

would be organized within the ongoing process control plan (OPCP) and failure mode and effects analysis (FMEA) documentation tools. More than likely, in most cases only one or two of the tools will be used. But the array of tools available for analysis should not be underrepresented. Likewise, the number of iterations with any one tool, to continue to interpret and understand the overall problem circumstance for improvement, will vary. The quality of the problem solution, and overall robustness, will determine the number of iterations that need to occur. This implies important technologist roles and relationships as a data analyst.

Synchronous Leader, Action

The final phase in a problem solution includes recommendations in the form of leadership and action, an important component of the professional

development of the technologist. Actions may consist of new procedures to be followed, new equipment to be procured based on conclusions that processes analyzed were not capable, or others. This will drive the establishment of new standards, training approaches, and perhaps other studies. For example, if it is determined that new equipment is needed to implement a solution and improvement, new studies and iterations will likely be required. This is what ongoing improvement is about, of course, as depicted in Figure 5. It would be quite common, for example, to determine that additional training is required or better gaging is needed, or to identify shifts from one characteristic to another. Unquestionably, however, the costs of such actions will need to be detailed and presented with justifications for changes, and improvements brought forward.

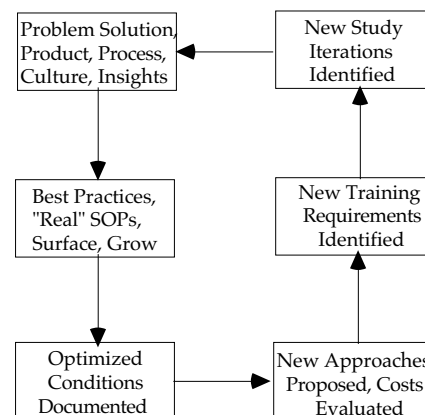


Figure 5. Ongoing improvement systems result from technologists' leadership behaviors.

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5. Teachers' Attitudes Toward Computer Use

by Sherry Hill Howie and Jia-Rong Wen

In recent years global demands for knowledge about and application of technology have greatly impacted educators. However, research shows a resistance of teachers to new innovations that affects their levels of usage and stages of concern (Hall, 1977; Kluever, 1992). Because technology in education is an innovation that impacts education, it is valuable to assess teachers' attitudes as they learn and adapt to changes in technology. A cross-cultural comparison of teachers' attitudes may lend more insight into areas affecting attitudes. By learning about teachers' attitudes toward using computers in education, teacher training may be planned better to address concerns and needs of teachers as they learn about technology.

For this purpose, we compared teachers in the Republic of China (ROC) and the United States in their attitudes toward using computers in teaching. We also sought information on the degree to which middle school teachers have accepted computers. Cultural and other differences prompted us to expect a significant difference in attitudes between the two groups of middle school teachers we surveyed, which included

junior high school teachers of Taiwan, ROC, and San Bernardino County Schools, California—the latter group being surveyed six months after the first group. Taiwan geographically is 14,000 square miles in size with 716 junior high schools, while San Bernardino County is 20,000 square miles (largest county in the USA) with 37 school districts and 66 junior high/middle schools. For the survey in Taiwan, 100 out of 716 junior high schools (from the seventh to ninth grade) were selected by random sampling. Each of the 100 schools received five surveys for principals to distribute to teachers. Of the 500 surveys, 412 were returned, yielding a response rate of 82.4%.

For the survey in San Bernardino County, 66 middle schools were selected at the same time, each receiving 10 copies of the questionnaire. Of the 660 questionnaires sent, 203 were returned, which resulted in a response rate of 30.7%. The total number of surveys returned for both Taiwan and San Bernardino was 615.

The authors designed the questionnaire. The three psychological areas that affect attitudes are reflected in the survey questions. These areas, adapted

from the research of Gardner (1993), Kluever (1994), and Massoud (1991), measure fondness for, confidence in, and perceptions of usefulness of computers in education. The questionnaire used 15 questions and a Likert scale of five options: Strongly Agree, Agree, Not Sure, Not Agree, and Strongly Disagree.

BACKGROUND

The Ministry of Education for the ROC of Taiwan started to infuse computer-assisted instruction (CAI) into education more than 20 years ago. Today, more than 4,000 teachers have been trained, and they have developed thousands of CAI materials that have been sent to every school of every level for teachers to use as teaching aids. However, despite much effort, including two Six-Year Plans for infusing CAI and training teachers, very few Chinese teachers used computers in teaching after 15 years of promotion (Wu, 1992).

A problem faced by Chinese teachers is using Chinese characters in a western-developed technology. The computer design follows western cultural backgrounds and living habits. Keyboards, for example, are developed by the orientation of the alphabetic

order, and all the other peripheral input and output equipment are developed with consideration of English users. Thus, using advanced computer technology for input and output of Chinese characters is inconvenient. In Taiwan, the input of Chinese characters into computers is usually done by separating the character roots or using phonetic symbols. This process is difficult and slow and greatly hinders Chinese teachers' or students' willingness to use the computers. Since there are differences in cultural backgrounds and social situations between the Republic of China and the United States, the attitudes toward using computers may be different; therefore, there may also be differences in the development of computer education in each country.

In teacher training in CAI, teachers in Taiwan sign up for classes on a voluntary basis and may wait as many as four years before they are able to take classes at the regional universities where programs are administered through the ROC Ministry of Education. In contrast, in San Bernardino County, California, new teachers are required by the state to have training in computer applications to earn teaching credentials. This requirement is implemented through university teacher training programs, and continual updating is available through district and university in-services.

Other important differences lie in the fact that 50% of USA students own their own computers, according to a 1992 study by the International Association for the Evaluation of Academic Achievement, compared to less than 5% of students in Taiwan. That study, "Computers in American Schools, 1992: An Overview," also found that 99% of schools in the United States have computers. Furthermore, schools in Taiwan have only IBM machines, while schools in the United States use many different brands, some of which do not share software. Hardware in US schools tends to be older than machines in Taiwan. In contrast, Taiwan has a centralized plan to use computers in schools throughout the island, but the United States has 50 state plans with no centralized administration of a national plan. Taiwan's plans are funded by the government, but each state in the United States is funded according to the state budget. These are differences between the two

societies that may influence differences in teachers' attitudes.

WHAT WE LEARNED

Our original expectation that middle school teachers of the ROC and the USA do have significant differences in their attitudes toward using computers was affirmed. The teachers of both groups have positive attitudes, but they are significantly different in the degree to which they like using computers, see usefulness of them in teaching, and have confidence in their abilities to use them. The attitudes toward using computers of teachers in the Taiwan group are not as positive as those of teachers in the USA group.

The data showed that there are two points on which teachers of Taiwan have much more positive attitudes toward using computers than teachers of the USA: (a) If they understand how to use computers, teachers of Taiwan are more eager to use them than teachers of the USA are, and (b) the Taiwanese group is more eager to research and study cooperatively with other teachers in learning about computers than teachers of the USA group.

We found that the attitudes of Taiwanese middle school teachers who graduated from universities differ significantly from Taiwanese teachers with other educational backgrounds. Teachers who graduated from universities were more positive and accepting in their attitudes than teachers from other backgrounds. Also, Taiwanese middle school teachers who graduated from different departments showed significantly different attitudes toward using computers. For example, teachers who graduated from departments of natural sciences, engineering, and education differed significantly in their more positive attitudes from teachers who graduated from other departments. Lastly, Taiwanese teachers with 5 years or less of experience had more positive and affirmative attitudes toward using computers than those with 6 or more years of experience.

The results of the analyses and comparisons for both Taiwanese and the American middle school teachers' attitudes toward using computers may be summarized as follows:

The attitudes of Taiwanese middle school teachers toward using comput-

ers change according to the following variables:

1. Teacher's age—the older teachers manifest more passive attitudes toward using computers.
2. Highest educational background—the teachers with higher degrees in educational backgrounds have more positive and affirmative attitudes toward using computers.
3. Departments they graduated from—teachers who graduated from departments of natural sciences, engineering, and education have more positive attitudes toward using computers.
4. Years of teaching experience—this may be related to age. Teachers with more than 6 years of teaching show much more negative and conservative attitudes toward using computers than teachers with 5 years or less of teaching experience.

The attitudes of the American middle school teachers toward using computers do not change according to the variables of sex, grades, courses, age, highest educational background, departments, and years of teaching experience, indicating that in the USA it is quite a common idea to use computers for everyday purposes, and people of the USA often regard using computers as a matter of course. Because of the commonness of computers, they have more positive attitudes.

Computers are the products of scientific civilization and have a close relationship to conduct of human lives. It is an inevitable trend that computers be used in teaching for better education in an information age. However, people usually need time to accommodate or adapt themselves to new innovations. The findings from the analyses and comparisons of the data (in the three psychological areas affecting attitude—fondness for using computers, perceptions of usefulness of computers, and confidence in using computers) show that teachers of the USA significantly possess more positive attitudes than teachers of Taiwan. This finding definitely impacts teacher training in both Taiwan and the USA. Teacher training courses need to address the areas of attitude identified in this study so that teachers will be helped to develop positive and constructive attitudes toward using computers.

References

- Gardner, D. G., Discenza, R., & Dukes, R. (1993). The measurement of computer attitudes: An empirical comparison of available scales. *Journal of Educational Computing Research*, 9(4), 487–507.
- Hall, G., George, A. A., & Rutherford, W. L. (1977). *Measuring stages of concern about the innovation: A manual for use of the SoC Questionnaire*. Austin: University of Texas, Research and Development Center for Teacher Education.
- International Association for the Evaluation of Educational Achievement. (1992). *Computers in the American schools, 1992: An overview*. St. Paul, MN: Author.
- Kluever, R. C. (1992, April). *The computer attitude scale: Assessing teachers' attitudes toward computers*. Paper presented at the annual conference of the American Educational Research Association, San Francisco.
- Kluever, R. C. (1994). The computer attitude scale: Assessing changes in teachers' attitudes toward computers. *Journal of Educational Computing Research*, 11(3), 251–261.
- Massoud, S. L. (1991). Computer attitudes and computer knowledge of adult students. *Journal of Educational Computing Research*, 7(3), 269–291.
- Wu, T. (1992). *The research and statistics on information education of secondary schools in Taiwan area*. Taipei, Taiwan: National Science Institute.

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