Title  The impact of computers on teachers: A general computer attitude study of
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The Impact of Computers on Teachers: A General Computer Attitude Study of Teachers in Singapore

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ABSTRACT

The information technology (IT) masterplan for education is a blueprint for the integration of IT in education as a strategy to meet the challenges of the 21st century. IT-based teaching and learning will be a key strategy for equipping the young with the skills needed in future. But before this can be achieved, teachers must first be made to master IT, so there is a need for them to undergo intensive computer training to be confident enough to use IT in the classroom. This study is carried out with the purpose of measuring the general computer attitude of these teachers by using an adapted scale designed in the form of a survey questionnaire. The general computer attitude is defined by four dimensions: computer anxiety, computer in-confidence, computer learning and usage in-attitude, and future in-perception on the wide use of computers (in-vision). A short interview with a small sample is also carried out. Results show that the general computer attitude of teachers is positive, based on the results derived from the four sub-scales.

INTRODUCTION

Today, teachers in Singapore are facing a tremendous challenge in their career with the integration of information technology (IT) in schools under the IT masterplan for education. But before IT can be put to good use, teachers must first be equipped with basic computer skills. They must go through a series of IT training and be confident in using IT in their classroom teaching. How do these teachers feel whenever they face new technology? A number of studies carried out overseas which involved mostly pre-service teachers are in the area of computer attitude. These studies covered common dimensions like anxiety, confidence and so on and using such scales as Reece and Gable’s (1982) Attitudes Toward Computers, Gressard and Loyd’s (1986) Computer Attitude Scale (CAS), Maurer’s (1983) Computer Anxiety Index (CAIN) or Raub’s (1981) Attitude Toward Computer (ATC).

This paper looks at the impact of computers on teachers with respect to their general computer attitude and how variables like age, gender, level taught, experience, training and computer ownership affect this attitude. Generally, it has been known that teachers’ attitudes towards computers affect the instructional use of computers and the likelihood of profiting from training (Kluever et al., 1994). While teachers’ negative attitudes on computer education seemed to be due to their lack of knowledge and experience (Summers, 1990), there could be other factors that affect teachers’ attitude in Singapore that need to be studied.

The introduction of new technology in the classroom has always been met with resistance from teachers. It takes a rare breed of teachers to implement technology into the classroom (Reed, Anderson, Ervin and Oughton, 1995). Fear of change seems to be a major contributing factor among teachers here as well as everywhere. This fear of change is related to anxiety which is defined as the state of being troubled and uneasy in mind, the state of causing worry and eagerness (The Oxford Study Dictionary, 1992). Anxiety that is associated with the use of computers is termed as computer anxiety and this is one of the factors that is embodied into the general computer attitude that attracts most attention.
There have been many definitions of computer anxiety in the literature. Rohner and Simonson (1981) describe it as the "mixture of fear, apprehension, and hope that people feel when planning to interact or when actually interacting with a computer. Because of this feeling, people who are computer anxious, when given the choice between using and not using a computer, often choose not to use." Maurer (1983), on the other hand, defines computer anxiety as "the fear and apprehension felt by an individual when considering the implications of utilizing computer technology, or when actually using computer technology. The individual is in the state (of computer anxiety) because of the fear of interaction with the computer even though the computer possesses no immediate or real threat." Cambre and Cook (1987) define it as "... the fear of using computers as measured by psychological changes or responses on self-report instruments." Kolehmainen (1992) considers this type of anxiety as "... a fear of prejudice, which appears when one is using computer technology, or when one is thinking about the consequences of their use."

The effect of computer anxiety on teachers in Singapore is definitely something that we would like to include in this general computer attitude study. The level of computer anxiety among teachers will affect the way training should be set up as well as how comfortable teachers are in learning and imparting knowledge the IT way.

Besides computer anxiety, computer confidence is also an important factor. Computer confidence is different from computer anxiety as it relies more on a person's own knowledge and experience. This may not be the case for computer anxiety. Confidence is defined by the Oxford Study Dictionary (1992) as the feeling of certainty, self-reliance and boldness. When a teacher is confident in using the computer, he is not likely to be afraid of exploring the benefits of IT nor is he afraid to make mistakes during his contact with the computer and the application he is running. When he is confident, he is in control of the situation. His general computer attitude will then have to depend partly on how confident he is in the way he handles the computer.

A study carried out by Levine and Donitsa-Schmidt (1997) proposed a causal model relating measures of computer-experience, computer-related attitudes, computer-related confidence and commitment to computer learning. It was based on attitude-behaviour theory which suggests that beliefs about an object lead to an attitude toward it, and that attitudes are an important precursor of behaviour. The model hypothesises that computer attitudes and computer confidence reciprocally affect one another in a positive way, and that both positively affect commitment to learning. The results of this study could provide some insight into the attitude-behaviour theory which can be extended to adult teachers.

Poage (1991) finds that confidence contributed significantly to the success of students. Although five factors related to confidence in the study were derived, this study, however, focused on the general computer confidence in using computers which may not encompass all the factors.

Teachers' attitude towards learning and using computers is indeed a factor that will determine whether teachers will make progress in acquiring the skills needed to manage IT in the classroom. The interview conducted in this study revealed that if teachers' attitude towards learning the use of computers was negative to begin with, then little could be done to motivate them. This may not be totally true since there are strategies that can be used to bring about changes in the person's attitude.

Most teachers want to use technology, but their use has been limited to fairly narrow applications (Huang, Waxman & Padron, 1995). The researchers found that there were few research studies that addressed teachers' attitudes toward technology. Earlier studies of teachers' perception on technology had found that High School student teachers viewed technology as being more effective than elementary school teachers (Padron, 1993), and that attitude changed more positively with respect to using computer instruction (Brownell, Brownell & Zirkler 1993). Teachers who were comfortable with technology use
and were aware of ways it could help them, did their jobs better (Sheingold & Hadley, 1990). In most other studies conducted, computer anxiety and computer confidence were always included as the main focus with age, gender and experience as the independent variables.

The general computer attitude of teachers in Singapore in this study was measured by an adapted instrument that encompasses four dimensions of interest—computer anxiety, computer in-confidence, in-attitude towards learning and using computers and future in-perception of the use of computer (in-vision). The research questions set out in this study were as follows: Are Singapore teachers' general computer attitude towards IT and the use of computers in schools positive? Which dimension(s) of the general computer attitude is (are) predominant among teachers in Singapore? Are there any gender-differences? Are there age-differences among teachers in Singapore as far as their general computer attitude is concerned? What are the roles of training and experience in determining whether teachers develop the required general computer attitude that enable them to accept IT and use the computers in schools?

**METHOD**

Subjects

The subjects were selected from an audience of teachers attending a conference held at the end of the year in 1997. They were made up of male and female teachers from primary and secondary schools and a junior college. They came from various ages and were teaching various subjects. One-hundred and seventy-three teachers (n=173) completed the general computer attitude survey questionnaire from out of a total of two-hundred and fifty forms distributed (70% return).

Questionnaire and procedure

The adapted research instrument was a single page survey questionnaire. The first part comprised of six demographic variables—gender, age, school level taught, computer training, computer experience and computer ownership. The second part was devoted to the measure of the proposed general computer attitude with 20 items in a 4-point Likert-scale format. The dimensions of interest were computer anxiety, computer usage and learning in-attitude, computer in-confidence and computer future in-perception (in-vision). The third part of the questionnaire required the respondents to give additional open-ended feedback on how IT and computers had affected them and their work. The survey questionnaire was made simple to read and was made to fit a single sheet of paper. As a follow-up study, six teachers were interviewed.

**RESULTS**

The current general computer attitude of teachers in Singapore was found to be generally positive. The average of all item mean was computed as 1.685. This was within the "strongly agree" and "agree" range of the scale and was interpreted as a positive response to the survey. This meant that more could be done for teachers to acquire the range of IT skills through well-designed training programmes that would elevate their existing level of competence. With this positive general computer attitude and the continued support from the relevant authorities, teachers in Singapore would be willing to further explore the scope of the technology and the instructional methodology, and integrate these into their curricula.

In order to determine the dimensions or sub-scales that showed dominance in the overall general computer attitude, factor analysis was carried out on the 20 items in the questionnaire. The method of Principle Component Analysis with Oblimin rotation was
chosen to determine the factor loading of each item. A factor loading of .40 was chosen as the criterion for the lower bound of meaningful loading. The items converged into four factors—computer anxiety, computer in-confidence, computer learning and using in-attitude and computer in-vision.

Chart 1 below shows the mean score of the four general computer attitude dimensions.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Mean Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anxiety</td>
<td>1.88</td>
</tr>
<tr>
<td>Learning &amp; Using in-Attitude</td>
<td>1.88</td>
</tr>
<tr>
<td>In-Vision</td>
<td>1.46</td>
</tr>
<tr>
<td>In-Confidence</td>
<td>1.47</td>
</tr>
</tbody>
</table>

The mean for anxiety was 1.88, computer learning and using in-attitude was 1.88, in-vision was 1.46 and in-confidence was 1.47. Teachers in Singapore possessed a good vision of the future use of IT and computers in school and were confident in using the computers. The means for anxiety and learning and using computers in-attitude dimensions on the other hand, were somewhat higher than in-vision and in-confidence. In view of this, teachers general computer attitude could be improved further by carefully examining and working on these two dimensions: computer anxiety and computer learning and using in-attitude.

There could be many reasons to explain why teachers' attitude towards learning and using computers could be attributed. It could be personal, environmental or even provoked. The feedback from the interview confirmed the notion that when teachers' computer learning and using attitude was negative, effort to train the teachers could be impeded significantly. Computer learning and using attitude among teachers can be improved if these teachers were given more opportunities to attend training sessions that emphasised the benefits and improvements in teachers' production capabilities when computers were being used as a tool.

The descriptive statistics showed that there were more female teachers (134) than male teachers (39). The majority of teachers (99) were young teachers below 35 years of age. There were 51 middle-age teachers (between 35 and 45 years old) and 23 senior teachers (above 45 years old). Most teachers were from secondary schools (86). There were 61 teachers from primary schools and 26 from the junior college. About 73 teachers had gone the most training (more than 10 sessions), 71 had gone some training (5-10 sessions) and 29 the least (less than 5 sessions). Teachers with most experience (more than 3 years) totalled 111 teachers, while those with some experience (between 1-3 years) numbered 44. Eighteen teachers had less than 1 years' experience. Most teachers (153) owned a computer. Twenty teachers in the survey did not own a computer.
There is also a need to know whether there were any differences between the general computer attitude of male and female teachers. In this study, the variable gender was tested by ANOVA on experience and training. It was found that there was no significant difference on experience. This showed that there was no difference in experience for male and female teachers in Singapore. There was also no significant difference on training. This meant that the Ministry of education or other training agencies had given the same opportunity to male and female teachers in its training schedules teachers attended. There was no discrimination on the approach adopted in training teachers.

There was also no significant gender difference when MANOVA was performed using all sub-scales as dependent variables. This meant that there was no difference in the general computer attitude of male and female teachers in Singapore.

In all other sub-scales, no significant difference was found. Some previous studies showed gender differences while others did not. In the study by Massoud (1994), significant results were found for computer anxiety, computer liking and computer confidence and gender which showed that males had more positive attitudes than females towards computers. Cambre and Cook (1987), also found significantly higher anxiety in females than males. Dyck and Smither (1994) found that there was no gender differences for computer anxiety and computer attitudes when experience was controlled.

For Singapore teachers, no gender differences in their general computer attitude were found. A similar result was also found by Jones and Wall (1985) who claimed that there were no gender differences in computer related activities. Teachers interviewed also supported the fact that gender was not considered a factor in teachers' general computer attitude. On the other hand, the perception that age could be a factor in determining the general computer attitude was raised among teachers interviewed. Some felt that older teachers were more resistant to IT and the use of computers, at least in their school. Others felt that there was no difference in the age group as everyone was in a similar boat. Yet others felt that the senior ones were more receptive on the use of IT than the rest.

Significant difference was found in this study for age on one sub-scale—computer anxiety. The mean difference of -1.780 was significant at the .05 level for age group 1 (below 35 years old) and age group 2 (35 - 45 years old). Teachers in age group 2 were more anxious than those in group 1. The mean difference of -2.241 was also significant at .05 level for age group 1 and age group 3 (more than 45 years old). Teachers in age group 3 were more anxious than those in group 1.

<table>
<thead>
<tr>
<th>Mean for Anxiety vs Age Group</th>
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<tbody>
<tr>
<td>Anxiety</td>
</tr>
<tr>
<td>Age Group 1: below 35 years</td>
</tr>
<tr>
<td>Age Group 2: 35 - 45 years</td>
</tr>
<tr>
<td>Age Group 3: above 45 years</td>
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Chart 2 - Mean for Anxiety by Age
From the above results, we can say that older teachers were most anxious about using computers than the other two groups of teachers. Middle age teachers in the range between 35 and 45 years of age also seemed to have a higher level of anxiety than younger teachers. The results showed that the younger teachers were the least anxious about computers as compared to the rest of the teachers. There were no significant results for age with the other three sub-scales.

On the roles of training and experience in determining whether teachers develop the required general computer attitude that enable them to accept IT and the use of computers in schools, most part of the research study involved experience, training and age. A two-way MANOVA was carried out for age and experience while at the same time controlling training as a covariate variable. MANOVA showed that there was a significant influence of experience on all sub-scales. No interaction effect was found. Age was not significant.

This finding was consistent with that of previous studies. Computer experience as manifested in the amount of exposure one obtained from using computers was indeed a strong factor in deciding the general computer attitude of teachers, students, professionals as well as other users in studies carried out elsewhere.

Following a univariate analysis, experience showed significant difference on two sub-scales—computer anxiety, and learning and usage in-attitude. The result on computer anxiety was supported by Loyd and Gressard (1986) who found that limited computer experience was a factor influencing computer anxiety.

<table>
<thead>
<tr>
<th>Anxiety vs Experience Group</th>
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<tbody>
<tr>
<td>Experience Group 1 Less than 1 Year</td>
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<tr>
<td>Experience Group 2 1 - 3 Years</td>
</tr>
<tr>
<td>Experience Group 3 More than 3 Years</td>
</tr>
</tbody>
</table>

Post Hoc Test using Tukey HSD on the sub-scale—computer anxiety, revealed a significant mean difference among teachers whose experience were less than 1 year (group 1), teachers whose experience were between 1 to 3 years (group 2), and teachers whose experience were more than 3 years (group 3). Mean differences between group 1 and group 2 was 2.5707 (p<.05) which means that teachers in experience group 1 had a higher anxiety level than those in group 2. Mean difference between group 2 and group 3 was 2.8182 (p<.01) which means that teachers in experience group 2 had a higher anxiety level than those in group 3. Mean difference between group 1 and group 3 was 5.3889 (p<.01) which naturally means that teachers in experience group 1 had an even higher anxiety level than those in group 3. From these we could conclude that teachers who were most experience were the least anxious. This was followed by teachers with some experience and finally teachers with the least experience were the most anxious.
Tukey HSD Post Hoc Test showed that on the sub-scale—learning and using computer attitude, there was a significant mean difference among teachers whose experience varied. (Note: Low mean on this sub-scale meant more positive attitude). Mean difference (Mean difference (n=173)=2.333, \(p<.05\)) was significant between experience group 1 (teachers with less experience) and experience group 3 (teachers with most experience). This showed that most experience teachers had more positive learning and using computers attitude than less experience teachers. In general, we could conclude that teachers attitude on learning and using computers can be improved if teachers were given the necessary exposure on IT and the use of computers. The first step towards this would be to make sure that teachers can access the computers freely any time they feel like it. In this respect, access to computers was a key factor in raising teachers experience.

Similar analysis was performed for training and age when experience was controlled. Significant difference was found for age on the sub-scale—computer anxiety and for training on the sub-scale—learning and using computer in-attitude.

On the sub-scale—learning and using computers in-attitude, the mean difference for teachers in the training group 1 (less than 5 sessions) and that of teachers in training in group 2 (between 5 and 10 sessions) was -1.8504 (\(p<.05\)). Noting that lower mean difference in this sub-scale meant more positive learning and using computers attitude, teachers with less training had more positive attitude than teachers with some training. These group of teachers were more eager to learn and use computers as they wanted to find out more. On the other hand, those who already had some training, were less positive. Clearly, this could present itself as an area of concern. Possible reasons could be attributed to the way the training was conducted: Were there provisions for varying levels of training designed to meet teachers of differing age group? Were teachers comfort taken into consideration in terms of schedules, duration of training and expectations? These considerations would be important for planners and trainers if teachers were to benefit from the training they were given.

Teachers interviewed generally felt that training and experience helped them a lot in their struggle to master IT and the use of computers in school. They were also appreciative of the government’s computer purchase scheme to encourage teachers to buy computers. ANOVA showed there was a significant influence on computer experience (\(F(1,171)=7.683, p<.01\)). The mean for experience for those without computers (mean (n=20) = 2.15) was lower than for those with computers (mean (n=153) = 2.56) (\(F(1,171)=7.683, p<.01\)). Hence, teachers who own computers had more experience than
those who did not. This finding was similar to the study done by Harvey and Wilson (1985) who reported that those who own computers had more positive attitudes toward computers than those who did not have computers at home.

**DISCUSSION**

The current assessment of the general computer attitude was that teachers in Singapore are positive towards the use of IT and computers in school. But, the concern that seemed to bother them very much was time factor. Teachers interviewed also agreed on this. They found that more time would be needed to prepare lesson plans when computers were used. Time was also needed to explore and navigate the application programmes in order to select the best contents and the approach to integrate them into the lesson. In other studies, possible hindrances related to technology integration include: teachers’ lack of personal free time to develop IT lessons, too few computers per student, not enough time in school time-table for computer-based instruction, and lack of expertise (Loyd & Gressard, 1986).

Teachers also found difficulty in applying what they learnt in an IT training to suit the classroom environment. They felt that mastering to learn how to use the computer was one thing and that teaching using the computer was quite another. They were not taught sufficient strategies on how to use IT for classroom teaching in a real situation and in a physical sense. What they were taught were theories or suggestions that were not tested on the ground. Teachers could not find a comfortable link to work with given what they learn in the training could not be translated into what they could do with IT in the classroom. Teachers also found that although they were overwhelmed with vast information, many were either lacking in relevance or were not specific enough for them to consume. The insufficient pool of relevant resources for teachers to use must be addressed. It would take a while for this to be resolved as time would be needed for software houses to produce the titles and applications in order to meet current needs. In this respect, the Ministry of Education had initiated a partnership scheme with software companies and vendors to customise courseware and applications relevant to the local needs in addition to setting up a software clearing-house. Teachers were also of the opinion that IT should not be used for the sake of using it. Rather, when the lessons lent themselves to the use of IT, only then should IT be used.

In studies where there were gender differences, cultural biases and sexual discrepancies might have a great effect on females’ attitudes toward the computer as suggested by Jackson and Yamanaka (1985) and Collins (1985). In Singapore, however, such biases could generally be seen to be fading off.

There was age difference in term of the level of computer anxiety found in this study. Results of prior research on the relationship between age and computer anxiety were mixed, with most studies reporting no age differences (Gilroy & Desai (1986), Massoud (1991) and Woodrow (1991)). The finding of this study not only found age significance but seemed to contradict the research finding of Dyck and Smither (1994) who found that older adults (55 years and above) were less computer anxious than younger adults. The difference in the finding could be attributed to the nature of the sample in terms of the profession. This study made specific reference to teachers and not to a sample with mixed profession.

Teachers from all the age, training and experience group possessed a positive vision as they perceived the importance of IT and the use of computers in the future. This enhances their belief that they need to acquire the necessary skills in order to be relevant to the profession. They are working toward acquainting themselves with the new technology and are willing to attend courses and workshops sponsored and organized by the Ministry of Education as well as on their own. This is despite the prevailing complaint of time factor.
Experience was found to be a major significance in determining the general computer attitude of teachers in Singapore. In fact, among those who are able to overcome some of these hindrances are teachers who have had prior experience with computing (Hunt & Bohlin, 1991). Teachers gain more experience if there were ample opportunities to sign up for training and if access to computers were made readily available. In this respect, the training courses that are lined up for teachers would present them with the challenge that they would definitely take up.

**REFERENCE**

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