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A Study of the Effectiveness of the Contextual Lab Activity in the Teaching and Learning Statistics at the UTHM (Universiti Tun Hussein Onn Malaysia)

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Inaccurate concept in statistics contributes to the assumption by the students that statistics do not relate to the real world and are not relevent to the engineering field. There are universities which introduced learning statistics using statistics lab activities. However, the learnng is more on the learning how to use software and not to enhance the knowledge in statistics. Thus, this research was done to test the effectiveness of the contextual lab activities in learning engineering statistics for the engineering students in the UTHM (Univer siti Tun Hussein Onn Malaysia). The objectives of this research is to survey the understanding, motivation and acceptance between the students, who had gone through the contextual lab activity and the non-contextual lab activity based on the questionnaires. In addtion, the test result was measured using the independent *t*-test. This research is done using the quasi-experiment. There were 265 civil, mechanical and electric students who are taking engineering statistics in their second semester. The sample consisted of 155 students which were divided into two groups: 72 students in the treated group and 83 students in the control group. The treated group followed the contextual lab activity while the control group followed the non-contextual lab activity. The findings showed that there is no significant difference between the students' understanding and motivation from both groups. However, there is a significant difference for the acceptance between both groups. The findings also show that there is a significant difference for the post-test mean score between the two groups. The treated group whcih had gone through the contextual lab activity scored higher than the non-contextual. In conclusion, the contextual lab activity is able to help the engineering statistics students in their learning process.

Keywords: statistics, contextual, lab activity

Introduction

The ultimate objective of the Malaysian Vision 2020 is that Malaysia will be a fully developed country by the year 2020 (Rakyat Jaya Sdn Bhd, 1996-2001). Since then, a lot of methods of teaching and learning with the aid of technology have been introduced, so that the students will not only to learn the theory or concept, but also be exposed to the technology. As for the Centre of Science Studies in the UTHM (Universiti Tun Hussein Onn Malaysia), the centre introduced mathematics and statistics computer lab in the process of teaching and learning mathematics and statistics. The reason was not to replace the lecture or tutorial, but enhance the knowledge in mathematics and statistics.

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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 CORD (Center for Occupational Research and Development) in Waco, Texas, USA, when the Malaysian education officers, technical lecturers and teachers attended courses at the centre (Md Kamaruddin & Wan Ahmad, 2007a). Through the contextual concept, the students were able to understand abstract concepts through concrete experiences. Students prefer this method, because usually, they learn mathematics very mechanistic, which is, memorizing the formula and solving problems using the formula (Md Kamaruddin & Wan Ahmad, 2007b). Not only the students are able to learn faster, but also the workplace and lab activities help students develop critical thinking skills (Md Kamaruddin & Wan Ahmad, 2007b). 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. 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. Due to this reason, the implementation of contextual concept is used in the statistics computer lab activities in UTHM.

Purpose of the Study

Researches had been done to compare the treated group of students who did the contextual lab activity with the control group which did not do any lab activity. However, before this, there was no reasearch comparing between students who use the contextual lab activity with the non-contextual lab activity. Thus, this research was done to test the effectiveness of the contextual lab activity in learning statistics for the engineering students in UTHM. The objectives of this research were as follows:

(1) To determine whether there is any statistical significant difference in the understanding, motivation and acceptance between the contextual and the non-contextual groups;

(2) To determine whether there is any statistical significant difference in the test results between the contextual and the non-contextual groups.

Conceptual Framework

The conceptual framework of this research was adapted from Chua (2006). The dependent variable of this study was the achievement test. The researchers investigated whether the use of the contextual concept in the lab activities influenced the students' achievement in the statistics test as compared to the use of the non-contextual concept in the lab activities (see Figure 1). Both groups were taught by the same lecturer to eliminate the extraneous variable.

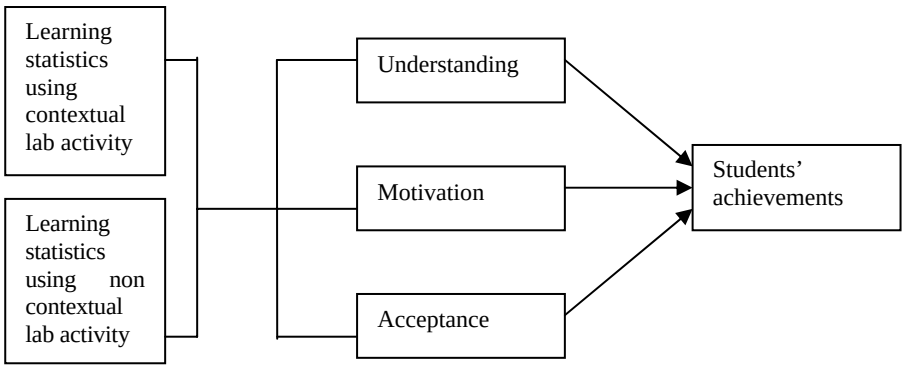

Figure 1. Conceptual framework.

There are many definitions of the contextual learning. The definition that the Technical Education Department uses is the one that was given by the CORD (The CORD, 1999, p. 1),

> In contextual learning, 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 mind naturally seeks meaning in context—that is, in relation to the person's current environment—and that it does so by searching for relationship that make sense and appear useful.

Contextual approach was introduced for the students' technical and career preparation or Tech Prep by the CORD, Texas, USA. Contextual approach is one of the Tech Prep elements. According to Kolb's experiential learning theory, the students learn best by thinking and doing (Kolb, 1985). In the contextual approach, the lab activities or mathematical experiments help students to study by this method. According to CORD, one of the key elements in the contextual approach is to carry out learning in workplace setting, where possible (First Malaysian Tech Prep National Convention, 1997).

Literature Review

It will be great, if the students can relate the formulas and theories that are taught in the classroom to their everyday lives or their future jobs. It is not easy to bring students to the real life atmosphere, let say a company. Thus, if we cannot bring them to the companies, we need to simulate the workplace. In the lab practical, besides making them understand the concept, the students also work in environment or group projects that simulate the workplace. In the contextual approach, students engage in problem-solving investigation that integrate skills and concept from many content areas, and students works autonomously to construct their own learning and culminate in realistic products (Berns & Erikson, 2001). By using the lab activities or mathematical lab in the contextual approach, it helps them understand the concept better as the concept of experiential learning explores the cyclical pattern of all learning from experience through reflection and conceptualizing to action and on further experience (Kolb, 1985).

In the first project by the Ohio State University College of Education and Bowling Green State University, the definition of 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).

Research Methodology

This research focused on the contextual concept in the statistcs lab activities for the second year degree engineering students from the Faculty of Civil, Electrical, Mechanical Engineering, UTHM. The population for this research was all the second year engineering degree students, which consisted of six classes, from the Faculty of Civil, Electrical, Mechanical Engineering, UTHM. One class from the Electrical Engineering Faculty and one class from the Mechanical Engineering Faculty were selected as the treated group, while another one class from the Electrical Engineering Faculty and another one class from the Mechanical Engineering Faculty was selected as the control group. The treated group will use the contextual concept in the statistcs lab activities, while the control group will use the non-contextual concept in the statistcs

lab activities.

In this research, a quasi-experimental research design was used. The research instruments were the pre-test, and post-test questionnaires. The students were given a pre-test before they did the lab activities. After the lab activities, they were given and post-test the questionnaires. Researchers designed questionnaires which consisted of four main sections: background, understanding, motivation and acceptance. Before the questionnaires were given to the respondents, a pioneer test was done where 10 degree students were randomly selected to answer the questionnaires. From the pioneer test, the Alpha-Cronbach values are shown in Table 1.

Table 1

Pioneer Test

Section	Category	Items	Alpha-Cronbach
B	Understanding	10	0.649
C	Motivation	10	0.729
D	Acceptance	13	0.612

The values of Alpha-Cronbach are all greater than 0.6 and according Mohd Salleh and Zaidatun (2002), that are higher than the mean of the validity.

Data Analysis

There were 72 students in the treated group and 83 students in the control group. The descriptive statistics and *t*-test for the pre-test are shown in Tables 2 and 3.

Table 2

Descriptive Statistics for Pre-test

	Group	*N*	Mean	Std. deviation	Std. error mean
Pre-test	Treated	72	2.54	1.150	0.136
	Control	83	2.42	1.072	0.118

Table 3

T-test for Pre-test

		Levene's test for equality of variances		*T*-test for equality of means						
		F	Sig.	*t*	*df*	Sig. 2-tailed	Mean difference	Std. error difference	95% confidence interval of the difference	
									Lower	Upper
Pre-test	Equal variances assumed	1.540	0.217	0.672	153	0.503	0.120	0.179	-0.233	0.473

Notes. *F*—for *F* or *F*-ratio, *sig.*—for significance, *t*—for *t*-test and *df*—for degrees of freedom.

Since the sig. for the Levene's test = 0.217 > 0.05, the value of p was taken from the equal variances assumed row. Since $p = 0.503 > 0.05$, there is no significant difference between the two groups. The assumption was the two groups had the same cognitive level.

In sections B, C and D, the researchers wanted to survey the students' perception towards their undestanding, motivation and aceptance, respectively, from the statistics lab activities. The descriptive statistics and *t*-test for the questionnaire in section B are shown in Tables 4 to 9.

Table 4

Descriptive Statistics for Understanding

	Group	*N*	Mean	Std. deviation	Std. error mean
Understanding	Treated	10	3.65500	0.196426	0.062115
	Control	10	3.62700	0.241249	0.076290

From the 10 items in section B, the overall value of the mean score for the contextual group is 3.655 (σ = 0.196), while the overall value of the mean score for the non-contextual group is 3.627 (σ = 0.241).

Table 5

T-test for Understanding

		Levene's test for equality of variances		*T*-test for equality of means						
		F	*Sig*.	*t*	*df*	Sig. 2-tailed	Mean difference	Std. error difference	95% confidence interval of the difference	
									Lower	Upper
Under standing	Equal variances assumed	0.062	0.806	-0.285	18	0.779	-0.028000	0.098379	-0.234687	0.179297

Since the sig. for the Levene's test = 0.806 > 0.05, the value of p was taken from the equal variances assumed row. Since p = 0.779 > 0.05, there is no significant difference between the two groups.

Table 6

Descriptive Statistics for Motivation

	Group	*N*	Mean	Std. deviation	Std. error mean
Motivation	Treated	10	3.32500	0.486558	0.153863
	Control	10	3.16600	0.314226	0.099367

From the 10 items in section C, the overall value of the mean score for the contextual group is 3.325 (σ = 0.487), while the overall value of the mean score for the non-contextual group is 3.166 (σ = 0.314).

Table 7

T-test for Motivation

		Levene's test for equality of variances		*T*-test for equality of means						
		F	*Sig.*	*t*	*df*	Sig. 2-tailed	Mean difference	Std. error difference	95% confidence interval of the difference	
									Lower	Upper
Motivation	Equal variances assumed	3.469	0.079	-0.868	18	0.397	-0.159000	0.183160	-0.543805	0.225805

Since the sig. for the Levene's test = 0.079 > 0.05, the value of p was taken from the equal variances assumed row. Since p = 0.397 > 0.05, there is no significant difference between the two groups. The two groups had the same level of motivation.

From the 13 items in section D, the overall value of the mean score for the contextual group is 3.620 (σ = 0.318), while the overall value of the mean score for the non-contextual group is 3.345 (σ = 0.208).

Since the sig. for the Levene's test = 0.496 > 0.05, the value of p was taken from the equal variances assumed row. Since p = 0.014 < 0.05, there is significant difference between the two groups. The treated group

scored higher than the control group for acceptance. Lastly, the result of the post-test is given in Tables 10 and 11.

Table 8

Descriptive Statistics for Acceptance

	Group	*N*	Mean	Std. deviation	Std. error mean
Acceptance	Treated	13	3.62000	0.318205	0.091858
	Control	13	3.34357	0.208238	0.055654

Table 9

T-test for Acceptance

		Levene's test for equality of variances		*T*-test for equality of means						
		F	*Sig.*	*t*	*df*	Sig. 2-tailed	Mean difference	Std. error difference	95% confidence interval of the difference	
									Lower	Upper
Acceptance	Equal variances assumed	0.478	0.496	2.658	24	0.014	0.276429	0.104006	0.06177	0.49108

Table 10

Descriptive Statistics for Post-test

	Group	*N*	Mean	Std. deviation	Std. error mean
Post-test	Treated	72	8.00	1.601	0.189
	Control	83	6.23	1.971	0.216

Table 11

T-test for Post-test

		Levene's test for equality of variances		*T*-test for equality of means						
		F	*Sig.*	*t*	*df*	Sig. (2-tailed)	Mean difference	Std. error difference	95% confidence interval of the difference	
									Lower	Upper
Post-test	Equal variances not assumed	16.990	0.000	6.169	152.369	0.000	1.771	0.287	1.204	2.338

Since the sig. for the Levene's test = 0.000 < 0.05, the value of p was taken from the equal variances assumed row. Since $p = 0.000 < 0.05$, there is significant difference between the two groups. The treated group, which is the contextual group, did better than the non-contextual group.

Conclusions

In this research, from the students perception, both groups felt that the lab activity helped them undertsand 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 enginering 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 conclusion, the contextual lab activity is able to help the engineering statistics students in their learning process.

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