The Effects of Worked Example Application on Electrical Technology Course

Chung Boon Chuan,
Politeknik Kota Bharu, Kelantan
chungpkb2011@gmail.com

Lee Moi Fong,
Politeknik Port Dickson, Negeri Sembilan
leemoifong@polimelaka.edu.my

Melissa Khor Suan Chin
Politeknik Kota Bharu, Kelantan
melissa@pkb.edu.my

Abstract
The purpose of this research is to identify the relationship between the effects of *Worked Example Application* and the performance of the students taking the Electrical Technology course. The objective of the research is to prove that there is a significant effect towards the students' performance in the quasi experiment with the 2x2 factorial. The data analyzed involved ANCOVA analysis with the significant level of 0.05 (5%) in two way used to test the hypothesis in relation to the effect of the independent variable, that is Courseware Mode using *Worked Example Application D(WEA)* and *without using Worked Example Application T(WEA)* towards one dependent variable, that is the students' performance. The data being analyzed for this research is at the significant level of 0.05 (5%). The purpose of this research is to test whether interaction exists between worked example and the students' performance in the learning of Electrical Technology. The findings of the test had proven that there is a significant relationship between the students' performance and the types of courseware mode being used. However, there is no significant relationship between genders.

Keywords: of Worked Example Application, Electrical Technology

1.0 Introduction
This research will find out to what extend is the effectiveness of using the Worked Example Application in the teaching and learning to increase the students' performance in *Electrical Technology* (DET1013) course, specifically for the Electrical Engineering Department. This research promotes self-learning that uses the Worked Application learning method in the *Electrical Technology* course. *Worked Example Application* or *Expert Example* provide examples of calculation in details and complete guide for students' reference. All the examples produced will change according to the value inserted by the students. Worked Example Application will help the students to understand any teaching unit in more detail. Students will be able to use Worked Example Application through Standalone. The *Worked Example* Application is used to demonstrate step by step of how to complete a task to solve the problem that involves calculation. In addition, through this Worked Example Application too, it can help the students to build procedures skills. For example, how to how to solve a problem or strategic of using the skills learnt.

1.1 Project Rationale

The rationale of this research being conducted is to provide assistance in the teaching process, both inside and outside of the classroom. This application is one of the application that can capture the students' interests towards the sections that involve calculations and then provides information about the course. Students get the knowledge and understand the calculation units much better through the *Worked Example Application* system. *Worked Example Application* system is unlike the examples that commonly being used in the teaching and learning. This *Worked Example* Application will provide a guideline in solving certain problem. Solution guide for every example depends on the value inserted by the students. This application will demonstrate the steps in solving the problem in the *Electrical Technology* course. This application also can diversify the teaching and learning techniques that can be used by the lecturers outside of the classroom.

1.2 Research Hypothesis

Based on the purpose and the research question, the hypothesis below are built at the significance level of 0.05.

i. Hypothesis 1:

Students that uses different Courseware Mode method will significantly achieve different min score for Post-test ($\overline{X}$). $\overline{X}$ **T(WEA)** ≠ $\overline{X}$ **D(WEA)**

ii. Hypothesis 2:

Students that uses *Worked Example Application courseware* method **D(WEA)** will achieve significantly higher min score for Post-test ($\overline{X}$) compared to the students that are not using the *Worked Example Application* T(WEA) courseware method. $\overline{X}$ **D(WEA)>** $\overline{X}$ **T(WEA)**

iii. Hypothesis 3:

Female students will achieve significantly higher min score ($\overline{X}$) compared to the male students that uses the *Worked Example Application* **D(WEA)** method. $\overline{X}$ **female- D(WEA) >** $\overline{X}$ **male - D(WEA)**

2.0 Literature Review

2.1 Cognitive Load Theory

The Cognitive Load Theory can supply a more reasonable explanation to clarify about the differences in terms of students' observation using the schema-bases approach. The Cognitive Load Theory also shows that students' focus are the effect from the teaching and learning materials being used. There are 10 application principles recommended by Toh [2] In order to comprehend this statement in a greater depth, three types of loads have to be differentiated. The loads are intrinsic load, germane load and extraneous load. Intrinsic load refers to the complication of the additional aids provided to the students during their mental teaching. Germane load refers to the place claimed upon the working memory

forced by mental activity that contribute directly in learning. Extraneous load refers to the mental activity during learning that does not contribute directly during learning.

2.2 Problem Solving using Worked Example

Problem solving: In depth understanding in learning can be interpreted into problem solving method, producing solution to problem or transferring knowledge regarding how to solve another problem. Worked Example: Alexandra, Stacy, Wendell, Anthony [1] use Worked Example theory to create learning through experience. Worked Example is one of the effective methods that can be used to build new cognitive skills according to Ruth and Mayer [4]. Worked Example is more efficient in learning new tasks because they reduce the load in the working memory, making it possible for students to learn the steps in solving problem. Students prefer using Worked Example compared to textual explanation. Learning competency starts with initial learning through introducing examples that can manage cognitive load and then followed by practice.

2.3 Worked Example

Can encourage learning by focusing towards learning in solving calculation problem. Solving problem by including problem solving steps can give effect towards students' achievement according to the research by Tamara, Kester, Paas [7]. Ron, Salden, Aleven, Schwonke, and Renkl [5]. The usage of Worked Example has enhanced knowledge and skills by giving explanation to students. Worked Example as a successful tool that trains a student's expertise according to David and Kent [3].

3.0 Metodology

Research Design

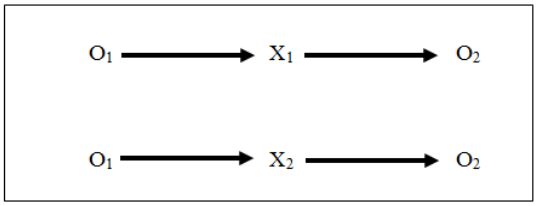
This research uses quasi experiment design with factorial 2x2. The data analyzed involves ANCOVA analysis with the significant level of 0.05 (5%) in two way used to test the hypothesis related to the effect of two independent variables that is Worked Example Application **D(WEA)** and without using Worked Example Application **T(WEA)** towards the dependent variable that is students' performance. The analyzed data for this research is at the significant level of 0.05 (5%). The purpose of this research is to test whether interaction exist between Worked Example Application towards students' performance in Electrical Technology (DET1013) learning. This quasi experiment design is as shown in Diagram 2 and 3 below:

Courseware Method D(WEA) and T(WEA)

		Courseware	
		T(WEA)	**D(WEA)**
Gender	Male		
	Female		

Figure 1: Courseware Method T (WEA) & D (WEA)) and Gender

Independent variable : courseware method **T (WEA)** & **D (WEA)**
: Gender (male and female)
Dependent variable : students' achievement level.
FACTOR A: TWO Courseware Method with: Courseware with the Worked Example Application and Courseware without using Worked Example Application.
FACTOR B: gender with two types (level): male and female



O_1 - Praujian
O_2 - Pencapaian
X_1 - Kaedah Pembelajaran **T(WEA)**
X2 - Kaedah Pembelajaran **D(WEA)**

Figure 2: Courseware Method T (WEA) & D (WEA)) and Gender

Variable

This research involves three types of variables that is independent variable, dependent variable and moderator variable.

a. *Independent variable :* The two independent variables involve in this research are the two courseware method T(WEA) dan D(WEA) and Gender factor (male and female)
b. *Dependent variable:* Dependent variable in this research are the Post-test min score after the courseware method T (WEA) and D(WEA).
c. *Moderator variable :* Moderator variable in this research conducted is the Post-test min score before the courseware method T (WEA) and D(WEA).

Research Framework

In this research, the researcher based on the research conceptual framework below:

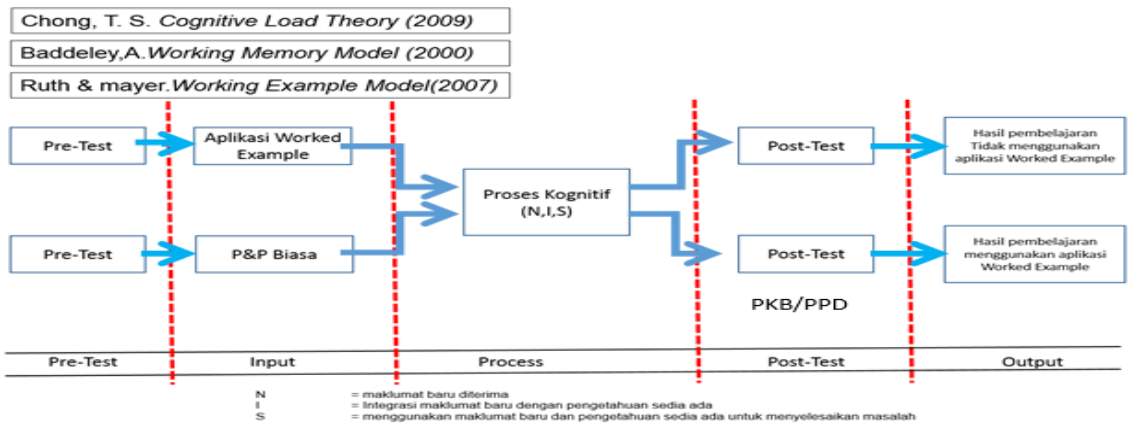


Figure 3: Research Framework

Sampling

The sample in this research is selected randomly and limited to the students taking the Electrical Technology (DET1013) course for the Electrical Engineering programme in Politeknik Kota Bharu and Politeknik Port Dickson. The number of subjects involved in this research is 20 person (10 person from PKB + 10 person from PPD) every group (T(WEA) and D(WEA) method). The total number of the research subject involved in this research is 40 students and divided into 4 groups (2 PKB groups+ 2 PPD groups).

Research Instrument

Questionnaire used in this research is divided into two sections. Section A is to obtain information regarding respondents' achievement before learning using every courseware method built. Section B consists of the same questions as section A but had been given treatment. It is conducted in order to obtain information from the respondents regarding the usage of the two courseware method reviewed.

Data Collection Procedure

Data collection process is conducted by giving initial briefing by the researcher regarding the data collecting procedure to ensure that the procedure is obeyed. The students are divided into two groups. Each group consists of 20 students. To collect the data, group one (uses worked example application D(WEA) will enter first for the teaching and learning process.

4.0 Research and discussion

Data Analysis and Research Findings

Data analysis is used in various techniques in this research. The Statistical Analysis of Covariance (ANCOVA) technique is used to analyzed the data from the research. Statistical inference analysis is used to determine the main effect and effect of interaction between the independent variable and the moderator variable towards the dependent variable. The result from the statistical inference analysis is discussed based on the research hypotheses that are being tested at the significance level of p=0.05 (5%).

i. ANCOVA Univariate test for the dependent variable (marks from the Post-test), fixed factor (Application and covariate (marks from the Pre-test)

Dependent Variable: Post_test			
F	Df1	Df2	Sig.
0.025	1	38	0.876

Table 1 : Dependent Variable: Post_test

Tests of Between-Subjects Effects

Dependent Variable:Post_test

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1.247[a]	2	.624	62.028	.000
Intercept	2.087	1	2.087	207.584	.000
Pre_test	.896	1	.896	89.092	.000
Mod	.515	1	.515	51.236	.000
Error	.372	37	.010		
Total	20.048	40			
Corrected Total	1.619	39			

a. R Squared = .770 (Adjusted R Squared = .758)

Table 2: Dependent Variable: Post_test

Based on the analysis table above, it can be concluded as the following: There is a significant difference between the min score of the Pre-test and the min marks of the Post-test (The value of significance is 0.000 smaller than the value of **p=0.05 (5%)**). From here, we can conclude that the treatment given to the respondents had significant effect. There is a significant difference between the min marks of the Post-test and the marks of the Pre-test according to the Worked Example Application used (the value of significance is 0.000 smaller than the value of **p=0.05 (5%)**)

ii. Two way ANOVA analysis is used to observe the difference between Worked Example Application and without Worked Example application towards students' achievement. ANOVA for the dependent variable (marks from the Post-test) and fixed factor (Application) as a support for the research done.

Descriptive Statistics

Dependent Variable: Post_Test

Mod	Jantina	Mean	Std. Deviation	N
D(WEA)	L	.7500	.17838	12
	P	.8063	.10836	8
	Total	.7725	.15345	20
Tanpa(WEA)	L	.5000	.18841	11
	P	.6889	.19003	9
	Total	.5850	.20781	20
Total	L	.6304	.21989	23
	P	.7441	.16382	17
	Total	.6788	.20377	40

Table 3: Descriptive statistics

Based on the Descriptive Statistics Analysis table, it can be concluded as the following:
It had been found that the students that uses Worked Example Application D(WEA) obtained higher min score for the Post-test ($\overline{X}$) (mean=0.7725) compared to the students that did not use Worked Example application T(WEA) (mean=0.5850)

iii. ANCOVA Univariate test for the dependent variable (marks from the Post-test), fixed factor (gender) and covariate (marks from the Pre-test) to observe the effect of using Worked Example Application D(WEA) towards gender.
The female students will obtain significantly higher min score in terms of achievement ($\overline{X}$) compared to male students that use ***Worked Example Application.***

(No interaction exists in the min plot for the dependent variable of Worked Example Application and gender).

Tests of Between-Subjects Effects

Dependent Variable:Post_test

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.732[a]	2	.366	15.273	.000
Intercept	1.970	1	1.970	82.186	.000
Pre_test	.606	1	.606	25.278	.000
Jantina	.000	1	.000	.006	.937
Error	.887	37	.024		
Total	20.048	40			
Corrected Total	1.619	39			

a. R Squared = .452 (Adjusted R Squared = .423)

Table 3: test of between –subject effects

Based on the analysis table above, it can be concluded as the following:
There is a significant difference between the min score from the Pre-test and the min score from the Post-test). (The significance level is 0.000 smaller than the value of **p=0.05 (5%)**). From here, we can conclude that the treatment given to the respondents had significant effect. There is no significant difference between the min score from the Post-test in terms of gender difference. (The value of significance is 0.937 bigger than the value of **p=0.05 (5%)**)

5.0 Conclusion and recommendations

The research conducted managed to achieve its objectives, whereby certain questions raised before this regarding the effects of Worked Example in application had been answered. The research findings show

that the Worked Example aspect influences the results of the students' performance. However, there are no significant differences in terms of gender and Worked Example. Outcome of this research shows that, worked Example are more efficient in learning new tasks. This finding also proof worked example will reduce the load in the working memory, making it possible for students to learn the steps in solving problem. Students prefer using Worked Example compared to textual explanation. Learning competency starts with initial learning through introducing examples that can manage cognitive load and then followed by practice.

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