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Training teacher educators: a case study of integrating information technology into teacher education

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Abstract

The use of IT has had, over the last decade, a growing influence on our educational systems and this is particularly prevalent as we approach the next century, with promises that the Information Technologies will revolutionise education. This paper reports on the findings of a survey of Information Technology and Teacher Education in four secondary schools in China. The investigation shows the current situation of computer use in those secondary schools, the teacher educators' understanding and their attitudes to the integration of the new technology into the curriculum. In conclusion, suggestions for training have been made based on the above investigation and these will be implemented in the spring of 1997.

Keywords

Attitudes, collaborative learning, computer assisted instruction (CAI), information technology, integration, research

1 INTRODUCTION

The use of IT has had, over the last decade, a growing influence on our educational systems, and this is particularly prevalent as we approach the next century, with promises that the Information Technologies will revolutionise education. However, starting to utilise the IT tools that are available to schools requires a deep understanding of the structure of our institutions. In fact, most of these tools do not fit into the method of conventional classroom instruction, and it is only our teachers who can transform the classrooms. The teacher is considered to be the most critical factor in the effectiveness of CAI, and his or her attitude to and competence of using computers and integrating computers into classrooms will directly influence the effectiveness of CAI (Chen, 1994; Watson, 1993). Today it is "teacher training", which includes pre-service training and in-service training that has to come onto the agenda to promote the integration of IT into education.

The training of pre-service teachers has gained wide concern. Many researchers, such as Jongejan et al (1990) all urged that the pre-service teacher should be trained to the level of being comfortable with the use of the computer and develop their abilities and self-efficacy to integrate technology as an instructional tool. Special curriculum subjects such as educational technology should be offered to pre-service teachers. In addition, IT should be integrated into the pre-service training itself, so that the pre-service teachers could learn about computers and their use in learning and teaching, at the same time as they are being personally educated in the learning process in an IT environment. This important means to train pre-service teachers has been strongly stressed by some researchers (Gooler, 1989). A survey of new teachers conducted by Handler (1992) and Pigott (1995) revealed for example, that using and observing computers during pre-service training programmes contributes greatly to later practice when integrating IT into instruction - that is, "they teach as they were taught".

In China, normal schools (which are senior high school level, with pupils approximately 15 to 18 years of age) are responsible for the training of pre-service teachers for elementary schools. The application of IT in normal schools will not only increase the quality and efficiency of these schools themselves, but will also advance the integration of IT in schools generally through the influence of their graduates. However, as some researchers reported (Criswell, 1989; Handler and Pigott, 1995), the application of IT in teacher education in the developed countries is still insufficient to meet the needs of education development. It may be worse in China's system of teacher education. Accordingly, it is an urgent need to promote the integration of IT into teacher education, while the training for teacher educators is one of the major prerequisites. For this reason, we selected the training of teacher educators for our research issues, and conducted this survey to find out the situation in terms of their competences in and attitudes towards IT, together with its integration into instruction, which is considered to be the basis of training.

2 METHOD

Instruments

The questionnaire was developed in the form of a 5-point Likert-type scale, in reference to the research literature concerned. The first part is designed to collect the demographic characteristics of the sample, including ages, genders, subjects taught, and educational backgrounds. The second part concerns the teachers' experience of familiarising themselves with computers and CAI. The purpose of the third part is to find out the sample's competence in computer usage and its integration into instruction, including knowledge about and skills in the use of hardware, software, programming, CAI and instructional software development. The fourth part of the questionnaire reflects the sample's concerns about various kinds of competence to be trained. Finally the teacher educators' attitudes towards the computer and its use in instruction, are demonstrated in the last part.

The sample

197 teacher educators from 4 secondary schools in Beijing were selected by means of stratified random sampling, and 185 valid questionnaires entered the final analysis.

Procedure

The investigators explained the purpose of the questionnaire initially, then the teacher educators answered it independently without signing their names.

Data management and analysis

The responses were recoded and converted to scores, according to the structure of the questionnaire. The data was managed with database software and analysed using Spss/pc+.

3 RESULTS

3.1 General information about the sample

Background information

The age distribution of the sample is listed in table 1.

Table 1 Age distribution of the sample

Age	Frequency	Percent
-25	16	8.6
25-35	68	36.8
35-45	36	19.5
45-	65	35.1
Total	185	100.0

The groups of "younger than 35" and "older than 45" make up most of the sample. The sampled teacher educators, 61% of which are female, included all the subjects taught in secondary schools. 79.1% of them had gained a university Bachelor's degree and the others were almost all graduates from polytechnic schools.

Experience of using computers

67.9% of the sample reported having used computers themselves. 19.7% of them had some experience of applying computers in instruction, while only 2 out of 185 educators had used computers for more than 5 lessons. 60.8% of them had some knowledge of CAI, whilst only 9.2% reported having been taught systematically. (In addition, only 10% of them had ever written any instructional software, and only 6.2% of them had experience of programming instructional software, most of whom majored in maths or sciences).

3.2 Competence on the computer and its integration into instruction

Five kinds of competence

As shown in the table 2, all competence levels listed were considerably low.

Table 2 Educators' competence on the computer and its integration in instruction

Competence	Mean	SD	Minimum	Maximum
Hardware	2.03	.97	1.00	4.50
Software	1.65	.94	1.00	4.89
Programming Language	1.56	.83	1.00	4.67
CAI	1.80	.95	1.00	4.67
Courseware development	1.38	.66	1.00	4.67

Note: The numbers in the columns of mean, minimum and maximum are scores on a 5-point scale.

Whilst it can be assumed that the ability for programming language and instructional software development is not really necessary for teacher educators, the knowledge and skills to integrate IT into instruction are mandatory, and the levels indicated accordingly are far more worrying. MANOVA illustrated significant difference among these three kinds of competence - on hardware, software and CAI (P=.0000), among which the competence level in CAI was found to be the most insufficient.

Since no significant difference in the levels of competence was found between the two groups "younger than 25" and "25 to 35", they were aggregated into one group, and thus only 3 age groups exist. One way ANOVA among these three groups demonstrates significant differences in the five kinds of competence (P<.001). The order is "younger than 35" > "35 to 45" > "older than 45".

There is no significant gender difference in any of the five kinds of competence except that female educators are found to be more capable of CAI (T=2.40, df=155, P=.018).

3.3 Value on the competence to be trained and attitudes towards IT and its integration into education

The survey examined the values that educators placed on knowledge about and skills of using hardware, programming, application software, CAI and instructional software development, as training contents for teacher educators or student teachers, and their attitudes towards IT and its integration into education.

Competence, attitudes and value on the competence to be trained

As shown in table 3, there was no significant correlation between the knowledge level and attitudes. Since most of the sample had no experience of CAI, we reconsidered the relationship using only those who had used CAI, and found that the competence in CAI use was highly correlated with the perceived value of training in software knowledge for student teachers (P<.05), that is, the more they knew about CAI, the more strongly they stressed training about software knowledge for student teachers.

Table 3 Analysis of correlation (* P<0.05, ** P<0.01)

	Attitudes of total sample		Attitudes of CAI conductors	
	Over Computer	Over CAI	Over Computer	Over CAI
Knowledge of CAI			0.5949**	0.3999
Hardware ET	0.1355	0.3839**	0.2646	0.2164
Programming ET	0.2573*	0.4897**	0.3998	0.4905*
Software ET	0.3846**	0.5549**	0.6665**	0.5313*
Integration ET	0.2038	0.7523**	0.1982	0.6010**
Development ET	0.1725	0.5410**	-0.0271	0.2117
Hardware ST	0.0616	0.2705*	0.2210	0.2048
Programming ST	0.1622	0.3965**	0.3540	0.4637*
Software ST	0.1359	0.5051**	0.4332*	0.5460*
Integration ST	0.2038	0.7523**	0.1982	0.6010**
Development ST	-0.0054	0.3379**	0.0296	0.2276

Note: ET stands for training for teacher educators while ST stands for training for students.

The relationship among educators' competence with and attitudes towards the computer and its application in education, and values placed on the competence to be trained was analysed. As far as the sample was concerned, there was no significant correlation between the competence and attitudes, and the relationship between the value and attitudes was complicated. In detail, the attitudes towards CAI were significantly correlated with the perceived value of training (P<.01) and the perceived value of training in hardware knowledge for student teachers (P<.05). The attitudes towards computers were only linked with values placed on training teachers' programming language and the uses of application software with significant correlation coefficients. However, as far as the teachers with CAI experience are concerned, significant correlation was found between the level of CAI knowledge and attitudes towards the computer (P<.01), between views about training for application software use and attitudes towards the computer (P<.05). Furthermore, attitudes towards CAI were significantly correlated with three kinds of training skills of teacher educators and student teachers, whose correlation coefficients decline as follow: integrating IT into instruction, using application software, and programming.

The effects of teacher educators' characteristics on their view of training

Statistical analysis shows that there are no differences between genders on their perceived values of training contents. An ANOVA using age (x3) and education (x3) as independent variables was performed on the values placed on training content. Although not detailed here, the analysis reveals some significant effect or interaction effect on the teacher educators' view of integrating IT into the curriculum and instructional software development. Young teacher educators pay nearly the same attention to integrating IT into the curriculum, regardless of their educational backgrounds, while for older teacher educators, educational background has a significant effect, in that those from Higher Education pay more attention to the integration of IT within the curriculum. For training teacher educators' in developing

instructional software, we found that teacher educators from Higher Education tend to regard this more highly. This difference is also more significant in the older group rather than the younger group.

Moreover, teacher educators' experiences with computers and CAI has an impact on their views towards training. Results of T-tests indicate that teacher educators with CAI experience pay more attention to the training teacher educators' ability to integrate IT into the curriculum, and training students' ability in this respect. Teacher educators with some CAI knowledge think it more critical to train an ability for programming, and the uses of application software. Teacher educators who have written CAI script regard more highly the training for the integration of IT into the curriculum, training the ability of developing instructional software, and training students' ability to integrate IT into the curriculum.

Effects of subject variables on attitudes

Finally we found that the teacher educators' age, gender and educational background have no significant effect on attitudes. However, past experiences of using CAI do influence attitudes to some degree. In particular, teacher educators with some knowledge of CAI show a more positive attitude towards the computer than do those who have written CAI script.

4 DISCUSSION AND PROPOSAL

Teacher educators' attitudes towards IT and its integration into instruction: exciting or worrying?

Teacher educators in this survey were all highly positive and active in IT use and its application in instruction in spite of their differences. Exciting as it seems, we are concerned that there was no significant correlation between competence and attitudes. Only when those with experiences of integrating IT into classrooms were analysed separately, could high correlation between knowledge and attitudes be found ($P<.05$). Educators may have expectations for computer use which are too high and do not consider restricting factors sufficiently, such as the ability level of students, the objectives to be achieved, and the content to be taught, or they may just invest blindly in purchasing facilities and hardware which are fashionable. This is often found to be so when computers are introduced into schools (Hodgson, 1986; cf. Hodgson, 1994).

In general, there are three stages which seem to occur during the implementation of IT into teacher education. In the early stage (which we term Stage 1), most of the policy makers, administrators, teacher educators and teachers do not recognise the wide ranging importance and implications of computer technology in education, and so they do not know WHY to change. Therefore, only computer teachers and technicians are involved in the use of Information Technology. There is still a large percentage of secondary schools in China which are at this stage. In the second stage, Stage 2, the policy makers and educational administrators, teacher educators and teachers are forced by the rapid development of new technology to think about how to meet the needs of the information age. They start to invest money to purchase facilities, hardware and software, and to train teachers. Some of them even reward those subject teachers who are willing to use computers in their teaching. They have realised the importance of IT and have good intentions, but do not know HOW to use

it in schools or WHAT changes should be encouraged. Finally, the ideal stage, Stage 3, is when the administrators and teacher educators understand the role of IT in education and have changed in respect of both their professional practice and research. They must develop mature experiences in integrating IT into teacher education for initial teacher education and in-service teacher training.

Training teacher educators to integrate IT into instruction: an urgent and difficult task

Research results indicate that although Beijing is advanced with respect to education development among cities in China, teacher educators' abilities in instruction with IT is rather poor. The average competencies recorded are too low to meet the demands of carrying out instruction in an information-rich environment as well as teacher training. It is an urgent need to improve teacher educators' skills in order to ensure and enhance the effect of teacher training. We must also face up to this rather poor situation and endeavour to train teacher educators first.

As reported, teacher educators' educational theories are out of date particularly in the area of CAI. What they need most are both the theory and practice of integrating IT into instruction. Many of them have little chance of accessing computers or using technology in education because of the low level of economic and technical conditions, which creates an unimaginably difficult situation for training. Many teacher educators have no intention of developing instructional software because of their lack of ability. Certainly, it is not necessary for everyone to design and develop software, and the experience from computer industries indicates that there is no need for teacher educators to repeat the work of others. In this collaborative society, teachers should know how to choose and take advantage of information and spend more of their time in preparing for their students.

Training should consider prior cognitive structure, and focus on the young teacher educators, especially the active ones

Some research (Cornu, 1992; Watson, 1993; cf. Hodgson, 1994) show that the training model that relies on a core of highly motivated teachers, expecting to pass their knowledge and pedagogical agenda on to their colleagues through a "cascade" effect has limitations, and in many cases the anticipated effect has not worked. However, this plausible view is not necessarily strong evidence against establishing a core of experts. In China, our teacher educators' competence in IT is so low, and the variances among individuals so great, that it will take a long time to improve them all. Thus, we must take advantage of a core and help them become the experts. Though their change can never be directly passed on to other teachers, the collaborative team learning will be helped by these pioneers acting as experts to organise new co-operative teams. We propose co-operative learning therefore, to activate and maintain the "cascade" effect, and our research is on-going.

Content and organisational model of training

To date our training has only focused on technology itself, which is of little help to our teacher educators in obtaining competence in the integration of IT into instruction. However our research is in accord with that of Collis (1994) and Taylor and Stuhlman (1995). In addition, Oliver's study (1995) showed that in pre-service training of teachers using IT, those who emphasise pedagogy tend to more frequently use

computers in instruction than those who only devote themselves to the technology itself. We intend to train those active teachers in the secondary schools with:

- basic computing skills;
- up-to-date theories of learning and instruction;
- the wide ranging effective applications of IT in education;
- the trends of IT uses in education, and those aspects which are misleading computer uses in education;
- how to select and evaluate software, and how to integrate new technology into classrooms, etc.

Some recent literature (Hunsaker and Johnston, 1992; Hollings and Worth, 1992) indicated that co-operative team learning will help teachers to absorb the researchers' thoughts, through discussing and negotiating instructional design and study. Gradually, such instruction will lead them to become expert teachers. Perhaps through this training model, we shall see teacher educators improve their ability to integrate IT into the classroom.

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6 BIOGRAPHY

Qi Chen is a professor of educational psychology in the department of psychology at Beijing Normal University. She has been involved in research in computers in education since the 1980s. She has investigated the variables affecting the outcomes of computer use in classrooms, and has published papers on this theme. More recently, she has focused particularly on teachers' training in IT at different levels of education, especially upon the training of teacher educators.