculated for these questions. Two questions each on the pre- and post-course survey asked students to rate their skill in typing and computer programming, and mean scores on these questions were calculated.

For the fifty Likert-scale questions regarding the preservice teachers' attitudes toward computers, which represented the primary focus of the study, pre- and post-course mean scores were calculated . To calculate statistics, strongly agree was given a value of 1, agree was given a value of 2,

up to strongly disagree with a value of 5. Thus on positively-worded items, a low score represented a positive attitude, with the reverse being true on negatively-worded items.

To determine the effects of participating in the computer applications course, multiple t-tests were used to compare attitudes at the beginning and at the end of the course. Since use of multiple t-tests introduces the possibility of finding spurious significant differences, a highly-stringent probability value was used to determine whether differences were meaningfully significant. Items on which pre- and post-course differences were significant at the $p<.0001$ level were considered to represent the most important attitude changes. Secondarily, differences at the $p<.001$ level were also explored.

Results

A summary of the characteristics of the subjects is presented in Table 1. Most of the students were education majors, seeking teaching certification. Most had not completed their student teaching and were not currently teaching. Students appeared to have enrolled in the computer course at varied points in their college career; about half had completed only a few education courses, while about half had completed more than six courses. Most students had had little experience with microcomputers, with 40 of 73 who answered having less than six months of experience, and 33 having more than 6 months' experience.

Table 2 presents the results of the students' pre- and post-course self-ratings of their skill in typing and computer programming. In both areas, students' perceived that their skill had improved, however the improvement was greater in computer programming. Students appear to have entered the course with good typing skill, whereas their initial programming skill was low, and could be improved considerably through their experience in the course.

Table 3 presents results on all 50 Attitude Survey items, with responses to the items worded positively appearing first (Table 3a). The lower the mean score the more positive the attitude on these items, with scores ranging from 1 (most positive) to 5 (least positive). The second half of Table 3 (Table 3b) presents responses to items worded negatively. On these items the higher the mean score, the more positive the attitude (1 - least positive to 5 - most positive). Questions were assigned to the following categories, derived from the literature: liking of computers, anxiety, value of computers for society and education, confidence about learning about and using computers, and perceptions of gender-appropriateness of computer use. Although Table 3 presents all results, major results will be discussed here.

As shown in Table 3, attitudes toward computers, as indicated by responses on the 50-item Survey, were generally more positive after the students had completed the computer literacy course. Attitudes on all but eight items became more positive, and on those few items the differences were not statistically significant.

On twelve items there were highly significant pre-post differences, at the $p<.0001$ level, so positive attitude changes represented by these items were considered to be of major importance. It is in the area of anxiety about computers, and the related factors, confidence in learning about and confidence in using computers, that the greatest attitude changes appear. In fact, of the twelve most significant attitude changes, eight were related to

anxiety and confidence. These items, noted in Table 3, were items #103, 109, 111, 117, 118, 123, 127, and 129. For example, responses to item #109, "I get a sinking feeling when I think of trying to use a computer," showed the greatest increase of those to any item (3.45 pre, 4.25 post. Note that on negatively-worded items a higher score is more positive.). Similar results occurred in response to the other anxiety/confidence items: item #103, "I feel confident with my ability to learn about computers," (2.42 pre, 1.72 post), #111, "Computers make me feel stupid," (2.95 pre, 3.69 post), #117, "I'm not the type to do well with computers," (3.51 pre, 4.00 post), #118, "I feel comfortable using computers," (2.75 pre, 2.11 post), #123, "Computers make me feel uncomfortable," (3.22 pre, 4.05 post), #127, "Computers make me feel uneasy and confused," (3.30 pre, 3.95 post), and #129, "I think using a computer would be difficult for me," (3.51 pre, 3.98 post).

Significant differences at the $p<.0001$ level also occurred on three items related to liking computers (items #102, #107, and #128). For example, the mean scores on one of the liking items, #102, "I like using computers," were 2.27 pre- and 1.75 post-course. Finally, differences at this highly significant level were found on one item, #141, related to valuing computers. The preservice teachers disagreed more strongly at the end of the course with the statement, "Microcomputers will increase the amount of stress and anxiety students experience in schools," (3.47 pre, 3.64 post).

Also, as noted on Table 3, on five additional items pre-post differences were significant at the somewhat lower level of $p<.001$. Again on these items the preservice teachers showed more positive attitudes at the end of the course with relation to anxiety towards (item #104), liking (item #121), and valuing computers (items #140, #142, #147).

Thus the general pattern of significant differences on the pre-course versus post-course administration of the Attitude Survey indicated an improvement in attitudes toward computers. Initially the non-significant decline in scores on the eight items mentioned earlier was still of some concern, because five of the items were related to perceptions of computers as a male domain, that is, the scores seemed to indicate increased sex-stereotyping. For example, scores on item #106, "Using a computer is more important for males than females," were 4.71 (pre) and 4.45 (post), and scores on item #130, "Working with computers is more for males than females," decreased from 4.65 (pre) to 4.52 (post). Responses on a few of the other items were already very positive at the beginning of the course and became only slightly less positive. For instance on item #101, "Knowing how to use computers is a worthwhile and necessary skill," mean scores were 1.26 (pre) and 1.42 (post). Similarly, in response to item #112, "If a problem is left unsolved in a computer class, I would continue to think about it afterwards," students' mean scores were 2.22 (pre) and 2.42 (post). As mentioned earlier, the decline in scores on these eight items, although noted on Table 3, does not appear to be important in that none of the differences on these items was statistically significant.

Discussion

This study was conducted to investigate in-depth the effects of participation in a computer literacy course on the attitudes of preservice teachers towards computers. While many researchers have studied computer attitudes, few have investigated the effects on attitudes of long-term participation in a computer course. Of particular interest to educators

are the effects of such a course on the attitudes of teachers. This study extended previous work conducted with preservice teachers.

In this study, participation in the course appears to have improved students' attitudes. Students' responses indicated that they liked computers more at the end of the course, had less anxiety about using computers, had more confidence in their ability to learn about and use computers, and generally valued computers more for education and for society in general.

The design of the computer literacy course itself was studied in an effort to begin to determine why attitudes may have improved so significantly on so many factors, particularly anxiety and confidence about using computers. Of importance was the fact that the course was systematically designed, based on sound principles of instructional development (cf. Dick & Carey, 1990; Gagne, Briggs, & Wager, 1988; Sullivan & Higgins, 1983). At the beginning of each segment of the course the preservice teachers were provided with a set of objectives which clearly described the skills and knowledge they would be mastering. Instruction, frequent hands-on practice, and objectives-based feedback were provided. Tests and projects measured skills and knowledge the students knew they were responsible for. (For a more complete description of the course, see Savenye, Davidson, and Smith, 1991). These preservice teachers, in fact, throughout the course frequently mentioned to instructors and the professors coordinating the course that they felt the course was clear and fair and that they were learning useful skills. They often said the significant amounts of hands-on practice made them feel more comfortable using computers now and later when they would be teachers.

Thus it appears that an intense, systematically-designed course emphasizing hands-on computer skills teachers would use later in their classrooms may have made the difference in making attitudes toward computers more positive. While it is difficult to manipulate these factors and experiences in existing college courses which often are required to teach certain skills by state mandate, future studies might be conducted to begin to parcel out which elements in such a course seem to be most effective. This could prove especially useful for practitioners who are responsible for designing short courses to train inservice teachers, and other computer trainers who need to know how to have the most impact in the shortest time.

That scores declined somewhat on eight of the fifty items does not appear to be of serious concern. First, the differences were not statistically significant. In addition, the decrease on at least one item was likely to have been due to the fact that the students had just completed an intensive summer course on computers. Athough their attitudes were still positive, students were not as likely at the end of their perhaps grueling experience to say, for example, that they would continue to think about an unsolved computer problem after class. The declines on a few of the other items seem to follow a pattern which appeared in the Savenye, et al., 1992 study. After learning about appropriate and inappropriate classroom uses of computers, students seem to have a less glowing overall opinion about the value of computers. They were somewhat less likely to indicate that knowing how to use computers is a worthwhile and necessary skill, and somewhat more likely to indicate that our country would be better off if there were no computers. Again, the latter response may simply be an indication of weariness of the topic of computers at the end of an intense course of instruction.

While the tendency of some of these primarily female students to regard computers as more of a male domain after their computer course than before was not significant, it may yet be worth investigating. While most of the students in the course were females, the two course instructors were foreign-born males. As Bandura (1986) has stated, role models can have a significant influence on behaviors. In her 1990 study on the effects of role models on student attitudes toward gender-appropriateness of careers, Savenye indicated that gender of the role model can influence perceptions of the gender-appropriateness of activities. It appears that a worthy research question would be the effects of the gender of the course instructor, and possible interactions with gender of student on student perceptions of how appropriate computer activities are for men and women.

Another interesting investigation might be to conduct a factor analysis, possibly by pooling many data sets, to determine how the fifty items load on factors derived from the theoretical and empirical literature mentioned in the introduction.

Conclusion

Many national studies have called for increased use of technology in school (cf. U.S. Congress, Office of Technology Assessment, 1989). Well-trained teachers are the key to effective use of technology. Snelbecker (1981) has suggested that teachers are the critical factor in successful implementation of technology in the schools. This study was based on the assumption that teacher success in learning about technology is partially dependent upon positive attitudes toward technology. That such an assumption is justified is supported by the work of such researchers as Stevens (1982). While this study indicates that a systematically-designed computer literacy course improves attitudes preservice teachers, future researchers should investigate the most powerful attitudinal factors related to computers, the instruments used to collect computer attitude data, the effects of gender of student and gender of instructor, and methods for directly influencing attitudes of teachers toward computers and other technologies.

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Table 1
Characteristics of the Preservice Teachers in the Computer Attitude Study

Characteristics						
1.	Major?	Education	Other			
		45	23			
		(66.2%)	(33.8)			
2.	Seeking certification?	Yes	No			
		58	15			
		(79.5%)	(20.5%)			
3.	Completed student teaching?	Yes	No			
		18	54			
		(25.0%)	(75.0%)			
4.	Currently teaching?	Yes	No			
		13	60			
		(17.8%)	(82.2%)			
5.	Number of previous courses in education?	0	1-2	3-4	5-6	>6 courses
		11	23	11	7	21
		(15.1%)	(31.5%)	(15.1%)	(9.6%)	(28.8%)
6.	Previous experience operating microcomputers?	0	few days to 1 mo.	1-6 mos.	7 mos	>1 yr.
		15	16	9	8	25
		(20.5%)	(21.9%)	(12.3%)	(11.0%)	(34.2%)
8.	Own or have easy access to a microcomputer?	Yes	No	Missing		
		29	43	1		
		(39.7%)	(58.9%)	(1.4%)		
9.	Taken any formal or informal courses in use of computers?	Yes	No			
		31	42			
		(42.5%)	(57.5%)			

Table 2
Pre- and Post-Course Mean Self-Ratings of Skills

Competency		PRE Mean	POST Mean
A.	How would you rate your typing skill?	2.58	2.91
B.	How would you rate your computer programming skill (in any language)?	1.34	2.82

Note. Scores range from 1 (nonexistent) through 2 (poor), and 3 (good) to 4 (excellent).

Table 3a

Pre- and Post-Course Mean Scores on Computer Attitudes

Items Worded Positively		PRE Mean	POST Mean	
Liking of Computers				
102.	I like using computers.	2.27	1.75	**
107.	I like using computers in my school work.	2.38	1.80	**
108.	I wish I could use computers more frequently at the university.	2.49	2.20	
110.	Once I start to work with the computer, I would find it hard to stop.	2.98	2.58	
112.	If a problem is left unsolved in a computer class, I would continue to think about it afterwards.	2.22	2.42	--
114.	A job using computers would be very interesting.	2.74	2.55	
116.	I look forward to using the computers at the university.	2.41	2.17	
121.	When there is a problem with a computer program I can't immediately solve, I would stick with it until I have the answer.	2.62	2.18	*
128.	I think working with computers would be both enjoyable and stimulating.	2.33	2.23	**
149.	Someday I will have a computer in my home.	1.69	1.55	
Anxiety (Or Lack of It) About Computers				
Value of Computers for Society				
101.	Knowing how to use computers is a worthwhile and necessary skill.	1.26	1.42	--
132.	I will probably need to know how to use a computer when I leave school.	1.88	1.68	
Value of Computers for Education				
105.	I will use my knowledge of computers in many ways as a teacher.	2.27	2.02	
122.	Learning about computers is a worthwhile and necessary subject for all prospective teachers.	1.71	1.71	

Table 3a, cont.

Pre- and Post-Course Mean Scores on Computer Attitudes

Items Worded Positively , cont.		PRE Mean	POST Mean	
Value of Computers for Education, cont.				
124.	It is important to know how to use computers in order to get a teaching position.	2.77	2.66	
134.	Supplying every student with a microcomputer is a worthy educational objective.	2.38	2.23	
135.	Teachers should demand that they be taught how to use microcomputers in their classrooms.	2.54	2.24	
136.	Microcomputers will require students to become active learners.	2.39	2.17	
139.	If we do not use microcomputers in school instruction, our students will grow up illiterate and deprived of a basic skill.	3.08	3.00	
140.	If my school district had the money, I would insist that they buy microcomputers in most every school subject.	2.81	2.38	*
145.	Computers can improve learning of higher-order skills.	2.21	2.13	
150.	Computers will improve education.	1.80	1.75	
Confidence About Learning About Computers				
103.	I feel confident about my ability to learn about computers.	2.42	1.72	**
125.	I know that if I work hard to learn about computers, I can do well.	1.64	1.60	
Confidence About Using Computers				
118.	I feel comfortable using computers.	2.75	2.11	**
131.	I am able to do as well working with computers as most of my fellow students.	2.33	1.97	
Perceptions About Gender-Appropriateness of Computer Use				
126.	Females can do as well as males in learning about computers.	1.36	1.38	--

Note. Mean scores range from most positive (1 = Strongly Agree) to least positive (5= Strongly Disagree). N may vary due to students skipping some items.
-- indicates an item for which responses were more negative after the course.
** pre/post differences significant at the p<.0001 level
* pre/post differences significant at the p<.001 level

Table 3b

Pre- and Post-Course Mean Scores on Computer Attitudes

Items Worded Negatively		PRE Mean	POST Mean	
Liking of Computers				
119.	Working with computers is boring.	3.68	4.03	
Anxiety (Or Lack of It) About Computers				
104.	Working with a computer would make me nervous.	3.48	3.98	*
109.	I get a sinking feeling when I think of trying to use a computer.	3.45	4.25	**
111.	Computers make me feel stupid.	2.95	3.69	**
117.	I'm not the type to do well with computers.	3.51	4.00	**
123.	Computers make me feel uncomfortable.	3.22	4.05	**
127.	Computers make me feel uneasy and confused.	3.30	3.95	**
129.	I think using a computer would be difficult for me.	3.51	3.98	**
Value of Computers for Society				
115.	I don't expect to use computers when I get out of school.	4.03	4.23	
133.	Computers are gaining too much control over people's lives.	3.35	3.66	

Table 3b, cont.

Pre- and Post-Course Mean Scores on Computer Attitudes

Items Worded Negatively, cont.		PRE Mean	POST Mean	
Value of Computers for Education, cont.				
137.	Microcomputer instruction will deny students the opportunity to reason with others.	3.46	3.73	
138.	Using microcomputers as a teaching tool puts too much additional work on already overburdened teachers.	3.60	3.73	
141.	Microcomputers will increase the amount of stress and anxiety students experience in schools.	3.47	3.64	**
142.	Microcomputers will decrease the amount of teacher-pupil interaction in schools.	3.15	3.58	*
143.	Microcomputers will isolate students from one another.	3.33	3.59	
144.	I object to all the attention being given to computer technology because it detracts from the real problems now faced by teachers.	3.50	3.69	
146.	Computers will displace teachers.	4.11	4.33	
147.	Computers will dehumanize teaching.	3.70	4.03	*
148.	Our country would be better off if there were no computers.	4.48	4.39	--
Confidence About Learning About Computers				
Confidence About Using Computers				
Perceptions About Gender-Appropriateness of Computer Use				
106.	Using a computer is more important for males than females.	4.71	4.45	--
113.	More men than women have the ability to become computer scientists.	4.62	4.58	--
120.	Using computers is more enjoyable for males than females.	4.60	4.56	--
130.	Working with computers is more for males than females.	4.65	4.52	--

Note. Mean scores range from most negative (1 = Strongly Agree) to least negative (5= Strongly Disagree). N may vary due to students skipping some items.
-- indicates an item for which responses were more negative after the course.
** pre/post differences significant at the p<.0001 level
* pre/post differences significant at the p<.001 level