

A Delphi Study Analysis of ICT Skills in Secondary Vocational Schools

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Abstract: The development of a high-quality education system is one of Malaysia's main priorities. Focus has centred on the development of experienced, competent, progressive human capital bearing high moral and ethical standards. The Education Development Master Plan (EDMP) 2006-2010 submitted by the Ministry of Education implements 22 vocational subjects (VS) in secondary schools. This is to develop vocational skills in preparing students to meet the need for skilled and semi-skilled workers after graduating high school to support economic development. This study identifies the elements of sustainability for the implementation of VS in secondary schools in Malaysia based on the strategy outlined by the International Centre for Technical and Vocational Education and Training (UNEVOC) based in Bonn, Germany. The methodology used for this study is the Delphi study. Twelve panels of experts in the field of technical and vocational education in Malaysia were involved in the study consisting of four rounds of Delphi. In the first round, interviews were conducted on a panel of experts on the basis of interview protocols. The results of these interviews showed that ICT skills are one of the elements necessary for the preservation of VS teaching in secondary schools. Subsequently a questionnaire was developed with the aid of an expert panel in the second to fourth rounds of the Delphi study. The questionnaires developed will be used by VS teachers in order to gain a perception of ICT skills in the conservation of VS teaching in secondary schools.

Key words: Sustainable Development • Sustainability • Vocational Subjects • Delphi Study • ICT Skills

INTRODUCTION

Although information communication technology (ICT) has been long established, it is a relatively new element in Malaysian society. Developments in ICT have increased the ability of society to ease into the new decade [1]. ICT skills are an important component of our educational system today. ICT skills and knowledge are not just limited to computer use, but are also applicable in various fields. In technical education ICT skills are particularly vital in the design of an invention or creation. At higher levels, ICT skills promote and create innovation, individual transformation and social change [2].

Sustainability is defined as circumstances that do not change or are maintained as per the original [3]. The concept of sustainability is part of the discourse of international discussions dating back to the 1980s. According to Pavlova [4], the term 'sustainable development' has many meanings and definitions depending on the organization exemplified. The concept of sustainable development was first defined by the Brundtland Commission Report, the World Commission

on Environment and Development. According to Brundtland [5], sustainable development has been conceptualised in a variety of purposes, one of them being,

'...development that meets the needs of the present without compromising the ability of future generations to meet their own needs...'

Apart from the Brundtland definition, sustainability is also defined as the future paradigm of thinking which balances environmental, social and economic planning, including the development and upgrading of the overall quality of life [6]. Therefore, sustainability concept should be promoted and instilled through many means including the education system.

Vocational education is regarded as a major source for skilled and semi-skilled workforces. Hence, it plays an important role in determining the sustainability of economic growth and competitive achievements. In the Malaysian vocational education curriculum, vocational subjects (VS) consist of 22 elective subjects which are given emphasis in the Education Development Master Plan (EDMP) 2006-2010 by the Ministry of Education.

Table 1: Subject of Vocational Education by Specialisation

Field	Vocational Subjects
Engineering Services	<ol style="list-style-type: none"> 1. Servicing of Domestic Electrical Appliances 2. Domestic Wiring 3. Servicing of Refrigeration and Air Conditioning Equipment 4. Gas and Arc Welding 5. Motorcycle Servicing
Construction	<ol style="list-style-type: none"> 1. Domestic Construction 2. Furniture Making 3. Domestic Plumbing 4. Architectural Signs 5. Interior Design Basis
Home Economics	<ol style="list-style-type: none"> 1. Custom Clothing and Tailoring 2. Catering and presentation 3. Food Processing 4. Home Hair Care and Toiletries 5. Early Childhood Care and Education 6. Basic Gerontological Services
Agriculture	<ol style="list-style-type: none"> 1. Landscape and Nursery 2. Food Crops 3. Aquaculture and Animal Recreation
Computer Applications	<ol style="list-style-type: none"> 1. Computer Graphic 2. Multimedia Production

Source: Curriculum Development Centre, Ministry of Education [8]

This is to develop vocational skills in preparing students to meet the need for skilled and semi-skilled workers after graduating high school to support economic development [7]. Table 1 shows VS which are grouped according to key areas.

The Ministry of Education (MOE) has set a National Key Performance Indicator (NKPI) specifically affording access to affordable and quality education. In the NKPI to-5, technical and vocational education (TVE) plays an increasingly important role in the Malaysian development agenda. The Minister's Key Performance Indicators (KPIs), Ministry of Education Malaysia is targeting a 100% student participation in vocational and skills streams towards the end of 2015. According to [9], VS are one of the subjects in the group encompassing TVE at the secondary level in secondary schools that will be addressed in order to achieve NKPI. It is tabulated that there will be a rather significant increase of students enrolling in VS between the years 2010 and 2015.

The Delphi study is the use of expert opinion. This method of study first began at the RAND Corporation by Olaf Helmer and Norman Dalkey in 1953 to examine specific problems in the military [10]. The main objective of the Delphi study is to obtain a valid feedback and agreement regarding high-level problems via questionnaires given to a group of expert panels. This is

done by providing each individual in the panel of experts a questionnaire containing the same questions as well as group feedback from previous rounds [10].

Delphi studies are often used to consolidate and refine the opinion of a heterogeneous group of experts on the basis of collective information provided in the judging process [11]. The Delphi study conducted by [12] in the preparation of the principal research instrument involves principals currently working or those who were previously employed at the university in the El Paso area, Texas. This technique is a process that exemplifies the use of written responses rather than bringing individuals together in discussion.

Delphi studies generally exhibit three characteristics: transparency, feedback control and statistical analysis group [13]. According to [14], the five fundamental elements of Delphi studies are where (i) samples are individually selected without each sample being aware of the answers provided by other participants in the panel of experts, (ii) samples are only informed of answers submitted by samples in the second round of data analysis in which research findings are submitted to all panel members, (iii) samples do not receive any pressure from any party or other samples to determine their questionnaire responses, (iv) data is analysed statistically and (v) data samples are unbiased, playing a pivotal role in the panel to finding a solution.

The study was conducted to identify the elements that would ensure the continuity of VS in tandem with achieving the goals and objectives of VS in secondary schools. Elements of sustainability are very important in maintaining VS and improving the quality of life in the country with regard to post VS secondary school education.

MATERIALS AND METHODS

Research Design: A four round Delphi study was conducted in this study. Its aims were to achieve a high level of consensus views among the panel of experts formed by researchers in order to identify the elements necessary to preserve VS in secondary schools. In addition, findings at this stage were also implemented to construct questionnaire items for conducting surveys on VS teachers to gain insight on the identification of sustainability required for VS. This method has been used extensively to predict and identify needs in educational research. For example, in clinical education, Delphi studies have been used in various ways, including predicting, planning and curriculum development [15].

Participants and Procedures: The sample selection was individuals with high levels of knowledge in the field of TVE in Malaysia. However, [10] in [16] stated that researchers found it difficult to apply the title Delphi ‘expert’ to an individual solely on the basis of the individuals’ assessment of the academic community, their contributions and achievements in their career. For purposes of determining the sample, the following criteria were applied as a basic guide to setting the panel of experts for the Delphi survey:

- Individuals being lecturers at Public Institutions of Higher Education (PIHE) must hold a Doctor of Philosophy (PhD) degree in TVE or sustainable development, while individuals being lecturers at the Institute of Teacher Education (ITE) must have service experience spanning 10 to 15 years in TVE or individuals being teachers must have more than 10 years in TVE-based teaching.
- Individuals must possess knowledge of the curriculum and implementation of TVE-based subjects at either the university, ITE or school level.
- Individuals are directly involved in VS, especially from the Ministry of Education.
- Individuals are willing to participate in a set round of Delphi study sessions.

The panel of experts were selected on the basis of their willingness and ability to express opinions on the topics being discussed and having extensive experience on these matters [17]. Coinciding with the criteria set, a 12 person expert panel was finally selected [12].

The First Round of the Delphi Study: In the first round of the Delphi study session, the researcher met and interviewed all participants to identify the sustainable elements of VS based on the interview protocol prepared by the researcher. The researcher also discussed the concept of sustainable development in the Malaysian context. Methods carried out in the first round provide the anchoring force in exploring and understanding the phenomenon of a study in greater depth and systematically explore the interpretation of the expert panel members via conversation, expressions of feelings and their views [18, 19]. A further study of the first-round Delphi was used as a basis to develop questionnaire items that were applied in the second-round Delphi study session.

The Second Round of the Delphi Study: In the second round, the researcher once again faced each participant of the expert panel to explain the format and method of answering the questionnaire constructed on the basis of findings in the first round. During these meetings, the participants were given the opportunity to examine every item, with explanations of the terms which were less understood. Participants were also given a further two weeks to approve, comment and make any improvements to the questionnaire items.

The Third Round of the Delphi Study: For the third round, the participants forming the expert panel of researchers were once again requested to agree on items that were analysed in the previous round without adding any new items. Reasons were given should the scale of approval exceed the majority consent of the earlier rounds. In short, the third-round session aimed to bridge the differences of opinion among participants in the Delphi expert panel.

The Fourth Round of the Delphi Study: The purpose of the fourth round was to bridge the gap in views amongst the expert panel established by the researchers based on questionnaires that were analyzed in the third round, in which all items in this round of questionnaires finally achieved a high level of agreement amongst the experts.

The researchers' action to terminate the rounds once a high level of agreement is consistent with the opinions of [20-23]. In their opinion the optimum number of rounds in a Delphi study is between two and ten rounds in order to limit findings to suit the purpose and objectives of the study. However, the cycle can also be terminated once a high level of agreement among experts has been reached and the required information has been obtained or the initial agreement on the number of rounds to be successfully terminated by the researcher.

RESULTS AND DISCUSSION

Delphi Study Participants' Profile: Eight staff members from the public and private higher education institutes, an ITE lecturer, two education officers from the Ministry of Education and a specialist teacher were appointed as the panel of this Delphi study.

First Round of the Delphi Study Findings: Interviews were conducted on the basis of interview protocols prepared by the researcher. The sustainable development strategy of technical and vocational education and training [24] was used as the basis for the formation of the interview protocol. ICT skills have been identified as one element in the preservation of VS in secondary schools. Following is an excerpt from the informants or the panel of experts in the first round.

'He wants to repair cars, but cars are more complicated nowadays. Everything is automatic now. He must understand or learn at least a little ICT. Sometimes we ourselves don't expose students to ICT. These students are the ones most fit to use computers' (Informant 4).

'Even though we might be reluctant, we need to introduce ICT-based skills. ICT skills and values facilitate and enhance our capacity for knowledgeable employee' (Informant 9).

Second to Fourth Rounds of the Delphi Study Findings:

A questionnaire was jointly developed by an expert panel in the second to fourth rounds of the Delphi study. Table 2 shows the questionnaire items that were developed for the elements of ICT skills.

The study conducted found that ICT skills have been identified as an element for the sustainability of VS in secondary schools. The end of the fourth round of the Delphi study found a high consensus among the panel of experts with the values of QR = 1 and median = 5 (strongly agree) to each element of the questionnaires on ICT skills. Among them were: (i) VS students must produce learning reports using computer applications, (ii) VS students should be exposed to computer usage, (iii) VS students need to be able to use the internet to source for information for VS-related assignments, (iv) ICT skills should be a criterion in the evaluation of VS students, (v) ICT skills can produce students who are more creative and innovative, (vi) ICT skills are necessary in designing projects, (vii) ICT skills should be incorporated across the VS curriculum, (viii) ICT skills are an added value to VS students apart from technical skills and (ix) VS students who master ICT skills produce quality work.

Innovation can help students, particularly in the areas of TVE in designing new creations. In the context of education, information technology (IT) is an electronic network to search for, collect, store and process information effectively and quickly to assist in

Table 2: Questionnaire of ICT Skills

Item	Element- ICT Skills	M	Med	QR
1	VS students must produce learning reports using computer applications.	4.25	5	1
2	VS students should be exposed to using information technology tools to perform efficiently.	4.25	5	1
3	VS students need to be able to use the internet to source for information for VS related assignments.	4.25	5	1
4	ICT skills should be a criterion in the evaluation of VS students.	4.25	5	1
5	ICT skills may produce more creative and innovative VS students.	4.25	5	1
6	ICT skills are necessary to design a project.	4.25	5	1
7	ICT skills should be incorporated across the VS curriculum.	4.25	5	1
8	ICT skills are an added value to VS students apart from technical skills.	4.25	5	1
9	VS students who master ICT skills produce quality work.	4.66	5	1

Key:

M - Mean

Med - Median (the approved panel of experts)

QR - Quartile Range (0 - 1 = indicates a high consensus among the panel of experts according to [25])

the process of teaching and learning [26]. However, the systematic Instructional System Design should be applied such as that proposed by [27] when designing the instruction.

The result of the construction of the questionnaire regarding the elements of ICT skills also indicated that the expert panel agreed to exemplify ICT skills as an added value in preserving VS teaching in secondary schools. They also argued that ICT skills should be incorporated across the VS curriculum.

ICT skill is a 'must' for every growing and ever changing global economy. In only five years' time regardless of the industry or the position, most jobs will require at least basic IT skills. ICT is synonymous with a knowledge economy (k-economy) and innovation-economy (i-economy). The skill has significant importance in the development and welfare of people and communities [28]. Suzana *et al.* [29] determine the factors that influence the sustainability of ICT hubs and categorise them into three domains: technology, organizational and environment. Thus, in designing the instruction the teacher must also give attention to technical, organizational and environment aspects are considered three prominent elements for the success of the implementation of ICT in education.

CONCLUSION

The Delphi study method had confirmed the importance of ICT skills in determining the sustainability of VS. The inclusion of ICT is expected to enhance the implementation of VS in the efforts to produce skilled and semi-skilled workers in this country. A competent workforce should exhibit good ICT skills.

REFERENCES

1. Abdullah Mat Rashid and Aminuddin Hassan, 2008. Use of information and communication technology in the teaching of technical and vocational education. UPM Publisher: Serdang, Selangor, Malaysia.
2. Jamalludin Harun and Zaidatun Jamalludin Tasir, 2003. *Multimedia in education*. Pahang: PTS Publication & Distributors.
3. House Dictionary, Third Edition, 2002. Kuala Lumpur: Dewan Bahasa Dan Pustaka.
4. Pavlova, M., 2009. Technology and vocational education for sustainable development- Empowering individuals for the future. United Kingdom: Springer.
5. Brundtland Report, 1987. In world commission on environment and development. Our common future: OUG.
6. Ruhizan M. Yasin and Norzaini Azman, 2005. Sustainability education through teacher education programs at the Faculty of Education UKM. Proceedings of the Seminar on Education 2005 - Education for Sustainable Development, Universiti Sains Malaysia, pp: 761-766.
7. Education Development Master Plan (EDMP), 2006-2010 Government of Malaysia.
8. Curriculum Development Centre, 2001. Vocational Subjects Concept Paper. Malaysia Ministry of Education.
9. Ahmad Tajudin Jab, 2009. TVET managing in the Global Economic Downturn. The 6th Annual National Technical and Vocational Education and Training Conference in 2009. Concorde Hotel, K. Lumpur, 12th - 13th May 2009.
10. Helmer, O., 1968. Analysis of the future: The Delphi Method. In: J.R. Bright, (Ed), Technological forecasting for industry and government: New Jersey: Prentice-Hall Inc.
11. Jones, J.E., 1979. A look in future: The 2020 organization. Retrieved on October 22, 2009. From <http://www.improve.org.2020org.html>.
12. Dunlap, K., J. Daresh, M. Ganter and M. Hvizdak, 1998. View from the field: The principal's perspective on effective school leadership characteristics. Paper Presented at the Annual Conference of the American Educational Research Association, San Diego.
13. Dalkey, N.C., D.L. Rourke, R. Lewis and D. Snyder, 1972. Studies in the quality of life: Delphi and decision-making. Lexington, MA: Lexington Books.
14. Linstone, H. and M. Turoff, 1975. The Delphi method: Technique and applications. Reading, Massachusetts: Addison-Wesley.
15. Thangaratinam, S. and C.W.E. Redman, 2005. The Delphi Technique. The Obstetrician & Gynaecologist Journal, 7: 120-125.
16. Steward, J., C. O'Halloran, P. Harrigan and JA. Spencer, 1999. Identifying appropriate tasks For the preregistration year: Modified Delphi Technique. British Medical Journal, 319(7204): 224-229. Retrieved on 18 NOV 2009 from <http://bmj.bmjjournal>.
17. French, P., C. Psychol, Yin, Yo Ho and L.S. Lee, 2002. A Delphi survey of evidence-Based Nursing Priorities in Hong Kong. Journal of Nursing Management, 10: 265-273.

18. Morohaini Yusoff, 2001. Qualitative Research: Experience in field studies. Kuala Lumpur: Universiti Malaya Press.
19. Patton, M.Q., 2002. Qualitative research and evaluation methods. London: Sage Publication.
20. Martino, J.P., 1972. Technologies forecasting for decision making. New York: American Elsevier Publishing Company Inc. Martino.
21. Delbecq, A., A. Van De Ven and D. Gustafon, 1975. Group technique for program planning: A guide to nominal group and Delphi process. Glenview, IL: Scott-Foresman.
22. Ludwig, B., 1997. Predicting the future: Have you considered using the Delphi methodology? Journal of Extension, 35(5), 233-239. Retrieved on 10 NOV 2009 from <http://www.joe.org/joe/1997october/tt2.html>.
23. Bauder, S.M., 1999. A competency requirements analysis for digital television engineers. A competency requirements analysis for digital television engineers. Unpublished Masters Thesis, University of Wisconsin-Stout. Retrieved on October 25, 2009 from <http://www.sbe.org/pdf/Thesis.pdf>.
24. UNESCO, 2004b. Suggestions to UNESCO for Action Planning in TVET for Sustainable Development. Expert Meeting on Learning for Work, Citizenship and Sustainability, Bonn, October 2004. UNESCO, Paris. UNESCO, Paris. http://www.unevoc.unesco.org/publications/pdf/SD_ActionPlan_e.pdf (06.08.2005).
25. Diana, L.W., B. Randall and V.K. Karla, 2004. Teacher belief about educational software: A Delphi Study. Journal of Research on Teaching in Education, 36(3): 213-229. Retrieved on 12 November 2006 from iste@iste.org. www.iste.org.
26. Rozina Jamaludin, 2002. Fundamentals of multimedia in education. Series Star studies and education. Kuala Lumpur: Utusan Publication and Distributors Sdn.
27. Homa Edalati Fard, Zaidatun Tasir and Azidah Abu Ziden, 2010. Hybrid instructional design model based on constructivism for web. World Applied Sciences Journal, 11(1): 44-48.
28. Evin M. Tas, 2011. ICT education for development - A case study. Procedia Computer Sci., 3: 507-512.
29. Suzana Basaruddin, Haslinda Sutan Ahmad Nawi, Nur Syufiza Ahmad Syukur, Kamaruzaman Jusoff, Nor Azah Johari and Hamdan Salleh, 2010. Influencing factors for effective community ICT Hubs. World Applied Sciences Journal, 11(1): 114-117.