Instructional Technology Competencies Perceived as Needed by Vocational Teachers in Ohio and Taiwan

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Abstract

The purpose of this study was to explore and describe the perception of the knowledge, importance, and educational needs of instructional technology for vocational and career-technical education teachers and draw comparisons between Ohio and Taiwan. The objectives of this study were to determine: (a) the demographic characteristics of vocational teachers such as age, gender, highest degree earned, instructional technology experience, and specialty, (b) the perceived knowledge and importance of instructional technology competencies for vocational teachers in Ohio and Taiwan, (c) the perceived need for further education in instructional technology by vocational teachers in Ohio and Taiwan, and (d) the relationships among the demographic characteristics of vocational teachers and their instructional technology education needs.

The population was all vocational education teachers working at 44 comprehensive high schools and six Joint Vocational Schools (JVS) in the Central Region of Ohio and 22 vocational high schools in Kaohsiung district, Taiwan, during 2001-02 academic years.

The Borich needs assessment model was adapted to determine the need of instructional technology knowledge and skills for vocational teachers and the instrument consisted of two parts: (a) demographic data, and (b) a Likert-type scale, to measure the perceived importance and knowledge of instructional technology for teachers. A questionnaire was designed to gather information about vocational teachers’ school and program characteristics and their perceptions of the instructional technology importance and knowledge in their program. The questionnaire was developed with two parallel versions – English version for Ohio and Mandarin version for Taiwan.
Introduction

Changes in the workplace require continual professional development as a means of skill upgrading, even for teachers with a degree in education. New ways of teaching and learning are requiring teachers to assume the roles of coach and facilitator and to situate student learning in real-world contexts. Teachers must be able to use new technologies, and with continually changing roles and responsibilities, teachers need an effective professional development plan that can help them keep current and embrace new ways to improve their practice.

Statement of the Problem

Instructional technology is used to manage and instruct in vocational and career-technical education and encompasses not only the computer but also other technologies and delivery systems. The career preparation of teachers, internationally, is impacted by their opportunities and decisions regarding their use of technology and is often contingent on their level of instructional technology knowledge and skill. As Sormumen and Chalupa (1994) noted, a U. S. Office of Technology report maintained that the use of technology could not be fully effective unless teachers receive adequate training and support. Due to the rapid changes in technology and reduced funds, instructional technology competencies’ training for teachers is limited. Teachers need instructional technology competencies so they can teach these competencies to students for their entry-level job requirement.

Cross-cultural studies on instructional technology in education have gained considerable attention. The findings of cross-cultural studies provided information leading to better understanding of teachers’ perceptions of instructional technology competencies across countries and identified some universal variables related to teachers’ perceptions of instructional technology. This comparison study between Ohio and Taiwan also will provide information of each nation’s circumstances in educational needs of instructional technology competencies. The information was the resources worldwide in teacher education for references of future research.

Purpose and Objectives

The purpose of this study was to explore and describe the perception of the knowledge, importance, and educational needs of instructional technology for vocational and career-technical education teachers and draw comparisons between Ohio and Taiwan. The objectives of this study were to determine:
1. The demographic characteristics of vocational teachers such as age, gender, highest degree earned, instructional technology experience, and specialty.
2. The perceived knowledge of instructional technology competencies possessed by teachers.
3. The perceived importance of competencies for instructional technology vocational teachers in Ohio and Taiwan.
4. The perceived need for further education in instructional technology by vocational teachers in Ohio and Taiwan.
5. The relationships among the demographic characteristics of teachers and their instructional technology education needs.
Literature Review

Instructional technology is the great enabler and provides, for those who have access to it, extends powers of perception, comprehension, analysis, thought, concentration, and articulation through a range of activities that include: writing, visual images, mathematics, music, physical movement, sensing the environment, simulation, and communication (Carpenter, 1989). Instructional technology, in all of its various forms, offers users the tools to access, manipulate, transform, evaluate, use, and present information. Instructional technology in schools includes computers, televisions, video cameras, video editing equipment, and TV studios. According to some empirical indication, students who use technology as a tool may become better at managing information, communicating, and presenting ideas (Plotnick, 1999).

Early computer technology initiatives in schools were essentially technology centered. As Anderson et al. (1979) noted, the principle seemed to be that “as long as the facilities are available and teachers are trained in computing, adoption… is inevitable”. But it soon became evident that access to hardware and software alone were insufficient to ensure successful uptake of Informational Technology (IT) in schools. Learning how to use IT in the classroom requires pedagogic understanding of what computer assisted learning applications are trying to do and of what the hardware and software are capable of doing. In consequence, later initiatives of IT tended to focus on pedagogic rather than technical concerns.

Many professional organizations have incorporated instructional technology into their professional standards (Abramson, 1993). In 1989, the International Society for Technology in Education (ISTE) formed an alliance with the National Council for Accreditation of Teacher Education (NCATE) and established guidelines for technology competencies for all teacher education programs. ISTE developed standards for instructional technology competencies including: (1) the use of computer-based technologies to access information to enhance personal and professional productivity, and (2) application of computers and related technologies to facilitate emerging roles of the learner and the educator (Thomas, 1993). NCATE (2000) proposed that pedagogical studies of teachers need to include knowledge and appropriate experiences with educational computing, including the use of computer and related technologies in instruction, assessment, and professional productivity.

For vocational and technical education, Perkins II legislation and national and state reports addressing reform imply that a teacher must be prepared to use computers and technology throughout the instructional program. Furthermore, Perkins III legislation focuses the Federal investment on high-quality programs in developing, improving and expanding the use of technology to provide professional development for teachers.

Students are confronted by more information than they can possibly assimilate and are overwhelmed by the need to learn the mechanics of locating information. To develop the student’s capacity to recognize his or her need for information, and the ability to locate, evaluate, and use it becomes essential. Teachers must work in partnership with each other to articulate what students should know in regard to instructional technology competencies that pose an enormous challenge as a resource to the teacher because the use of computer technology may be changing the way teaching is conducted (Sheingold & Hadley, 1990). The fundamental change required to use computers for teaching is to affect teachers’ existing conceptions of the teaching and learning process and conceptions of their pedagogic role.
Methodology

This study employed a descriptive survey that collected data from members of a population in order to determine the current status of that population with respect to one or more variables (Gray, 1987). A descriptive survey involved asking the same set of questions of a large number of individuals either by mail, by telephone, or in person (Fraenkel & Wallen, 1996).

The difficulties of this research design are: (a) the clarity of the questions, (b) getting respondents to answer questions thoughtfully and honestly, and (c) getting a sufficient number of questionnaires back (Salant & Dillman, 1994). A significant advantage of survey research is that it has the potential to provide a lot of information obtained from a large sample of individuals. In order to succeed in survey research, the understanding and avoiding major errors of survey research will be crucial. According to Miller (1998), the major errors of survey research include:

1. Frame error. According to Groves (1989), frame error occurs when the frame or survey population from which a sample is drawn does not include all elements of the population that the researchers wish to study. A discrepancy between intended target population and actual survey population results in frame error. For this study, frame error was controlled by ensuring that the most accurate list was secured from both the Ohio Department of Education and the Department of Technical and Vocational Education in Taiwan.

2. Sampling error. Sampling error occurs when researchers survey only a non-random subset or sample of all people in the population instead of conducting a census (Salant & Dillman, 1994), and can be controlled by just increasing sample size and using a random sampling procedure. Because sampling error can be estimated, it is often the only specific error referred to when survey results are presented.

3. Selection error. Selection error is a type of an external validity threat resulting from duplicate entries in a frame, and occurs when certain sampling units in the population have a greater or lesser chance of being selected into the sample than the other sampling units (Salant & Dillman, 1994). Selection error was controlled by checking the lists to ensure that there was no duplication of names in this study.

4. Non-response error. Non-response error is the most problematic error in survey research, and occurs when people in the sample do not respond to the questionnaire and are different from those who do in a way that is important to the study (Salant & Dillman, 1994). In this study, a code number was placed on each questionnaire to allow the researcher to identify non-respondents for follow-up purposes. The double-dipping technique was used to control non-response error by drawing a random sample (10-20%) from the list of non-respondents to get their response by phone, interview, etc. and statistically compare respondents to non-respondents. If there was no difference, data would be collapsed. If responses were different, a proportionately weighted formula would be calculated to get adjusted data (Miller & Smith, 1983; Ary, Jacobs, & Razavieh, 1990).

5. Measurement error. Measurement error occurs during data collection and from four sources that include survey method, the questionnaire, the interviewer, and the respondent, and occurs when a respondent’s answer to a given question is inaccurate, imprecise, or cannot be compared in any useful way to other respondents’ answers.
According to Ary, Jacobs, and Razavieh (1990) and Fraenkel and Wallen (1996), the purposes of correlational research are to: (a) describe relationships that exist among variables and/or (b) use the known correlation to predict from one variable to another. This study is concerned with determining the relationships among the demographic characteristics of teachers and their instructional technology education needs, and that would help explain and predict perceived instructional technology competencies by vocational education teachers at vocational schools in Ohio and Taiwan.

Population and Sample

The populations of this study consisted of all vocational education teachers working at 44 comprehensive high schools and six joint vocational school districts (JVSD) in the Central Region of Ohio and 10 teachers per 22 vocational high schools in Taiwan. Considering the size of Ohio and Taiwan and the practical constraints in gathering data from the total populations of vocational teachers, the accessible populations for this exploratory study was chosen as secondary vocational teachers in the Central Region of Ohio and Kaohsiung District (included Kaohsiung City and Kaohsiung County) of Taiwan during the 2001-02 academic year.

All 44 comprehensive high schools and six JVS were identified from a list published by the Division of Career-Technical and Adult Education, Ohio Department of Education, and Department of Technical and Vocational Education in Taiwan (n=22). The researcher selected all qualified vocational teachers (N=247) in central Ohio and randomly selected 10 teachers per school in Taiwan (n=220) by using a 2000-01 directory that listed all vocational education teachers at schools in Ohio and Taiwan. Generalizations can be made only to the secondary schools located in the Central Region of Ohio and Kaohsiung District of Taiwan. Those schools that were not part of the accessible population may differ, thus, causing potential error if generalizations were they to be extended to other schools.

Instrumentation

The Borich (1980) needs assessment model was adapted to determine the need of instructional technology knowledge and skills for secondary vocational teachers. A questionnaire was designed to gather information about secondary vocational teachers’ school and program characteristics and their perceptions of the instructional technology importance and knowledge in their programs. The questionnaire was developed with two parallel versions: (1) English version used for the Central Region of Ohio; (2) Mandarin version using for Kaohsiung District of Taiwan.

The suitability and clarity of the instrument were assessed through a field test with 15 Ohio vocational teachers who are in the CAREERTECH (careertech@lists.acs.ohio-state.edu) e-mail list that was established by the National Dissemination Center for Career and Technical Education for Question-And-Answer Service and of similar characteristics of those in the study. The internal consistency reliability of the instrument was assessed using a pilot test of 15 vocational teachers in an area close to the Central Region of Ohio using Cronbach’s alpha. For research purposes, a useful standard is that the coefficient of
reliability should be at least .50 to .60 and preferably higher (Nunnally, 1967). In this study, a Cronbach’s alpha was used to establish the internal consistency reliability of the final instrument on educational needs and coefficients ranged from .67 to .98. These procedures controlled for measurement error.

Findings

Objective 1 of the study was to describe the demographic characteristics of Ohio and Taiwan vocational teachers. In Ohio, around one-quarter of the respondents had six to ten years of teaching experiences, while the most prevalent age group of the respondents was 41-50 (41.8%), followed by the 51-60 year age group (21.4%). Forty-seven percent of the respondents were male and the most common academic degree held was a bachelor’s degree (46.2%), followed by a master degree (29.7%). Regarding program characteristics, the primary curricula taught during the 2001-2002 school year was in the category of Business and Management (42.9%) followed by Industrial and Engineering Systems (25.8%), and Environmental and Agriculture Systems (14.3%). Curricula of other programs included: Human Resources and Services (6.6%), Art and Communication (5.5%), and Health Services (4.9%).

In Taiwan, 26 percent of the respondents had five or less years teaching experience, while the prevalent age group of the respondents was 31-40 (39.3%), followed by the 41-50 year age group (34%). Forty-five percent of the respondents were male and the most common academic degree held was a bachelor’s degree (82.7%). The main curricula taught during the 2001-2002 school year was in the category of Industrial and Engineering Systems (31.4%), Business and Management (23%), Marine Science (14.1%), and Human Resources and Services (11%). The other programs included: Health Services (7.9%), Art and Communication (7.9%), and Environmental and Agriculture Systems (4.7%).

Objectives 2, 3, and 4 of study were to describe the perceived competence, importance, and educational needs of instructional technology competencies possessed by vocational teachers in Ohio and Taiwan using the Borich Needs Assessment Model. For Ohio vocational teachers, the top three perceived competencies were: insert and eject floppy disk and CD-ROM; start up and shut down the computer according to computer type; and save a document using both the save and save as commands. The top three perceived competencies were in the category of computer operation skills. The least perceived competencies were: effective use of distance learning desktop video conferencing, and tele-teaching technologies and how to use FTP to send or retrieve files from remote computers.

The perceived importance levels of competencies for Ohio vocational teachers were included: check spelling, grammar, and word usage in word process; identify and use icons, windows, and menus; and enter and edit text in word process. Using FTP to send or retrieve files from remote computers and using Gopher to browse resources on the Internet were the two least perceived importance levels of competencies.

The top three perceived competence levels for Taiwan participants included: insert and eject floppy disk and CD-ROM; start up and shut down the computer according to computer type; and copy and move block of text in word process. The least perceived competencies were how to connect a video output device (LCD panel or LCD projector) to computer for large screen display and how to use camcorder and edit video from a camcorder in media communications category.
Analysis of perceived importance levels of competencies among 86 competencies, Taiwan vocational teachers placed high levels of perceived importance in: protect against computer viruses; name a document; and copy and move blocks of text in word process. The least perceived importance competencies included check spelling, grammar, and work usage in word process and set up and operate a videocassette recorder/player and monitor/TV in media communications category.

In Ohio, the top five instructional technology competency needs included: protect against computer viruses; create custom layouts including columnar reports in database; insert database fields into word processing document; effective use of distance learning desktop video conferencing, and tele-teaching technologies; and create a graph or chart from spreadsheet data. In Taiwan, the top five perceived needs included: protect against computer viruses; use digital document camera for 3D objects as well as documents and slides presentation; produce a video; connect a video output device to computer for large screen display; and use camcorder and edit video from a camcorder. For Both Ohio and Taiwan participants, the lowest instructional technology competency needs was located in the category of computer operation skills.

Objective 5 of the study was to describe the relationships among the demographic characteristics of teachers and their instructional technology educational needs. The correlation coefficients among eight areas of instructional technology educational needs were negligible or low associations in both Ohio and Taiwan according to Davis’s conventions for describing measures of association. An analysis of the differences between Ohio vocational teachers and Taiwan vocational teachers found the seven of the top 15 competencies were the same:

- Protect against computer viruses.
- Effective use of distance learning desktop video conferencing, and tele-teaching technologies.
- Insert database fields into word processing document.
- Use File Transfer Protocol (FTP) to send or retrieve files from remote computers.
- Create a database with multiple fields.
- Create custom layouts for database including columnar reports.
- Use a database to sort records.

Conclusions and Implications

Demographics

The following conclusions and implications were drawn from the research findings and are applicable only to the subjects of the study. From the analysis of the findings, more than 70% of Ohio vocational teachers had a Bachelor’s Degree or higher and 16% had an Associate Degree or less. About 95% of the Taiwan vocational teachers had a Bachelor’s Degree or higher. Thus, the information revealed that the academic preparation of respondent vocational education teachers was fairly high, especially for the Taiwan vocational teachers.

Approximately 50 percent of Ohio and Taiwan vocational teachers had 10 years or more of teaching experience at the present school. This fact showed that more than one-half of respondent teachers were a fairly experienced teacher that leads one to assume that they were somewhat familiar with instructional technology technique and materials.
Surprisingly, this study discovered that there was an even distribution of male and female respondents. The researcher expected a greater proportion of female teachers compared to males. Therefore, results of this study represent a gender balanced perspective of participation in instructional technology competencies needs. For teachers in Ohio (n = 182), 67% were 41 years of age or more. Thus, the data presented a mature teaching faculty who should have more interest in learning the new information about instructional technology and its applications. However, the average age of Taiwan vocational teachers (38) was slightly younger than Ohio teachers (43).

When looking at both Ohio and Taiwan vocational teachers’ teaching specialty, the predominant teaching fields were in business and management, and industrial and engineering systems. For Ohio teachers, 43% had a specialty in business and management follow by industrial and engineering systems (26%). Around 31% of the Taiwan teachers taught in industrial and engineering systems and 23% in business and management. Thus, the data showed that both Ohio and Taiwan vocational teachers were in the same major clusters of career fields in business and management, and industrial and engineering systems.

When exploring the instructional technology experience of vocational teachers, 24% of the Ohio vocational teachers had not attended any instructional technology training or workshop. About 32% had 6-10 hours of some kind of instructional technology training. Surprisingly, nearly 42% of the Taiwan vocational teachers had not had any instructional technology training experience.

Conclusions

1. The average Ohio vocational education teacher was either male or female, with a Bachelor’s or higher degree, taught in business or engineering and had more than 10 years of teaching experience.

2. The average Taiwan vocational teacher was either a male or female, with a Bachelor’s or higher degree, taught in business or engineering, had more than 10 years of teaching experience and more than 40% of them were without instructional technology training experience.

Teachers’ Instructional Technology Educational Needs

The difference in mean scores for educational needs (the perceived importance score subtract the perceived competence score, and then multiply the result by the average perceived importance score) was calculated for Ohio and Taiwan vocational education teachers in each instructional technology competence areas. Participants in this study perceived a considerable amount of competence about computer operation skills. The findings show that computer operation skills were not a major educational priority for the vocational teachers in both Ohio and Taiwan. The lower educational needs scores in this area may imply that the teachers already have received information, have been self-taught, and/or have participated in computer literacy training or workshops. Information about creating and name/ rename subdirectories/folders and starting an application and creating a document in the area of computer operation skills were vocational teachers’ most important educational needs in computer operation skills. The fact that the rapid spread of computers and computer-based technologies has had a huge impact on Ohio teachers since Perkins II
and III legislation implied computer literacy for teachers for a long time. Therefore, the computer operation skills were not a major educational priority for the vocational teachers. Results confirmed that vocational teachers’ competence for protecting against computer viruses in setup, maintenance, and troubleshooting of computer system area was low. In this area, both Ohio and Taiwan vocational teachers reported protecting against computer viruses as the number one educational need among the 86 competencies with the highest mean (Ohio = 7.88; Taiwan = 5.43). The reason could be that the infestation with a computer virus is unpredictable and uncontrollable.

Seven items among the top 15 ranked very high in educational needs among Ohio and Taiwan vocational teachers and could be summarized in the two categories: database and telecommunications. Teachers are the key to every school. Database, as a data management program, can be very useful for teachers in keeping attendance records and/or recording grades, generating printed progress reports, sorting and locating particular records by category, importing records or merging files, and communication with district resources for class registration. Telecommunications; such as using Internet web browser to locate web sites, using an appropriate search tools to find accurate information for a specific topic, using e-mail to send, receive, reply and forward messages, using conferencing tools to chat with or interview a colleague online, and creating web pages; were a booming and useful technology tool for any educational settings. Educational courses, formal or informal, should be planned that meet the most important identified needs of the vocational teachers in Ohio and Taiwan.

This researcher ranked educational needs for each item under the eight-domain areas. This information can help both Ohio Education Department and the Ministry of Education of Taiwan in placing their priorities for instructional technology educational programs on the items that were ranked high. Target planning will help meet the needs of vocational teachers, attract a wider array of teachers, and lead to the success of instructional technology educational programs. Educational courses should be planned that meet the identified needs of vocational teachers, with emphasis given to those needs ranked highest.

Conclusions
1. For both Ohio and Taiwan vocational teachers, the lowest instructional technology educational need was computer operation skills with average mean score .37.
2. Protecting against computer viruses was the most important educational need for both Ohio and Taiwan vocational teachers.
3. Database and Telecommunications, among the eight-domain areas, were the top two instructional technology educational needs for both Ohio and Taiwan vocational teachers.

Relationship between Demographic Characteristics and Instructional Technology Needs

The relationship among selected demographic characteristics and educational needs were either low or negligible in this study. The findings appear to indicate that both Ohio and Taiwan participants have similar educational needs. Therefore, the instructional technology training program based on the educational scores will service the various groups of vocational teachers, regardless of their demographic characteristics.

The relationship between teachers’ education degree held, instructional technology training experience and educational needs had a negligible to low relationship. Similar
characteristics may account for the lack of association. A negative coefficient means that the predicted value of the dependent variable (educational needs) decreased when the value of the independent variable (teachers’ education degree held) increases. Vocational teachers with higher degrees had lower educational needs; had more instructional technology training experience and had lower educational needs. Instructional technology competencies need to be constantly practiced and updated as new technology emerges (Liao, 1993; 1995, Huang & Padron, 1997; Redmann, 1998).

Conclusions
1. Age, gender, year of teaching, and teaching specialty had low to negligible association with educational needs.
2. Teachers’ degree held and instructional technology training experience had negligible to low association with educational needs.

Recommendations

Recommendations for Vocational Education Practice
1. Formal educational opportunities (courses, workshops, seminars, etc.) should be offered to update vocational teachers’ instructional technology knowledge and skills on a consistent basis and teachers should take advantage of these opportunities when offered. If the available offerings do not meet the needs of vocational teachers, vocational teachers should assume their professional responsibility by being proactive in communicating this to appropriate service providers.
2. The Ohio Department of Education and the Ministry of Education in Taiwan, college/university teacher education programs, professional associations, and other service providers should place a high priority on increasing the instructional technology knowledge and skill levels of vocational teachers.
3. New instructional technology and applications are created almost daily. Results of this study indicate that setup, maintenance, and troubleshooting of computer system and database were the important priorities for Ohio vocational teachers, while telecommunications was an important priority for Taiwan vocational teachers. New information about instructional technology and applications such as maintenance and troubleshooting of computer system, database, and telecommunications should be provided periodically as an education training or workshop for teachers.

Recommendations for Theory
1. Studies based on the discrepancies analysis of Borich Need Assessment Model to determine accurate measurements of the differences between perceived competence and importance of instructional technology competencies to find out perceived instructional technology educational needs for teachers should be conducted.
2. The International Society for Technology in Education (ISTE) standards for instructional technology competencies including: 1) the use of computer-based technologies to access information to enhance personal and professional productivity, and 2) application of computer and related technologies to facilitate emerging roles of the learner and the educator should serve as references of instructional technology competencies.
Recommendations for Further Research

1. The findings of the instructional technology educational needs of vocational teachers should be used to explore how vocational teachers use these instructional technology competencies in the classroom or in other professional activities for further research.
2. The relationships among selected demographic characteristics and educational needs were negligible to low. Therefore, further studies should analyze the relationship of other selected demographic characteristics and educational needs in other states and countries in order to verify if there are differences or common patterns in findings.
3. Cross-national studies have provided information leading to better understanding of teacher’s perceptions of instructional technology competencies across countries and identified some universal variables related to vocational teachers’ perceptions of instructional technologies and applications. Further research should include other countries for comparison.
4. Most of the studies (Uko, 1985; Arede, 1994; Layfield & Dobbins, 2000) that used Borich’s model had very low correlation coefficients among needs and characteristics. Similar studies should explore other variables, such as types of computer currently using, effectiveness of the use of computer in the instructional process, and ethnicity.
5. The advanced instructional technology competencies for professional development such as: 1) integrate teaching methodologies with knowledge about use of technology to support teaching and learning; and 2) exhibit leadership in the identification, selection, installation, maintenance, and management of computing hardware and software and the uses of computer and related technologies throughout the curriculum should be researched further.
6. This investigation should be replicated at other points in time.

References


