World Transactions on Engineering and Technology Education
Vol.4, No.2, 2005

IT-integrated instruction for aboriginal elementary schools in southern Taiwan

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ABSTRACT: In this article, the author investigated the status of information technology (IT)-integrated instruction in aboriginal elementary schools in southern Taiwan. The research objectives included: teachers' information literacy, teachers' attitude towards IT-integrated instruction, teachers' IT-integrated teaching behaviour, as well as their barriers and needs in integrating IT into instruction. A self-developed questionnaire with close- and open-ended questions was conducted on 284 teachers from 27 different aboriginal elementary schools in the remote mountainous area in southern Taiwan. Based on these results, the researcher reached the following conclusions: the performance of teachers from aboriginal elementary schools in southern Taiwan in information literacy and IT-integrated teaching behaviour still left much room for improvement; teachers' age, time spent on computers and computer ownership impacted on several different related aspects; gender was not a significant factor distinguishing teacher competence and attitude, but it affected teachers' IT-integrated teaching behaviour; and the major barriers and difficulties they faced in integrating IT into instruction were shortage of hardware, software, labour and opportunities to improve their competences and related skills.

INTRODUCTION

Research Background

Taiwanese aboriginal children who live in remote mountain areas have suffered from shortages in educational resources and difficulties in raising their academic performance [1][2]. The application of information technology (IT) should allow aboriginal children to obtain learning materials via the Web and thus help to solve resource shortage problems in some way.

The Department of Education of Taiwan has provided funding for these aboriginal schools to bridge the digital divide, thereby providing aboriginal children with better educational opportunities. However, few investigations have been conducted to ascertain how these schools cope with newly installed computer equipment, how technology-integrated instruction is implemented, what barriers they are trying to overcome, as well as what help they need in order to better utilise IT so as to give their children a better educational environment.

With these concerns, the study described in this article was conducted in order to investigate:

- The computer competence of teachers in aboriginal schools;
- Their attitudes and teaching behaviour of integrating IT into instruction;
- How teachers' personal background affect their attitude and teaching behaviour in IT-integrated instruction;
- The barriers that teachers encounter and the help that they need to successfully apply IT into educational instruction for children in aboriginal elementary schools in southern Taiwan.

LITERATURE REVIEW

Educational Disadvantages of Taiwanese Aborigines

Cultural difference is one of the major obstacles for Taiwanese aboriginal children in improving their academic performance. Aboriginal students in Taiwan also suffer from educational disadvantages due to their being geographically distant from formal education services. The mixture of historical and geographical disadvantages lead to inequalities in the following aspects:

- Shortage of educational resource;
- Shortage of teachers and school staff;
- Teachers' limited opportunities to upgrade and improve their teaching skills and exchange teaching experiences with teachers based in cities [3][4].

To establish a multicultural-based educational environment for all different groups in Taiwan, the Ministry of Education of Taiwan announced its *Aboriginal Educational Policy* in 1998 [5]. Teachers are encouraged to develop culturally-relevant material for aboriginal students, and researchers are provided with research funding to investigate new changes and the current status of aboriginal education in Taiwan. Research has been increasing since then, and many researchers (eg refs [6][7]) have pointed out that, in addition to the historical and geographical related disadvantages, Taiwanese aboriginal children face a new challenge: the digital divide.

Information Technology and Aboriginal Education

Even though information technology gives aboriginal children a promising future to overcome shortages in educational resources, they have suffered for a long time. Nevertheless, as Hsieh and Chen have pointed out, *we need to get across some*

thresholds (such as budget and computer ability) in order to get the benefits from this charming information technology [8]. Those who cannot cross such thresholds become the most vulnerable group in this highly developed new era of information technology.

In order to bridge the digital divide caused by geographical related factors, the Taiwanese Ministry of Education announced a ten-year long *Information Basic Construction Plan* in 1997 [9]. In 2001, *A Blueprint for Information Technology* was also developed to raise teachers' and students' information literacy nationwide in a concerted effort to decrease the digital divide by way of providing schools with the necessary IT equipment [10].

The Teacher's Role in IT-Integrated Instruction

Many researchers have investigated teachers' and students' computer competences and the implementation of IT-integrated instruction in Taiwan's urban area (eg refs [11-13]). However, very few have actually focused on how teachers and students in aboriginal schools cope with the overwhelming IT-related education policies and the implementation of IT-integrated instruction. As Hsieh and Chen indicated, in order to benefit from IT, it is important to increase the opportunity of contact with IT and to strengthen competences in IT applications [8].

Hsieh, Chen and Guo also emphasised the importance of the teacher's role in the implementation of IT-integrated instruction [13]. However, computer teachers are needed by Taiwan's schools at every different level, but the quantity and quality of computer teachers are serious concerns, especially for Taiwan's elementary and junior high school education levels.

Indeed, the computer competences of teachers, their attitudes and teaching behaviour when integrating IT into instruction should be examined.

METHODOLOGY

Subjects and Sampling

Over 200 teachers from 27 aboriginal elementary schools in Pint-Dong County in southern Taiwan responded to a specially designed questionnaire. Computer teachers were also invited to respond to the short-answer and open-ended questions. Three schools volunteered to accept intensive interviews plus field observations.

Instrument

A self-developed close-ended questionnaire with short answers and open-ended questions was developed. These questions were categorised into six parts according to different concerns, specifically:

- Personal information;
- Teachers' computer competences;
- Teachers' attitude towards integrating IT into instruction;
- Teachers' teaching behaviour when integrating IT into instruction;
- The difficulty of integrating IT into instruction;
- The level of help and needs they required in order to improve IT-integrated instruction.

Procedure and Statistical Methods

Over 200 copies of the questionnaire were delivered during December 2004. The questionnaires were mailed to the principals of the schools. The principal of each school then delivered the questionnaire to teachers so that they could fill out the questionnaires. From March to June in 2004, 147 valid copies were collected. The valid return rate was 70%.

Intensive interviews and field observations were also conducted among three schools. A total of 15 teachers participated in the interviews. Three interviews were also followed up with a school trip to examine the arrangement of the computer classrooms and the condition of the computer facilities.

Major statistical methods, such as prescriptive statistics, t-test, one-way ANOVA and Scheffe, were conducted in order to analyse the data.

RESULTS AND DISCUSSION

Analysis of Qualitative Data

The Overall Performance of Teachers at Aboriginal Schools

For the147 teachers who responded to the questionnaire, both their computer competence and performance in integrating IT into class instruction left much room for improvement. This was despite their positive attitude towards integrating IT into instruction. Table 1 reveals teachers' overall performance concerning the three key aspects.

Table 1: Teachers' overall performance for the three aspects.

	Sample	Mean	SD	Total Score
Computer Competence	147	113.40	26.06	200
Attitude towards IT-integrated instruction	147	79.06	20.15	100
IT-integrated teaching behaviour	147	33.46	5.79	100

The Factor of Gender Difference

Does the factor of gender difference affect teachers' computer competences, attitude towards IT-integrated instruction and teaching behaviour? The results indicate that gender was not a significant factor that distinguished teachers' information literacy and attitude ($t=0.243$, $p>0.05$; $t=0.438$, $p>0.05$), but was a significant factor related to the frequency of teachers' behaviour in integrating IT into the curriculum ($t=.-1.122$, $p<0.01$.)

The Factor of Age

Teachers were grouped into four categories according to their age, namely: *20-30 years old*; *31-40 years old*; *41-50 years old*; and *over 51 years old*. The research analysis revealed that teachers' computer competences, attitudes and behaviour when integrating IT into the curriculum were significantly different because of the teacher's age ($F=16.545$. $p<0.001$; $F=8.516$, $p<0.001$; $F=6.684$, $p<0.001$). A further Scheffe analysis

indicated that the younger the teachers were, the better performance they had regarding the three different aspects.

The Factor of Computer Ownership

How does the factor of computer ownership affect teachers' computer competences, attitude towards IT-integrated instruction and teaching behaviour? According to the research results, the investigators found that ownership of computers significantly affected teachers' performance in all of the three aspects ($t=2.834$, $p<0.01$; $t=2.443$, $p<0.05$, and $t=2.483$, $p<0.05$). In other words, teachers who had a computer and had Internet access had higher computer literacy, more positive attitude towards IT-integrated instruction, and better performance in integrating IT into teaching activities.

The Factor of Time Spent on Using Computers

Teachers were grouped into four groups based on the self-estimated total time spent weekly using the computer in the categories of *Less than one hour*; *1-3 hours*; *4-7 hours*; and *More than 8 hours*. The research analysis (see Table 2) showed that teachers' computer competences, attitudes and behaviour in integrating IT into the curriculum were significantly different because of teachers' time spent using computers ($F=29.267$, $p<0.001$; $F=14.526$, $p<0.001$; and $F=10.329$, $p<0.001$). A further analysis indicated that the more time that teachers spent on computers, the better performance the teachers had regarding computer competences, attitude and teaching behaviour.

Analysis of Qualitative Data: Barriers and Needs

Based on the analysis of the qualitative data collected from the open-end questions, the following finding regarding the barriers encountered and needs for teachers are summarised below.

Shortages in Computer Hardware and Educational Software

A very common barrier for aboriginal elementary schools in integrating IT into instruction was the shortage of computer hardware. Teachers gave the following comments:

- *We have only one printer at the computer classroom, but it is out of order long time ago*;
- *The hard disks for our computers have only 2 or 3 GB capabilities. With the Win98 installed, we can hardly run anything*;
- *Yes, we do have some CAI software, but we never use them because our computers are not equipped with CD-ROM…;*
- *We have six teachers but only two computers at the school. We usually take turn to use them for printing only.*

During the researcher's field trip to the three schools, the researcher observed that none of the printers at the three schools was running well; one was out of ink and the other two were out of order.

Difficulty in Hardware Maintenance Due to Shortages of Funding and Personnel

Due to shortages in funding and labour, computer facilities' maintenance was a headache for all the schools. Teachers responded with the following comments:

- *We have no computer teachers here, and we know very little about computers…;*
- *Well, we just shut them down and restart them. If it still doesn't work, re-install the system is the only thing we can do;*
- *The government gave us money to buy computers, but didn't give us money to maintain and fix them when they are out of order. Besides, the people in the computer company don't want to come to our school because it is really too far away.*

Teachers' Basic Computer Skills and Information Literacy Need to be Reinforced

Many teachers were not prepared for the new technology, and gave the following statements in the interviews:

- *We know how to use* Word *to prepare some simple teaching material. But that would be all…;*
- *I got stocked when paper is jammed. I can't even handle the printer;*
- *I feel quite stressful when the principal and other teachers talk about computers, the Internet. I wish I could retire soon and don't have to face all these problems.*

Furthermore, heavy teaching loads prevented teachers devoting more time to learn the new skills required.

More Convenient and Multiple Methods for Teachers in Remote Mountain Areas to Upgrade Related Skills

Many teachers mentioned the needs to attend training workshops, seminars and conferences in order to learn from experienced teachers based in cities. They gave the following comments:

Table 2: Teachers' overall performance for the three aspects.

	Gender	Age	Ownership	Time Spent
Computer Literacy	t=0.243	F=16.545***	t=2.834**	F=29.267***
Attitude	t=0.438	F=8.516***	t=2.443*	F=14.526***
Behaviour	t=-1.120*	F=6.684***	t=2.483*	F=10.329***

Note:

- *** P<0.001; ** P<0.01; * P<0.05
- Gender: (1) Female; (2) Male.
- Age: (1) 20-30 yr; (2) 31-40 yr; (3) 41-50; (4) More than 50.
- Computer ownership: (1) Yes; (2) No.
- Time Spent: (1) less than 1 hr; (2) 1-3 hours; (3) 4-7 hours; (4) more than 7 hours

- *It is really not easy for us to attend the workshops in cities. It takes at least two days to attend a one-day workshop;*
- *That would be wonderful if the workshop can be held in our community, but it is impossible. The money issue;*
- *Yes, we can try to attend during winter and summer vacations. But we need to find place to stay for the nights. It is quite expensive. We can't afford it.*

CONCLUSIONS AND SUGGESTIONS

Based on the analysis and discussion presented above, the conclusions of the research findings are summarised as follows:

- Teachers' information literacy, attitudes and behaviour towards integrating information technology into the curriculum differed significantly because of teachers' age, time they spent on computers and computer ownership;
- Gender was not a significant factor that distinguished teachers' information literacy and attitude, but was a significant factor that was related to the frequency of teachers' behaviour of integrating IT into the curriculum design.
- The major barriers and difficulties they faced were: shortage of computer facilities and labour to effectively utilise and maintain equipment, teachers' low competence in basic computer skills, and the difficulties encountered in attending training seminars due to distance and financial difficulties.

Suggestions

The following suggestions are made:

- Training programmes or seminars should be organised to raise teachers' basic computer literacy and skills for integrating IT into instruction; this can be organised and provided over the Internet or in local communities for teachers in remote mountainous areas.
- Educational policies should be organised to reduce teachers' loads; and travel reimbursements should be provided to encourage teachers to overcome time restraints and distance difficulties when attending related conferences, seminars and workshops.
- Intensive interviews and research should be conducted to investigate the phenomenon of female teachers who tend to integrate IT into instruction less frequently than their male colleagues, while their computer literacy and attitude were considered to be on par with their male colleagues.
- Teachers who owned a computer with Internet connection performed significantly better than teachers who had no computer equipment at home in all three key aspects; so each teacher should be equipped with a basic computer and Internet facilities to start the first step in applying IT to improve their teaching quality.
- A collaborative team of younger teachers and senior teachers should be formed so as to encourage and help senior teachers to learn new technologies and develop IT-integrated curricula together.
- Funding from the government should also be allocated to private computer companies; schools in remote areas should be encouraged to rent computer equipment and Internet access from private computer companies, thereby harnessing personnel from such companies for hardware maintenance.

ACKNOWLEDGEMENT

This research was supported by the National Science Council, Taiwan, under Grant NSC 92-2521-S-214-001.

REFERENCES

1. Chou, T.C., *Education for Pai-Wan Tribe*. Taipei: Wu-Nan Publishing (2001).
2. Tang, G.D., R*esearch on Aboriginal Education*. Taipei: Wu-Nan Publishing (2000).
3. Chen, C.L. *Taiwan's Aboriginal Education*. Taipei: Bookstore of Taiwan Normal University (2004).
4. Lin, H.P., Talking about the barriers and possible solutions about elementary education for aborigine. *Aboriginal Educ. Quarterly*, 13, 91-96 (1999).
5. Horng, C.H., Taiwan aborigines' educational policy. *Policy Monthly*, 58, 17-21 (2000).
6. Chang, C.S., Problems and solutions for elementary education in aboriginal community. *Communication of Educational Reform*, 17-18, 51-53 (1996).
7. Chen, P.C. and Shan, W.Y., A study on the information literacy of elementary school teachers in aboriginal districts – an example of Ping-Tung area. *J. of I-Shou University*, 10, 71-86 (2003).
8. Hsieh, H-L. and Chen, P-C., An explorative study of the digital divide in education: another look at Taiwan. *World Trans. on Engng. and Technology Educ.*, 3, **2**, 223-226 (2004).
9. Ministry of Education, Taiwan, Information Basic Construction Plan (1998),
10. http://networklab.csie.ncu.edu.tw/moeplan/network_3.htm
11. Ministry of Education, Taiwan, A Blueprint of Information Technology for elementary and junior high schools (2001), http://www.edu.tw/EDU_WEB/EDU_MGT/MOECC/EDU7892001/information/itpo/itprojects/itmasterplan.htm
12. Chen, H,.S. and Shyu, H., In-service teachers' information literacy content and training program. *Info. and Educ.*, 80, 11-22 (2000).
13. Chen, P.C. and Shan, W.Y., Digital divide in the educational system of Taiwan and the possible solutions. *Communications of the Institute of Information and Computing Machinery*, 6, **3**, 117-124 (2003).
14. Hsieh, H.L., Chen, P.C. and Guo, M.R., From teachers' information literacy to IT-integrated instruction. *Information and Educ.*, 92, 87-95 (2003).