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Instructional Technology Competencies Perceived by Technical and Vocational Education and Training (TVET) Students in Malaysia

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Abstract

This study examines the development of an instrument to investigate the educational needs of Malaysian students undergoing technical education and vocational training (TVET), their perception of the importance and relevance of TVET in Malaysia, as well as the factors that contribute to instruction competencies required to enhance the knowledge and reasoning skills of TVET students. A framework model is presented with the aim of revising and further developing curriculum competencies in TVET education based on reviews of the philosophies and learning theories from past studies, and in particular, the Analysis, Design, Develop, Implement, Evaluate (ADDIE) instructional design model. It is proposed that by extending the ADDIE instructional design model to include three learning theories, namely the behaviourist, cognitive, and constructivist theories, a sustainable program can be developed that focuses on assessing the reasoning skills of TVET students. The instruction competencies derived from this revision could enhance the employability of TVET graduates.

Keywords: ADDIE Instructional Design Model, Behaviourist Learning Theory, Cognitive Learning Theory, Constructivist Learning Theory, Instructional Design Model, Technical Vocational Education and Training (TVET).

Introduction

Vocational education is frequently under-rated in Malaysia against a backdrop of the prevailing perception of vocational school students being academic under-achievers or failures. As a result of this, many parents do not encourage their children to pursue technical and vocational training (John, 1993). This negative perception towards vocational education has its roots in the early history of vocational training when such training was assigned to students who obtained poor results in the Sijil Rendah Pelajaran (SRP) examination (or Penilaian Menengah Rendah (PMR), and subsequently Form Three Assessment (PT3), and were unable to continue their studies in Form Four in regular upper secondary schools which focus mainly on academic studies. Apart

from that, education that is associated with blue-collar jobs does not qualify school leavers for white-collar jobs that are seen as commanding much higher salaries.

Generally, students in Malaysia have a poor perception of Technical Education and Vocational Training (TVET) (Ismail & Abiddin, 2014; Awang et al., 2011). Whereas many students in the more developed countries such as Germany, Austria, and Taiwan choose technical and vocational education to prepare for their careers, youth in Malaysia are reluctant to pick this alternative education stream even though they may be weak academically (Kaos Jr, 2016; Chan, 2015; Sulaiman et al., 2015). This negative perception is largely due to the limited knowledge and information available about TVET, its lowly recognition by society, and by the fact that there are few opportunities for higher education opportunities in this stream.

Problem Statement

In the government's national transformation agenda (Prime Minister Office, 2016, 2014; Thaib, 2015) to promote economic development through increased productivity and global competitiveness, vocational education transformation initiatives are among the strategies put in place. Such planning has also taken into account the practices of other countries (O'Gara, Mechur, & Hughes, 2009), particularly high-income economies that are reaping the rewards of their education systems where vocational training occupies a place of importance (Asian Development Bank, 2014). Among these countries are France, Finland, Germany, South Korea and Singapore. Such high-income economies are not heavily dependent on their natural resources but build their prosperity on their people who are knowledgeable, skilled, and professional in their work.

Technical and vocational education play a very important role in the engine of change to speed up the nation's rise in economic and social status. Instructional content and good presentation in vocational training are essential to the development of human capital to nurture a skilled labor force to enable Malaysia to be competitive economically on the global stage (Ahmad, Jailani, & Fadilah, 2011; Ramlee & Ramziah, 2012). Vocational colleges, community colleges, technical colleges and other training institutions must recognize that they function not only to train and transfer skills in various fields of technical expertise but also to link their educational undertaking to social needs and social improvements. Through continuous enhancement of the educational system, technical and vocational colleges are a key contributor to the effort to mould creative and innovative students who can contribute more effectively to the economic development and prosperity of the country.

How might the government make TVET education a more attractive option to students faced with making career choices for their future? How might graduates from TVET institutions contribute to the government's transformation effort to make Malaysia a developed nation by 2020? ("PM Outlines Several...", 2017; Prime Minister Office, 2014) To contribute meaningfully, TVET graduates need to be more versatile in their competencies and more progressive in their thinking. Hence, it is essential that reasoning skills such as logical thinking, critical and creative thinking, and problem-solving skills are developed and mastered by students in TVET institutions (Amiruddin et al., 2016; Bakar, 2011). According to Fisher and Scriven (1997), such skills are

necessary to interpret and evaluate observations, information received, or arguments raised in a discussion. According to Ennis (1996), critical thinking is a skill set that is required to solve complex problems. Drucker (1999) asserts that the economic development of a country is determined by its human resources equipped with optimal mental strength, not just physical skills. However, doubts linger about the level of TVET students' reasoning skills. Do students of TVET institutions have the competencies to function in key skill areas?

Various attempts, for instance, educational talks (Lim, 2015), industry apprenticeship programs (Majid, 2017; Zain, 2008) and others (Sauffi, 2015; Awang et al., 2011) have been conducted by the Ministry of Education and relevant agencies to promote technical and vocational education by making it more appealing and rewarding in terms of career choice. Nevertheless, most parents and students still prefer academic education to technical and vocational education. Why does this phenomenon occur in the 21st century when skills from TVET training are very much in demand to fulfil the government's vision to become an industrialized nation? It is important to help parents and students see the vast opportunities in potential careers that require workers with technical and vocational qualifications. There is, thus, an urgent need to change the perception of students, parents and the community with regard to technical education and vocational training to one that offers as good or better prospects in terms of job opportunities and pay upon graduation as compared with white collar jobs.

The instrument developed in this study has three overarching objectives: 1) determine the philosophies or philosophical paradigms that should be adopted by TVET students, 2) determine the factors that contribute to instruction competencies in reasoning skills, and 3) identify the educational needs, knowledge competence and importance of instruction competencies as perceived by TVET students. For these reasons and to the best of the researchers' knowledge, there is no instrument available at the time of writing to address the above-mentioned problem in Malaysia. In addition, the development of a valid model used for predicting the correlation of factors that contribute to the perceived educational needs of instructional technology competencies might help to improve TVET students' employability after graduation, as well as provide evidence for the need to develop activities required for change in pre-service programs for TVET teachers.

Literature Review

This review of literature focuses on learning theories used in the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) instructional design model, as well as Behaviorist and Cognitivist theories. These theories are discussed in relation to how they support the development of a program or a curriculum or course to allow students to achieve specific learning objectives.

Defining Instructional Design Models and Learning Theories

Instructional Design

Richey et al. (2010) define instructional design as "the science and art of creating detailed specifications for the development, evaluation and maintenance of situations which facilitate learning and performance" (p. 5). Instructional design can be viewed as a way of systematically

developing instruction to achieve learning objectives (Bofill, 2016; Mustafa et al., 2016). The instructional design process is guided by instructional design models chosen by instructional designers (Bofill, 2016; Kelly, 2016; Mustafa et al., 2016) to help them move from theory to practice (Bofill, 2016; Dick et al., 2015; Morrison et al., 2010).

Instructional Design Models

Instructional design models refer to the procedures the instructional designer should follow to create a course, curriculum, training material for instruction with the intention of organizing content to suit learners' needs (Bofill, 2016; Kelly, 2016; Mustafa et al., 2016). Instructional design models are important and useful to the designer of instruction because they close the gap between instructional and learning theory, and thus help to create a learning environment conducive to the directing and managing of the instructional development process (Zain et al., 2016; Branch & Kopcha, 2014).

There are many different models and processes for designing instruction in educational settings; these can be summarized as (i) the Gagne's nine events of instruction, (ii) Dick and Carey model (Bofill, 2016; Reiser & Dempsey, 2012), and (iii) the ADDIE model (Maznah, 2016; Bofill, 2016; Branch & Kopcha, 2014; Nordin, 2010). The common characteristics in the first step of these models is the analysis of the prevailing situation(s) to identify the needs required. This shows the importance of conducting a need analysis for decision-making purposes prior to designing instructions or developing appropriate activities. The ADDIE (Analysis, Design, Development, Implementation, Evaluation) model is a widely accepted instructional design model applicable in various settings (Kelly, 2016; Twilley, 2014; Kunzler, 2012). Therefore, the underlying framework in this study will be based on the ADDIE model.

The Gagne's Nine Events of Instruction was developed by Gagne, an American educational psychologist. He believed that certain mental conditions, or stages or series of "events" were associated with the learning process from the setting of goals to the assessment of performance (Zhu & St. Amant, 2010; Krull et al., 2010; Smith & Ragan, 2000; Gagne, 1988, 1964). So, he developed a nine-part learning approach or experiences of nine events of instruction he thought mirrored the cognitive stages associated with learning process (Krull et al., 2010; Gagne, 1985; Gagne & Leslie, 1974). The nine events of instruction are gaining attention, informing the learner of the objectives, stimulating recall of prerequisite learning, presenting the stimulus material, providing learning guidance, eliciting the performance, providing feedback about performance correctness, assessing the performance, and enhancing retention and transfer (Kruse, 2009; Gagne, 1988).

Another model is the Dick and Carey model developed in 1978 (Dick et al., 2015, 2011, 1978; Raja Hussain & Ismail, 2008). It is one of the most widely used design models (Reiser & Dempsey, 2012; Dick et al., 2011; Gustafson & Branch, 2002). The Dick and Carey instructional design model provides a systematic design of instruction using the nine-steps of the design model, namely identify instructional goal, conduct instructional analysis, identify entry-level behaviours, write performance objectives, develop criterion-referenced test items, develop instructional strategy,

develop and select instructional materials, design and conduct formative evaluation, and revise instruction.

The ADDIE model guides the development process toward a product that serves the needs of the learner (Mustafa et al., 2016; Almomen et al., 2016; Kunzler, 2012). It consists of five phases that sometimes overlap; they can be interrelated but must incorporate a learning theory in the instruction to provide flexible guidelines for developing effective and efficient instruction. The five phases are: (1) the Analysis phase - determining what needs are to be met with the instruction relating to the skills and tools available to the learner (Kunzler, 2012; Stevens, 2012); (2) Design phase – drawing up what may be considered the blueprint for course development, since it relates to the course goals and objectives to be achieved by the instruction, for example, lesson format, learning activities, time allocation, and assessment (Baharom, 2014; Stevens, 2012); (3) Development phase - preparing instructional materials, including the content format and learning management system to be used to deliver the instruction, thus acting as an interface between instructional designer and learner (Kunzler, 2012; Stevens, 2012); (4) Implementation phase - delivering course content to the learner. The delivery format may vary, particularly in addressing the mechanism by which the learner receives course materials and participates in the learning process (Kunzler, 2012; Stevens, 2012), and lastly (5) Evaluation phase – this is an interactive and ongoing process and can take place any time during the course development and delivery processes (Kunzler, 2012; Stevens, 2012).

Learning and Instruction

Learning refers to the acquiring or imbibing of information that is relevant to the components incorporated in the design phase (Bajbouj et al., 2015; Sink, 2014; Rozitis, 2014; Ertmer & Newby, 2013; Yilmaz, 2008). The learning theories used in this study were behaviorist, cognitive and constructivist theories (Rozitis, 2014; Doolittle & Camp, 1999).

Literature on Learning Theories reflecting a Paucity in Instructional Design Model Framework Behaviorist Learning Theory

The theory of behaviourism focuses on the study of overt behaviour's that can be observed and measured (Sackney & Mergel, 2007; Smith & Ragan, 2005; Good & Brophy, 1990; Watson, 1930). According to this theory, the learner is conditioned to respond to a stimulus (Hung, 2001; Doolittle & Camp, 1999; Skinner, 1974), and the response can be observed and measured quantitatively, irrespective of how the thought processes occur in the mind. The Behaviourist Learning Theory has a major influence on educational instruction and practices (Gomboc-Turyan, 2012; Fur, 2010). Instructional contents or curricula are broken down into small instructional steps, after which an interactive question or an activity elicits responses from students who receive corrective or confirming feedback (Sink, 2014). In this regard, it is the role and responsibility of the instructional designer or lecturer to find appropriate techniques or methods to help students master the contents taught (Bloom, 1968).

Gomboc-Turyan (2013) examined the implementation of behaviourist and constructivist approaches and their methodologies in studio-based post-secondary courses. Using an experimental method, evaluation was carried out on the effects and impact of each approach or

methodology on achievement, retention, and behaviour among college undergraduate students who were taught the Interior Design (INDS) curriculum in a university setting. The findings of the study showed that the Behaviourist and Cognitive Load Theories and the Constructivist method of instruction and approach had the potential to meet learning goals effectively, although the Behaviourist approach was limited in its ability to broaden undergraduate students' knowledge and confidence. The study also concluded that teaching of the software instruction in a behaviourist-centred classroom and the application of this knowledge in a broad, constructivist atmosphere could greatly impact students' learning outcomes. However, the study essentially focused on assessing the learning outcomes and impacts of implementing the Behaviourist and Constructivist methods in the interior design curriculum through an experimental method. Carried out on college undergraduates, the study did not have an adequate sample size, nor did it describe the instrument used to measure the efficacy of behaviourist and constructivist methods. Hence, the findings cannot be generalized to other studies or contexts. Moreover, the study lacked a theoretical framework that explained how assessment was conducted to evaluate students' understanding of the materials taught. Also lacking were guidelines on planning and designing instruction used in the Interior Design (INDS) curriculum.

In summary, Behaviourists believe that learning occurs as a result of interactions between the student and the surrounding environment, thus triggering changes in his or her responses. However, the Behaviourist learning theory does not explain how knowledge is involved to guide those responses. Hence, the Cognitive learning theory is introduced to explain the transition process that takes place in the mind, based on how the mind collects, processes, stores and presents information, and how existing knowledge is transferred to new situations, ideas and concepts (Edgar, 2012).

Cognitive Learning Theory - Information Processing Theory

The Information Processing Theory views learners as a processor of information (Mayer, 1996). The study of the learner's mind can be conceptualized as a study of how sensory input is transformed, stored, retrieved and used whenever it is required (Gurbin, 2015; Zhang et al., 2006; Hunt, 1980). For instance, using the Information Processing Theory, Kandarakis and Poulos (2008) examined the teaching and evaluation procedures of learning strategies that worked for students with neuro-developmental disorder problems. The study recommended employing the INCLUDE strategy based on the assumption that the success of students with special needs in education was a result of interactions of classroom demands, learning needs, and accommodation. The study also showed that teachers who had a better interpretation of the Information Processing Theory were better able to understand how learning is processed in the brain by using the Learning Vector Quantizer (LVQ) neural network and by adopting different ways of evaluating teaching strategies with the aim of improving retention and retrieval of information. The investigation, however, focused only on students with special needs using the experimentation method. Moreover, the study lacked a theoretical framework to explain how an experiment could be conducted and evaluated to demonstrate learning effectiveness. Guidelines on planning and designing instruction used in the experiment were also not mentioned.

In another study, Riha (1992) investigated decision-makers' behaviour and characteristics in terms of their cognitive styles, rules of thumb biases, intellectual abilities, personality, and cognitive abilities which differed and correlated with each other by employing the Information Processing Theory and principles within the Management Information System (MIS). The study involved managerial judgment for deriving a systematic way to design Decision Support Technology (DST) based on associated theories. The results showed that even though the gender of individuals in diverse occupations differed, consistent patterns of information processing abilities were found that could be predicted through the use of a hierarchical control model of cognitive processing and stereotype concept. Nonetheless, the study did not categorize information activities in terms of either human or computer processing needs, and hence, it neither spelt out clearly the purpose of examining how the computer was used for decision-making and problem-solving, nor did it specify the design and new technology used to support human cognitive needs and abilities. In addition, the study also lacked a theoretical framework, and thus, it limited the generalizability of the findings. As a result, the study did not facilitate a systematic approach to the planning of instruction in educational settings.

Constructivist Learning Theory

The theory of constructivism is widely used in educational literatures such as for teacher training, curriculum development and assessment (Kyarizi, 2016; Bada, 2015; Ogundola et al., 2010; Tam, 2000). Constructivism is viewed as a theory of learning to identify how learners construct meaning and knowledge through experiencing things and through their experiencing of a phenomena, rather than receiving and storing externally-sourced knowledge (Tam, 2000; Ben-Ari, 1998; Bereiter, 1994). For instance, Kyarizi (2016) investigated the constructivist epistemology aspect relevant to the argument on the relationships between different forms of the theory of knowledge and the creation of knowledge in the vocational curriculum. Also discussed was how such relationships influenced vocational knowledge of professional instructions in Technical and Vocational Education and Training (TVET) in Uganda. The research findings in that study indicated that vocational knowledge by constructivist epistemologies is continuously evolving as learners experience new things. Thus, learners should have an open-minded attitude to learn, re-learn and unlearn as a result of rapid changes in society, technology and the organization in order to become competent vocational practitioners in their respective fields. The study focused on examining findings from past studies to assess the relationships between different forms of knowledge and knowledge creation based on the constructivist theory in Uganda. However, the study not only failed to measure the relationship between different forms of knowledge and knowledge creation in the TVET curriculum, it also did not provide any practical framework for incorporating the constructivist theory in the course design. As such, the study was not able to facilitate a systematic approach to instruction planning in the TVET curriculum.

Ismail and Ibrahim (2014) explored the effectiveness of entrepreneurship curriculum in Malaysian polytechnics through observation and interviews with curriculum planners with the aim of promoting students' entrepreneurial ambitions. The study revealed that the development of entrepreneurship education in Malaysian Higher Education Institutions could contribute to meeting both the policy and the industrial needs of the country. However, some students

indicated that the curriculums offered in their polytechnics were rather outdated, if not obsolete, and that they were not attractive enough to promote entrepreneurship among the students. This was evident from the activities and programs at the polytechnics that had largely failed to capture students' interest even though they possessed entrepreneurial traits. Hence, the study identified the need to examine and improve the relevancy of the teaching materials and pedagogical techniques, as well as the need to ensure that the existing entrepreneurship curriculum was aligned with and meet job market requirements. Despite the many useful points raised in the paper, the study lacked a theoretical foundation and framework and subsequently resulted in poorly designed training materials. As the study focused on polytechnics only, the outcomes of the study did not specify the importance and knowledge of instruction competencies, and therefore, did not lend themselves to generalization and application to other studies.

Learning theories bring several benefits to instruction. First, the application of existing learning theories in different theoretical perspectives would enable the realization of multiple ways of effective learning and instruction. Second, lecturers are able to better understand the needs of their students, and this would help them teach according to their students' abilities. Third, clearly-articulated learning outcomes or competence descriptors can provide lecturers with information to adjust teaching methods to help students progress in their learning. Fourth, every lecturer needs to understand his/her student's foundation of beliefs so that teaching can be modified to maximize learning. Therefore, learning theories have the potential to enhance the learning process. When lecturers apply learning theories to try to cater to the needs of every individual student, they might find it too time-consuming. Another disadvantage is that unless properly trained, the lecturer is unable to properly evaluate his own instruction and therefore would not be able to see the full effect of the application of learning theories.

Literature on Instructional Design Model reflecting a Paucity of Theoretical Foundation

The ADDIE instructional design model is widely used in social sciences and education settings both overseas and in Malaysia. The reason for its popularity is that it adopts a systematic approach with steps to analyse, design, develop, implement, and evaluate a given instruction (Seels & Richey, 1994). This facilitates the development of efficient teaching and learning materials (Nordin, 2010). For example, Mustafa et al. (2016) employed the ADDIE instructional design a model that focused specially on the design phase to explain the processes involved in designing an English language communication program for healthcare professionals. The findings reported positive responses as the iterative approach of ADDIE is able not only to select course contents, but also the interactions between the arrangement of learning activities and learners that are arranged systematically in order for learning and course delivery to take place efficiently. The model also allows for identifying and resolving any issues that might arise in the initial phases of course development before proceeding to the development phase of the model. Nevertheless, the abovementioned study focused only on developing an English language communicative course for healthcare professionals in Malaysia. It neither explained the sampling method nor the theory or theories underpinning the study. Thus, the findings could not be generalised to other studies, and only resulted in a poorly designed training program which formed part of the Continuing Professional Development course (CPD).

A study by Chu, Jeng, and Cheng (2015) examined the knowledge and skills involved in designing the ITouYing game using the ADDIE instructional design model techniques for learning orthographic projection among 7- 9 Grade students from three industrial vocational senior high schools in Tainan city, Taiwan. The findings indicated that the approach not only had the potential to design an innovative serious game to help students learn orthographic projection, but it was also capable of improving their visualization skills in a 3-D model and a multi-view format. However, the study focused merely on three industrial vocational senior high schools. Again, the findings could not be generalised to all industrial vocational high schools in Taiwan. Moreover, the ADDIE model used for the study did not explain how the researcher was able to achieve his research objective. It also lacked a theory underpinning the study. Application of the ADDIE model, without any underlying theoretical knowledge, can result in poorly designed training or programs for vocational high schools.

Other Influencing Factors

Based on the literature reviewed, there are many other factors that might have influenced perceived educational needs for instruction competencies. Of these, training on instruction and experience in designing instruction are the two major factors to be investigated among the TVET students in the Malaysian university setting, as explained in the following paragraphs.

Training on Instruction

Past studies have found a positive relationship between training and perceived knowledge on the one hand, and the educational needs of instruction competencies in reasoning skills on the other. For example, Madden and Hardre (2016) conducted a study with thirteen graduate teaching assistants at a medium-sized university in the United States. The authors examined the impact of a self-paced online instruction design on teaching assistants' teaching efficacy, perceived teaching competence, and satisfaction with the current knowledge of delivering instructional concepts through an experimental method. The study showed that the self-paced online training on instructional design concepts significantly increased the teaching assistants' satisfaction with their knowledge of principles and theory of instructional design of the learning environment, and knowledge in using technology to support their instructional goals. This result was supported by the findings of studies by Love Stowell (2015) which confirmed that undergraduate Science, Technology, Engineering and Mathematics (STEM) students gained in formal training on pedagogical, skills and mentored teaching practice at the beginning of their education. They reported an increase in the quality of instruction.

Experience in Designing Instruction

Past studies that looked into the success of students and teachers who had experience in designing instructions in a training program concluded that a number of higher learning institutions worldwide, including Malaysia, had failed to adequately equip their teachers and students with positive experiences of integrating educational technology into the curriculum (Hsu et al., 2014; Masood, 2010; Könings, Brand-Gruwel, & van Merriënboer, 2010).

Theoretical Framework

It has been established through research that competencies in learning theory, the ADDIE model, experience in designing instruction, and training on instructional technology directly impact student mastery of instruction (Madden & Hardre, 2016; Cheung, 2016; Hsu et al., 2014; Azwin et al., 2014; Kantar, 2013; Ojose, 2008). Past studies involving teacher competencies have theoretical underpinnings derived from learning theories, such as the Behaviourist Learning theory (Skinner, 2011). Information Processing theory (Atkinson & Shrifin, 1968), and Constructivist Learning theory (Vygotsky, 1997). Factors that contribute to educational needs vary widely. Survey instruments have been commonly used to solicit perceptions of students regarding beliefs about their own abilities (Guskey, 1987). From a questionnaire, researchers were able to identify constructs influencing needs assessment and use the constructs to predict educational needs for instruction competencies in student populations. In this study, the focus is on the perceptions of TVET students with regard to: (1) philosophies or philosophical paradigms that are applicable to them; (2) level of knowledge of instruction competencies; (3) level of importance of instruction competencies; (4) experience in designing instruction, and (5) training in instructional technology to enable them to become part of a competent labour force in Malaysia. Data from this instrument will be used to validate a conceptual model to be constructed to determine the most influential predictors of educational needs for TVET students' instruction competencies.

In order to examine potential correlations among constructs, a search of the literature was made to examine various instruments used to measure the competencies construct. The objective of the study is to understand TVET students' competence level in understanding instruction and to determine correlations with constructs that may impact instruction competencies. To accomplish this, an instrument needs to be developed and validated before measuring the constructs of instruction competencies that may provide an insight into possible factors impacting the educational needs of students with regard to instruction competencies. Structural equation modelling (SEM) has been used for many studies involving competencies to enable researchers to conduct a confirmatory factor analysis as well as to construct path coefficients to determine the relationships between factors (Berry, 1987). As a statistical tool, structural equation modelling (SEM) can be used to determine construct validity and find evidence for potential predictions among constructs. In order to utilize SEM, there is a need to define a hypothetical model derived from theories defining constructs to be measured (Kline, 2005). For the purpose of this study, a hypothetical model will be developed from the literature related to educational needs for instruction competencies.

Based on the review of related literature, it is proposed that three learning theories (Behaviorist, Cognitive, and Constructivist theories) be included in the theoretical framework together with perceived instruction training and perceived instruction experience to predict TVET students' perceived needs for instructional competencies in reasoning skills. Figure 1 depicts the theoretical framework of this study. It shows the theories and their relationships to be examined for this study.

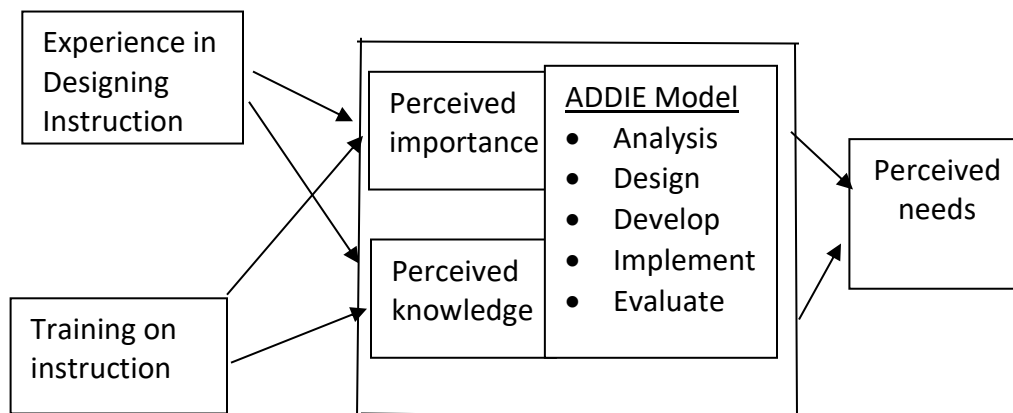


Figure 1. The proposed theoretical framework

Methodology

Theoretical Assumptions - Objectivist and Constructivist Epistemology

The epistemological assumption of the positivism paradigm is one of objectivism (Scotland, 2012). Objectivism assumes that the researcher remains detached from the participants of the research, and meanings are determined by nature and are not influenced by personal beliefs or paradigms (Aliyu et al., 2014; Dzurec & Dzurec, 1992). According to past studies, the positivism paradigm has been associated with a broad variety of theories and practice, such as logical positivism, behaviourism, empiricism, and cognitive science (Hwang, 1996). In this study the focus is on behaviourism, on uncovering the truth by using closed-ended questionnaires as the data collection method (Tubey et al., 2015; Lincoln & Guba, 2000, 2005; Neuman, 2003). On the other hand, the epistemological assumption of constructivism paradigm is about how an individual constructs his or her own reality by social, experiences and cultural means (Bada, 2015; Bisman & Highfield, 2012; Ernest, 1999; Gredler, 1997). Studies have shown that no two persons' understanding of reality by social interaction or with the environment is the same (Bisman & Highfield, 2012). However, this does not mean that those who hold these views believe in the existence of multiple realities (Bada, 2015; Crotty, 1998). Instead, what it does mean is that each of us has a unique constructed view of reality in our day-to-day experience as a human being when we interact with members of the society and with the environment. In addition, the constructivism paradigm is also associated with a broad variety of theories and practice e.g. constructivist theory (Bada, 2015; Riegler, 2012). Hence, this study will use the constructivist theory since the focus is on how lecturers construct their own understanding or meaning when they give their input in the comments column of the questionnaire (Bisman & Highfield, 2012).

Research Design

This study will employ a mixed-method sequential explanatory design, where quantitative data will be collected first, followed by qualitative data, which is intended "to refine the results from the quantitative data" (Creswell, 2005, p. 515). The major variables used for this study are perceived educational needs (dependent variables), while the independent variables are experience in designing instruction, training in instructional technology, perceived level of the

importance of instructional technology competencies, and perceived level of knowledge of instruction competencies.

Sampling Design and Recruitment of Sample

The target population will comprise students aged 12 and above who have enrolled in technical and vocational education and training (TVET) institutions in Malaysia. The sampling technique used to obtain a representative sample of the population is based on Cochran's (1977) formula, which helps to determine the appropriate sample size. In addition, a multi-stage cluster and random sampling technique is in the selection of the sample according to the type and location of schools, according to the criteria proposed by Van Deursen and Van Dijk (2009). Consent will be obtained from students who agree to participate before the final administration of the survey instrument. The reasoning skills ability will be evaluated through a questionnaire.

Instrumentation

Questionnaire

The questionnaire will be developed by adopting and adapting questionnaires from the previous literature (Alyaseen, 2017; Sanders, 2016; Kasilingam et al., 2014; Sulaiman, 2012; Lathers, 2010; Rovai et al., 2009; Smith, 2009; Ferris & Aziz, 2005; Hamlin, 1998). The questionnaire will be developed in the English language, with back translation from English to Bahasa Melayu. The questionnaire will consist of five parts. The first part will measure the respondent's perceived level of the importance and knowledge level of the affective domain, cognitive domain, and psychomotor domain in instructional technology competencies. The second part is related to their perception of training in designing instruction. The third part is to solicit the respondents' feedback on their perceived experience in designing instruction. The fourth part is related to students's perceived needs for further training in designing instruction. The last part is to collect the demographic information from the sample; blank spaces will be provided for open-ended comments by respondents.

For the first, second, third, fourth and five part, a 5-point Likert scale will be developed with responses ranging from "1 (none)", "2 (very little)", "3 (somewhat)", "4 (very)" and "5 (a great deal)". This study will gather feedback on the perceived level of knowledge competence and perceived level of importance of instructional technology competencies, and the need for further education in instructional technology. The study also will investigate the relationship between experience in designing instruction, training in instructional technology, perception of instructional technology, and perceived level of knowledge, level of importance and educational needs.

Interview

The findings from the survey questionnaire will provide guidelines for the preparation of interview questions to explore further the characteristics of perceived knowledge competence, perceived importance and perceived educational needs of students, especially the relationship between variables or constructs. The main purpose of conducting the interview is to "develop a detailed understanding that might provide useful information and that might help people learn about the phenomenon" (Creswell, 2005, p. 203). The interview protocols for this study will be

developed based on findings in the literature review on instructional technology competencies that are linked to the proposed framework of this study. The objective of qualitative data analysis is to have an in-depth understanding of the area of interest for this study. Open-ended questions will be designed as a semi-structured guide to collect perceptions of students on what factors they consider important for (1) designing of instruction, (2) level of knowledge of designing instruction, and any educational needs to render the learning process more successful. Each interview is scheduled to last approximately 30 – 45 minutes; an audio recording of the interview (with consent from the interviewees) will be made for the purpose of analysis later.

Pilot Test

The pilot testing of the instrument will be conducted by hand delivery of an information sheet along with the instrument to a sample of 30 students either from technical or vocational colleges located in Malaysia. The purpose of this information sheet is to provide participants with details of the pilot study, an understanding of their role in the research study, and instructions for participating. After pilot testing the instrument, respondents have the opportunity to provide feedback on the instrument to determine its consistency, readability of the questionnaire/instrument, and to check on the estimated completion time. An incentive of RM\$5 in voucher form will be given to each student who returns the feedback form. Suggestions for changes to the items on the instrument will be noted and revised or modified accordingly. The instrument will be subjected to reliability and validity testing using item-total statistics and internal consistency reliability methods. A coefficient of .60 or better (Nunnally, 1978) is considered acceptable according to Cronbach's alpha level for this study. An item analysis will be conducted to determine which items to retain, refine, or remove from the instrument. Subsequently, a confirmatory factor analysis (CFA) will be conducted to examine the construct validity of the instrument.

Data Collection Procedures

In the first step, initial contact will be made with the Educational Planning and Research Division (EPRD) and Technical and Vocational Education Division (TVED), Malaysia Ministry of Education by mailing them a copy of the research proposal, cover letter and the instrument for their comments and approval. After approval is received from the authorities concerned, a cover letter and the instrument will be couriered or mailed to the principals of the selected high schools / vocational colleges for their permission to conduct a pilot study.

Pilot Testing of Instrument

After permission is granted by EPRD and TVED, a cover letter together with the instrument will be couriered to the principals of selected high schools / vocational colleges. The cover letter will explain the intent of the study, an invitation to students participate in the study, explanation of the instructions pertaining to the completion and return of the instruments. The cover letter also contains an assurance that respondents' identities and feedback will be kept confidential, and that the intent of the study is to simply to collect data for the purpose of constructing a survey instrument to evaluate students' perceptions of instruction competencies.

Administration of Survey Instrument

For the actual administration of the survey instrument, procedures that are similar to those in the pilot test will be followed, but a different set of students will be used.

Interviews

The first step of the procedure is to make initial contact with the principals of selected TVET colleges/schools by sending them a letter to request permission for the researcher to conduct data collection in their schools. Upon being granted permission to do so, the second step is to seek the assistance of vocational college principals to select 1 – 3 students who had participated in answering the questionnaire to be interviewed for this study. The third step of the procedure is to interview the selected students.

Data Analysis

The data will be screened for missing data after the participants have completed the hardcopy of the instrument and any incomplete questionnaire with missing data will be removed. Subsequently, the data will be subjected to a normality test (Threadgill, 2016; Coakes et al., 2010; Hair Jr et al., 2006) after examination for possible errors that may result from recording, coding, missing information, influential or outlier's cases before running any analysis.

Data Analysis Plan for Quantitative Data

Data collected from the survey will be analysed using descriptive statistics and structural equation modelling to construct path coefficients. In order to describe interval and ratio data, the information will be represented in the form of frequencies, means, percentages, and standard deviations. Relation statistics will be used to determine the variables between each construct to determine the relationship among the constructs and students' perception of the level of knowledge, importance and educational needs. As for the structural equation model, the researcher will identify two main components: (a) a measurement model that represents the relationships of latent variables with its indicators (or observed variables), and (b) a structural model which describes the relationship between the latent variables.

Data Analysis Plan for Qualitative Data

The qualitative data from the interviews will be analysed using word frequency searches, targeted word and phrase searches to uncover common themes that are expected to emerge from the data.

Contribution of the Study

Two important significances of the study can be concluded from the findings of this study. First, this study will add to the body of scholarly research and literature on technical and vocational education and training, with special focus on students' perceived instruction competencies. Second, findings from this study will give the instructional designer an idea of what competencies she or he needs to have when editing and creating content for the curriculum. Hence, the results will provide specific professional development opportunities that are vital for overcoming the perceived deficiency in instruction when designing the instructional technology curriculum.

Limitations

This study will be limited by several factors. First, participation in the study is voluntary. Second, the time frame for the study will be limited to six months. Third, the study group is limited to students from vocational high schools vocational and vocational colleges in Malaysia. Lastly, the study results may not apply to other institutions outside of the study group.

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