A STUDY OF THE EFFECTIVENESS OF THE CONTEXTUAL APPROACH TO THE TEACHING AND LEARNING STATISTICS IN THE UNIVERSITI TUN HUSSEIN ONN MALAYSIA (UTHM)

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ABSTRAK

Konsep yang tidak tepat dalam statistik menyumbang kepada andaian oleh pelajar bahawa statistik tidak berkaitan dengan dunia sebenar dan tidak berkaitan dengan bidang kejuruteraan. Sejak pengenalan teknologi dalam pengajaran dan pembelajaran, terdapat universiti yang memperkenalkan pembelajaran statistik menggunakan aktiviti makmal statistik. Walau bagaimanapun, pembelajaran lebih kepada pembelajaran bagaimana untuk menggunakan perisian dan tidak untuk meningkatkan pengetahuan dalam bidang statistik. Tujuan kajian ini adalah untuk mengkaji keberkesanan teknologi dalam pengajaran dan pembelajaran statistik kejuruteraan secara kontekstual. Kajian ini akan mengkaji keberkesanan pengajaran dan pembelajaran kejuruteraan menggunakan kaedah konteksual. Pengajaran dan pembelajaran kontekstual menggunakan klip video statistik dalam power point, aktiviti kelas yang menggunakan makmal statistik dengan perisian SPSS digunakan untuk memahami konsep statistik. Dalam kajian ini, kaedah gabungan kualitatif dan kuantitatif digunakan. Kajian ini menggunakan kaedah kualitatif untuk mencari perspektif responden untuk menjawab persoalan kajian 1 dan 2, dan kajian ini juga menggunakan kuasi-eksperimen untuk menjawab persoalan kajian 3 dan 4 dalam menentukan keberkesanan pembelajaran kontekstual. Rekabentuk 4 kumpulan Solomon telah digunakan di mana pelajar telah dibahagikan kepada empat kumpulan: 2 kumpulan kawalan dan 2 kumpulan rawatan. Instrumen kajian terdiri daripada temubual berstruktur, dua set tugasan aktiviti makmal statistik, satu set soal selidik, ujian pra dan pasca-ujian dan Soal Selidik Strategi Bermotivasi untuk Pembelajaran (MSLQ). Dari Soalan Kajian 1 "Adakah klip video statistik dalam persembahan power point dalam pembelajaran statistik membantu pelajar untuk memahami konsep statistik?", Kumpulan kontekstual memberi respon lebih positif berbanding dengan kumpulan bukan-kontekstual. Dari Soalan Kajian 2 "Adakah

makmal matematik menggunakan perisian SPSS dalam statistik pembelajaran membantu pelajar untuk memahami konsep statistik?" Kumpulan konteks memberi respon lebih positif berbanding dengan kumpulan bukan-kontekstual. Dari Soalan Kajian 3 "Adakah terdapat sebarang perbezaan statistik yang signifikan dalam tahap motivasi di dalam kelas antara kontekstual dengan kumpulan bukan-kontekstual?", Kumpulan konteks lebih bermotivasi berbanding dengan kumpulan bukan-kontekstual. Dari MSLQ, min keseluruhan bagi Seksyen 2 (kontekstual) 3,8955 berbanding dengan Seksyen dan 6 (bukan kontekstual) iaitu 3,5264. Daripada Soalan Kajian 4 "Adakah terdapat perbezaan yang signifikan antara pencapaian pelajar dalam ujian pasca kumpulan kontekstual dengan kumpulan bukan-kontekstual?", Kumpulan kontekstual medapat prestasi yang lebih baik daripada kumpulan bukan-kontekstual. Terdapat perbezaan yang signifikan dan min kumpulan kontekstual (Seksyen 2) 38.63 dari markah penuh 50 manakala min kumpulan bukan-kontekstual (Seksyen 6) adalah 28,589. Kumpulan yang dirawat, yang merupakan kumpulan kontekstual, mendaoat min lebih baik daripada kumpulan bukan-kontekstual. Kajian ini tertumpu kepada pengajaran dan pembelajaran statistik kejuruteraan secara kontekstual untuk pelajar kejuruteraan di Universiti Tun Hussein Onn Malaysia. Kajian ini telah mengenalpasti bahawa pelajar kejuruteraan pengajaran dan pembelajaran kontekstual dapat memberi motivasi dan pelajar mendapat prestasi yang lebih baik dalam ujian mereka

ABSTRACT

Inaccurate concept in statistics contributes to the assumption by the students that statistics do not relate to the real world and is not relevant to the engineering field. Since the introduction of technology in the teaching and learning, there are universities who introduced learning statistics using statistics lab activities. However, the learning is more on the learning how to use software and not to enhance the knowledge in statistics. The purpose of this research is to study the effectiveness of technology in the teaching and learning engineering statistics contextually. This study will investigate the effectiveness of the teaching and learning engineering using contextual approach. The teaching and learning contextually using statistics video clips embedded in power point, class activities using statistics lab with SPSS software are used in order to understand the statistics concepts. In this research, combining methods is used. This research use qualitative research to find the perspectives of the respondents as to answer research question 1 and 2, and this research also use quasi-experiment as to answer research question 3 and 4 in investigating effectiveness of the contextual learning. Solomon's Four-Group Design was used where the students were divided into four groups: 2 control groups and 2 treated groups. The research instruments consisted of a structured interview, two sets of statistical lab activities assignments, a set of questionnaire, a pre-test and a post-test and the Motivated Strategies for Learning Questionnaire (MSLQ). From Research Question 1 which is "Does the statistics video clips embedded in power point presentations in learning statistics helps students to understand the statistics concepts?", the contextual group gave more positive responses compare to the non-contextual group. From Research Question 2 which is "Does the mathematical lab using SPSS in learning statistics helps students to understand the statistics concepts?" the contextual group gave positive more responses compare to the non-

contextual group. From Research Question 3 which is "Is there any statistical significant difference in the level of motivation in class between the contextual with the non-contextual groups?", the contextual group were more motivated compared to the non-contextual group. From the MSLQ, the overall mean for Section 2 (contextual) is 3.8955 compared to and Section 6 (non-contextual) which is 3.5264. From Research Question 4 which is "Is there any significant difference between the students achievement in the post-test of the contextual group with the non-contextual group?", the contextual group perform better than the non-contextual group. There is significant different and the mean of Contextual Group (Section 2) is 38.63 from the full mark of 50 while the Non-contextual Group (Section 6) is 28.589. The treated group, which is the contextual group, did better than the non-contextual group. This research has focused on the teaching and learning engineering statistics contextually for the engineering students in Universiti Tun Hussein Onn Malaysia. This research has identified that teaching and learning engineering students contextually were able to motivate and perform better in their test.

CONTENTS

CHAPTER 1

INTRODUCTION

1.1 Introduction

For a K-society, our country needs students with higher order thinking and problem solving. We need students graduated with the ability to use what they learn in higher learning institutions to solve problems in the real world. In higher learning institutions, students learn the basic knowledge and they are suppose to apply the knowledge on their working environment. However, we found out that there are students who do not learn what they should even though they completed their studies in the higher learning institutions. In addition we have students passing the exams with flying colour but are not able to solve simple problems. In universities or schools, mathematics, science, engineering are often considered as difficult subjects and not many students are able to learn these abstract subjects. This is because according to Kolb in Hull(1999), less than one-fourth of the students are abstract thinkers. Kolb elaborates on four types of students which are the accommodator, diverger, converger and assimilator (1985). The accommodator learns best by experiencing and doing, the diverger learns best by watching and experiencing, the converger learns best by thinking and doing. These three types of learner are the concrete learners. The last type of learner which is the assimilator learns best by watching and thinking. This is the only type of learners that is an abstract learner. The traditional method of teaching and learning is more on drill-oriented where a student is considered as a good student based on how many A's that he can get from the national exams. However they may A without

understanding and how do we help them get deeper conceptual understanding and think creatively (Sawyer, 2011).

1.2   Background to the study

Mathematics is used in many subjects such as civil engineering, electrical engineering mechanical engineering, physics, chemistry, etc. Thus mathematics is very important especially in technical subjects or what we say mathematics is the language for engineering subjects. Students' basic in mathematics must be strong, especially if they want to major in engineering. However we have students, including engineering students, who learn mathematics just for the sake of passing the examinations or just to get the credit hours. Due to this, many of them forget what they learn in mathematics after the examination. In order to make the learning memorable, we need the lesson to be exciting to students as they are able to connect their studies to the real world. Some of the students in UTHM are unable to make connections between what they are learning in mathematics & science and how this knowledge will be used in technology subjects. In mathematics, engineering students learn algebra, calculus, differential equations, numerical method and engineering statistics. From theses topics, engineering students always question why they have to learn engineering statistics. They argue that they only need to learn algebra, calculus and numerical method. Mechanical engineering students would say they use a lot of vector applications, electrical engineering students would say they use complex number and all engineering students would say they use algebra, differentiation and integration in their engineering subjects. However they never consider statistics is important and this subject is used in their engineering subjects. In fact there are good students in UTHM who questions why they have to learn statistics. They do not realise that there a lot of application of statistics in engineering. For example, the use of probability in random signals processing, the use of hypothesis tests in quality control, the use of sampling in production, etc. This is because students have difficulty in understanding the concept in statistics. Generally the students are expected to make connections on their own. Most students learn statistics very mechanistic, that memorizing the formula and solving problems using the formula without knowing its application in the real world. In addition, students have difficulty in understanding the abstract

concept in statistics. These problems are not only face by lecturers in UTHM, but also true to statistics lecturers in other universities in Malaysia. One lecturer in UIA said now she is trying to introduce real life question in her statistics class in order to make students like statistics. Another lecturer in UPSI said he combines real life questions and solve the questions using software. He said he can see students starting to appreciate statistics. However he has not done any research about the effect of his new method of teaching because he feels the important thing he can changes in his students. Another lecturer in UMP said most students learn statistics just as a prerequisite to get the degree. Her engineering students said statistics is easier than engineering mathematics and that is why they like statistics but they do not know the connection of statistics in the real world. They just learn statistics just to pass the examination and to improve their grades.

In the education reform in United States, statistics is added as a new topic in elementary school (Heaton, R. M and Mickelson, W. T., 2003). From their research, it was found that integrating statistics into the elementary curriculum is more difficult and complex teaching and learning than expected. They further suggested that teachers need the intellectual support and encouragement necessary to understand the process of investigation in meaningful contexts in order to attend the children understanding on statistics. Thus the effective method of teaching is needed to teach statistics. Thomas and Love and David Hiderbrand (2002) discussed on making statistics more effective in School of Business. There many others methods that had been done to make the teaching effective, for example John Truran and Anne Arnold (2002) use consulting in teaching elementary statistics. They suggested that the existence of a real client adds a degree of realism and they emphasized to students the importance of blending statistical calculations with meaningful communication.

The challenge in mathematics education is finding the best way to teach mathematics statistics. Mathematics is essentially a structured hierarchy of proposition forged by logic on a ulation base. However, the teaching of mathematics is more on focusing the mathematical procedures or mathematical technique (Smith, G., 1998). In UTHM, there are engineering students who feel that they do not need to take statistics as some commented that it is just a e of time. Students frequently view statistics as the worst course taken in college (Smith, G.,). In higher learning institutions, engineering statistics is offered as a service course where engineering students have to take the subject and very often the teaching and learning

seem to be activities directed primary to students' passing the subject rather than stimulate learning that lasts (Sowey, E. R., 1995).

In 1997, the Technical Education Department under the Ministry of Education, Malaysia, introduced the contextual concept in the teaching and learning mathematics and science subjects in all the Malaysian technical secondary schools. The Ministry got the idea from the Center for Occupational Research and Development in Waco, Texas, USA when the Malaysian education officers, technical lecturers and teachers attended courses at the centre. From the pilot test, through the contextual concept, the students were able to understand abstract concepts through concrete experiences (First Tech Prep Convention, 1997). Students prefer this method because usually they learn mathematics very mechanistic, which is, memorizing the formula and solving problems using the formula. Not only the students are able to learn faster but the workplace and lab activities help students to develop critical thinking skills. From the research done by Selva Ranee, computer-based simulations into contextual approach provided students the opportunity to reflect on their cognitive processes within the context mathematics. The findings indicated that the contextual group are able to transfer learning to a new situations and this approach can be significant instructional innovation in enhancing high-order thinking skills in mathematics (2003). A survey done by Mohd Sahar Sauian (2002), in a school in Segamat in Malaysia, showed that contextual-based teaching is relevant and a preferred approach in a non-urban setting.

Inaccurate concept in statistics contributes to the assumption by the students that statistics do not relate to the real world and is not relevant to the engineering field. According to delMas, C., et all (1999), researchers and educators have found that statistical ideas are often misunderstood by students. Since the introduction of technology in the teaching and learning, there are universities who introduced learning statistics using statistics lab activities. However, learning is more on the learning how to use software and not to enhance the knowledge in statistics. Due to this reason, the implementation of contextual concept is used in the mathematics and statistics computer lab activities in UTHM. The reason was not to replace the lecture or tutorial but to enhance the knowledge in mathematics and statistics.

Researches had been done to compare the treated group of students who did the normal lab activity with the control group who did not do any lab activity. Then two studies have been done to compare between students who use the contextual lab activity with

the non-contextual lab activity and compare between students who watch the contextual video with the non-contextual video. For the first pilot test, there were 265 civil, mechanical and electric students who are taking BSM 2922 Engineering Statistics for their 2nd semester session 2007/2008 (Md Kamaruddin, et al, 2008). The sample consisted of 155 students which were divided into two groups : 72 engineering degree students in the treated group and 83 engineering degree students in the control group. The students in the contextual group studied engineering statistics did the contextual lab activity. The non-contextual group studied engineering statistics did the non-contextual lab activity. In this research, from the students perception, both groups felt that the lab activity helped them to understand statistics concept and motivated them to learn statistics. However the contextual group scored higher than the control group for acceptance. From the observations of the activity and the interview with the students, both groups were more actively involved with the lab activity but few students from the non-contextual group commented that they prefer memorizing the formula and then use in the exercises. In addition they felt the lab activity was a burden to them. The contextual group felt that they want more activities especially related to their engineering subjects. From the findings, the contextual group scored better in the test. This is because the method of teaching and learning using contextual concept, which use 'hands-on', and *'minds-on'* activities that related to the real world is able to attract the students' interests and stimulate them to learn statistics.

In the second pilot test, there were 265 mechanical and electric students who are taking BSM 2922 Engineering Statistics for their 2nd semester session 2007/2008 (Md Kamaruddin, et al, 2008). The sample consisted of 153 students which were divided into two groups : 70 engineering degree students in the treatment group and 83 engineering degree students in the control group. The treatment group watched the contextual video while the control group watched the non contextual video. The findings show that there is no significant difference between the level of understanding, motivation and acceptance from both groups. However the finding shows that there is a significant difference for the achievement scores between the two groups. The treatment group who had gone through the contextual video scored higher than the control group. In conclusion, the contextual video helps the engineering statistics learning process.

Problem Based Learning (PBL) was now being introduced in UTHM in 2006. In UTHM, is no research on the effectiveness of Problem Based Learning (PBL) in teaching and

learning Engineering statistics but there was one research on Differential Equations. There were three classes of Technical Education and these students were divided into three groups: control group, fresh PBL group and experienced PBL group (Md Kamaruddin, et al, 2007). The control group followed the traditional method of teaching and learning, the fresh PBL group has just gone through the PBL method of teaching and learning and the experienced PBL group had undergone PBL training from the previous semester. Four types of instruments were designed and used for this study: questionnaires, students' presentations and 2 quizzes. The first topic that the students learned was first order differential equation. Thus the first quiz focused on the application of differential equation in the Newton's Law of Cooling and the second quiz focused on solving Newton's Law of Cooling problem. For the two quizzes, both PBL groups scored better than the control group. *One-Way Anova* was used and from the findings, there are significance differences between the control group and the fresh PBL, and also between the control group and the experienced PBL group but there is no significant difference between the fresh PBL group and the experienced PBL group for the two quizzes. Even though the student felt that the PBL method took them a longer time to understand a concept and they found too much information that make them confused, both PBL groups agreed that the PBL method helped them to be independent as well as practiced them to work as a team, motivated them to learn mathematics and they scored better in both quizzes. Lastly, the experienced PBL group gave smoother and clearer presentations and more confident when presenting compare to the fresh PBL group. All the three pilot tests done in UTHM were as separated research. There is no research which combines the video, lab activity and PBL. These researches were done on the contextual teaching and learning as a method or approach. All these researches give positive feedback.

Many researchers have found out that PBL is very effective and helps the students, not only in understanding the concepts but also in developing themselves. In the study by Acar et all (2003), they found that PBL provided the basis for the development of systems engineers. Sometimes students are not able to connect what they learn in class with the real world. PBL will be a good method of learning as the creation of most PBL classes is built around the delivery of the real-world learning experience to the students (Cockayne et all, 2003). Traditional method is a one-way method of teaching and the students are expected to just accept what the teacher teaches. However in PBL, there is a connection between the teaching method and the depth and

complexity of the learning, as the students may be expected to reach the level of analytically complex comprehension through the problem-based work that is not done in the traditional method of teaching (Graaff et all, 2003).

1.3 Problem statement

From the ERIC, ProQuest, Ebcohost, journals, etc showed that there are a lot of research done on contextual teaching, contextual learning, contextual approach, learning in context, etc. Many of the research were done in the primary schools, secondary schools or teacher training colleges and there was one research on engineering statistics in a higher learning by Jorge Luis Romeo (2007) in State University of New York in Syracuse, New York in 2007. Another problem is that there are many researches study the comparison between using technology and not using technology. There are not many research compare between teaching and learning contextually using technology with teaching and learning noncontextually using technology. Thus this research is done to examine whether the contextual teaching and learning engineering statistics using technology to the engineering students will improve in their achievement test.

1.4 Purpose of study

The purpose of this research is to study the effectiveness of technology in the teaching and learning engineering statistics contextually. The instructional design will used contextual video and contextual statistics lab class activities for higher learning institution. Then this research will test on the effectiveness of the contextual approach.

1.5 Objective of the study

This study will investigate the effectiveness of the teaching and learning engineering using contextual approach. The teaching and learning contextually using statistics video clips embedded in power point, class activities using mathematical lab with SPSS software are used in order to understand the statistics concepts. To achieve the stated purpose four main research questions were formulated related to the outcome and learning processes as a guide towards the completion of this work.

1.6   Research questions

The first two research questions were formulated related to the learning processes. The third and fourth question was related to learning outcome. These research questions are used to guide this study, given the contextual teaching and learning as a learning method:

Research Question 1:   Does the contextual approach statistics video clips embedded in power point presentations in learning engineering statistics helps students to understand the statistics concepts?

Research Question 2:   Does the contextual approach in statistical lab using SPSS in learning engineering statistics helps students to understand the statistics concepts?

Research Question 3:   Is there any statistical significant difference in the level of motivation in class between the contextual with the non-contextual groups?

Research Question 4:   Is there any significant difference between the students' achievement in the post-test of the contextual group with the non-contextual group.

Based on this information we make conclusion, will determine whether the teaching and learning using contextual approach will help engineering students to understand the statistics concept.

Research Hypothesis

The research hypothesis is as below:

Ho :   There is no significant difference between the students achievement in the post-test of the contextual group with the non-contextual group

Research variables

This study investigated the effect of an independent variable on a dependent variable. The independent variable is the teaching method namely contextual method. The operationalized dependent variable is the gain score, which is the difference between Post Test and Pre Test scores.

Apart from the independent and dependent variable, this study also looked at several process variables to help explain the outcome of the study. The framework for explaining the outcome is presented in Table 1.1.

Table 1.1: Framework for explaining the outcomes

Input	Process	Output
Teaching strategies using technology	Software application (SPSS) Class Activity Multimedia approach using video Motivation	Quantity of learning –score from test

1.9   Expected results

Since video, lab activities and contextual learning methods were used, it was expected that any classes that took these as the medium of instruction must be able to perform much better in terms of gain score (difference in marks between Post Test and Pre Test) in statistics and their students

ceptance of the method. Since there are huge bodies of research had proven that the contextual learning always bring the highest impact in learning thus the researcher expected that the classes that carry contextual learning as a medium of instruction would excel more than the non contextual.

1.10   Theoretical framework

The research conceptual framework is adapted from Johnson, E. B. (2002) and is shown as following:
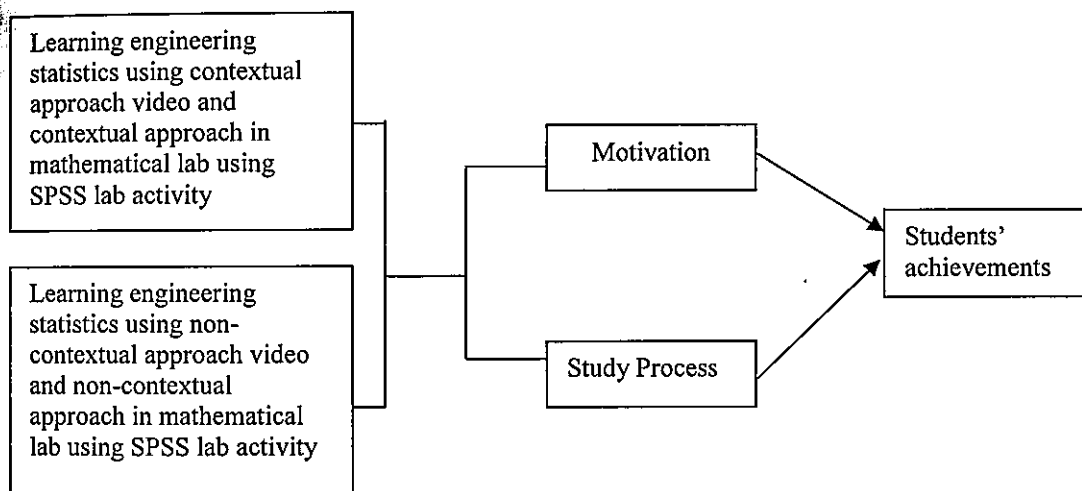
Figure 1.1: Conceptual Theoretical Framework

1.11   Limitation

The following scopes of this study need to be recognized and acknowledged. This research is only focusing on the Engineering Bachelor Degree students who are taking BSM 2922 which is Engineering Statistics in the 1st or 2nd Semester in Session 2009/2010 in the Universiti Tun Hussein Onn Malaysia. For the 1st semester, Engineering Statistics is offered to

the civil engineering students while for the 2nd semester this subject is offered to the electrical and mechanical engineering students.

There are six topics in the BSM 2922 Engineering Statistics which are Random Variables, Popular Distributions, Sampling Distributions, Estimations, Hypothesis Tests and Simple Linear Regression. In the second chapter which is the Popular Distributions, there are three topics which are Binomial, Poisson and Normal distributions. The topic that is focused in this study is only on Normal Distribution. The results of this study, therefore, cannot be generalized beyond this topic. The module that will be referred in this study will be based on the BSM 2922 Engineering Statistics Module, Universiti Tun Hussein Onn Malaysia.

There are only three engineering faculties in the Universiti Tun Hussein Onn Malaysia : Faculty of Civil and Environmental Engineering , Faculty of Electrical and Electronics Engineering and Faculty of Mechanical and Manufacturing Engineering. These faculties will divide the students into sessions according to their majors. Thus the number of students and the numbers sections will be decided by these three faculties. For the findings of this research to be generalized for a bigger population, a replication for this study must be made.

1.12   Scope

The scope or limitation of this study is it only covered Normal distribution topic as recommended in the syllabus of BSM 2922 Engineering Statistics subject. The study used 128 engineering students from two engineering departments only namely the Electrical and Mechanical Engineering Departments. Four sections where only two sections from each department were selected from the degree engineering courses at the second semester were selected. . The result from this study is limited to Universiti Tun Hussein Onn Malaysia, Batu Pahat, Johor which represented the other 5 Malaysian Technical University (MTUN) universities (MoHE) in Malaysia only. The independent variables were the two different teaching methods called contextual and non contextual approach. The dependent variables were the gain score (the difference between Post Test and Pre Test) and also affective gains like attitude, motivation and

participation level. The instruments used were the Pre Test, Post Test, questionnaire, video and tape recorders.

1.13 Significance of study

This research will produce a model and also one way of implementation of contextual approach in the teaching and the learning engineering statistics in higher learning institutions. Hence it will help students to learn mathematics and most importantly to apply it in their engineering subjects. The model of contextual teaching and learning developed in this study can be used for other mathematics courses such as algebra, calculus, differential equations, numerical method, engineering mathematics, etc. The result can also be extended to the secondary and primary schools which would help both students and teachers.

1.14 Definitions

There are several variables which are pertinent in this research. For the purpose of this study, the variables used in this research are defined as follow:

1.14.1 Contextual Teaching and Learning

Contextual mean pertaining to or depending on the context. Contextual Teaching and Learning occurs only when students (learners) process new information or knowledge in such a way that it makes sense to them in their own frames of reference (their own inner worlds of memory, experience, and response). This approach to learning and teaching assumes that the

naturally seeks meaning in context, that is, in relation to the person's current environment and that it does so by searching for relationships that make sense and appear useful.

1.12 Engineering Statistics

Engineering statistics is a branch of statistics that has several subtopics which are particular to Engineering (http://dictionary.reference.com/). Engineering Statistics in this study refer to the only statistics subject that is offered to the civil, electrical and mechanical students in Universiti Tun Hussein Onn Malaysia. The Engineering Statistics focused on six topics which are Random Variables, Popular Distributions, Sampling Distributions, Estimations, Hypothesis Tests and Simple Linear Regression.

1.14.3 Learning

Learning is one of the most important mental function of humans, animals and artificial cognitive systems which relies on the acquisition of different types of knowledge supported by perceived information. It leads to the development of new capacities, skills, values, understanding, and preferences. Its goal is the increasing of individual and group experience (http://dictionary.reference.com/).

1.14.4 Statistical Lab Activity

Statistical Lab Activity in this study will focused on the hands-on activity that the students do in the statistic lab in the Universiti Tun Hussein Onn Malaysia.

1.14.5 Class activities

Class means a collection or division of people or things sharing a common characteristic, Activities mean work that involves direct experience by the student rather than textbook study. Thus Class activities in this research mean an instructional method that challenges students to

learn," working cooperatively in groups to seek solutions to real world problems
(http://dictionary.reference.com/).

1.14.6 Student

A student is a person who is engaged in study or the one who seeks knowledge from professional teachers or from books; as, the students of an academy, a college, or a university (http://dictionary.reference.com/). Students in this study refer to engineering students who are taking Engineering Statistics

1.14.7 Teaching

The act, process, or art of imparting knowledge and skill: education, instruction, pedagogy, schooling, training, tuition, tutoring (http://dictionary.reference.com/).. The method of teaching that is focused in this study is on the teaching and learning using contextual and non contextual approach.

1.14.8 Video

Video in this study will focus on the pertaining to or employed in the transmission or reception of television pictures (http://dictionary.reference.com/).

1.15 Summary

In this chapter, the history and the research done on the teaching and learning mathematics and statistics are discussed. Then the researcher continued on the significance of the implementation of to contextual teaching and learning.

CHAPTER 2

LITERATURE REVIEW

2.1   Introduction

This chapter covers discussions from areas that are directly and indirectly related to the variables of interest. The literature review will focus on the contextual teaching and learning and also on application of contextual approach in technology. Before discussing on the research on contextual, the history how contextual learning was introduced in America and Malaysia must be known first.

2.2   Introduction of Contextual Teaching and Learning (CTL) in America

In America, the country focus on reforming the schools as to produce more effective schools as measured by the achievement of all students have flooded the country (Berns, R. and Erickson P., 2001). In addition due to increasing demands for accountability in education, many states and districts across the nation have imposed instructional improvement initiatives in an attempt to ensure effective delivery of subject matter and student learning (Sargent, 2000). According to Robert G. Berns and Patricia M. Erickson (2001),

"The changing nature of jobs and advancing technology has influenced career and technical education (CTE) curriculum. The growing body of knowledge about how people learn and what makes for effective teaching have caused career and technical educators to reexamine the basic principles and methodology of career and technical education."

Thus in America, the workplace/community learning focuses on the subject matter that connects to the workplace or the real world. According to Sargent (2000),

"Given current emphases on state standards, experienced educator may be inclined to seek' real world' affirmation that their curriculum and teaching strategies are relevant and useful to today's students."

Although the workplace/community learning programs vary considerably; all programs are designed to increase participation and awareness of the workplace and provide the knowledge and experience that will help educators prepare students to enter (and learn from) work-related experiences (Sargent, 2000).

2.3   The Implementation of Contextual Teaching and Learning (CTL) in Malaysia

The implementation of Contextual Teaching and Learning (CTL) was first started in Malaysian Technical Schools, then in the Malaysian Community Colleges and then in the Kolej Universiti Tun Hussein Onn Malaysia (KUiTTHO) which is now known as the University Tun Hussein Onn Malaysia (UTHM)

2.3.1 The Implementation of Contextual Teaching and Learning (CTL) in Malaysian Technical Schools

As for Malaysia, the students in secondary school or higher learning institutions have difficulty in understanding abstract ideas or theories. Even students in the science stream in secondary schools are not doing well in their mathematics and science subjects although the Malaysian government wants more students in the science stream in upper secondary schools. In order to achieve 80% science students in secondary school, in 1995 and 1996, the Technical Education Department under the Malaysian Ministry of Education, sent their officers, lecturers and principals from the polytechnics, the technical teachers training colleges, and teachers and principals from vocational and technical schools to the Centre of Occupational Research and Development (CORD), Waco, Texas, USA to see whether "TECH PREP" can be implemented in Malaysia. (First Malaysian Tech Prep National Convention, 1997).

The definition and elements of Tech Prep are as follow: (First Malaysian Tech Prep National Convention, 1997):

Tech Prep or Technical Preparation is a product of an education reform in the USA. It is a competency based technical curriculum jointly designed with business and industry that provides a sequence of studies from the secondary to the post-secondary levels and prepares students for high-skill occupations. The curriculum emphasizes basic competencies in mathematics, science and communication, which lead students to a 2-year associate degree.

Then in a meeting on 21 December 1996, a decision was made that all vocational/technical secondary schools will adopt the Contextual approach ['Tech Prep's Methodology'] in the learning and teaching of mathematics, additional mathematics, physics, chemistry and biology. Thus in 1997 the panels of writers are drawn from vocational /technical secondary schools (SMV/T) involved in writing the Malaysian modules. Only few topics were selected from each mathematics and additional mathematics subjects. There is no change in the syllabus but the method of learning and teaching will follow the contextual approach. Each module for each

subject attempts to provide an integrated learning experience using video, text, skill practice, problem solving exercises and mathematics, additional mathematics, physics, chemistry and biology laboratories. Videos produced by CORD are used and the writers only need to prepare the synopsis in Bahasa Malaysia.

Based on the Malaysian modules, after one month of implementation of this approach to selected technical schools, a pilot project was carried out to gauge the effectiveness of the contextual approach before the First Tech Prep National Convention. After watching the video, the students started to realize the use of mathematics in real life situations. The students enjoyed the laboratory activities and they were more involved with the lesson. The students were more motivated because they started doing their homework given by the teachers. Weak students who did not like mathematics tended to appreciate mathematics. It seemed that the barrier between them and mathematics had been broken. A good student commented that she would still understand the concept by either method but she understood faster with the contextual approach. After a month, these two classes were given the same test. Due to the result of the study where the findings were very positive (11% increase in performance) and hence the implementation of the contextual learning in mathematics, additional mathematics, physics, chemistry and biology subjects in the year 1998 for all vocational /technical secondary schools (First Tech Prep National Convention, 1997). Furthermore, the Minister of Education announced that all topics in all mathematics, additional mathematics, physics, chemistry and biology would use the contextual approach. The education minister announced as follow:

"From the year 1998 onwards, all vocational/technical secondary schools will adopt the Contextual approach ['TECH PREP'S METHODOLOGY'] in the learning and teaching of mathematics, additional mathematics, physics, chemistry and biology".

Since all vocational/technical secondary schools use the same syllabus for mathematics and science subject as all the academic secondary school in Malaysia, the Technical Education Department decided that the syllables would not be changed but the method of learning and teaching would follow the contextual approach to learning. (First Malaysian Tech Prep National Convention, 1997).

The decisions Technical Education Department accepted are as follows: (First Malaysian Tech Prep National Convention, 1997)

Table 2.1: Implementation Criteria of Contextual Learning in Malaysia

	The elements of Tech Prep	Decision
1.	Provide sequence of studies from secondary school to post secondary school,	Technical Education Department can provide a sequence of studies from technical school to polytechnics or from technical school to community college or from community college to polytechnics for the **technical subjects**.
2.	Prepare students for skills occupation,	The syllabus in the community college and in the polytechnics is already providing students with skills occupation
3.	Provide a competency based technical curriculum jointly developed with business and industries,	
4.	Emphasize basic competencies in mathematics, sciences and communication,	The basic competencies that the Technical Education Department emphasized are only mathematics (mathematics & additional mathematics) and sciences (physics, chemistry & biology). The decision was made due to the National Examination result on these subjects.
5.	Leads to a 2 or 3 associate degree (training beyond high school),	Students in vocational or technical schools can apply to enter to the community colleges or polytechnics. Students in other schools (boarding schools, academic schools, etc) can also apply.
6.	Provide a contextual approach to learning	All the schools in Malaysia must use the same syllabus for mathematics and science subjects. Therefore the Technical Education Department decided that the syllables will not be changed but the method of learning and teaching will follow the contextual approach to learning.

In 1998 two representatives from each vocational /technical secondary school for each mathematics, additional mathematics, physics, chemistry and biology subjects were given the contextual approach training by the writers of the modules. In 1998 and 1999, the writers are again drawn from vocational /technical secondary

school involved in writing the Malaysian modules for all the topics. JPT spent 4.8 million ringgit to produce the modules for all students in vocational /technical secondary schools.

2.3.2 The Implementation of Contextual Teaching and Learning (CTL) in Malaysian Community Colleges

In the year 2001, community college was introduced to help weak students or who are not abstract thinkers to further their studies after secondary schools. Most of the courses introduced in community colleges have continuations courses in polytechnics. The aim for applied mathematics in college community is for the students to relate to the real life situations that relate to their field. The topics were selected from the topics in CORD modules. The syllabus was constructed by refereeing to the CORD modules. The method of teaching applied mathematics is constructed so that students will be exposed to the mathematic concepts. Contextual approach learning will be used so that students will be able to understand abstract concepts through concrete experience. Each topic will be started with videos to show the students the use of mathematics concept in real life situations. Applied mathematics will also focus on the problem solving method. Students will be trained to make decision through simulation of real working life situations. Laboratory activities will give the students the chance to investigate, build and apply the algebraic and geometric principle through hands-on learning.

Applied mathematics curriculum was constructed base on four principles. Firstly is for the students to have the basic knowledge so that they can further their studies in polytechnics, secondly for them to master the concepts in mathematics and thirdly that they are able to use appropriate technology such as scientific calculator and computers. Lastly is for the students to expand and enhance their knowledge, skill in order to become competent students. The students will learn mathematics that base on applied mathematics concept in real life situations. This will increase their potential in their career or in their further education. In order the implementation of teaching applied mathematics will be successful, in the year 2002, representatives

from each college community who taught mathematics, additional mathematics, physics, chemistry and biology subjects were given the contextual approach training.

2.3.3 The Implementation of Contextual Teaching and Learning (CTL) in Malaysian Higher Learning Institution

As Malaysia is moving towards Knowledge-society or K-society, the country needs students with higher order thinking and problem solving. Even though students in higher learning institutions completed their studies but many are not learning what they should. Not many students are able to learn abstract subject such as mathematics and physics. Mathematics knowledge is very important especially in technical subjects or what we say mathematics is the language for engineering subjects. .In order to achieve this, we need the lesson to be exciting to students as they are able to connect their studies to the real world. Some of the students in Kolej Universiti Teknologi Tun Hussein Onn (KUiTTHO) are unable to make connections between what they are learning in mathematics & science and how these knowledge will be used in technology subjects, for example, the used of probability in random signals processing. In addition, the students have difficulty in understanding abstract concept in mathematics even though they need to understand the concepts as they relate to the engineering subjects. Generally the students are expected to make connections on their own. Thus the need of integrated simulated learning is important in order to solve this problem. Activities enable them to become active participant in the learning process while providing them with a rich problem-solving environment. Contextual in school should be expanding to higher learning institutions so that a continuous implementation will be effective.

The Second Tech Prep National Convention was again organized by JPT, Ministry of Education in August at Kuala Terengganu. One of the purpose was to introduced contextual learning to other schools or higher institutions. Five representatives from KUiTTHO, including the Rector of KUiTTHO, attended this convention. Since from 1998 to 2000 more than 80% of the KUiTTHO (Kolej Universiti Teknologi Tun Hussein Onn) intake was from Malaysian Technical Secondary Schools, The Rector from KUiTTHO suggested that the contextual

Approach should be introduced in KUiTTHO or now it is known as UTHM. Thus it is UTHM's obligation to introduce this program as a continual process in higher learning institutions, and thus in 2001, contextual approach in the teaching and learning mathematics was introduced in Science Learning Centre in UTHM

From 1998 to 2000 more than 80% KUiTTHO intake are from vocational /technical secondary schools. Since contextual has been implemented in vocational /technical schools and community college, it is KUiTTHO obligation to introduce this program as continuous process in higher learning institutions. These students will enter the working life within 3 to 4 years. KUiTTHO obligation is to make these students ready for workplace environment.

2.3.3.1 Methods of Learning in KUiTTHO

The methods of learning in KUiTTHO are as below:

(a)   Lectures

(b)   Tutorial : Student presentation, discussion, exercises

(c)   Practical : Hands-on, laboratory activities, industrial training

(d)   Task : Small project, application of knowledge approach

(e)   Final year project : Invent new method or material or instrument, combine all the knowledge that was taught

In tutorial, video for certain topics will be shown to motivate students and to let them realize the use of certain topics in real life situations, especially in engineering situations. The mathematics video committee in KUiTTHO is in the process of producing these videos. One example of the selected topics chosen is the conic sections. The physics video committee is planning to produce an iterative physics module in CD form.

In practical, mathematics laboratory is introduced while physics has already had the laboratory. Since mathematical laboratory implemented in school is not appropriate in higher learning institutions, mathematical laboratory in KUiTTHO are fully equipped with computers. Students will simulate mathematical algorithm using computer. They are encouraged to explore by trial and error. Certain abstract concept

can be simplified using the computers. For example, for double and triple integrals, students can use Maple to see how the sketches of the solid so that they are able to find the area or volume of the solid. After these exercises they should be able to imagine and draw any given solid equations. They can also use Maple to solve exercise in Numerical Method. For example they can find the root or roots for certain polynomials that use bisection or Newton's method with the computer. From the feedback of the students who watched the video, the response was very encouraging. Even from the feedback of the students who took Numerical Method the response was also encouraging. In conclusion contextual approach is relevant in higher learning institutions. Hands-on skill, communication skill and intellectual ability are the main core in KUiTTHO which is parallel to contextual learning.

KUiTTHO's students focus on their specific field. Contextual learning will produce students that are well trained and credible. Contextual learning gives an approach that will explain the concept that students learn. Once they know the concept and able to combine all the knowledge that was taught, they should be able to apply it in their projects, researches and future career.

2.4   What is Contextual Teaching and Learning (CTL)?

There are many definitions of the contextual learning. The definition that the Technical Education Department uses is the one that was given by the Center for Occupational Research and Development (First Malaysian Tech Prep National Convention, 1997):

The Contextual learning means learning that incorporate examples which are drawn from everyday experiences in personal, societal and occupational life and which provide concrete hands-on applications of material to be learned.

Contextual teaching and learning (CTL) is a system of instruction based on the philosophy that students learn when they see meaning in academic material, and they see meaning in schoolwork when they can connect new information with prior

knowledge and their own experience. The meaning emerges from the relationship between content and its context (Johnson, E. B., 2002).

Contextual teaching and learning also is defined as a conception of teaching and learning that helps teachers relate subject matter content to real world situations (United States Department of Education Office of Vocational and Adult Education, 2001). Berns and Erickson (2001) in Shamsid-Deen, I. (2006) further explain contextual teaching and learning as an innovative instructional process that helps students connect the content they are learning to the life contexts in which that content could be used.

In the first project by the Ohio State University College of Education and Bowling Green State University, the definition of the contextual teaching and learning was developed as the conception of teaching and learning that helps teachers relate subject matter content to real world situations and motivates students to make connection between knowledge and its applications to their lives as family members, citizens, and workers; and engage in the hard work that learning requires (National Conference on Teacher Quality, 2000). As I mention earlier, contextual approach was introduced by the Center for Occupational Research and Development to the students so that they will be well prepared technically when they enter the career world. The good thing about the contextual learning approach is that this is method of teaching the way students learns. (First Malaysian Tech Prep National Convention, 1997). Contextual Teaching and Learning (CTL) helps us relate subject matter content to real world situations and motivate students to make connections between knowledge and its applications to their lives as family members, citizens, and workers and engage in the hard work that learning requires (The Ohio State University, 1999).

The contextual teaching and learning initiative is an ongoing effort or work (Berns, R. and Erickson P., 2001). In the first project by the Ohio State University College of Education and Bowling Green State University, the definition of the contextual teaching and learning was developed as the conception of the teaching and learning that helps teachers relate subject matter content to real world situations and motivates students to make connection between knowledge and its applications to their lives as family members, citizens, and workers; and engage in the hard work that learning requires (National Conference on Teacher Quality, 2000). The contextual Approach was introduced for students' technical and career preparation or