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5. The articles may either be written in English or Filipino. All articles written in either languages must be accompanied by an Abstract which is written in English.

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INTEGRATING E-MODULE AS A TOOL IN TEACHING CONCEPTS OF SIGNIFICANCE LEVEL IN EDUCATIONAL STATISTICS FOR GRADUATE STUDENTS

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Abstract

The need to understand statistics in conducting research is very important especially when working on quantitative data. A very important concept that needs to be fully understood particularly in hypothesis testing is the significance level. Collado (2015) found out that graduate students have a fair level of understanding of the concepts of significance level; thus she constructed an e-module on the said topic designed for use by graduate students. The e-module was used in conducting true experimental design particularly randomized pretest-post test control group design with two classes of graduate Statistics to compare instructions with e-module and without e-module. The class with e-module was only given brief discussion on the interventions, while the group with e-module was taught with pure lecture method. The students taught with e-module obtained relatively higher scores than the students taught without the e-module only in one cluster of the lesson.After controlling the initial differences in scores, there was no significant difference in the mean scores of graduate students who differ in sex and intervention revealing further that e-module can be a substitute to lecture method. This implies that e -module could reinforce graduate students' independent learning and could help them cope with the lessons missed in class. E-module can also be taught in combination with the traditional methods to better improve the understanding about the level of significance.

Keywords: e-module, significance level, statistics, true experimental, Graduate Students

Introduction

Statistics is a structural method in solving a problem and frequently used in various fields (Sahari,et al.,2009). Statistics is the systematic collection and analysis of numerical data, in order to investigate or discover relationships among phenomena so as to explain predict and control their occurrence. Statistics is divided into two branches: Descriptive and Inferential Statistics (Harris, 2007). Descriptive statistics are used in everyday life in areas such as government, healthcare, business, and sport while Inferential (analytical) statistics makes inferences about populations (entire groups of people or firms) by analyzing data gatheredfrom samples (smaller subsets of the entire group), and deals withmethods that enable a conclusion to be drawn from these data and investigates whether thedata are consistent with that hypothesis (Harris, 2007).

It is important for researchers to understand statistics so that they can be informed, evaluate the credibility and usefulness of information, and make appropriate decisions. Some of the major purposes of statistics are to help us understand and describe phenomena in our world and to help us draw reliable conclusions about those phenomena (Baltimore County Public Schools, 2010).

With these importance mentioned, it is stated in CHED memo no. 53, series of 2007 on policies and standards for graduate programs in education for teachers and other education professionals as part of the goal of Graduate education that:

…Graduate education is also one of the most effective means of developing capacities related to doing research that will improve educational theory and practice in the many different aspects of the educational process…

Aside from that, the curriculum outline found in the same document includes 9 units of core/foundation courses for both thesis and non-thesis program which includes 3 units Statistics, 3 units methods of research and 3 units that depends on students' major. Hence, Commission on Higher education requires the graduate students to take statistics course to prepare them in making research.

With these, the need to understand statistics in conducting research is very important especially when working on quantitative data. One of the basic concepts needs to be developed is the significance level because this is the guide of the researcher whether to accept or reject the null hypothesis stating that there

is no significant relationship/difference or correlation between and among the variables involved. However, methodologists constantly point out that researchers misinterpret *p*-values (Magnuson. nd). Furthermore, Collado (2015) in her study cited that significance level is a misleading term that many researchers do not fully understand (Creative Research Systems, 2014), thus some researchers misinterpret their research' results (Bruce, 1994) and so her study aimed to investigate the level of understanding on significance level by graduate students who took statistics and would probably write their thesis or dissertation. She found out that graduate students have a fair level of understanding on the concepts of significance level revealing that they have fairly correct notions about levels of significance so as part of her problem, a module, on significance level with particular focus on specific levels of significance and its importance is designed for use of graduate students. Since the module was only part of her problem, the effectiveness of the module was not yet checked.
Thus, this study aimed to determine the effectiveness of integratingthe e-module as a tool in teaching significance level in educational statistics for graduate students.

Statement of the Problems
The purpose of this study was to determine the effectiveness of the e-module as a tool in teaching among the graduate students enrolled in Statistics during the first semester, school year 2015-2016. Specifically, this study aimed to answer the following questions:

1. What is the level of understanding on concepts about significance level of the studentsin the 2 classes of Statistics taught before and after the interventiona) withe-module and b) without e-module?

2. Is there a significant difference between the mean gained score (total and per cluster) of students when grouped by intervention?

3. After controlling the initial differences in scores, is there significant difference in the mean score of graduate students who differ in sex and intervention?

Methodology

This study employed true experimental design particularly the randomized pre-post test control group design. The design used in the study was shown below.

Group	Pre-test	Teaching Method	Post-test
A	O_1	With e-module	O_2
B	O_3	Without e-module	O_4

Legend: O_1 and O_3 – pretest, O_2 and O_4 –post test

This study also used descriptive-comparative type of research. The subjects of the study were the students enrolled in graduate Statistics during the first semester, SY 2015-2016. To compare the effectiveness of the instruction with e-module and without e-module, random sampling on larger class was performed to have equivalent number of samples. This is in consideration of conditions that need to meet in using statistical test.The class with e-module was only given brief discussion on the interventions, while the group with e-module was taught with pure lecture method.

The study made use of assessment test on level of understanding on level of significance that serves as pre-test and post-test adopted from Collado(2015) with a Cronbach's alpha of 0.702. The reliability in the current study was 0.876.

Findings

Section 1. Level of Understanding on Concepts about Significance Level of the Students enrolled in Statistics Class Taught with E-module and without E-moduleBefore and After the Intervention.

Table 1.1 Level of Understanding on Concepts about Significance Level of Students in Statistics Class Taught Before and After the Interventionwith E-module and without E-module.

Level	With e-module		Without	
	Before	After	Before	After
	f (%)	*f* (%)	*f* (%)	*f* (%)
P	2 (8.3)	0 (0)	0 (0)	0 (0)
F	16 (66.7)	4 (16.7)	7 (70)	0 (0)
M	6 (25)	7 (29.2)	3 (30)	5 (50)
G	0 (0)	6 (25.0)	0 (0)	5 (50)
VG	0 (0)	7 (29.2)	0 (0)	0 (0)
Total	24 (100)	24 (100)	10 (100)	10 (100)

P(poor);F(fair);M(moderate); G(great);VG(very great)

The interventions conducted in the two classes have changed the level of understanding of students in statistics class from poor-moderate to fair-great understanding.This indicates that there was a level up on understanding concepts about significance level of students in statistics class after the interventions.

Based on the frequency count and percentage, the interventions performed were effective in increasing the level of understanding on significance level. The intervention with e-module can improve level until very great understanding compared with intervention without e-module; it can increase level until great understanding only.

Table 1.2Descriptive Statistics of the Level of Understanding on Concepts about Significance Level of Students in Statistics Class Taught Before and After without E-module

Table 1.2 shows that the intervention without e-module can improve the level of understanding of the participants in the concepts on meaning of significance, importance of significance, types of decision error, *p* value and confidence level but not with specific levels of significance. Further lecture-discussion on specific levels of significance was needed to improve the level of understanding on specific levels of significance concepts.

	Concepts	Before M/Md* (SD)	QD	After M/Md* (SD)	QD
a.	Meaning of significance	33.3* (8.05)	F	68.33 (16.6)	G
b.	Specific levels of significance	23.3 (14.1)	F	25.00 (16.2)	F
c.	Importance of significance	33.8 (15.7)	F	65.00 (14.2)	G
d.	Types of decision error	26 (10.8)	F	58.00 (20.4)	M
e.	*p* value	55 (30.5)	M	61.67 (22.3)	G
f.	confidence level	25* (26.4)	F	100* (21.1)	VG
	Overall	33.7 (9.4)	F	58.16 (10)	M

Legend: 0-19.49(Poor understanding), 19.5-39.49(fair understanding), 39.50-59.49 (moderate understanding), 59.50-79.49(great understanding) and 79.5 -100 (very great understanding).
*not normally distributed

Overall, the level of understanding of the participants increased from fair (M=33.69, SD=9.43) to moderate (M=58.16, SD=10.04).

Table 1.3 Descriptive Statistics of the Level of Understanding on Concepts about Significance Level of Students in Statistics Class Taught Before and After Intervention with E-module

	Concepts	Before M/Md* (SD)	QD	After M/Md* (SD)	QD
a.	Meaning of significance	50* (20.3)	M	83.33* (23.5)	VG
b.	Specific levels of significance	16.67* (16.3)	P	58.34* (32.6)	M
c.	Importance of significance	29.17 (16.8)	F	64.58 (27)	G
d.	Types of decision error	31.25 (14.8)	F	60.83 (24.1)	G
e.	*p* value	41.67 (20.2)	M	66.67* (23.1)	G
f.	confidence level	50* (35.1)	M	100.0* (40.8)	VG
	Overall	32.13 (11.8)	F	64.26 (22.2)	G

Legend: 0-19.49(Poor understanding/P), 19.5-39.49(fair understanding/F), 39.50-59.49 (moderate understanding/M), 59.50-79.49(great understanding/G) and 79.5 -100 (very great understanding/VG).
*not normally distributed

As gleaned from table 1.3, the levels of understanding on concepts about significance level were improved in the statistics class taught with e-module. The result shows that 2 clusters were improved from moderate to very great. Overall, the level of understanding on concepts about significance level of students in statistics class taught with e-module improved from fair (M=32.13, SD=11.17) to great (M=64.26, SD 22.2).

Based on the results presented in table 1.2 and 1.3, the interventions performed were effective in increasing the level of understanding of students in concepts about significance level. The interventions without e-module can improve the level of understanding until moderate understanding only while with the aid of e-module, the level can be increased even until great level.

This was also showing that students have different understanding in the concepts of statistics with the difference in the level of understanding.

Section 2.Significant difference between the mean-gained score (the total and per cluster) when grouped by intervention.

Table 2.1 Significant difference between the mean gained score (the total and per cluster) when grouped by intervention in the randomized samples.

Cluster	Treatment	N	Mean (SD)	t(df) Sig. (2-tailed)
Meaning of significance	without	10	1.80 (1.14)	t(18)=-.88, p= .391
	with	10	2.40 (1.84)	
Specific levels of significance	without	10	.10 (1.20)	t(18)=-2.88, p=.010**
	with	10	2.40 (2.22)	
Importance of significance	without	10	2.50 (1.84)	t(18)=-.41, p=.686
	with	10	2.90 (2.47)	
Types of decision error	without	10	3.20 (2.86)	t(18)=.30, p=.771
	with	10	2.80 (3.19)	
p value	without	10	.40 (2.41)	t(18)=-.67, p=.509
	with	10	1.10 (2.23)	
confidence level	without	10	1.30 (.67)	t(18)=1.74, p=.098
	with	10	.60 (1.08)	
Over all	without	10	9.30 (6.15)	t(18)=-.77, p=.453
	with	10	12.20 (10.24)	

*significant at 0.05 level
**significant at 0.01 level

Table 2.1 reveals that there was no significant difference in the mean gained scores of students taught with or without e-module. Significant difference only existed in the concept of specific levels of significance, t(18)=-2.88, p=0.010.The gained score of students taught with e-module was significantly higher only in concept of specific level of significance. Furthermore, the result also reveals that students taught with e-module have higher scores in some clusters but students taught without e-module have also obtained higher scores in others.

The study was supported by theresult of the studies of Ramey (2015), Gundlach, Richards, Nelson, and Levesque-Bristol (2015) showing that the interventions such as e-module, fully online, flipped sections, used of instructional videos can improve the learning of students in statistics but no difference with traditional lecture-discussions.

Section 3. After controlling the initial differences in scores, is there significant difference in the mean score of graduate students who differ in sex and intervention.

Table 3.1 Descriptive Statistics of the Mean Score of Graduate Students who differ in Sex and Intervention after controlling differences in pre-test score

Sex	Treatment	Unadjusted Mean (SD)	N	Adjusted Mean
Female	Without	21.0 (4.08)	4	23.4[a]
	With	24.0 (11.15)	6	24.2[a]
	Total	22.8 (8.78)	10	
Male	Without	22.83 (3.82)	6	21.538[a]
	With	25.00 (5.94)	4	24.253[a]
	Total	23.70 (4.60)	10	

a. Covariates appearing in the model are evaluated at the following values: PRE = 12.500.
Dependent Variable: POST

Table 3.1 shows that the mean score of students taught with e-module was higher than the mean score without e-module for both male and female graduate students.

Table 3.2. Significant difference in the mean score of graduate students who differ in sex and intervention after controlling the initial differences in scores
Tests of Between-Subjects Effects
Dependent Variable: POST

A 2 by 2 between-groups analysis of covariance was

Source	Type III Sum of Squares	F(df), Sig.	Partial Eta Squared
Corrected Model	79.75[a]	F(4)=.37 p=.826	.090
Intercept	676.71	F(1)=12.56 p=.003	.456
PRE	42.83	F(1)=.80 p=.387	.050
Sex	2.42	F(1)=.05 p=.835	.003
Intervention	13.85	F(1)=.26 p=.620	.017
Sex * Intervention	3.60	F(1)=.07 p=.799	.004
Error	808.00		
Total	11699.00		
Corrected Total	887.750		

a. R Squared = .090 (Adjusted R Squared = -.153)

conducted to assess the effectiveness of the two interventions in improving the scores of students in the concepts of level of significance for male and female participants. The independent variables were the interventions (with e-module and without e-module) and sex.

The dependent variable was post test scores in level of significance. Pretest scores were used as a covariate to control for individual differences. The two-way effect of sex and intervention, main effect of intervention and main effect of sex were not significant. Similar to the result of
Liu and Garfield (2002). Furthermore, this also shows that since there was no significant difference, then e-module can be a substitute to lecture method especially that approaches in teaching graduate students were different from undergraduate students.

Conclusions

Based from the result and discussions, the following conclusions were the following:

1. The interventions without e-module can improve the level of understanding until great understanding only while with the aid of e-module; the level can be increased even until very great level.
2. The understanding of the students taught with e-module and without e-module was the same except on specific levels of significance concept. The students taught with e-module learned better in the specific level of significance compared with students taught without the e-module. E-module can be substitute to lecture method.
3. After controlling the initial differences in scores, there was no significant difference in the mean score of graduate students who differ in sex and intervention.

Recommendations

Based from the findings of the study, the following are recommendations:

- The e-module could reinforce them in independent learning.
- E-module could be a substitute to traditional learning. This can also help the graduate students to cope up with the lesson missed in class.
- E-module can be taught in combination with the traditional methods to better improve the understanding in the level of significance.
- Graduate teachers to continue integrating innovations in class and further studies could also be conducted.

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