The Use of Institutional Development and Innovation Grant (IDIG) E-module and the Students' Academic Performance in NGEC 4 (Mathematics in the Modern World)

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ABSTRACT

The Institutional Development and Innovation Grants (IDIG) are awarded to higher education institutions to enhance their qualifications and relevance to local, regional, national, and global priorities. This is part of the CHED K to 12 Transition Program, aiming to upgrade Philippine higher education. The IDIG aims to enhance HEIs' role as quality education providers and catalysts for positive change, focusing on nationalism, inclusive growth, and global competitiveness through Grants projects (CHED K to 12 Transition Program, 2024). During this pandemic, we used the online mode as new normal instead of face-to-face delivery of our teaching and learning activities. The IDIG Project intends to determine the effectiveness of these e-modules through Blackboard OLMS on the academic performances of Bachelor of Science in Marine Transportation (BSMT) students at John B. Lacson Foundation Maritime University (Arevalo), Inc. This research aims to determine the efficacy of the Institutional Development and Innovation Grant in improving students' academic performance in New General Education Curriculum 4 through Online Learning Management System. One Group Pretest-Posttest was used as research design to assess the effectiveness on the academic performance of the 40 first-year Bachelor of Science in Marine Transportation students chosen by simple random sampling enrolled during the second semester of the school year 2020-2021. A validated and reliability tested multiple-choice questionnaire designed by the researchers was used. Statistical tools used were mean, standard deviation, and t-test of dependent samples with a .05 significance level. The Cohen's d effect size was calculated to measure the effectiveness on their academic achievement. The pretest mean score performance was "Fair" which means that the students have mastered few competencies while their posttest mean score performance was "Good," which means that students have mastered on the average competencies. Since the Cohen's d effect size was greater than 1.0, it has a significant effect on the academic achievement. It was found out that e-learning module was 84% effective in improving students' academic performance based on the mean gain and effect size. It is recommended that this platform will be used in other courses and will be conducted after the pandemic.

Keywords: IDIG, e-module, academic performance, one group pretest-posttest

Introduction

Improving the quality of mathematics education requires paying attention not only to academic factors but also to the entire teaching-learning situation. In the study of Singh et al. (2021), they found that interest in mathematics is not directly related to its execution, indicating that teachers significantly influence student behavior and thought. There is a need to develop instructional strategies that can improve students' learning outcomes. Mathematics predicts success, while attitude shapes life. Attitudes include emotional and cognitive elements, influencing how one perceives situations. Emotional evaluations can be positive, while cognitive beliefs shape beliefs and views on the subject (Mazana et al., 2019).

The outbreak of the COVID-19 pandemic has led to widespread school shutdowns, and many schools have opted education utilizing online learning platforms. Many countries have forced lockdown measures to diminish social contact and to restrain the spread of the novel coronavirus (Brodeur et al., 2020; Eyles et al., 2020). To mitigate the negative influence of physical closures, many schools have provided purely online lessons to their students. The evaluation of the effectiveness of distance delivery of education for students' academic outcomes is highly imperative, particularly during an ongoing severe pandemic such as the COVID-19. In e-learning, the students and the instructor work together on a web-based platform rather than face to face. Things in e-learning are generally simple to organize with the use of a learning management system, which allows the user to freely do things like accessing the syllabus, monitoring academic progress, and communicating with fellow students and instructors (Mahajan & Kalpana, 2018). When determining which students will be most successful in online learning, it is important to consider students' attitudes. According to Kim et al. (2014), students' attitudes are critical to learning in mathematics. Studies suggest attitudinal factors, such as self-efficacy, enjoyment, and boredom, significantly contribute to a student's success in a course (Tempelaar et al., 2012). Although these previous findings suggest a relationship between attitudinal factors and academic success, further research is needed to explore the relationship between attitudes toward mathematics and success in math courses (Deshler & Fuller, 2016). Educators also want to see greater student achievement in the classroom, but it can be difficult to identify strategies that will work for all students (Johnson, 2014). Combining technologies with differentiated instruction has several advantages, but when they are used in a balanced way, they provide an instructional method that promotes student achievement. Studies have indicated that e-learning improves student learning outcomes, leading to higher grades and a better understanding of ideas. Studies have indicated that e-learning improves student learning outcomes, leading to higher grades and a better understanding of concepts (Leach, 2016). John B. Lacson Foundation Maritime University (Arevalo), Inc. uses a Learning Management System, an alleyway for online learning specifically of training and instructions accessible to the JBLFMU community (see Figure 1). This is a learning technology designed for 21st-century learners that provides easy access to the lessons and substantial knowledge anytime-anywhere with ease. The platform is Moodle-based which enables teachers to easily create e-courses, add activities and assignments, and keep an eye on their students' progress. It also allows the teachers and students to communicate and encourage collaboration between them in forums and discussions. The online functionality of JBLFMU e-learning provides a convenient way to receive quality instruction apart from the traditional way

or face-to-face mode of teaching (Open Learning Management System, 2020).

The NGEC 4 (Mathematics in the Modern World) deals with nature of mathematics, appreciation of its practical, intellectual, and aesthetic dimensions, and application of mathematical tools in daily life. The course proceeds to survey ways in which mathematics provides a tool for understanding and dealing with various aspects of present-day living, such as managing personal finances, making social choices, appreciating geometric designs, understanding codes used in data transmission and security, and dividing limited resources fairly. These aspects will provide opportunities for actually doing mathematics in a broad range of exercises that bring out the various dimensions of mathematics as a way of knowing, and testing the students' understanding and capacity (CHED Memo No. 20, 2013). This course is listed as a general education course for first year students.

Figure 1. John B. Lacson Foundation Maritime University e-Learning

This study was conducted because of the following reasons: The instructors of the JBLFMU (Arevalo), Inc. may benefit from the findings of this study. The results will provide the instructors of the practical solutions and practicable direction for more effective instruction inside the classroom. The results of this study may likewise move school administrators to provide in-service seminars, workshops, and training for their teachers to learn the use of the IDIG e-learning module through Blackboard OLMS. The students will certainly be benefited from the results of this study since these will inform them about the need to adjust to new instructional modes which may lead to better learning of their subjects at this time of pandemic. This study was anchored under the learning theories for online education specifically the Theory of Community of Inquiry (CoI) developed by Garrison et al. (2000) having three distinct presences of cognitive, social, and teaching. It determines the students' academic performance in NGEC 4 with the use of the IDIG e-learning module through Blackboard OLMS. This study aimed to determine the effectiveness of the use of the IDIG e-learning module through Blackboard OLMS in NGEC 4 (Mathematics in the Modern World) to the academic performance of the first-year BSMT students in NGEC 4 during the second semester of the school-year 2020-2021. Specifically, this study sought answers to the following questions:

1. What are the pretest and posttest mean score performances of the students in NGEC 4?
2. Is there a significant difference in the pretest and posttest mean score performances of the students in NGEC 4?
3. What is the mean gain of the pretest and posttest mean score performances of the students in NGEC 4?
4. How effective is the IDIG e-module taught using the Blackboard OLMS as a learning mode in terms of students' performance in NGEC 4?

Methodology

Research Design

The research design was a One Group Pretest-Posttest. It's a type of research design used by educational researchers to see how a treatment or intervention affects a specific group of people (Sage Encyclopedia of Communication Research Methods, 2017). Pretest-posttest designs are commonly utilized in behavioral research to compare groups and measure changes resulting from experimental treatments. In the study of Delucchi (2014), the pretest-posttest instrument reveals statistically significant gains in knowledge for each course section and all sections combined. The results demonstrate that pretests can establish students' prior knowledge at the beginning of the semester, while posttests measure learning at the end of the course. In this study, the One Group Pretest–Posttest was used because only one group received a pretest and posttest to determine their academic performance in NGEC 4. The researchers used this design to determine the effectiveness of the IDIG e-module in NGEC 4 after it was administered online via Blackboard OLMS as the learning modality used by JBLFMU-Arevalo during the pandemic.

Participants

The study's participants were 40 first-year BSMT students enrolled in NGEC 4 during the second semester of the school year 2020-2021. They were drawn from a single intact section using simple random sampling. Another group of 40 students took part in the NGEC 4 pilot testing (Mathematics in the Modern World). This study is voluntary, and the participants' privacy is protected by the use of the Privacy Notice Form (PNF) and Informed Consent Form (ICF).

Instrument

The instrument used in this study was a multiple-choice test designed by the researchers. The Table of Specifications (TOS) was created to assist in the construction of the instrument prior to reliability testing. It was validated by a panel of jurors chosen for their expertise in terms of content and instrument appropriateness, as well as reliability testing using the Kuder-Richardson (KR) 20 with a reliability index of 0.92. The remaining items after reliability testing were 50. The pretest-posttest exam covered the course syllabus's midterm topics. The following topics were covered in the midterm such as the following: Inductive and Deductive Reasoning, Intuition, Proof and Certainty, Polya's 4 Steps in Problem-Solving, Problem Solving Strategies, Mathematical Problems Involving Patterns and Recreational Problems, Data Management, Measures of Central Tendency (mean, median, mode, weighted mean), Measures of Dispersion (range, standard deviation and variance), Measures of Relative Position (z-scores, percentile quartiles, box, and whisker plots), Probabilities and Normal Distributions, Linear Regression, and Correlation (least square line). Each item correctly answered by the students is given a one point score.

Data Collection

This research was conducted from February to March 2021 during the school year 2020-2021. The data for this study was gathered using a pretest and a posttest. The pre- and post-tests were given to the group online using Blackboard OLMS and the assistance of an IT expert. The researchers administered the pretest to the group online during the first class session. This set of data was labeled as "pre-course." Meanwhile, the posttest was administered following the midterm examination. The results of both tests were obtained after one hour with the assistance of an IT expert using Blackboard OLMS. The IDIG e-module was used as a learning modality through Blackboard OLMS. The IDIG e-learning materials were developed prior to the pandemic as part of the IDIG Project, which was funded by CHED. It is an e-module because it contains topics or lessons, objectives, teaching and learning activities, and evaluation. Meanwhile, the school acquired the Blackboard OLMS with funds from the IDIG CHED Project Grant. This platform, on which the module's components were embedded, is overseen by an IT expert. Topics or lessons, objectives, teaching and learning activities, and evaluation, including output submission, are all delivered online through this Blackboard OLMS or moodle (also known as mrooms). The group was instructed using an e-learning approach. This intervention lasted six weeks during the second semester of school-year 2020-2021.

Data Analysis

The following statistical tools were used in this study: The mean was used to calculate the mean score performances of the students in the pretest and posttest. Table 1 displays the mean scale, descriptive rating, and indicators for interpreting pretest and posttest scores.

The standard deviation was used to determine the level of homogeneity in the students' NGEC 4 performance. The t-test of dependent samples was used with a significance level of .05 to determine the significant difference between the pretest and posttest of one group in NGEC 4. The Cohen's d effect size was used to determine the effectiveness of an IDIG e-learning module in NGEC 4 taught via online learning through the use of Blackboard OLMS on students' academic performance in NGEC 4.

Table 1

Mean Scale, Descriptive Rating, and Indicators for Interpreting the Pretest and Posttest Scores

Mean Scale	Descriptive Rating	Indicators
40.04-50.0	Excellent	Students have mastered all the competencies
30.03-40.03	Very Good	Students have mastered most of the competencies
20.02-30.02	Good	Students have mastered competencies on the average
10.01-20.01	Fair	Students have mastered few competencies
1.0 – 10.0	Poor	Students have mastered very few competencies

Results and Discussion

The final participants in this study were 40 out of 41 intact first-year BSMT students from JBLFMU (Arevalo), Inc. during the second semester of the 2020-2021 school year. This means that one student did not participate because the study is voluntary and protects the participants' privacy by using the Privacy Notice Form (PNF) and Consent Form (CF). Table 2 presents the pretest and posttest mean score performances of NGEC 4 students. The students' pretest mean score performance before the intervention is described as "Fair," indicating that they have mastered only a few competencies, whereas their posttest mean score performance after the intervention is described as "Good," indicating that they have mastered on average competencies. Furthermore, this means that students' performance in NGEC 4 improved from pretest to posttest. The research results support the findings of Schalich (2015) the effectiveness of pretest posttest on the students' performance. In the study of Dimitrov and Rumrill (2003) different pretest-posttest designs are presented in a manner that can help rehabilitation professionals to better understand and determine effects resulting from selected interventions. Table 3 presents that there is a significant difference between the students' pretest and posttest performance in NGEC 4, $t(40) = -2.392$, $p = .022$. This means that the students performed significantly better after the intervention. This study supports Marsden and Torgerson's (2012) findings that interventions are most effective for those with low baseline scores who show pre-post gains. This means that the students performed significantly better after the intervention. The research results support the findings of Sadhasivam et al. (2013), that students' posttest scores improved significantly when compared to their pretest scores. However, since there is no comparison or control group, several factors that may affect students' "Good" performance in NGEC 4 were not identified in this study.

Table 2

Pretest and Posttest Mean Score Performances of the First-Year BSMT Students taking NGEC 4

Test	*M*	Descriptive Rating	*SD*
Pretest	18.93	Fair	7.49
Posttest	29.67	Good	10.28

Table 3

Significant Difference in the Pretest and Posttest Score Performances of the Students taking NGEC 4

Test	t	df	Sig.
Pretest - Posttest	-8.487*	39	0.000

Note: *Significant at 0.05 alpha

Table 4

Mean Gain of the Pretest and Posttest Mean Score Performance of the Students taking NGEC 4

Pretest Mean Score Performance	Posttest Mean Score Performance	Mean Gain
18.93	29.67	10.74

Table 4 presents the mean gain of the pretest and posttest mean score performance of the students taking NGEC 4 which is 10.74. The Cohen's *d* effect size is 1.002. The intervention has a large effect because the effect size is more than 1.0 (Cohen, 1988), as cited by Lenhard and Lenhard (2016). This means that the IDIG e-module taught using the Blackboard OLMS as a learning mode is 84% effective (Coe, 2002) in terms of improving students' NGEC 4 performance.

Conclusions

The following conclusions were based on the study's findings: The significant difference in pretest-posttest mean score performances indicates that the students performed well after the intervention. Moreover, based on the mean gain and effect size, the IDIG e-module taught through Blackboard OLMS is an effective material for learning. However, there is no comparison or control group, and many factors that could affect the students' academic performance were not considered.

Recommendations

The following recommendations were made based on the study's findings: Use of other instructors' Blackboard OLMS in courses other than NGEC 4. Furthermore, to conduct another study with a comparison or control group, possibly after the pandemic or when the COVID-19 vaccine becomes available. Lastly, a follow-up study may also be conducted to validate the findings of this research.

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