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## Student Understanding Through the Application of Technology Enabled Active Learning in Practical Training

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### Abstract

The review of the application of Technology Enabled Active Learning (TEAL) is based on the concept of a learning format that involves the delivery of lessons content in the laboratory, simulations and hands-on experience by students in conducting technological innovation. This study was conducted to determine the level of application of TEAL among students to help improve the understanding of the students so as to enhance their creativity and innovativeness as well as to provide facilities for the application of TEAL in the laboratories of the Faculty of Technical and Vocational Education (FTVE), Universiti Tun Hussein Onn, Malaysia. The study sample consisted of 227 students from among 518 undergraduate students from the FTVE Semester 1 2014/15 Session. Six laboratories at the Department of Professional Education (DPE) were used for this study. The determination of the sample size for this study was based on the strata sampling method of calculation. The study instrument was quantitative in nature, whereby a questionnaire was used to obtain data from the respondents. The questionnaire was designed using a five-point Likert Scale. The data obtained were analysed to obtain the mean score, standard deviation and correlation. The results showed that the level of the application of TEAL in practical learning is high, the application of TEAL to assist in improving the understanding so as to enhance creativity and innovativeness is high, and the provision of laboratory facilities at the FTVE in helping to create a TEAL learning environment is high. Meanwhile, the hypothesis of the study showed that there is a moderate relationship between the level of application of TEAL and the understanding of students in enhancing their creativity and innovativeness. On the whole, TEAL should be implemented to help improve the students' understanding. In order to enhance the creativity and innovativeness of students, the study found that instructors and students must together apply TEAL optimally in teaching and learning activities.

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**Keywords:** Technology Enabled Active Learning (TEAL); Understanding; Creativity and Innovation; Teaching and Learning

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## 1. Introduction

The education sector in this country is dynamic and is undergoing many changes and reforms in the 21st century. The primary objective of these changes is to transform Malaysia into a centre for academic excellence in the Asian region and also at an international level in this century. Thus, education in Malaysia needs to undergo changes in order to raise the level of excellence and quality of its education to that of world standard in order to gain the status of World Class Education. Widespread development and technological advances have had an impact on reforms in the national education system. Technology-based learning is also being increasingly implemented in the teaching and learning process in higher education institutions. As a result, Technology Enabled Active Learning (TEAL) format was first developed at the Massachusetts Institute of Technology (MIT) in 2001 by a physics professor named John Belcher to bring about changes to the format of innovative teaching and learning so as to give rise to active learning. According to Morrison & Long (2011), TEAL is a new learning format that combines three elements: lectures, simulations and hands-on skills by the students. The approach used for the implementation of the TEAL format is aimed at creating an effective learning system to improve students' understanding so as to enhance their creativity and innovativeness from the context of the application of technological innovations so as to produce active learning (Puteh et al., 2006) especially in practical terms (Ramona & Gabriela, 2012). Therefore, this study was designed to identify the level of application of TEAL in learning among students in the Faculty of Technical and Vocational Education (FTVE). In addition, this study aims to identify the level of application of TEAL in understanding practical learning so as to enhance creativity and innovativeness. At the same time, this study also reviewed the laboratory facilities at the FTVE in helping students to create a TEAL learning environment. Moreover, this study also identified the extent of the relationship between the level of application of TEAL and the increase in the students' creativity and innovativeness.

## 2. Objectives and Hypothesis of the Study

To ensure that the objectives of this study can be achieved, the following objectives were identified:

- i. To identify the level of application of TEAL in practical learning in the lab among students.
- ii. To identify the level of application of TEAL that helps to improve students' understanding so as to enhance their creativity and innovativeness.
- iii. To identify laboratory facilities in FTVE in helping students to create a TEAL learning environment.
- iv. To identify the relationship between the level of application of TEAL and the students' understanding in enhancing the creativity and innovation of students.

Based on the 4 research objectives, the hypothesis or expectation has been outlined at the beginning of the study to answer the research questions mentioned previously:

- $H_0$ : There is no relationship between the level of application of TEAL and the students' understanding in enhancing the creativity and innovativeness of students.
- $H_a$ : There is a relationship between the level of application of TEAL and the students' understanding in enhancing the creativity and innovativeness of students.

## 3. Highlights of the Study

Therefore, the application of TEAL is an innovative learning method which combines teaching methods as well as group research in the laboratory and simulations using multimedia technology, audio visuals, the internet, animations or 3-Dimensional images, and explanations by the course instructor through the use of the latest innovations in technological equipment, according to Parishan, Jafari, & Nosrat, (2011). The infusion of innovative

elements is important for the development of the mind so as to increase the students' understanding in order to generate creative and innovative thinking, thus generating active learning whereby they are given the opportunity to use the actual technological equipment itself. An innovative learning method can produce an active learning environment and increase the level of the students' understanding of what has been studied (Rasidi Sidik, 2009). In this century, the education system should play an important role in the implementation of learning innovations in the teaching and learning process that is consistent with the changes in this technological era. The implementation of TEAL into current learning is possible because the students are passive and do not have the power of creative and innovative thinking during the teaching and learning process. According to Han and Chin (2012), students are also often reluctant to share their ideas during lesson discussions. This is due to shortcomings in the planning, construction and use of uninteresting teaching aids. During the teaching and learning process, lecturers, in particular, do not use teaching aids that can attract students to begin to engage in the activities being carried during the teaching of courses in higher education institutions (Khalil, 2011).

In addition, learning by means of technology-based discussions can improve the perception of educators in facilitating the dissemination of information to students and communication with them (Sahin, 2012), and educators can start planning to use technology in teaching (Han & Shin, 2011). This positive influence of TEAL is based on increased technological and pedagogical knowledge, which are effective for the learning of a particular subject. Several universities and colleges, such as the University of North Carolina, State University and the Massachusetts Institute of Technology have successfully implemented this TEAL model. Usually the teaching and learning activities for active learning in the classroom include group learning and collaboration, important visualization and simulation tasks sent via laptop and the internet, hands on experiments and the use of personal response systems that can enhance the students' understanding (Drake, 2014).

Consequently, this leads to poorer student learning performance and little change. The students also do not acquire a solid understanding of learning causing more students to be more inclined to use the time available to involve themselves in activities that are not beneficial (Kost et al., 2009). According to a study by Che Ahmad et al. (2010), this hampers the smooth running of the learning process because the students are not given the opportunity to explore and arrive at their own understanding of a topic or phenomenon. To solve this problem, it is necessary to use more practical and effective methods of learning based on innovation to encourage students to think actively (Abreza Atan, 2009). In relation to this, a TEAL learning format should be developed to overcome the low level of understanding of students in practical learning in higher education institutions with regard to the use of technological innovations to bring about transformation leading to the creation of something new, whether in the form of a source or method that is more relevant to current developments towards the generation and development of minds for more dynamic nurturing of creativity and innovativeness (Abdul Rashid et al., 2010). In addition, in one study (CELE Exchange, 2010), it has been mentioned that this happens because students do not fully understand the learning concept because of the lack of technological approaches that are applied to generate creative and innovative thinking in learning.

Therefore, this learning format is introduced to overcome the students' low level of understanding in practical learning at higher education institutions regarding the use of technological innovations to bring about transformation in creating something new in the form of a resource or method that is relevant to current developments for the creation and development of more dynamic minds in order to change passive or traditional learning methods to active learning that involves students in technological innovations. This is important in order to produce graduates who possess a high level of creativity and innovativeness and are technologically skilled in the application of TEAL.

A good learning concept is the approach used in the delivery of a science that it is easy to understand because it motivates students to make a decision. There are some researchers who support the implementation of technology-based learning in education on the grounds that it provides opportunities for active learning and enables students to implement cognitive learning at a higher level, thus encouraging students to conduct scientific researches and make modifications to a concept (Jimi Yiannis, 2010).

This will help to enhance the students' understanding of learning more effectively. Students will also be skilled in using technology to search for a source of reference in order to complete an assignment. The students' skill in using technology is important in education to facilitate the students in having discussions with their course mates to share ideas and opinions to help in the development of their minds. Active learning in the classroom as a group is also carried out to help increase the students' understanding, whereby students share their ideas and knowledge in order to solve a problem together. In addition, this TEAL technology can improve the skills of

educators in preparing and developing methods to enable students to understand a theory or concept more clearly in learning sessions in real classroom situations (Kim, 2011).

Because of this, students are also unable to understand a good learning concept due to the application of a poor technological approach to generate creative and innovative thinking in learning (Kenn Fisher, 2010). It takes quite a long time for any change in the teaching format to be put into practice in teaching and learning. However, in order to transform a passive or traditional learning method into active learning, the laboratory should be equipped with high-tech equipment, and has to be coordinated so that it is in accordance with the requirements of the curriculum, current technology and skills needed by the students. Moreover, lack of exposure in the application of technology in teaching among teachers has resulted in a lot of technological equipment available in the classrooms and the laboratories not being used optimally and effectively.

In order for the TEAL learning method to be successful, it is necessary to plan the teaching and learning of technology and design. What is of utmost importance is to have qualified educators or educators who are experts in the use of innovative technology to facilitate learning sessions according to plans based on the level of the students' ability by organizing practical activities and maintaining a comfortable environment. This means that students can openly access information from materials, components and equipment. A comfortable learning environment enables students to develop a broad knowledge base and to be creative, critical and innovative in their thinking by using technology to obtain accurate information (Lee, 2011). It should be emphasized that although the use of technology in education is costly in terms of providing the necessary equipment and technology for the students, it can help them to generate their own design ideas and to make the exploration of knowledge more interesting.

Therefore, in order to successfully transform education as planned in helping to achieve the vision of 2020, the implementation of the TPACK pedagogical knowledge by teachers in order to produce individuals and a generation who can think critically, creatively, innovatively and outside the box or uniquely needs to be seriously emphasized. In fact, the application of TEAL cannot be fully implemented also if the laboratory facilities are inadequate. Students will become passive if no hands-on and simulation elements are used during learning. TEAL technology cannot be expanded and aligned with the passage of time in the absence of the necessary equipment.

#### **4. Methodology**

This study used a quantitative approach in the form of a survey to test and answer the research questions. The aim of this study is to obtain the views and perceptions of respondents with regard to the application of TEAL in helping to improve students' understanding in enhancing their creativity and innovativeness. The survey can also be used to explore the relationships between variables, or the method of explanation. In this study it is also necessary to find the correlation between an increase in the level of application of TEAL and the students' understanding in enhancing creativity and innovation. This method was chosen because it is able to decipher the issues and problems in the application of TEAL in practical learning. Descriptive statistics such as mean, percentage, ranking and standard deviation, as well as inferential statistics were used to analyse and describe the research questions. Based on this justification, a research design in the form of a survey is a very suitable and reliable method for answering all the research questions put forward.

##### *4.1. Population and Sample*

The research population comprised undergraduate students from the Faculty of Technical and Vocational Education, Universiti Tun Hussein Onn. A total of 518 undergraduate students were identified. The rationale behind the selection was that the students must meet all the demands and requirements of the study. Almost all the respondents had used the labs. They were degree students who have been through learning in the laboratories of the Department of Professional Education, FTVE. According to Cochran's (1977) calculation, the required sample size was 227 respondents from various programs of study to be selected by strata layered random sampling (Chua, 2006). From the results of these calculations, it was found that the number of samples for each undergraduate student from the various programs of study was as indicated in Table 1.

Table 1. Number of Respondents Involved

Academic Program Faculty of Technical & Vocational Education	Population	Respondents involved	Sample
Bachelor of Vocational Education (General Machining) – BBA	34	15	
Bachelor of Vocational Education (Building Construction) –BBB	137	60	
Bachelor of Vocational Education (Catering) –BBC	80	35	
Bachelor of Vocational Education (Metal Welding and Fabrication) – BBD	34	15	227
Bachelor of Vocational Education (Electric & Electronic) –BBE	142	62	

#### 4.2. Research instruments

The research instrument selected for this study was in the form of questionnaires to obtain feedback and to collect data from the respondents (Tuckmen and Mohd Shukri, 2010). The Likert scale was used in the questionnaire because this scale is a composite measure that contains two or more items that are intended to evaluate a variable. This study will use a questionnaire consisting of five (5) sections to measure the level of application of TEAL among students towards helping to increase the students' understanding in enhancing their creativity and innovativeness, as well as the provision of facilities for the application of TEAL in the laboratory of the Faculty of Technical and Vocational Education (FTVE), Universiti Tun Hussein Onn, Malaysia.

#### 4.3. Data Analysis

The data that were obtained were arranged for analysis in the order of the questions. The raw data obtained based on the returned questionnaires were reviewed and examined. The data obtained were analysed using SPSS software. Table 2 gives a summary of the data analysis based on the research questions and the research hypothesis.

Table 2. Analysis method for answering the research questions

No.	Question	Analysis Method
1.	What is the extent of the level of application of TEAL in practical lab learning among students?	Mean score Standard deviation
2.	How far has the level of application of TEAL aided in students' understanding in enhancing the creativity and innovativeness of students?	Mean score Standard deviation
3.	How far have lab facilities at the FTVE aided students in creating a TEAL learning environment?	Mean score Standard deviation
4.	Is there a relationship between the level of application of TEAL and enhanced student creativity and innovation?	Correlation Test Pearson's Correlation

## 5. Results

A total of 227 sets of questionnaires were distributed to the undergraduate students from the FTVE. The number of respondents according to gender is shown in Table 3.

Table 3. Gender Numbers in the Study

Gender Factor	Frequency (f)	Percentage (%)
Males	82	37.4
Females	142	62.6

Meanwhile, respondents were successfully selected from various programs of study in the FTVE by using calculations to determine the number of respondents involved. Normality tests were also conducted in this study to determine whether the data obtained were normally distributed or not. Thus, among the normality tests that can be used are Skewness, Curtosis, and Q-Q plot graphs.

The data were analysed to obtain the mean scores, standard deviations and correlations. The results of the study show that the level of application of TEAL in practical learning is high, the application of TEAL to assist in improving the understanding of creativity and innovativeness is high, and laboratory facilities at the FTVE in helping to create a TEAL learning environment is high. The results of the study show that the level of application of TEAL in practical learning is high (mean score = 4.00). The application of TEAL to assist in improving the understanding of creativity and innovativeness is high (mean score = 4.01) and laboratory facilities at the FTVE in helping to create a TEAL learning environment is high (mean score = 3.93).

Table 4. Relationship between level of application of TEAL and understanding in enhancing creativity and innovation

Pearson's Correlation		Understanding	Application
Understanding	Correlation coefficient	1	0.414**
	Sig. (2-tailed)		0.000
	N	227	227
Application	Correlation coefficient	0.414**	1
	Sig. (2-tailed)	0.000	
	N	227	227

\*\*Correlation is significant at the level of 0.01 (2-tailed)

Table 4 shows the results of the study on the relationship between the level of application of TEAL in improving the understanding of creativity and innovativeness using Pearson's correlation. Based on Table 4, the hypothesis shows that the correlation coefficient for the relationship between the level of application of TEAL in improving the understanding of creativity and innovation was  $r = 0.414$ . According to Azizi et.al (2001) regarding the interpretation of the correlation coefficient, when  $r = 0.414$  it shows that there is a moderate relationship. A significant value was obtained when  $p = 0.00$ , which is smaller than the level of 0.01, thus indicating that there is a correlation between the level of application of TEAL and improving the students' understanding to enhance their creativity and innovation. Overall, this TEAL application should be implemented to help improve the students' understanding in enhancing the creativity and innovativeness of students. The study found that instructors and students must work together to apply TEAL optimally in teaching and learning activities.

## 6. Findings and discussions

This section of the discussions explains the results of the data analysis. It includes discussions on the level of application of Technology Enabled Active Learning (TEAL) in practical learning in the lab in helping the students to improve their understanding of creativity and innovativeness, and also discussions on the provision of laboratory facilities in the FTVE in helping students create a TEAL learning environment. Also included in this section are

discussions involving the relationship between the level of application of TEAL applications and increasing students' understanding of their creativity and innovativeness.

To observe the level of application of TEAL in practical learning in the lab among students, questionnaires have been used to obtain data on the frequency of use of technological innovations in education by the respondents. The results showed that the frequency of use of TEAL applications in practical learning among the respondents was high because it was already being used in lectures, where technological innovations in education have involved students actively and interactively by means of the medium of technology in learning, such as animation, creative Power point, internet, web sites, electronic communications and blogs. This assertion is supported by Parishan (2011), who stated that TEAL in practical learning uses group research teaching methods in the laboratory and simulations using films, the internet, animations and dimensional images, and multimedia technology in practical learning.

Meanwhile, the findings of the study revealed that the level of application of TEAL in helping to improve students' understanding of their creativity and innovativeness is high. This indicates that the level of understanding of learning using innovative technology applications can have a good influence on the minds of students. The students are also becoming skilful in handling technology to search for sources of reference to complete their assignments, whereby students are using technology to facilitate them in having discussions with other course mates in the sharing of ideas and opinions to assist in the development of their thinking. In addition, active learning in the classroom in groups can also be organised to help increase the students' understanding in sharing ideas and knowledge together to solve a problem in their lessons.

This study evaluated the laboratory facilities at the FTVE in helping students to create a TEAL learning environment. The findings showed that the level of creating a TEAL learning environment in the FTVE was moderate, where the facilities necessary for the application of TEAL in the FPTV labs still need to be further improved. This might be due to the students' lack of exposure to innovative equipment during the learning process. However, the innovative technological equipment available in the FTVE labs is adequate since most of the respondents approved of the computer facilities that are available in the laboratories to provide information. This indicates that the creation of a TEAL learning environment can be continued to foster the development of the students in order improve their performance in their studies.

In addition, the respondents were also of the opinion that these factors concerning the application of TEAL can increase the power of imagination to create an innovation that can enhance their knowledge and skills using current teaching and learning technology in line with rapid advancements in the field of technology. This is consistent with studies by Dori and Belcher (2010), who stated that the main factor in the application of TEAL was to change the mind-set of students in learning to create an active learning environment that is helpful, one which is coupled with technology to improve their understanding of concepts and to give students the opportunity to analyse for themselves a concept that they have learned.

The level of application of TEAL in practical learning has a positive and moderate relationship on improving the students' understanding of their creativity and innovativeness. This means that when the TEAL application is implemented, then the students' improved understanding will somehow have an effect on their creativity and innovativeness. Therefore, to improve the students' understanding in shaping creative and innovative thinking, this TEAL application can be used to help students to be open-minded and to be able to express their own views concerning a particular outcome. This is consistent with the findings of Niess (2013), who found that students can easily share ideas and develop their minds to solve problems with regard to creative thinking, and they can be bold in making their own decisions when performing a task. Hence, the TEAL approach should be coordinated so that its application in teaching and learning will be directed towards enhancing the creativity and innovativeness of students as required in contributing to the exploration of innovative learning practices in higher education institutions.

## **7. Conclusion**

This study was conducted based on the need to review the level of application of TEAL in the FTVE. The study showed that the level of application TEAL among undergraduate students in the FTVE with regard to the use of technological innovations is high, where it can in some way help to improve the students' understanding of creativity and innovativeness in the learning process. On the whole, the items that were studied were at a high and moderate level, thus indicating that there is still room for improvement in this area. From the overall level of studies

that have been obtained, it can be concluded that certain parties have to make improvements to the existing level of exposure to technological innovations in the FTVE so that these can be fully utilized by the students in their learning activities. The undergraduate students also have a role to play and should be aware of the importance of using the TEAL application. In addition, the instructors at the FTVE are encouraged to apply TEAL optimally in order to enhance their skills. In this way, the improvements that need to be made to the application of TEAL in learning will be a learning format that can assist in the effective teaching and learning of innovation systems.

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