

Developing the Principal Technology Leadership Competency Indicators for Technical High Schools in K-12 in Taiwan

Wen-Jye Shyr
National Changhua University of Education, TAIWAN

Received 9 March 2016 • Revised 14 October 2016 • Accepted 16 October 2016

ABSTRACT

The purpose of this study was to develop principal technology leadership competency indicators for technical high schools in K-12 in Taiwan in order to improve the effectiveness of school administration and teaching. In the first part of the study, five experts in the technology leadership field are interviewed to explore the technology leadership theorem model. In the second part of the study, eighteen experts in technology leadership and principals of technical high schools are recruited as subjects. Using the Delphi technique, questionnaires are constructed to assess competency indicators for principal technology leadership. In the third part of the study, the data from the questionnaire are analyzed using a KS-test and Kruskal-Wallis one-way analysis of variance by ranks. Finally, six dimensions and thirty competency indicators of the principal technology leadership of technical high schools in K-12 in Taiwan were established.

Keywords: competency analysis, delphi technique, technology leadership, technical high school

INTRODUCTION

Integrating technology into the classroom can be very difficult for both teachers and administrators. Muhametjanova and Cagiltay (2016) investigated the major barriers and possible enablers of the technology integration into instruction at the Kyrgyz-Turkish Manas University according to instructors and students. Aydin et al. (2016) explored ICT integration in Turkish K-12 schools purposively selected as a representation of public schools together with a private school. Administrative support is a key factor in the success of any kind of school reform, particularly reform dealing with technology integration (Young 2002; Georganne 2005) and those principals who model the use of technology are particularly instrumental in advancing the use of computer technology in the classroom (Kincaid and Felder 2002). Support from principals is crucial in determining whether teachers will integrate technology into their classrooms. This support requires that principals have basic

© Authors. Terms and conditions of Creative Commons Attribution 4.0 International (CC BY 4.0) apply.

Correspondence: Wen-Jye Shyr, National Changhua University of Education, No.1, Jin-De Road, Changhua 500, Taiwan, 500 Changhua, Taiwan.

 shyrwj@cc.ncue.edu.tw

State of the literature

- Current research offers principal technology leadership competency for elementary and junior high schools in Taiwan.
- Current research develops the dimensions of school technology leadership and to empirically investigate teachers' perceptions of elementary schools in Taiwan.
- Current research noted on case study to understand the experiences of elementary school principal's technology leadership.

Contribution of this paper to the literature

- This paper offers principal technology leadership competency indicators for technical high schools in Taiwan.
- It is noteworthy that the study examined consistency between technology leadership researchers, the principal of technical high schools, and the director of technical high schools.
- Results found that the process for obtaining consensus progressed as anticipated and that it was successful in identifying and validating the competency indicator.

technology skills and standards from which to work (Bailey 1997). As well as this, principals need to provide leadership by creating a vision, sharing the vision, acquiring funding, planning and coordinating the process of introducing technology, developing the curriculum, training, and setting the technology standards that will provide the basis for administrators' knowledge (Banoğlu 2011).

Although many principals' commitments and time-consuming work schedule leave little time for reflection on strategies and new techniques, the leadership principals provide for teachers is one of the most important factors that influence the effectiveness of technology programs (Jones 2001). While it is the responsibility of school administrators to understand the future of technology and what the ramifications are for education (Hall 2001), school principals must have sufficient knowledge of technology to guide them in their decision-making. Principals should understand the need to create a technology-use plan to support the teaching goals and the objectives of the school (Holland and Steward 2000). Principals should be strong visionaries with an understanding of pedagogical principles regarding innovation in the classroom and its impact on student learning. The use of technology can either be a major catalyst for change or a waste of valuable resources. It is up to the principals to make the right decisions.

Competency refers to the intellectual and/or physical ability to perform a task. A broader definition of this term (and which is used in this study) includes attitudes as well as skills and knowledge. Thus, for example, Spencer and Spencer (1993) referred to such competencies as knowledge, skills, positive attitudes, personal values and self-motivation. Competencies can be both observable and non-observable. Bailey (1997) identified eight important themes for leaders who want to integrate technology effectively: the ability to adapt to developments in technology, budgeting and planning for the integration of

technology, professional development of personnel involved in integrating technology, technological infrastructure, technical support in the implementation of technology, learning and teaching using technology, developing a curriculum in which technology is integrated, and individuals who consider themselves to be technology leaders. Cakir (2012) showed that school administrator, who has the primary responsibility for technology integration in the schools, and computer teachers, who play an important role in the integration of technologies in the classroom, need to have a great interest in and a highly positive attitude towards technology integration.

The principal's leadership competencies are critical for integrating technology into schools. Technology leadership roles in schools incorporate many responsibilities ranging from ensuring effective lighting in classrooms to the assurance of healthy computer usage. Principals' leadership competencies also include ensuring that technology is being used in ways that support principles and protect the equal access to technology (Michael 1998; Flanagan and Jacobsen 2003).

The National Educational Technology Standards for Administrators (ISTE 2002) were defined as: (1) leadership and vision, (2) learning and teaching, (3) productivity and professional practice, (4) support, management and operations, (5) assessment and evaluation, (6) social, legal, and ethical issues. In 2009, these standards were updated by the ISTE to include visionary leadership, digital-age learning culture, and excellence in professional practice, systemic improvement, and digital citizenship (ISTE 2009). According to Sujo-Montes and Gallagher (2010), the ISTE standards are a reflection of modern times and call for new attitudes from school principals; attitudes that focus on proficiency in using technology and a school vision that includes technology as an essential part of the curriculum.

In Taiwan, the names of technical high schools and their departments are complex. There are more than ten kinds of high schools, such as the High School of Industry, the High School of Commerce, the High School of Agriculture, etc. (Hung and Fua 2010). Taiwan has steadily implemented new curricula for technical high schools and authorized schools to partially develop their own curricula according to each individual school's missions and goals. While technical high schools principals now have considerable latitude in terms of curriculum development, they must also excel in leadership in order to achieve the goals of curriculum reform. It is not surprising that principals of many schools are lacking in both experience and ability when it comes to implementing curriculum development (Hsiao et al. 2008).

LITERATURE REVIEW

The main purposes of this section are to discuss the definition of core competency and the Delphi technique with reference to the relevant literature, as well as to define competency analysis.

The definition of core competency

Prahalad and Hamel (1990) defined core competency as one or multiple technologies. Many managers extend this concept into various skills and functions, including program engineering, production, new product idea processing and even the design of a company recognition system. They consider everything to be a potential core competency.

Delphi technique

The study was conducted using the widely used and accepted Delphi technique. This is a process that assembles the ideas and opinions of a group of individuals considered to be knowledgeable experts in a given field. The purpose of using the Delphi technique is to produce a reliable consensus of opinion through the use of a panel of experts.

The Delphi technique has been used in various fields of study, including program planning, needs assessment, policy determination and resource utilization, to develop a full range of alternatives, explore or expose underlying assumptions, as well as to correlate judgments in many disciplines. It uses questionnaires that include multiple questions to collect data from a panel of selected subjects. Any subject assigned a rank derived by ten or more points from the corresponding first Delphi median rank is requested to state the rationale for the dissenting opinion in the space given. In terms of the appropriate number of subjects for performing the Delphi technique, researchers should use as few subjects as possible and should verify the results by follow-up investigations. The number of experts used in an investigation using the Delphi technique is generally determined by the number required to constitute a representative pool of people equipped to give judgments and the information processing capability of the research team. However, the literature reveals no consensus as to the optimal number of subjects required to perform the Delphi technique. Researchers suggest that 10-15 subjects could be sufficient if the subjects involved in the Delphi technique constituted a homogeneous group (Delbecq et al.1975).

The Delphi technique has the following advantages: (a) There is no requirement for the expert panel to meet as a group; hence it is logically feasible that a national survey can be undertaken within a reasonable period of time and with minimal expense. (b) Responses are anonymous, thus providing an environment for collegial idea sharing. (c) Feedback to panel members is moderated by a facilitator (Linstone and Turoff 1975).

Definition of competency analysis

McClelland (1973) first suggested the term “competency” as a criterion for judging successful performance. Competency analysis identifies the behaviors required for professionals to perform work-related tasks. Identified behaviors include motive, attributes and skill, or knowledge of the fundamental attributes. Specifically, competency refers to employee performance required to work effectively when playing a role or undertaking a task. Thus, competency is not only an aggregation of knowledge, skills, and attributes, but

also involves being able to put theory into practice. Competency also refers to the ability to achieve an effective outcome in a specific situation (Chao et al. 2003). Competency frameworks have been applied in various settings, for example, for assessing company managers and employees and as training and recruitment tools (Rifkin et al. 1999).

RESEARCH DESIGN AND METHODOLOGY

Questionnaire design

To fulfill the research objectives, a questionnaire was designed to collect data in six dimensions: (1) leadership and vision, (2) learning and teaching, (3) productivity and professional practice, (4) support, management, and operations, (5) assessment and evaluation, and (6) social, legal and ethical issues. The questionnaire was designed to collect 30 competency indicators of the principal technology leadership at technical high schools. Each competency was rated by its importance to technology leadership. A Likert scale was used in this questionnaire. Members of the Delphi group were asked to assess each competency according to the following 5-point scale: 5=very important, 4=more important, 3=somewhat important, 2=less important, 1=least important in terms of technology leadership. At the end of each section of the survey, space was left for participants' comments regarding competencies required for principal technology leadership.

Participants

Eighteen experts in technology leadership field were recruited and asked to complete the questionnaires in order to construct the competency indicators required for a principal technology leadership. Six of the subjects have research experience in technology leadership; six subjects are principals of technical high schools in Taiwan and six are directors of technical high schools in Taiwan.

Instruments

The design of the instrument was crucial for gathering reliable and valid data for the study. The survey entitled, "Survey of Principal Technology Leadership Competency Indicators" was specifically designed to investigate experts' and principals' opinions regarding competencies required by principals to be technology leaders. Thirty questions were developed and verified by five experts in the technology leadership field as to content validity. The questions mainly concerned the experts' experiences in technology leadership and their thoughts and experiences. The pilot version of this instrument was reviewed by field experts in technology leadership and, based on their feedback, several revisions were made. Any item that lacked clarity or was ambiguous was reconsidered to establish consistency of wording and format.

Data analysis

The aim of this study was to determine the technology leadership competencies required by principals of technical high schools. Data collected from the questionnaires were analyzed by means of the Statistical Package for the Social Sciences (SPSS) software (Shavelson 1996). For the data analysis, descriptive analysis was adopted for mode (Mo), mean (M), standard deviation (SD), the Z-value of the K-S Test, and the Kruskal-Wallis one-way analysis of variance by ranks (χ^2).

RESULTS

The results of the three rounds of the experts' responses to the questionnaires are shown in the **Table 1**. The K-S test found that a value equal to 0.05 was statistically significant and that participants considered the items more important and consistent. In terms of the importance of principal technology leadership, the mean score for 30 working competencies in six dimensions were above 4.17, which indicated that the Delphi group considered the competencies listed in the questionnaire to be "more important". The Kruskal-Wallis one-way analysis of variance by ranks (χ^2), to prove the consistency of opinion of all the experts and the items which participants considered to be important.

Table 1. Consistency data analysis of principal technology leadership competency indicators

Competency Indicators	Mo	M	SD	K-S test	χ^2
1. Leadership and vision dimension		4.78			
1.1 Facilitate practical integration and utilization of technology.	5	4.78	0.43	2.020*	2.429
1.2 Reference data in making leadership decisions.	5	4.78	0.43	2.020*	0.607
1.3 Promote a school culture of innovative technology.	5	4.78	0.43	2.020*	0.607
1.4 Encourage communication between students and teachers, and team work to cultivate a vision for technology.	5	4.94	0.24	2.281*	2.000
1.5 Develop and execute systematic technological programs.	5	4.61	0.50	1.663*	0.442
2. Learning and teaching dimension		4.70			
2.1 Improve technological equipment to support teachers and enhance learning effectiveness.	5	4.94	0.24	2.281*	2.000
2.2 Support innovation in learning by developing a technological learning environment.	5	4.83	0.38	2.127*	0
2.3 Provide a student-centered technological learning environment that can be adapted to the individual differences of students.	5	4.72	0.46	1.904*	1.063
2.4 Support the improvement of teaching through technology and develop problem solving skills.	5	4.56	0.51	1.541*	1.417
2.5 Provide teachers with opportunity to improve their capabilities in technology application.	4	4.44	0.51	1.541*	1.700
3. Productivity and professional practice dimension		4.57			
3.1 Use technology to promote communication and collaboration among faculty, students, parents and the community.	5	4.72	0.46	1.904*	3.662
3.2 Organize technology learning groups to encourage faculty to improve their productivity.	5	4.61	0.50	1.663*	1.766

Table 1. Consistency data analysis of principal technology leadership competency indicators (continued)

Competency Indicators	Mo	M	SD	K-S test	χ^2
3.3 Utilize technological resources to support continued professional development	4	4.33	0.49	1.785*	0
3.4 Keep abreast of emerging trends in technology.	5	4.56	0.51	1.541*	3.091
3.5 Use various technological products to enhance interaction and collaboration among faculty.	5	4.61	0.50	1.663*	1.766
4. Support, management, and operations dimension		4.63			
4.1 Support the integration of technology with education.	5	4.50	0.51	1.419*	0.425
4.2 Effectively allocate financial and human resources to ensure that technology programs are maintained.	5	4.72	0.46	1.904*	3.662
4.3 Ensure that teachers are making full use of the resources at their disposal by driving technological solutions, strategic integration, and improvement measures.	5	4.72	0.46	1.904*	0.523
4.4 Implement standardized procedures to ensure the continued improvement and refinement of technology systems.	5	4.61	0.50	1.663*	3.091
4.5 Integrate technology into management and operations systems.	5	4.61	0.50	1.663*	0.442
5. Assessment and evaluation dimension		4.58			
5.1 Use technology to assess and evaluate teaching and administrative staff.	5	4.67	0.49	1.785*	1.417
5.2 Use technology to collect and analyze data, interpret results, and publish results, in order to improve teaching and learning.	5	4.67	0.49	1.785*	4.250
5.3 Employ diverse methods to assess the utilization of technological resources, with the aim of improving educational and operational productivity.	5	4.67	0.49	1.785*	5.667
5.4 Evaluate the use of technology among faculty, and make decisions about staff and their professional development accordingly.	4	4.33	0.49	1.785*	4.250
5.5 Assess technology utilization based on school evaluation indicators.	5	4.56	0.62	1.595*	2.583
6. Social legal and ethical issues dimension		4.47			
6.1 Ensure that technology resources are allocated fairly and in accordance with the needs of students and teachers.	4	4.33	0.49	1.785*	3.091
6.2 Communicate about social, legal and ethical issues to raise awareness of responsible use of technology.	5	4.61	0.50	1.663*	5.740
6.3 Raise awareness of privacy, security, and Internet safety issues.	5	4.67	0.49	1.785*	5.667
6.4 Promote a safe and healthy technological environment.	4	4.17	0.51	1.717*	2.517
6.5 Raise awareness of copyright and intellectual property.	5	4.56	0.51	1.541*	5.525

*p<0.05

CONCLUSIONS

The final 30 competency indicators revealed how important it was for a consensus to be obtained for establishing principal technology leadership. The analyses found that the process for obtaining consensus progressed as anticipated and that it was successful in identifying and validating the competency indicators demanded for principal technology leadership. The data analyses revealed decreased standard deviation and increased means, both of which are indicative of good consensus.

This research offers three major contributions. First, the results reveal the competencies required by technical high schools principals and also imply that their comparative importance is confirmed by the literature. Second, this research confirms the competency indicators of technical high schools principals in Taiwan. Third, the investigation supports the proposed methodology which is quantitative and qualitative.

In further research, a bigger sample is required in order to verify and generalize the results. In future research, principals should be familiar with different competency indicators and have different leadership experience. The proposed method could be useful in this regard; it can be used to draft various types of education and training for principals, and also be applied to establishing a detailed research process.

REFERENCES

- Bailey, G. (1997). What technology leaders need to know: The essential top 10 concepts for technology integration in the 21st century, *Learning and Leading with Technology*, 25(1), 57-62.
- Banoğlu, K. (2011). Principals' Technology Leadership Competency and Technology Coordinator ship. *Educational Sciences: Theory & Practice*, 11(1), 208-213.
- Cakir, R. (2012). Technology integration and technology leadership in schools as learning organizations, *The Turkish Online Journal of Educational Technology*, 11(4), 273-282.
- Chao, C.Y., Liao, W.C., Chien, F.E. & Huang, Y.L. (2003). Construction of a competency analysis model for vocational high schools. *World Transactions on Engineering and Technology Education*, 2, 121-124.
- Delbecq, A.L., Ven, V. & Gustafson, D.H. (1975). Group techniques for program planning: a guide to nominal group and delphi processes. Scott Foresman and Comp., Glenview, IL.
- Flanagan, L. & Jacobsen, M. (2003). Technology leadership for the twenty-first century principal. *Journal of Educational Administration*, 41(2), 124-142.
- Georganne, S. (2005). Educator perceptions of principal technology leadership competencies. Dissertation of University of Oklahoma.
- Hall, G. (2001). Leading the charge. *Principal Leadership*, 1(9), 40-42.
- Holland, L. & Steward, T. (2000). A different divide: preparing tech-savvy leaders. *Leadership*, 30(1), 8-10.
- Hsiao, H.C., Chen, M.N. & Yang, H.S. (2008). Leadership of vocational high schools principals in curriculum reform: A case study in Taiwan, *International Journal of Educational Development*, 28(6), 669-686.
- Hung, Y.L. & Fua, C.S. (2010). Brand management model of vocational high schools in Taiwan, *Procedia Social and Behavioral Sciences*, 2, 4229-4233.
- ISTE (2002). National educational technology standards for administrators, International Society for Technology in Education, Retrieved July 6, 2015, from http://www.iste.org/docs/pdfs/nets-for-administrators-2002_en.pdf?sfvrsn=2
- ISTE (2009). National Educational Technolgy Standards (NETS) for Administrators. International Society for Technology in Education, Retrieved July 6, 2015, from

- <http://www.amazon.com/National-Educational-Technology-Standards-Administrators/dp/1564842576>
- Jones, C.A. (2001). Tech support: preparing teachers to use technology. *Principal Leadership*, 1(9), 35-39.
- Kincaid, T. & Feldner, L. (2002). Leadership for technology integration: the role of principals and mentors. *Journal of Educational Technology & Society*, 5(1), 75-80.
- Linstone, H.A. & Turoff, M. (1975). The Delphi method: techniques and applications. Reading, MA: Addison-Wesley.
- McClelland, D.C. (1973). Testing for competence rather than for intelligence. *American Psychologist*, 28, 1-14.
- Michael, S.O. (1998). Best practices in information technology (IT) management: Insight from K-12 schools' technology audits. *International Journal of Educational Management*, 12(6), 277-288.
- Muhamedjanova, G. & Cagiltay, K. (2016). Integrating technology into instruction at a public university in Kyrgyzstan: Barriers and enablers. *Eurasia Journal of Mathematics, Science & Technology Education*, 12(10), 2657-2670.
- Prahalaad, C.K. & Hamel, G. (1990). The core competence of the corporation. *Harvard Business Review*, 79-90.
- Rifkin, K.I., Fineman, M. & Ruhnke, C.H. (1999). Developing technical managers: first you need a competency model. *Research Technology Management*, 42(2), 53-57.
- Shavelson, R.J. (1996). Statistical Reasoning for the Behavioral Sciences. Needham Heights: Allyn & Bacon.
- Spencer, L.M. & Spencer, S.M. (1993). Competence at work, New York: Willy.
- Sujo-Montes, L. & Gallagher, L. (2010). School, technology, and society home-school communications and access. In R. Papa (Ed.), *Technology leadership for school improvement* London: Sage, 167-188.
- Young, S. (2002). Taking the Lead. *Technology & Learning*, 21(5), 26-34.

<http://iserjournals.com/journals/eurasia>