Conference Paper

Effectiveness of Online Learning in Technical And Vocational Education and Training (TVET): A Meta-Analysis Study from a Malaysian Perspective

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Abstract.
Learning and teaching have been affected by the COVID-19 pandemic.However, besides its catastrophic impact, it is seen as a catalyst for the implementation of online learning. Online learning has become the main means to implement learning and teaching processes during the pandemic. This study was conducted to identify the effectiveness of online learning in Technical and Vocational Education and Training (TVET). The study uses a meta-analytical approach in which a total of 10 articles have been identified using *'Google'* and *'Google Scholar'* engine searches and were then finely reviewed. Among factors which contribute towards the effectiveness of online learning are the technique and delivery of instructors, interactive learning, learning syllabus, readiness and motivation of students.

Keywords: Interactive Learning, Online Learning, Motivation

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1. Introduction

Online learning has been widely implemented due to the COVID-19 pandemic. This is in tandem with the declaration of the World Health Organization (WHO) on the effects of infectious virus transmission. Consequently, Ministry of Higher Education Malaysia (KPT) has decided that all learning and teaching will be carried out online, replacing face-to-face activities.

There were many innovations that have been designed to ensure the effectiveness of online learning. Amongst the factors in ensuring that learning and teaching achieve the desired objectives, is through the creativity of the teachers. According to Mohamad Johdi (2007), teachers play an important role in determining whether learning objectives

are achieved or not. In order to support the role of teachers, the skill of using Information and Communications Technology (ICT) equipment should be at the highest level, in order to be able to use the online learning medium optimally. Various teaching methods and approaches are used to attract students and to rearrange the content of the learning to suit the online delivery method.

An interactive learning approach based on existing applications can assist on cognitive development and empower high-level thinking skills (Mechellino Enggol, 2021). Learning that can be carried out independently or through blended learning ensures that students work hard and are active in obtaining information. The use of audio visuals, such as the display of diagrams and videos, can give students a deeper understanding. While the use of interactive learning can enhance active involvement and increase student motivation in executing online learning.

2. Method

This study was conducted using quantitative approach in which meta-analysis technique was used to analysis data. Ten articles from academic publication related to the effectiveness of implementing online learning in TVET education were analyzed. Web search engine, *Google Scholar* was used to search for pertinent information. A search limit for scholarly literature were set starting from 2019 until 2022. Next, the keyword of effectiveness, online learning in the field of TVET, and the practice of online learning were applied to identify the articles. Based on the search, a total of 2820 relevant articles were identified. Since the numbers is too many, the researchers capped to the keyword of 'online learning in the field of TVET'. As a result, a total of 240 articles were found. An analysis method suggested by Creswell (2009) was adopted to analyse the data. This study implemented a high-quality meta- analysis technique as suggested by Pigott and Polanin (2020) which focusing on comprehensive search and unbiased screening and coding procedures. A systematic review meta-analysis technique had been applied in this study as per below

The approach of data in this study is suggested by Braun and Clarke (2006) which suggested that each theme analysis that are coded should follow the following steps:

1. Researchers should familiarize themselves with the data collected.

2. All the abstracted data from the documents should be transcribe.

3. Researchers should produce initial coding for the data

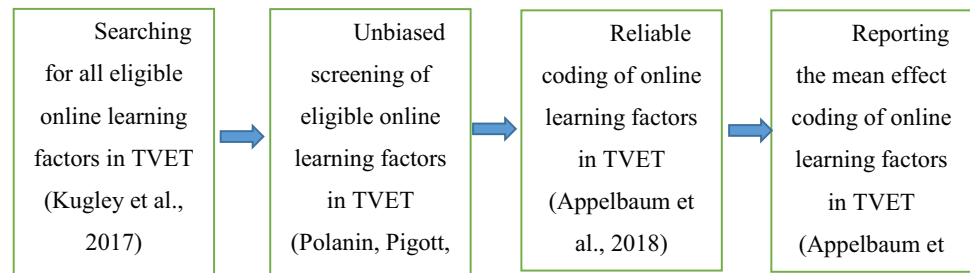4. Researchers should find themes that related to the data

Searching for all eligible online learning factors in TVET (Kugley et al., 2017)	→	Unbiased screening of eligible online learning factors in TVET (Polanin, Pigott,	→	Reliable coding of online learning factors in TVET (Appelbaum et al., 2018)	→	Reporting the mean effect coding of online learning factors in TVET (Appelbaum et

Figure 1: Systematic review meta-analysis technique.

5. Researchers should have to rechecking the themes developed from the abstracted data

6. Researchers must name the themes that are developed

The steps recommended by Braun and Clarke (2006) were used as a reference in this study where researchers have been familiarized with the data obtained from ten articles on online learning factors for Technical and Vocational Education. Data were collected until it reached the saturation point. According to Fusch and Ness (2015), saturation point is very important to ensure that the data that is used is valid for the analysis. Fusch and Ness (2015) stated that the documents that are referred as data must be fewer years back instead of been using papers that were published twenty years ago. This is because the contents and citation of the older papers may not be relevant with the current situation. Fusch and Ness (2015) added that data saturation is reached when there is no additional themes and no new information is gathered through the data collection.

3. Objectives

The study was conducted to identify the effectiveness factors of online teaching and learning in Technical and Vocational education in Malaysia

4. Result and Discussion

4.1. Results

Based on the analysis of 10 articles above, it is clearly shown that elements which contribute towards effectiveness of learning and teaching were teaching delivery, inter-active learning, syllabus and readiness and motivation. Interactive learning was found to

TABLE 1: Meta-analysis on online learning.

No	Journal and Author	Online Learning Effectiveness Factors			
		Learning delivery Approach (LDA)	Interactive Learning (IL)	Syllabus (S)	Readiness and Motivation (RM)
1.	Keberkesanan Pembelajaran Dan Pengajaran Dalam Talian (E-Pembelajaran) Terhadap Pembelajaran Pelajar Di Kolej Komuniti Hulu Langat (*Siti Azura Abu Hassan, Suzana Zainol Abidin & Zulkurnain Hassan, 2021*)	✓	✓	✓	✓
2.	*An Overview of the Effectiveness of Online Learning During theCOVID-19 Pandemic: The Perspective of Engineering Science Students of Sultan Ibrahim Polytechnic (Munirah Salleh, Mohd Faisal Jamaludin, Noor Syaheeda Mohd Safie & Julia Mohd Yusof, 2021)*	✓	✓		✓
3.	Kerangka Konsep E-Learning Projek Tahun Akhir Dalam Bidang Kejuruteraan Pasca COVID 19: Pelaksanaan Dan Penilaian *(Zulkifli Mansor, Siti Khalijah Shuib & Zaiful Hizam bin Hamidon, 2020)*	✓	✓	✓	✓
4.	Kajian Rintis Keberkesanan Makmal Maya Di Kalangan Pelajar Politeknik *(Rosmawati, Anis Sakinah & Ainul Azniza, 2020)*	✓	✓	✓	✓
5.	Kajian Keberkesanan Pembelajaran Interaktif Berasaskan Aplikasi Kahoot: Satu Kajian Tindakan Terhadap Kursus *Principles of Marketing (Faridah Che In & Afham Zulhusmi Ahmad, 2019)*	✓	✓	✓	
6.	Kajian Keberkesanan Pdp Amali Dalam Talian Dengan Penggunaan Perisian 'Electric Circuit Studio' Dan 'Video Pendek' Bagi Kursus Kejuruteraan 'Dee30043-Electronics Circuit' Bagi Pelajar Di Jabatan Kejuruteraan Elektrik, Polimas *(Huzairi Mohamed, Sofwan bin Ramli & Ismail Hashim, 2020)*		✓	✓	✓
7.	Keberkesanan Pembelajaran Interaktif Secara Dalam Talian Menggunakan ResQUE: Satu Kajian Terhadap Kursus Statistik *(Noor Suriani Nazruddin, Noryanti Samsudin & Nur Sa'adah Mohd Hisam , 2022)*	✓	✓	✓	✓
8.	Persepsi Keberkesanan Program Kemahiran TVETdalam Kalangan Pelajar Institusi Tahfiz Daerah Kota Tinggi Melalui Pendekatan Heutagogi *(Hasniza Tawyer & Hanirah Mohamad Nur, 2022)*	✓	✓	✓	✓
9.	Keberkesanan Penggunaan Video Sebagai Bahan Pengajaran Atas Talian Era Pandemik COVID-19 *(Mohammad Rasyidi Yusof & Faridah Jamil@Amat, 2020)*	✓	✓		✓
10.	Keberkesanan Penggunaan Kit R&I Amalan Bengkel Mekanikal (Memesin) Di Politeknik Melaka Semasa Pandemik COVID-19 *(Noraini Mohd Baidui & Norwadiah Mohd Andai, 2020)*	✓	✓	✓	✓
	TOTAL	9	10	8	9

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be the most vital element in the delivery of online teaching and learning while syllabus was slightly less important.

4.2. Discussion

The following discussion is based on four elements that have been identified as important in online teaching and learning.

4.2.1. Learning Delivery Approach

The instructional delivery by teaching staff must be in accordance with the cutting edge of teaching methods in order to ensure active involvement of students. Learning activities such as quizzes and group discussions are encouraged to fit the teaching methods. These active learning may prevent the class from becoming too bland if the theory class is fully executed. According to the research by Noor Suriani Nazruddin, Noryanti Samsudin, Nur Sa'adah Mohd Hisam (2022), teaching delivery which uses the ReSQUE application as a medium to conduct quizzes in teaching, will encourage active involvement of students. This study is corroborated by Faridah Che In and Afham Zulhusmi Ahmad (2019) in which, learning and teaching based on games can help increase students' self-confidence and active involvement in class.

Teaching delivery using the Heutagogical approach or self-determined learning in teaching teachers are seen to be able to cultivate interest in learning and increase student independence in line with the digital era (Berita Awani, 2020). Hasniza Tawyer and Hanirah Mohamad Nur (2022) claimed that the Heutagogical approach gives a new learning landscape among tahfiz Madrasah An-Naurah students. The presentation and guidance of the facilitator gives a positive perception of student involvement. The fixed duration according to the tasks given can ensure that independent learning can be carried out in an orderly manner.

The approach in the delivery of practical activities in technical and vocational were found to be implemented too. Presentation using video recording simulation provides effectiveness on student achievement. This is proven by the study of Noraini Mohd Baidui and Norwadiah Mohd Andai (2020), the application of cybergogy elements applied to practical courses could encourage students to be in an online learning environment.

4.2.2. Interactive Learning

According to Dewan Bahasa (2010), interactive elements enable continuous two-way information flow digitally. At the same time, the COVID-19 pandemic that hit the world confirms that the use of interactive elements between learning mediums or teaching aids can contribute towards its effectiveness in the online learning process. Development of an e-Learning Concept Framework by Zulkifli Mansor, Siti Khalijah Shuib and Zaiful Hizam (2020) for final year projects in the field of engineering, showed effectiveness and suitability to be used. Through this, students can access all class notes on the e-learning link in addition to provide test and quiz activities.

A study by Noor Suriani Nazruddin, Noryanti Samsudin and Nur Sa'adah Mohd Hisam (2022) also showed effectiveness in the subject of statistics. The ResQUE application used as an interactive teaching aid is easy to be used and has an attractive display. As a result, students' interest and active involvement in the topic of Probability and Hypothesis Testing were increased. Game-based learning using Kahoot application gets active student participation as in the study conducted by Faridah Che In and Afham Zulhusmi Ahmad (2019), using the game application in the form of drills followed by review by collecting points within the specified time.

The use of video as an interactive learning medium is beneficial and effective. The application of video, especially in TVET, is a method that hones skills and generate knowledge indirectly. Findings from Huzairi Mohamed, Sofwan Ramli and Ismail Hashim (2020) proved that the use of video in practical work conducted online using integrated software is very helpful for students. This method will deepen students' understanding while doing practical work online. Moreover, by re-watching the video recording, it may augment students' self-learning to carry out practical work.

Noraini Mohd Baidui and Norwadiah Mohd Andai (2020) in their study used R&I kit as a virtual lab which considered as an interactive element that meet the needs of online learning. Through this digital learning concept, it makes teaching process easier. The effectiveness of the study also shows active involvement of students in doing online practical simulation. The cybergogy approach is applied online, especially when it involves practical works. Wang and Kang (2006) contended students do not only achieve learning objectives but can also be actively involved during the ongoing teaching and learning process.

4.2.3. Syllabus

Syllabus is a document which considered as an important element in ensuring the effectiveness of learning. The objectives that have been set must be comply to the syllabus, while selection of procedures according to the suitability of online learning, contributes to the effectiveness of learning. Rosmawati, Anis Sakinah and Ainul Azniza (2020) found out that through virtual laboratory, adaptation of learning procedures could be developed. Topics are selected based on practical needs and online final exams can save time. In addition, teaching staff can determine the strategy to be used and determine the goal to be achieved.

Siti Azura Abu Hassan, Suzana Zainol Abidin, Zulkurnain Hassan (2021) developed a conceptual framework for the implementation and evaluation of final year projects. The implementation of the framework gives students an idea of the practicality of the project and the level that will be assessed. The study conducted showed an increase in student engagement through the medium and level of learning. From this procedure, teaching staff can prepare materials according to the plan that has been set.

4.2.4. Readiness and Motivation

The requirement for online learning is to have a device and internet access. Devices such as computer, tablet and smartphone should also support online application and have good internet access. The main aspect of student readiness and motivation is the medium that they used. According to Hasniza Tawyer, Hanirah Mohamad Nur (2022) the use of interactive medium increases the involvement and effectiveness of online learning.

Motivation of the new generation based on the study of Munirah Salleh, Mohd Faisal Jamaludin, Noor Syaheeda Mohd Safie, Julia Mohd Yusof (2021) found that the availability of devices and internet access affects the effectiveness and motivation of students. Attention and guidance from online instructor plays a role in increasing motivation to engage in online classes. In order to ensure the effectiveness, teaching staff should appreciate any results and involvement of students by giving words of encouragement and praise. This can stimulate student engagement online. Home distractions may also affect the learning readiness to join the class.

5. Conclusion

There are four elements which contribute towards effectiveness of online learning, especially in the technical and vocational education and training. Learning delivery which include methods and techniques used in teaching, together with interactive learning using online-based digital elements may attract student interest. These could improve student understanding. The structured syllabus helps to ensure the selection of materials and resources which are set based on learning objectives. The readiness and motivation of students include the learning process that is carried out.

To sum up, teaching staff need to excel in the use of information technology, especially those involving online learning. To ensure active involvement of students, it will depends on the delivery method used. The use of interactive materials is seen as a catalyst for online learning. Teaching materials such as notes and videos can be uploaded for students' self-learning. The game-based approach makes learning more interactive and could hindered students from becoming passive.

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