Title	Computer attitudes of Singapore students: A developmental study
Author(s)	Cheng Yuanshan
Source	*ERA Conference, Singapore, 23-25 November 1998*
Organised by	Educational Research Association of Singapore (ERAS)

Computer Attitudes of Singapore Students: A Developmental Study

Cheng Yuanshan
National Institute of Education, Singapore

ABSTRACT

Recently, the Ministry of Education of Singapore strongly encouraged teachers to use Instructional Technology (IT) in their teaching. However, the success of using IT in teaching practice is decided not only by the teachers' knowledge or skills of IT, but also by the students' attitudes to the IT. The previous research findings have suggested that the computer attitudes, such as computer anxiety, influence the learning connected with computers. The present paper reports the computer attitudes of the Singapore students from a view of development. A survey relevant to computer attitudes was conducted to the students from primary schools, secondary schools, junior colleges and university in Singapore. The study results show the similarities and the differences of computer attitudes among different age groups. The study results also reveal the relationship between the computer attitudes and other factors, such as gender, computer knowledge, time of spending with computer. The study results will be useful for both IT police makers and the teachers who implement the police into their teaching practice.

INTRODUCTION

As the development of the technology in the world, information technology (IT) has been considered as the most important technology in the next century. The rapid development of IT has shown a great influence on almost every aspect of our society. With IT, the useful information relevant to our life becomes accessible instantaneously. It has displayed considerable impact on today's education: It provides new and fast ways for students at different levels to obtain useful knowledge and techniques beyond their textbooks. It will bring a new era for schools in both teaching and learning. For being the leader in the new IT era and infusing IT into teaching at schools, a special plan called Masterplan for IT in Education was launched by Ministry of Education of Singapore. The aim of this plan is to provide the schools with enough IT resources, so that they can use IT for up to 30% of the curriculum time.

For integrating IT into education as a classroom teaching and learning tool, both teachers and students are required to have the skills of using computer and the knowledge of different computer programs. For the students, the goal of computer implementation in education is the effective utilisation of computers by the entire student population. It is a new and interesting challenge to the students. During the computer implementation, another important aspect that may influence students to use and learn IT is their attitudes related to computers. The development and maintenance of a positive attitude toward computers are crucial for students to master required computer skills. For instance, with confidence and pleasure, students will be more active to learn computer programs and to use computers. Anxiety-free students will be more concentrated on working with computers and be more motivated to use different computer programs; they will be better in learning different computer skills. On the other hand, negative computer attitudes promote a resistance to learning about computers and influence the acceptance and use of technology (Woodrow, 1994). For a better implementation of IT, it is necessary for us to learn the students' feelings and attitudes toward the computers. The main goal of the present study is to examine the computer-related attitude of Singapore students.

In the research of computer-related attitudes, several different dimensions of the attitudes were studied. Among these dimensions, computer anxiety is studied most. For instance, Powers (1973) used physiological measures as the indicators to observe computer anxiety level. The study results showed that when people had more computer experience or

used computers more often, their computer anxiety level was lower. Although by the physiological measures different index can be used as indicators, most of the studies (e.g., Jordan and Stroup, 1982; Raub, 1981) on computer anxiety were conducted by using questionnaire to measure anxiety. For assessing computer anxiety, different questionnaires were developed. Another dimension of computer attitude studied rather often is computer confidence (e.g., Poage, 1991). The other possible dimensions of computer-related attitudes could be the enjoyment, interests, attitude to learning computer, and vision about the computer future usage.

The Masterplan for IT in Education requires the implementation of IT to all different levels of schools. In other words, all students at different ages and from different school levels are all required to use IT and to learn through IT in the future. However, studies show that the students at different ages develop differently in their cognition, emotion, personality, and attitudes. Without knowing the computer-related attitude difference of the students at different ages, and treat all the students as the same, the implementation of computer in schools will face great difficulty. Only a few previous studies have studied computer attitudes from a view of development. All of them involved in investigating the secondary schools students. For example, Comber, Colley, Hargreaves and Dorn (1997) conducted a survey to secondary school students of England, and found that the younger students (aged 11-12 years) had greater experience with computers and more positive attitudes toward computers than older pupils (aged 15-16 years). Woodrow (1994) used a survey form to measure the different dimensions of computer attitudes of grade 8 and grade 11 students in Canada. She did not reported significant difference on the computer attitude between the students in different age groups. The only significant difference is the interaction between gender and age: The gender difference is more pronounced in the 11^{th} grade. Another study (Loyd & Gressard, 1984) examined the computer anxiety, computer confidence, and computer liking among high school and college students in the United States. The study results showed that on these computer attitudes, no clear age difference was found between these two age groups. The present study will use three school levels of students (primary level, secondary and junior college level, and university level), to examine the development of computer attitudes of the students in Singapore. Thus the development of computer attitudes of Singapore students will be investigated with a wider age range. That will provide a better view of students' computer-related attitudes.

Gender difference is a big issue that has been paid a lot of attention in different educational and psychological studies. In tradition, computer and IT are considered as associated with science or math abilities, and in Western society males always perceive they have higher ability in these areas (e.g., Cheng, 1997; Eccles, 1985; Fennema & Sherman, 1977; Hyde, 1981; Stipek & Gralinski, 1991). Over past decade, the research focuses on gender difference has revealed the dominance of males in computer use (e.g., Miura, 1987). In some studies, females, on the other hand, have been found to be less positive in computer attitudes than males, they are less confident about computers and show more anxiety about using them (e.g., Siann, Macleod, Glissov, & Durndell, 1990; Temple & Lips, 1989). In their study, Camber and his colleagues (1997) found that except the dimension of enjoyment of computers, males had more positive attitudes toward computers than females in both age groups. However, some studies showed different results. For example, when computer experience was statistically controlled, no gender difference were found for computer anxiety or computer attitudes (e.g., Chen, 1986; Dyck & Smither, 1994; Ogletree & Williams, 1990). Unfortunately, the results could not been repeated, other studies, by using experience as a covariate variable in statistical analysis, still showed the gender difference on computer attitudes (e.g., Comber et al., 1997).

In Singapore, significant gender difference was not observed as common as in Western society. Studies did not show significant gender difference on their perception of their abilities (Cheng, 1997), their verbal, non-verbal, and quantitative developments (Seng & Tan, 1998), and in their most feelings and perceptions about schools and the world (Mau, Cheng, Lim & Chan, 1998). All these findings make it interesting to study the gender difference on computer attitude of Singapore students.

METHOD

Subjects

The subjects in the present study were 327 students from three different school levels in Singapore. In the primary school level, 102 subjects (aged from 9 to 11 years) were selected from one government-aided school and two neighbourhood schools. In the secondary school and junior college level, 108 subjects were obtained from one government-aided secondary school, one neighbourhood secondary school and one junior college (aged from 14 to 17 years). In the university level, 117 subjects (aged from 21 to 37 years) were selected from National Institute of Education, Nanyang Technological University. They are either from a two-year Diploma in Education program or from a one-year Post-graduate Diploma in Education program.

Instrument

One survey questionnaire was created and it consisted of three sections which covered the following areas: Demographic data of the students, the computer-related attitudes, computer usage and knowledge.

1. Demographic data

In this section the subjects were asked to report their gender, age, race, and to provide the information related to computer using of their family members.

2. Computer attitude

This section consisted 22 items which were adopted from different computer survey questionnaires, such as Anderson, Krohn, and Sandman's (1980) Minnesota Computer Leteracy and Awareness Assessment Instrument, Woodrow's (1991) computer attitude scales, and Speier, Morris and Briggs's (1995) computer attitude scale. All of the items are Likert-type statements with four selections. They were supposed to measure computer anxiety, computer confidence, enjoyment, interests, liking of learning and vision about the future of using computers.

3. Computer usage and knowledge

This section consisted some questions which asked subjects to identify if they have a computer at home; how many hours per week they usually work and play with computers. In this section the subjects were also asked to recall the names of computer games, the computer languages, and other programs they had played or heard before.

Procedures

The subjects were asked to complete the survey questionnaire in their class, under the supervision of their teachers. The teachers conducted the survey followed by the provided instructions. It took about 15 minutes for the subjects to answer all questions.

RESULTS AND DISCUSSION

Sub-scales

A factor analysis with varimax rotation was performed on the subjects' responses to the 22 items in the questionnaire and six factors of computer attitude were obtained. On the basis of the items loaded on different factors, descriptive names to these factors were given: "*Enjoyment*", "*Anxiety*", "*Confidence*", "*Vision*", "*Learning*" and "*Interests*".

Considering each factor as a sub-scale, the alpha reliability was measured for these sub-scales and the results are shown in Table 1.

Table 1. Reliability estimates of each sub-scales of computer attitude.

Sub-Scale	*Alpha Reliability*
Enjoyment	.756
Anxiety	.496
Confidence	.604
Vision	.550
Learning	.643
Interests	.643

General computer attitude

Different sub-scales consist of different number of items, for comparing the general computer attitude on different sub-scales a special average score for each sub-scale was calculated. These scores were obtained from the total score of each sub-scale divided by the number of the items in the same sub-scale. All the average scores from the sub-scale are shown in Table 2.

Table 2. Average score on each sub-scale of computer attitude.

Sub-Scale	*Average score*
Enjoyment	3.37
Anxiety	1.97
Confidence	3.10
Vision	3.50
Learning	3.23
Interests	2.91

In each single item, the value is ranged from 1 to 4, so the median value of each item is 2.5, and the same is for the average score. This median value means that subjects' average or general attitude is neither positive nor negative. Except the sub-scale of *Anxiety*, on the other five sub-scales the higher the average score is the more positive attitude the subjects have. We can see that all the average scores on these five sub-scales is greater than 2.5. For the sub-scales of *Enjoyment*, *Confidence*, *Learning*, and *Vision* the corresponding value is greater than 3. The highest value came from *Vision*, it closes to the maximum value 4. For the *Anxiety* sub-scale, a higher value means the subjects' anxiety level is higher and then to have the more negative attitude. The average value on this sub-scale is smaller than 2. That shows the students' anxiety level is not high in using and learning computers. All the average values shown in Table 2 reveal a rather positive general computer attitude of Singapore students. They have rather low anxiety, rather high confidence, interests, enjoyment on computer. They also show a fully understand the future requirement of IT and computer usage, with a rather high motivation to learn computer knowledge and skills.

Development of computer attitude

Considering the total score on each sub-scale as a dependent variable and the school levels as an independent variable, MANOVA was performed. The analysis showed that with the use of Wilks' Lambda criterion, the combined dependent variables were significantly different by different school levels (Wilks' Lambda = .68, $F_{(12,578)} = 7.40$, $p < .01$). The result can be explained as that the students at different school levels are different in their general computer attitude. For identifying the difference, follow up ANOVA was performed for each sub-scale. The group mean scores and F test results are shown in Table 3.

Table 3. Group mean scores and F test results of the students in different school levels on each computer attitude sub-scale.

	Mean			*F ratio*
Sub-scale	*Primary*	*Secondary+JC*	*University*	
Enjoyment	21.85	19.92	19.43	23.12**
Anxiety	5.53	6.45	5.67	6.22**
Confidence	6.22	5.25	5.63	22.61**
Vision	14.10	13.96	14.01	.148
Learning	10.52	9.34	9.43	18.13**
Interests	12.88	11.13	11.11	30.12**

Note: ** means F ratio is significant at 0.01 level.

The results show that except the sub-scale of *Vision*, the students showed very significant difference on the other five sub-scales. Post hoc (Tukey) tests showed that the primary students had more positive attitude than either secondary plus junior college or university students on four sub-scales: *Enjoyment, Confidence, Learning, Interests*. On these sub-scales, post hoc test did not show any significant difference between the students in the secondary plus JC level and the students from university. On *Anxiety*, Tukey test showed that secondary and JC students had higher anxiety level than either primary or university students, but there is no significant difference between primary and university students. There is no significant difference was found among different group of students on *Vision*.

From the group means shown in Table 3 and the all test results mentioned above, we can say that no mater what age the students are, or in which school levels, all of them have realised the importance of IT and computer usage in the future. To face challenge and requirement of the future, students will be motivated to learn computer and IT.

On the other sub-scales, although all students' attitudes are rather positive, the primary students seem to have the most positive attitude to computer and IT than the students in the other two groups. The other two groups of students seemed to have similar attitudes except anxiety. All of these showed that the secondary or JC students seemed to have the least positive attitude among the students in all groups. The results seemed to be consistent with the study results Comber et al. (1997) obtained in England: the younger students had the more positive attitude. Based on the results obtained from the present study, could we simply conclude that the primary students in Singapore have the most positive attitude toward computers and IT? Is their computer-related attitude really more positive than the students in the other groups? If we consider the students' responses on other questions, such as the knowledge of the computer programs and the time spend with computers, a different explanation might come out.

Table 4 shows the responses on three questions which required the subjects to name computer games, computer languages, and other computer programs they had heard. The correct answer in the table means that the subject correctly named at least one computer game, one computer language, or one program other than computer game and computer language.

Table 4. Percentage of the students at different school levels named computer game, language, or other program correctly and the relevant significant test.

	Percentage of correct answer			χ^2
Knowledge	***Primary***	***Secondary+JC***	***University***	
Computer games	66.3	71.0	70.1	.572
Computer languages	0	1.9	47.0	112.6**
Other programs	30.4	54.2	66.7	37.65**

Table 5 shows the percentage of different students having computer at home and the average time they work and play with the computers per week. These two questions indirectly indicate that if the students could easily access computers and their experience of using computers.

Table 5. Percentage of computer ownership and average hours of using computer per week of the students at different school levels.

	Primary	***Secondary+JC***	***University***	***All students***
Hours per week	2.21	6.10	8.83	5.94
Ownership	54.5%	87%	94.9%	79.2%

As shown in Table 4, there is no significant difference to name computer games correctly among the three groups. Around 70 percentage of the students in each group named at least one computer game correctly. We may say that all the students from different school levels have paid some attention to computer games or enjoyed playing computer games. However, to name the computer programs except games and computer languages, significant difference was found. Only around 30 percentage of the primary students named at least one program correct. It is rather low, since there are so many programs are used everyday in schools. For the other two groups of students more than half of them can correctly name at least one computer program. In naming computer languages, no primary student could correctly name any computer languages. Even for the secondary or JC students there only 2 students correctly named one computer language. There are high percentage of secondary or JC students named computer language incorrectly (38.9%): Some of them listed other programs, such as MsWord or PowerPoint; and some of them just listed some names of language, such as Chinese or Malay. That means they have no basic concept about computer language. Significant difference was also found among different student groups on the time of using computers. The average using time of primary students is rather low and 38.6% of them do not use or play with computers at all. The possible reason is that only half of them have computer at home.

Combine all the responses on these questions together with the computer attitude results, we may say that the primary students have more positive computer attitude but their attitude still based on playing with and interesting in computer games. They have no ideas about higher level of computer programs or computer techniques. The secondary or JC students are better than primary students in understanding and using computer programs, but they are still not that good as university students.

Gender differences

The means and relevant significant test between male and female students on different sub-scales of computer attitude are shown in Table 6. The computer ownership and average time spend with computer of the male and female students are shown in Table 7.

Table 6. Group mean scores of male and female students and F ratio on different sub-scales of computer attitude.

	Mean		*F ratio*
Sub-scale	*Males*	*Females*	
Enjoyment	21.34	19.81	21.08**
Anxiety	5.46	6.09	6.53**
Confidence	5.94	5.48	11.98**
Vision	14.09	14.02	.122
Learning	10.32	9.40	23.54**
Interests	12.26	11.31	16.33**

Note: ** means F ratio is significant at 0.01 level.

Table 7. Percentage of computer ownership and average hours of using computers per week of male and female subjects.

	Males	*Females*	*All students*
Hours per week	8.18	4.87	5.94
Ownership	79.6%	80.6%	79.2%

From Table 6 we can see that except on sub-scale of *Vision*, comparing with females, the male subjects showed significant more positive computer attitude on the other five sub-scales. They enjoy working and playing computer more; they are more interested in computers and confidence in using computers; and they want to learn more about computers. They also showed lower anxiety level in using computers. In time of using computers, they spend significant more time than females ($F_{(1, 316)} = 14.01$, $p < .01$).

When the variable of time spent with computers was considered as a covariate variable and controlled in CANOVA, the test results did not show much difference: Very significant difference between males and females still existed for the sub-scales of *Enjoyment, Interests, Confidence*, and *Learning*. On the sub-scale of *Anxiety* only a marginal significant difference was obtained ($F_{(1, 294)} = 3.53$, $p = .061$). The results seem to be partially consist with the findings of Camber et al. (1997).

The results seemed to repeat some previous study results obtained in other countries (e.g., Camber et al., 1997; Miura, 1987; Siann et al., 1990; Temple & Lips, 1989). However, the results obtained from present study showed a very interesting aspect of gender difference of Singapore students. In the previous studies, most studies found no gender difference of Singapore students (E.g., Cheng, 1997; Mau, Cheng, Lim, & Chan, 1998; Seng & Tan, 1998): There was no difference found between male and female students in their performance, cognitive developments, attitude to the world and schools. It is possible that IT is more attractive to the male students than females. The finding of present study provides us another aspect to see the gender difference of Singapore students.

GENRAL DISCUSSION AND CONCLUSION

The present study results show that all students at different school levels have rather positive computer attitude, from it we can see the optimistic aspect of the implementation of IT in Singapore schools. Especially all students consistently realise the importance of IT and computer usage in the future. That means if the corresponding requirements about computer knowledge and techniques are asked to the students, their beliefs will support them to learn.

In the present study, primary students showed most positive computer attitude in enjoyment and confidence of using computer, in interests in and in active learning computers. They also showed lower anxiety level in using computers. However, their most positive attitudes may be just on the basis of low level computer knowledge and computer skills. The possible reason for it is that they do not spend a lot of time with computers and only half of

them have computer at home. For these students, the teachers or policy makers can arrange more IT into their course curriculum, at the same time they may consider to provide these students more opportunities to learn and use computers in school.

The secondary, JC or university students did not show significant difference in most computer-related attitudes. The results of this study repeated the findings of Loyd and Gressard (1984). Comparing with primary students, although their computer attitude is less positive, they have the higher-level computer knowledge and skills, and they spend more time with computers. For them, during the implementation of IT, the specific computer courses may be provided. At the same time the assessment on IT and computer knowledge may also need to be implemented.

The gender difference showed on computer attitude and time of using computer is need to be considered when IT is implemented in classroom teaching and learning.

During the last two decades, the computer attitude studies do not show a systematic investigation. The present study results were only based on a small sample of Singapore students and it can only be considered as a preliminary investigation on the computer attitude of Singapore students from the developmental perspective.

REFERENCES

Anderson, R. E., Krohn, K. & Sandman, R. (1980). *User's Guide for the Minnesota Computer Literacy and Awareness Assessment.* St Paul, Minn: Minnesota Computing Corporation.

Chen, M. (1986). Gender and computers: the beneficial effects of experience on attitudes. *Journal of Educational Computing Research, 2,* 265-282.

Cheng, Y. (1997). Expectation and learning outcome of university students. *Paper presented at the annual conference of Educational Research Association of Singapore.* Singapore.

Comber, C., Colley, A., Hargreaves, D.J. & Dorn, L. (1997). The effects of age, gender and computer experience upon computer attitude. *Educational Research Vol 39 (2),* 123-133.

Dyck, L.& Smither, J.A. (1994). Age differences in computer anxiety: The role of computer experience, gender and education. *Journal of Educational Computing Research, 10(3),* 239-248.

Eccles, J. (1985). Sex differences in achievement patterns. In T. B. Sonderegger (Ed.). *Nebraska symposium on motivation, 1984: Psychology and gender* (Nebraska Symposium on Motivation Series: Vol. 32, pp97-132). Lincoln, NE: University of Nebraska Press.

Fennema, E. & Sherman, J. (1977). Sex-related differences in mathematics achievement, spatial visualization, and affective factors. *American Educational Research Journal, 14,* 51-71.

Hyde, J. (1981). How large are cognitive gender differences? A meta-analysis using ω and *d. American Psychologist 36,* 892-901.

Jordan, E.W. & Stroup, D.F. (1982). The behavioral antecedents of computer fear. *Journal of Data Education, 22,* 7-8.

Loyd, B.H. and Gressard, C. (1984). The effects of sex, age, and computer experience on computer attitudes. *AEDS Journal, vol. 18,* 67-77.

Mau, R.Y., Cheng, Y., Lim, T.K. & Chan, T.F. (1998). Developing resilience: The role of teachers. *Paper Presented at Annual Conference of Educational Research Association of Singapore.*

Miura, I.T. (1987). Gender and socioeconomic status differences in middle-school computer interest and use. *Journal of Early Adolescence, 7,* 243-254.

Ogletee, S.M. & Williams, S.W. (1990). Sex and sex typing effects on computer attitudes and aptitude. *Sex Roles, 23,* 703-12.

Poage, J.A. (1991). Computer Confidence: A factorial model for the prediction of success in an introductory computer classes for preservice teachers. ERIC NO: ED333859.

Powers, W.G. (1973). The effects of prior computer exposure on man-machine computer anxiety. *Paper presented at The International Communication Association Convention.* Montreal, Canada.

Raub, A.C. (1981). *Correlates of Computer Anxiety in College Students.* Unpublished Doctoral Dissertation, University of Pennsylvania.

Seng, S.H. & Tan, A.G. (1998). Cognitive development of secondary school students in Singapore. *Paper presented at Annual Conference of Educational Research Association of Singapore.*

Siann, G., Macleod, H., Glissov, P. & Durndell, A. (1990). The effect of computer use on gender differences in attitudes to computers. *Computers in Education, 14,* 183-191.

Speier, C., Morris, M.G. & Briggs, C.M. (1995). Attitudes towards computer: The impact on performance. *Paper presented in the AIS Americas Conference on Information System.*

Stipek, D.J. & Gralinski, J.H. (1991). Gender differences in children's achievement-related beliefs and emotional responses to success and failure in mathematics. *Journal of Educational Psychology, Vol. 83, No. 3,* 361-371.

Temple, L. and Lips, H.M. (1989). Gender differences and similarities in attitudes toward computers. *Computers in Human Behavior, 5,* 215-226.

Woodrow, J.E.J. (1994). The development of computer-related attitudes of secondary students. *Journal of Educational Computing Research, 11(4),* 307-338.