Effectiveness of Training Methods on Technical Education and Vocational Students: A Systematic Review

Siti Zaharah Mohamed Alias, Khadijah Alavi & Mohd Nasir Selamat

Center for Research in Psychology and Human Well-Being, Faculty of Social Science and Humanities, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor, Malaysia
Corresponding Author: khadijah@ukm.edu.my

Abstract
Technical and vocational education and training (TVET) aims to provide students with the knowledge, skills and competencies required in an increasingly internationalised labour market and multicultural society. Initial education and training will need to react more effectively and promptly to change job requirements and societal trends. Training methods for technical and vocational education are needed to avoid occupational accidents and work-related diseases before they are exposed to the real life working situations. We conducted a systematic review of seventeen randomized paper of effectiveness of training methods in TVET. The aim of this paper is to examine the importance of training methods of technical and vocational students and demonstrates how training methods has brought benefits to students' performance. Overall, this systematic review revealed the most common training methods used: on the job training, project method, simulation, brainstorming and competency based training. These methods have been identified to be effective in teaching practical oriented subject like vocational and technical subjects. A selection of appropriate training methods will give ideas to educators, teachers, trainers, and instructors to change their teaching behaviour in order to educate younger generation to be prepared for the world of work. Moreover, the modern job market demands even more, good attitudes and continuous proactive lifelong learning are now keys to success.
Keywords: Training Methods, Technical, Vocational Students, Competencies, Systematic Review

Introduction
Technical and vocational high schools were established with the aim, among others, to prepare learners to be able to work, either independently or to fill existing job vacancies in the world of business and industry as middle-level manpower, especially in the related fields and skills/expertise that interest students. These schools also aim to equip students with the capabilities to choose a suitable career and with tenacity, persistence and competitiveness to develop a professional attitude in their areas of interest and expertise (Dadang, 2012). These

two objectives would greatly contribute towards improving the quality of graduates that will in turn improve national income and productivity. There will also improve the country's ability to anticipate the impact of global changes by providing the core work skills, general knowledge, and industry based and professional competencies that facilitate the transition from education into the world of work. TVET is frequently perceived as the solution to improve the opportunity of youths who lack the resources, skills or motivation to continue with higher education (Nurhayati et al., 2020; Devi et al., 2019). Moreover, many argue that TVET provides useful skills to prepare for youth entry into the labour force and improve their chances of a successful professional career (Quintini et al., 2006). On the other hand, technical and vocational training is defined as training for a specific technical and vocational in industry or agriculture or trade (Arnel et al., 2010). The creation of manpower will only be possible with individuals obtaining a career, by renewing their professions over time and by acquiring new skills and demonstrating effectiveness in different professional areas. For this to materialize, the necessary training infrastructure should be established at all level of education system (Selcuk et al., 2010).

Like in at all levels of education, to achieve adequacy and quality is one of the main objectives of training that are provided in technical and vocational schools. In technical and vocational schools, theoretical and practical training is given to the students that are needed by the related industries. It has been expected for the graduates of technical and vocational school to contribute dynamic impacts to the development of the economy process. Likewise, Salleh and Sulaiman (2016) claimed most employers nowadays become more aware of the importance of training to develop workers competencies. Tovey and Lowlor (2008) claimed training is concerned with the development of knowledge and skills to be used immediately or in very near future and deals with developing people who already have or who are just about to enter a job. TVET approach of learning and teaching requires the development of progressive interactive collaboration between experience-based workplace and systematic theory-based learning at learning institutions (Paryono, 2017). Therefore, every technical and vocational school must be in accordance with professional competence with the training of its graduates had received and the expectations of contemporary human resources. However, the graduates of technical and vocational schools, with their knowledge, applicationary experience should possess the characteristics of human resources that may be sought in the future (Selcuk et al., 2010). With the inevitable move towards a knowledge-based economy in the developed and developing countries, the role of both general education and technical education is being heralded as vital to the performance of this modern approach to economic development (Hutton & Raymond, 2016).

Training methods for technical and vocational students are needed to avoid occupational accidents and work-related diseases before they are exposed to the real life working situations. Numerous findings have found young adults are more prone to accidents compared to older adults and it happens due to lack of effective safety training and ineffective dispersion of safety knowledge to the young adults (Kean et al., 2012). In Malaysia, the term of Technical and Vocational Education and Training (TVET) is use as a general expression for different types and modes of education and training at various education levels. TVET can be associated with workplace as a main role in providing the skills workers. Also, TVET is associated with in-training, re-training, and upskilled training workers from various industries (Kahirol & Norlisa, 2016). The main function of TVET training centres in Malaysia is to provide

qualified technicians, artists and artisans are urgently needed for the agricultural sector, industrial and commercial for the economy (Ahmad, 2015). This paper illustrates the importance of training methods of technical and vocational students and demonstrates how training methods has brought benefits to students' performance.

Training Defined

In recent years, an evaluation of training program was conducted to examine the relationship between interest and participation in voluntary training program. Training is a sub-system of the organization because the departments such as marketing & sales, human resource, production, finance, etc. depends on training for its survival. Training is a transforming process that requires some input and in turn, it produces output in the form of knowledge, skills, and attitudes (Hutton & Raymond, 2016). Training has been defined as the systematic development of the knowledge, skills and attitudes required by an individual to perform adequately a given task or job (Armstrong, 2001). It clearly implies that the role of training is to improve the overall performance of the organization and driving force for sustainable development (Paryono, 2017). The term 'performance' is, therefore, interwoven with training. Training is the formal and systematic modification of behavior through learning which occurs as a result of education, instruction, development and planned experience. Development is improving individual performance in their present roles and preparing them for greater responsibilities in the future (Armstrong, 2001). Meanwhile, Goldstein and Ford (2002) defined training as the systematic acquisition of skills, rules, concepts or attitudes that results in improved performance in another environment. Based on the definition, training is an ongoing planned process that replicates many of the stages involved in the task in order to achieve the intended benefit. As Reynolds (2004) points out, training has a complementary role to play in accelerating learning. It should be reserved for situations that justify a more directed, expert-led approach rather than viewing it as a comprehensive and all-pervasive people development solution. He also commented that the conventional training model has a tendency to emphasize subject-specific knowledge, rather than trying to build core learning abilities.

Systematic Training

Training should be systematic in that it is specifically designed, planned and implemented to meet defined needs. It is provided by people who know how to train and the impact of training is carefully evaluated. The concept was originally developed for the industrial training boards in the 1960s and consists of a simple four-stage model (Reynolds et al., 2002), as illustrated in Fig. 1.
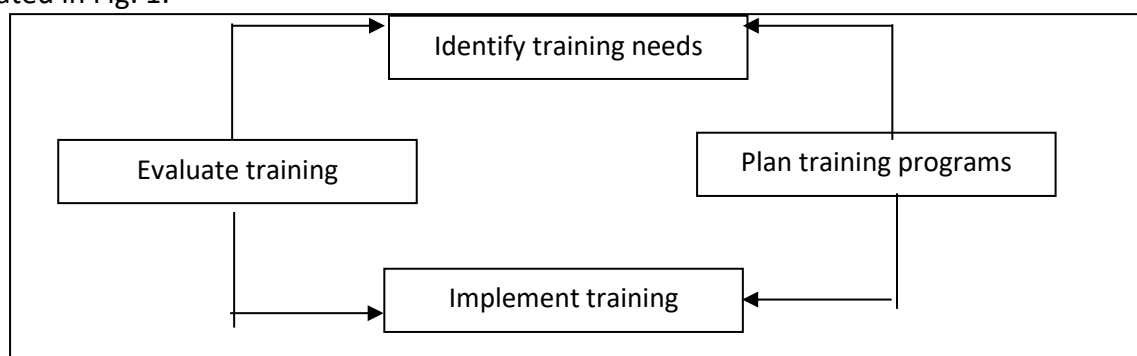

Fig. 1 - A Systematic Training Model

It is apparent that the term 'training' is not simply organizing classroom sessions. There is more to it. This process can help us to identify the role of the personnel responsible for organizing training and implementing the training policy. It would be worthwhile to discuss each of these segments in some detail (Reynolds et al., 2002).

Identify Training Needs
Any company delving into training and development of its workforce should first learn how to properly identify and assess training needs. This is the single most important thing that helps executives to address the gaps between the existing training and training which will be required in the future.

Plan Training Programs
Decide what sort of training is required to satisfy these needs. Planning a training program to support human resources (HR) functions in an organizational setting involves assessing the need, designing the materials to support human resource professionals, developing the training program, implementing the program and evaluating the impact of the program on departmental operational metrics.

Implement Training
Use experienced and trained trainers to implement training. The purpose of the implementation phase is to implement the training plan that you designed and developed in earlier phases of the systematic approach to training. This is when the learners undertake the activities of learning, produce the various tangible results that can be referenced as means to evaluate learners' progress toward achieving the learning objectives, and evaluation occurs not only of the results produced by learners but also the activities of implementation to ensure those activities themselves are high-quality. If the previous phases of assessment, design and development we done well, then this implementation phase should go quite smoothly.

Evaluate Training
The last phase of systematic training is evaluation. However, the evaluation really should have started even during the previous phase, the implementation phase because the evaluation is of both the activities of the trainer as they are being implemented and of the results of the training as it nears an end or is finished. The effectiveness of each step must be continually assessed. An overarching evaluation of the entire approach measures the value of the training program as it applies to company goals and employee performance and behavior. Evaluations can be completed by testing knowledge and skills immediately after completion of training or through consultation with employees and supervisors after work has resumed.

Methodology
The search strategy uncovered a total of 52 titles. After examining the titles, keywords and abstracts (where available) for relevance and excluding any duplicates, the complete manuscript of 48 potentially relevant papers was acquired. From these papers, 21 were relevant for this literature review. Of these, seventeen manuscripts were considered suitable to be included in this review. Content analysis and literature reviews published in English in peer reviewed journals were considered. Letters to the Editors and policy statements were

not considered for this review. Papers that researched the effectiveness of training methods were considered.

Results

Many different methods for training are available. Because each has its advantages and limitations, there is no one best way to train, and all of them can be effective in the right situation (Callahan, Kicker & Cross, 2003). According to Martin et al (2013), training is provided within a training program. In an organization, needs assessments are conducted to analyze problem areas and to identify potential solution strategies. If the identified need is training, then a training program is developed, which begins with recognition of training needs and methods, leads to training, and subsequently, evaluation (to examine the extent to which the identified needs are met and the problems are resolved). In this section, we identify sixteen different training methods that are used in technical and vocational organizations. Among these, five most common training methods used were revealed.

Table 2
Training Methods Used in Vocational Organization

Article	Author(s)	Training Methods Used	Description
1.	FNBE, 2010	On the job training	Teaching the skills, knowledge, and competencies that are needed for employees to perform a specific job within the workplace and work environment
		Apprenticeship training	Work-based form of providing vocational training. Based on a written fixed-term employment contract between an employer and an apprentice
		Special needs education and training	Designed for students who require special support with their studies due to disabilities, illness, delayed development or for some other reason
2.	Kean et al., 2012	Behaviour-based safety training	Used as intervention in developing good safety practices among young adults
3.	Elena Artemieva, 2016	Project method	The formation of specific skills through systematic organization of problem-oriented research. Train students in a similar situation as to be found in the real world of work
4.	Rudolf Tippelt, 2003	Active structuring	Active structuring attempts to conceptually structure a course area or theme through the application of a variety of social concepts and by diverse types of visualization according to the structure needed

Article	Author(s)	Training Methods Used	Description
		Brainstorming	The brainstorming method consists of processing students' spontaneous ideas about a pre-set theme, or problem which has been determined without qualitative comments from the trainer
		Simulation	Simulation is a technique in which specialized equipment or materials are used to portray a task situation
		Group work	Focused as it is on both participants and tasks, group work within a small group framework can be an ideal way of including a social element in learning themes
		Metaplan technique	The metaplan technique is a visualization and systemization method based on the use of written cards. This technique paves the way for a whole range of possibilities for the continuing analysis and structuring of existing knowledge
5.	Ayonmike et al., 2014	Competency based training	Specification of knowledge and skill and the application of that knowledge and skill to the standard of performance expected in the workplace
6.	Werner et al, 2012	On the job training	Teaching the skills, knowledge, and competencies that are needed for employees to perform a specific job within the workplace and work environment
7.	Anup Bhurtel, 2015		
8.	Dadang, 2012	The six steps teaching factory learning program model (TF-6M)	Replacing school's management with industrial management
9.	Wieckenberg, 2014	Brainstorming	Generates a large number of creative ideas. It consists of processing student's spontaneous ideas about a pre-set theme or topic
		Simulation	Simulation is a technique in which specialized equipment or materials are used to portray a task situation

Article	Author(s)	Training Methods Used	Description
		Project method	The formation of specific skills through systematic organization of problem-oriented research. Train students in a similar situation as to be found in the real world of work
10.	Odo, Adenle & Okwori, 2012	Activity based instruction	Form of classroom activity where the teacher effectively involves the learner in a task
11.	Addis, 2007	Competency based training	Specification of knowledge and skill and the application of that knowledge and skill to the standard of performance expected in the workplace
12.	Romina Bandura & Paul Grainger, 2019		
13.	Dar-Chin et al., 2006	Problem based learning	Teachers use practical problems as core themes in class and encourage students to conduct group discussion in order to develop student's ability in active learning, critical thinking and problem solving
14.	Huan Liew, 2017		
15.	Liviu Moldovan, 2012	Innovative tools and models	An innovative project that aims to develop and establish a regional network of vocational education and training centers
16.	Changwong, Sukkamart, & Sisan (2018)	Critical Thinking Skills/Problem Solving	Critical thinking is the tool that helps individuals find answers or solutions to a person's confusions and problems. Critical thinking is a mental process. From this, individuals need to actively and skillfully conceptualize, apply, analyze, synthesize, and evaluate information to reach an answer or conclusion.
17.	Theresa & Jonghwi, 2018	Simulation	Simulations learning enhance the relevance of particular skills. Simulation brings workplaces into the discussion. By using specialized ICT simulators, students can now learn about various types of equipment, including macro-sized tools, ultra-mini tools and highly expensive equipment that institutions cannot afford to buy.

Discussions

Based on the findings from these articles, on the job training, project method, simulation, brainstorming and competency based training are quoted as the most training methods used in technical and vocational organizations. These methods have become important worldwide

for the training of technical and vocational students. Today, the objective of training methods as a rule assist in the structuring of courses and in evaluating the standard of the qualification acquired at the end of the training process.

On the Job Training

On the job training is not a specific method but is any method used to show employees how to do the job while they are doing it. The greatest amount of the job training often occurs while the trainee is doing the various job tasks (Paul, 2007). On the job training for students has been used as a traditional instrument to increase employability of graduates with connected demand for the labor market. On the job training can help produce skills and competencies that may enhance a company's profitability and operability. Businesses are well placed as they know and understand the requirements and needs of its business industry. Hence, according to Elaine (2016), on the job training provide students with opportunities for experiential learning that may lead them to greater chances of employment after graduation. This training provides youths with skills on specific occupations which is vital for employability and holds more significance for the youths without higher level of education. Apart from natural resources and market, multinational enterprises seek skills in local workforce and on the job training helps the potential workforce with necessary skills to match job requirements in such companies. It is taken as the tool for human resource development through skill empowerment and for restoration of economic stability during financial crisis that leads to overwhelming rise in unemployment (Bhurtel, 2015).

Project Method

The project method is one of the most advanced methods to train students in a similar situation as to be found in the real world of work (Wieckenberg, 2014). The central idea of the project method is that a group of students analyze and develop a real life problem or tackle a present day topic within a preset time limit, working independently and with the division of tasks clearly defined. The special form of this training enables the students to not only contribute constructively to the lesson, but also to participate in the planning of the lesson beforehand. A great advantage also involves the product and practice oriented work. It helps students to occupy themselves with more than the vocational school and to make progress in transforming knowledge into practice. The project method is oriented towards problems concerning the teachers. By analyzing the problem and stating it more precisely and by finding and simulating action alternatives the method tries to find a solution for the problem. Within the project method, the teachers play a special role. They not only have professional competence, but also have to offer their help during the planning and decision processes within the project. Thus, according to Frank (2007), another important aim of project method is the communicating of work methodical competences and the possibility of communication and action processes within the project group.

Simulation

Simulation is a technique in which specialized equipment or materials are used to portray a task situation. Trainees are to pretend that the situation is real and carry out their tasks as they would in the actual situation. Simulation can be very realistic, for they can be based on real examples from the same organizations (Paul, 2007). Rudolf (2011), stated that simulation is especially valid for social learning centered around not only knowledge acquirement but also on the development of skills and attitudes that can enable students to make the steps

from theory to practice through real life application of the simulated situations. During the simulation, learners have to take decisions based on real or hypothetical model situations, defined by a set of rules that govern the situation. Simulation involves the use of a simulator where specific skills are developed through repeated practice with a multisensory experience of imitated conditions. (Martin et al., 2014). In addition, serious games and simulations are technologies increasingly used in education to give learners more control and opportunities to manipulate different parameters in their experiments. Augmented reality and virtual reality technologies allow students to apply theory to practice in a realistic, safe and controlled way. These technologies create authentic or close to realistic learning environments that were not previously available for such reasons as the high cost of installation and non-availability of internship opportunities (Theresa & Jonghwi, 2018).

Brainstorming
The brainstorming method consists of processing students' spontaneous ideas about a pre-set theme, or problem which has been determined without qualitative comments from the trainer (Rudolf et. al., 2011). Students can express their ideas either predetermined order or randomly, but this should be established beforehand (oral brainstorming). Brainstorming technique involves oral and pre-writing exercises for helping the learner and for expressing ideas by the teacher. It is a technique that is used under the discussion method. Brainstorming has a great importance in the teaching process. According to Wieckenberg (2014), brainstorming usually generates a large number of creative ideas. It can be used to identify and determine causes of problems, development of solutions and the implementation of these solutions. The major purpose of brainstorming as a teaching strategy is to foster and enhance communication skill, help to promote thinking and decision-making skill as well as foster different viewpoints and opinions. It may equally be used in all key areas of learning (Paul, 2007). In brainstorming techniques, the instructor carefully plans the lesson to reach the desired learning outcomes. The group interacts in response to questions, and the instructor refrains from entering the discussion as an active participant. Students are encouraged to learn about the subject by actively sharing information, experiences, and opinions.

Competency Based Training
Competency based training aims at preparing learners more effectively for real workplaces, which means that the acquisition of competences takes into account the requirements of the companies and industry (Ayonmike et al., 2014). Anane (2013) stated that competency based training is an industry and demand driven education and training programmes, its products have a high demand on the job market. Competency based training is different from the traditional system. It is based on defined competency standards which are industry oriented, it is unit based and modular and it can be applied to both formal and informal education, competency based training can be effective in easing the school-to-work transition and providing young people with skills that more closely aligned to employers' needs (Romina Bandura & Paul Grainger, 2019).The training is more learner centered than teacher-centered whereas more emphasis is placed on the learner's role in the learning process. Moreover, competency based training can also enhance quality. According to Addis (2007), competency based training is the aggregate of knowledge, skills and attitudes, it is the ability to perform a prescribed professional task. Therefore, Addis (2007) suggested that students should be

encouraged to build a portfolio of projects undertaken or item produced as evidence of proficiency and proof of ability to perform prescribed professional tasks.

Conclusion

This systematic review has drawn together into international data relating to technical and vocational training programs from 2000 to 2019 with consideration before pandemic COVID-19. Multiple issues faced by the government in the way to strengthen the field of Technical and Vocational Education and became worse when the outbreak of COVID-19 pandemic (Yeap et al. 2021). It is suggested that the most common training methods used from the multi country could form an integral and learning-active training where brainwork and manual labour are in balanced relation. There are five types of training methods commonly used among fifteen training methods found in this review paper. This finding should be able to provide proof that the discussed training methods are the best methods to be integrated as effective intervention into the technical and vocational training programme especially for student's safety practices behavior at the laboratories. The programme providers publish printed material in "road mapping" form or brochure to disseminate information about course offerings in TEVT by government agencies and private agencies (Khadijah et al., 2011).

However, technical and vocational training methods not only improving technical and vocational students' performance but also play a key role in promoting economic competitiveness and prosperity of the country. Young people's successful transition onto the labor market is one of the main criteria for assessing the success of a technical and vocational education and training (TVET) programs (Ludwig-Mayerhofer et al., 2019). The future labour market requires versatile vocational skills and solid competence complete with continuous renewal of competencies; and prepares the learner with higher levels skills/competencies necessary to display strong intellectual, ethical, and aesthetic qualities in order to function as responsible and productive citizens (Hutton & Raymond, 2016). Therefore, Werner et. al. (2012), suggested that students should be opened up to a new technologies and occupational change, which requires some recognition of informal employment as part of the economic and society reality. It is recommended that future research will include innovative training such as e-learning methods in order to improve quality and make it more adaptable to the labour market. Institutions should review and redesign their curriculum to arrive at a more holistic assessment of students' performance and preparation for the uncertain future labour market, using tools like the e-portfolio to support their career development and lifelong learning. Hence, digital technology could become the single biggest lever for productivity and competitiveness in the near future.

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