A Conceptual Model on Preparing Student in Mechanical Engineering Program at Malaysian Vocational Colleges

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Abstract

Technical and Vocational Education (TVE) has undergone several policy changes since its inception and this is apparent in Transformation of Vocational Education (TPV) which was introduced in 2013. Through this transformation, Vocational Schools (VS) were upgraded to vocational colleges (KV) and this effort shows Malaysian government’s efforts to boost (TVE) as an institution of excellence that is able to produce superior human capital and adapt the challenges of globalization and technological changes. This
research was conducted to develop a Model of Preparing Mechanical Program at College Vocational in Malaysia. Specifically, this research identified the possessed levels of competences of college vocational students in terms of technical and employability skills, examined the teaching methods employed in the teaching of mechanical in the college vocational, identified the challenges faced by mechanical program teachers with respect to instructional delivery, determined the adequacy of infrastructural facilities for effective teaching and learning of mechanical program in the college vocational and determined the adequacy of workshop tools and equipment in mechanical program for effective skills acquisition in mechanical program. These changes are closely related to factors such as technical skills, teaching methodology, infrastructure, and materials and equipment. This study used Structural Equation Modeling (SEM) using AMOS (Analysis of Moment Structures) to analyze the relationship between variables and tested the model to be developed. Five hundred and sixty-six students (566) of mechanical engineering program and seventy-five (75) mechanical engineering lecturers from vocational colleges in the southern states of Malaysia responded to the questionnaire conducted. It is recommended that the institutions continue to monitor and report on the needs required by industry. The higher authorities should also provide all the necessary facilities in line with the current technology and all parties involved should ensure that all the facilities are well maintained. In addition, continuous maintenance should be done to ensure that the facilities are at an optimum level and safe to be utilized.

Key Words: Globalization, Employability skills, Mechanical Engineering, Vocational Colleges

1 INTRODUCTION

TVET goals are to ensure that the education received meets the current economic development, in line with the changes in technology and market requirements, has a market value of merchantability industry and students are willing to put themselves in the world of work in the future\(^7\,8\,9\,10\). One of the frameworks of the Tenth
Malaysia Plan (2011-2015) is to establish and maintain a world-class human capital.

Rapid global development requires human capital who possesses knowledge and skills to shoulder the responsibilities of development. Technical education institutions and vocational training (TVET) contribute to the supply of skilled and semi-skilled workers who can be marketed to enhance the economic development of high-income countries. Skills introduced in TVET serve to produce an energy source that is not only of high-quality technical and skilled but also of high credibility in the technical field. Quality education and training are provided with adequate skills including competence and knowledge to students to master and in the field of technical and vocational. Vocational education nurtures highly skilled, knowledgeable and innovative individuals who are able to compete at the regional as well as global levels and relevant to current needs. The emphasis is on improving the quality of TVET graduates who are able to contribute towards becoming a high-income nation. Consequently, improvement in technical skills needs to be implemented continuously to enhance employability among graduates. Therefore, TVET must use appropriate teaching methods to ensure that the curriculum can be studied effectively. In addition to this, existing infrastructure facilities in the workshop should be kept in line with the current technology to ensure that students do not miss out on the equipment used by the industry. To ensure that students get the optimal learning in an environment such as workshops, the institutions must ensure that materials and equipment are sufficient for students use.

1.1 Relationship between Employability Skills, Teaching Methods, Infrastructure, Materials and Equipment.

Vocational education in Malaysia has experienced various innovations in the efforts to develop potentials of individuals. The innovations are in line with the new challenges faced by vocational education in the present day, which requires a more innovative paradigm in order to be able to produce first class human capital to generate skilled manpower to meet the challenges of the new economy and increase productivity and competitiveness of the economy. Accord-
ing to the Director of Technical and Vocational Education (TVE) of the Ministry of Education, vocational education debut is able to generate creative and innovative talents to accelerate the process of creating skilled workforce that has the values of humanity, marketability and skills to achieve global standard. Transformation involves technical and vocational curriculum, duration of study, teachers certification, infrastructure and primarily rebranding of vocational colleges.

Currently, vocational education in Malaysia is moving towards the concept of Education for all, as outlined by the UNESCO (United Nations Educational, Scientific, and Cultural Organization). Vocational Education Transformation concerns with necessary skills such as employability and entrepreneurial skills. Education curriculum also emphasizes on communication and management, as studies showed that students with learning disabilities had communication and motivation problems, which created challenges for them to secure jobs.

Technical skills in represent the 21st century skills that include basic academic skills comprising of the ability to work in teams, critical thinking, problem solving, and the ability to use technology to communicate effectively. According to International Board of Standards for Training, Performance and Instruction, these skills provide an integrated set of skills, knowledge, and attitude, which can promote effectiveness in carrying out the activities provided. The application of an integrated knowledge, skills, values, experiences, touch and external knowledge sources helps solve a problem or address a situation. Sutton stated that the technical skills of traits, skills and knowledge are necessary for someone to become efficient or superior. Results of a study defined technical skills as some of the features, which contribute to an employee’s good performance. The skills include employability skills and capabilities, as well as other features such as values, motivation, initiative and self-control. Voorhees had a similar view in defining technical skills. They defined the skills as dynamic combination of skills, capabilities and employability skills necessary in making a specific task. Technical skills also vary according to defined objectives and approaches by an organization to improve performance in the workplace.

The level of technical skills is important in the valuation of a
work ability level. For effective technical skills, TVET must use appropriate teaching methods to ensure that the curriculum can be studied effectively. Teaching and learning approaches should consider the student background and their needs. Students use many methods to learn, such as listening, observing, touching, reading and thinking. Teaching methods can also vary depending on teachers, way of transmitting knowledge and make sure their students understand the subject matter. Learning styles have been much discussed in the context of educational literature. Teaching and learning styles are typically based on methods such as teacher-centered, student-centered dan some time the combination of the teacher and student-centered learning. Kolb developed learning experiences that focus on the processes in the individual mind, drawing on the work of Dewey, Lewin and Piaget. He argued that knowledge is a combination of grasping experiences and transforming them.

In developing countries, TVET is limited in scale, scope, quality and importance. It is because the programs are not relevant to the needs of the indigenous labor market; curriculum and syllabus for a long time and institutions lack the tools and equipment necessary for practical education. Equipment in workshops and laboratories are often outdated as compared to the latest technology provided by the industry. In the context of Malaysian education found that students learning experiences were influenced by three main factors; performance of lecturers, services or processes involved in the delivery of services, and facilities and infrastructure. It was found that the quality of service was low especially in physical facilities, training equipment reliability and service provided. Institute managers should focus on creating and maintaining the facilities as well as the environment that can help support the training process to keep up with their clients satisfaction. Technical education and vocational training deal with hands-on work therefore; training equipment is one of the most important aspects in measuring the effectiveness of a training delivery. Thus, insufficient equipment and facilities hinder the progress of acquiring skills. Equipment and tools that do not function or are not available will effect implementation of technical training and hence less skilled graduates will be produced. To produce skilled graduates who can help with the development of the country, the institution must provide conducive teaching and
learning environment by providing teachers with the right quality, quantity, full-equipped workshop, a library, and updated laboratory materials with adequate equipment and machinery. Sufficient equipment and appropriate facilities will ensure vocational education able to improve students’ learning process by allowing them to engage in demonstrations and practices.

The adequacy of facilities in vocational institutions must be prioritized to ensure graduates’ ability to explore new sources of economic growth based on high technology to transform Malaysian Vocational Colleges. Vocational education should expose students with learning styles, machinery, equipment and materials, which can enhance their meaningful experiences and skills. Consequently, these efforts can help teachers to communicate more effectively with the learning content as well as assist students to learn in a more interesting, meaningful and long-lasting environment. Thus, teaching ineffectiveness resulted from missing or inadequate teaching facilities and equipment can hinder optimal learning.

2 OBJECTIVE OF THE STUDY

Developing a model in preparing mechanical program at vocational colleges in Malaysia

3 METHODOLOGY

The research methodology describes the procedures involved in carrying out the study which are discussed under relevant sub-headings below:

A. Research design

Descriptive survey research design was utilized for data collection in this study, which involves the use of questionnaire to determine the opinion and responses of the students.

B. Population and sample

The sample populations in this study were students; the strategy of selecting the sample was random sampling. A total of 517 male and 49 female students were selected because they had completed the syllabus of the National Occupational Skills Standard (NOSS)
or the National Occupational Skills Standards curriculum that was implemented in vocational colleges.

C. Instrumentation

A structured questionnaire developed by the researcher was the instrument utilized for data collection in this study, the instrument comprised statements that elicits responses from the respondents based on their perception on employability skills, competency of technical skills, teaching methods, facilities, infrastructure, and materials and equipment. The data obtained from the questionnaire were coded and processed using SPSS, version 17.

D. Data Analysis

The researchers use quantitative data analysis in stages with a mean value of all data to infrastructure, workshops, employability and teaching method. After getting the mean value, researchers continue to analyze using Confirmatory Factor Analysis (CFA) as a method for determining the strength and verify model compatibility for all data collected. CFA is a statistical method used to determine the legality of the structure of a variable to be evaluated. The model can be built using the power and validity of this method.

4 FINDINGS AND DISCUSSION

Before assessing the equivalence model, researchers needed to identify the reliability of the measurement model to ensure that all items in the questionnaire represent the four variables latent in the model of Employability Skills (Emp), Teaching (TMethod), Materials and Equipment (Wshop), and Infrastructure (Infra). In this study, each latent variable is represented by four measurement items. Overall equivalence of measurement model is determined by CFA (Confirmatory Factor Analysis). Measurement model corresponding with the hypothesis of the study data is important for all latent variables as item measurements (data) that are not commensurate with the latent variables in the model will degrade the reliability of the measurement of structural equation modeling (SEM). If all four of these latent variables fulfill all the conditions set, then the model is fine to be developed.
4.1 Confirmatory Factor Analysis (CFA)

Practical teaching method for each phase of learning with a weighting factor of more than 0.5 (Hair et al., 2010) showed that each feature good relationship and was suitable for each phase. Power to develop the model supported through the Model Fit influences a number of conditions, namely default model must have a combined value of CMIN / DF ≤ 3, RMSEA ≤ 0.08, CFI ≥ 0.9, TLI ≥ 0.9 (Arbuckle, 2007).

A. Respondents (Lecturer)

In this study, the default model by respondents from qualified teachers is shown in Table 1.

Table 1. The Default Model

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMIN/DF</td>
<td>2.102</td>
<td>fit</td>
</tr>
<tr>
<td>CFI</td>
<td>0.923</td>
<td>fit</td>
</tr>
<tr>
<td>TLI</td>
<td>0.961</td>
<td>fit</td>
</tr>
</tbody>
</table>

Table 2 shows the weighting factors for teachers findings after analysis (CFA) is carried out. Figure 1 shows a diagram of a construct of teachers findings with respective weighting factors.

Table 2. Weighting factors for Teachers Insights

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RMSEA</td>
<td>0.081</td>
<td>fit</td>
</tr>
<tr>
<td>CFI</td>
<td>0.960</td>
<td>fit</td>
</tr>
<tr>
<td>TLI</td>
<td>0.947</td>
<td>fit</td>
</tr>
</tbody>
</table>

In this study, the default model by students also needs to meet with the conditions specified as shown in Table 3.

Table 3. The default value for the model student

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PS</td>
<td>0.87</td>
<td></td>
</tr>
<tr>
<td>KCI</td>
<td>0.73</td>
<td></td>
</tr>
<tr>
<td>CAP</td>
<td>0.79</td>
<td></td>
</tr>
<tr>
<td>LL</td>
<td>0.84</td>
<td></td>
</tr>
<tr>
<td>MTS</td>
<td>0.94</td>
<td></td>
</tr>
<tr>
<td>MES</td>
<td>0.79</td>
<td></td>
</tr>
</tbody>
</table>

Table 4 shows the weighting factors for students findings after analysis Factor Authentication is carried out. Figure 1 shows a diagram of a construct of students findings with respective weighting factors.
Results of regression analysis showed that the model proposed by the researchers was appropriate where the four factors; namely the employability skills, teaching methods, materials and equipment and infrastructure are significant predictor variables as discussed above. In addition, the correlation coefficient between these four variables is $> 0.5$. This means that all these four variables affected each other.

Based on the Confirmatory Factor Analysis (CFA), constructs of the findings found correspondence between teachers and students based on the values of the coefficients obtained. Therefore, the model was built in accordance with both findings. The results showed that the four-measurement model formed by the latent variables and indicator variables correspond to the survey data. These results confirm that the latent variable models for measuring the
structural equation model can significantly be represented by the variables of each indicator. Overall results showed that the four measurement models are reliable.

5 CONCLUSION

The process of globalization promotes the development of technology and the changing nature of employees who need individual skills to adjust themselves to changes in the existing technology. The industry needs workers who are qualified and possess employability skills. Therefore, TVET should play its role to produce workers with these characteristics and this study was conducted to assess the effectiveness of the program towards the acquisition of mechanical skills among students in vocational colleges. Based on the findings, this study has produced a model, which can serve as a guide to the parties involved to further enhance the marketability of students who will become an employee in the future. Through this model, four key points are emphasized; employability skills, sufficient equipment and material as well as infrastructure and appropriate teaching methods used in mechanical programs at vocational colleges. If these four main points are given proper attention, TVET is able to produce highly skilled workers to accommodate the needs of employees of the industry in the future, and thus the objectives of the vocational colleges can be achieved.

References


