
**STUDENTS' LEARNING EFFICACY IN MATHEMATICS IN AN ONLINE AND
MODULAR MODE OF LEARNING**

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ABSTRACT

This study investigated the Student's Learning Efficacy in Mathematics in an Online and Modular Mode of Learning. The establishment of this study is in Pagadian City, school year 2020-2021. It is conducted the study in one of the higher institutional schools in Pagadian City that practices online and modular modes of learning. The research participants were the 136 Grade 10 Junior High School Students, 68 from the modular and 68 as well from online class. It was determined through the Slovin's Sampling technique. The researchers used Descriptive Research Design for this study. In this new normal learning, the researchers gathered data from a Likert Scale Survey Questionnaire. As analysed, the level of learning efficacy of modular mode of learning in terms of the following indicators namely; interest, study habits and module's content were all interpreted as high efficacy with an overall weighted mean of 3.716. On the other hand, the level of learning efficacy of online mode of learning in terms of the following indicators namely; Interest, Study Habits and Online Learning were all interpreted as high efficacy with an overall weighted mean of 3.733. Nevertheless, the result has no significant difference on Student's Learning Efficacy in Mathematics in an Online and Modular Mode of Learning. Therefore, both modular and online mode of learnings are all effective based on the student's learning efficacy in mathematics' response. The researchers recommend that the implications, which is made towards addressing findings identified in this study, be highly considered for evaluation and adoption.

KEYWORDS: *Learning efficacy; Online class; Modular class; New normal; Students; Mathematics; Interest; Study habits; module's content;*

1. INTRODUCTION

According to the World Health Organization, the Novel Corona Virus Disease (COVID-19) is an international public health emergency (Mahapatra & Sharma, 2020). The COVID-19 pandemic has become a world health concern and has had a significant influence on education (Pang-an, A., Arceno, J., Tantog, A. Alayon, M., & Luzano, J., 2022). Institutional schools in many places had to close in response to the COVID-19 pandemic and move to the new normal mode of learning. Globally, over 1.2 billion learners are out of the classroom (Li & Lalani, 2020). There are more than 1.2 billion children in 186 countries affected by school closures because of the pandemic. With this sudden change from the classroom, many parts of the world wonder about its impact on worldwide educational institutions (Aranzo, et al., 2023). The learning instruction that educational institutions can adopt may be one or a

combination of the following modalities, depending on the COVID-19 protocols and the particular context of the learners in the locality or school (Romorosa, et al., 2023). As a result, education has transformed dynamically, with the phenomenal rise of distance learning, wherein the delivery of teaching is via a modular and online platform.

In the Philippines, to flatten the spread of COVID-19, most governments have decided to establish quarantine protocols and temporarily shut down their educational institutions. Academics are directly affected as we are now embracing the impact of the virus. Delivery of classes is modular and online, where students, teachers, and the different institutions adapt to the societal change to ensure safety protocol. The establishment of modular learning mode is through digital and printed modules (Sumaoang & Dangle, 2020). In monitoring the progress of the learners, the teachers take responsibility. The students may ask the teacher for guidance via telephone, e-mail, and instant messaging/text message (Casanova, et al., 2023). The teacher shall do home visits to students needing assistance or remediation (Llego, n.d.). Printed modules will be distributed to students, guardians, or parents by the teachers. Online learning on national takes place in synchronous classes for real-time classes, time-based assessments, or asynchronous, delayed-time activities, like time-independent reviews and pre-recorded video lectures (Joaquin et al, 2020). It has dramatically impacted society's different educational institutions affecting the educators and the students. As academics are greatly troubled by how it must be delivered, mathematics subjects are significantly affected (Luzano, 2023).

Consequently, halfway through the march of the academic year 2020, the learning delivery methods in Pagadian City's locality is through modular and online learning. The learning is where the learner and the facilitator, or the source of knowledge, cannot be seen in a traditional classroom setting (Luzano, 2020). Its main features include the separation of instructors and learners in every class and implementing various tools to facilitate learner-teacher and peer interaction. Usually, instruction is through online tools, like video conferencing, discussion boards, and online assessments. The modular learning model was distributing handouts, books, and any written and printed materials to students who prefer the said learning environment. To combat the virus's expansion and ensure safety protocol in the locality, schools all around the city temporarily closed and swiftly transitioned from on-campus or face-to-face learning to modular and online learning.

The researchers are motivated to undertake the study because they are interested in determining the students' learning efficacy in mathematics in the new normal. Fleming (2019) conducted a poll that questioned students of what subject they considered to be the most difficult. What came out on the top of the result was mathematics. Math requires more application of the concept to be solved, understood, and performed successfully. For students, mathematics is not always about memorization - it takes a lot of patience and effort. The researchers are curious about how effective educational institutions are in modular and online learning modes amid COVID-19. It may lead to more extensive mathematical efficacy for students instead of adding mistrust in the subject via modular and online learning modes.

1.2 Objectives of the study

The study aims to determine the difference between the Online and Modular Mode of Learning and Students' Learning Efficacy in Mathematics. It focuses on one of the higher education institutions in Pagadian City, utilizing the Junior High School students as research

participants in the academic year 2020-2021 in Pagadian City. Specifically, it sought to answer the following sub-questions: the level of learning efficacy of modular mode of learning in terms of interest, study habits, and module's content, the level of learning efficacy of online mode of learning in terms interest, study habits, and online learning, the significant difference between online and modular modes of learning to the students' learning efficacy in mathematics, and the implications based on the findings.

Online Mode of Learning

Instruction delivered electronically via various multimedia and Internet platforms and applications is referred to as online learning. Web-based learning, e-learning, computer-assisted teaching, and Internet-based learning are all concepts that are used interchangeably (Maddison & Kumaran, 2017).

As the COVID-19 pandemic spreads, more people turn to online education because the only alternative is closing schools, colleges, and universities for an unspecified period (Martinez, 2020). As stated by Mishra et al. (2020), after the pandemic crisis, online platforms for learning became an educational development of the traditional system to the new regular learners and learning approach from the classroom to the Zoom or Google Classroom, from personal to interactive and from seminars to webinars.

As Mishra et al. (2020) studied, with regards to the understanding of students of online teaching-learning, they claimed that during the span of COVID-19, the online learning process allowed them to interact with their lessons beyond the four walls of the classroom. That prohibited the gathering of crowds in the school and provided an alternative for completing the syllabus. Since they were not used to learning with smartphones and computers, some students reported a lack of interest and focused during online classes.

According to Cortez (2020), there is no question that e-learning and blended learning will be the new standard in the Philippine educational system in this pandemic crisis that the Philippines and the entire world are going through. Depending on the students' needs, it is now only a matter of planning of how to apply it. Real-time and self-paced online courses, also known as synchronous and asynchronous, are currently being considered, as demonstrated by emerging ideas that see two primary forms of teaching that can be merge in blended learning synchronous and asynchronous teaching (Hubackova, 2015).

As Cortez (2020) studied, the understanding of the efficacy of Blended, Distance, Electronic and Virtual-Learning (BDEV-Learning) not influenced by the nature of internet connections, types of gadgets owned by students, socioeconomic status, and means of connecting to the internet. That takes into account the substantial disparity in their perceived potential for mathematics. Despite discrepancies in mathematical abilities and regardless of their own technological devices, quality of internet access, and means to communicate on the internet, most students perceived that they could attend online or distance learning and see that it is the same as in a conventional classroom environment. 76% of students said that when watching video lessons, they learn more, but it is clear that 90% of students still require validation when learning mathematics from their math teachers.

That shows that, although most people believe that video tutorials will help students learn mathematics, feedback from teachers is still an essential tool for students to gain trust in what they learned from a video tutorial (Cortez, 2020).

Modular Mode of Learning

According to the Ministry of Education (2013) of African countries, a standard approach is a rising instructional thinking trend that shifts ancient instruction techniques to an outcome-based learning paradigm. In keeping with Struyven et al. (2010) analysed that for college kids to amass these skills, faculties got to be organized around the learners. As explicit by Sadiq (2014), the standard approach may be a distinctive means of teaching. The academics ought to be provided enough coaching to style and implement a module in a schoolroom setting.

Flores and Savage (2007) have previously shown that pre-recorded lecture materials help achieve a better student performance, and students pay additional attention to categories that produce recorded lectures. Guro and Weber (2010) studied the United Nations agency that the lecture methods used at the tertiary level rarely take issue from those used at the first and secondary level. Leader (2012) argued that the teaching approach in modularized programs ought to permit students to proceed at their own pace, offer the chance to settle on their learning vogue, and permit them to spot their strengths and weaknesses.

Getinet (2016) studied the continual assessment practice in pedagogy as continuous testing during which students' weekdays for quizzes and tests are unending. Dejene (2019) explained that despite some apparent variations related to category size, it provides feedback from teachers within different establishments. Instead, these continuous study assessment results want constant dialogue and discussion among instructors on day-after-day teaching, following and sharing, and complementing.

Modern teaching is more straightforward in teaching-learning methods than traditional teaching methods; as a result of this standard approach, scholars learn at their own pace (Luzano & Ubalde, 2023). It is a free self-learning vogue during which immediate reinforcement and feedback is provided to follow exercise, encourage the scholars, and make them interested (Sadiq (2014). He concluded that the standard approach maximizes the probability of student participation in the schoolroom to fulfill the given tasks on the spot. Hence, the scholar's area unit is at liberty to be told in their vogue.

Modules should be valid for standard assurance and monitoring progress (Dangle & Sumaoang, 2020). Dangle & Sumaoang (2020) mentioned that academics should be ready to address some oldster and students' feelings, that is, to wait enough to reach the requirements and retort to the queries in real-time regarding learning. As Dangle and Sumaoang (2020) stated, the United Nations agency self-addressed those students who still cannot access the web; they're going to incline particular thoughts by home visitation as an example. Dangle & Sumaoang (2020) mentioned that the academics ought to re-evaluate the modules and check that every one of the teachings or activities area unit is acceptable to the learners' requirements.

Students' Learning Efficacy in Mathematics

Libii (2007) revealed that learning efficacy demonstrates how to evaluate the learning that an individual learner can make in a given class. Learning efficacy was the student's performance with their abilities to achieve something that aims to be intended accordingly.

The same article of Libii (2007) discussed students' grades and performance in their mathematics class to compare their learning efficacy. It shows the importance for students to know their performance as a learner to have the encouragement to accomplish tasks in

mathematics which are given to them, no matter how hard it is. The authors from the same study argued as well that some problems that are offered are complex. Most of the time, they start from easy solutions. However, it becomes more and more difficult in the more profound development of its concept. The difficulty level in math subjects tends to become more challenging as it is commonly delivered now in an online and modular type of learning. Learners with a high level of intelligence will have the possibility to have better learning efficacy in mathematics classes than learners with a low-level of intelligence but with a different learning environment (Putri & Prabawanto, 2019).

Students' learning efficacy in mathematics may require knowledge and deeper understanding, making it more challenging to many students. "Chalk-and-talk" as a traditional face-to-face discussion is still in demand nowadays for many learners, who need more guidance and step-by-step solution and explanation on the subject. Yet, the innovation and advancement of technology today made the teaching and learning of math to be facilitated online with many advantages (Shing & Voon, 2014). The theory from Multon et al. (1991) all contested that student's discernment of their learning environment either positively or negatively can affect their learning efficacy.

Consequently, Aliverni & Lucidi (2011) mentioned that learning efficacy is not only an appropriate reflection of the learner's learning performance in mathematics; it helps students adjust and adapt to the new learning environment even though they do not have enough online and modular experience (Swan, 2004). Engelbrecht et al. (2020) all analysed in their study the idea of online learning and how to enable its uses as implemented in a variety of mathematics teaching subjects, given the rise of new online mathematics learning resources and pedagogical approaches to teaching.

As has been said by recent reports, Choi et al. (2017) realized that K-12 online school and modular school learners had shown lower effectiveness in mathematics than their usual classroom school discussion. Moreover, different researchers are struggling in looking for what kind of educational approach online learning and modular learning appropriately well-suited to develop enhancement in mathematics performance. Many students control their learning efficacy (Chang & Ho, 2009), mainly for those naturally adaptive to different learning environments.

Also, the research findings of Jaffe (1997) showed that a more significant amount of communication and interaction with peers increased learners' learning efficacy. Bursal & Paznokas (2006) reported that the level of anxiety a student has with mathematics could be reduced depending on the pedagogical approach imparted in different learning platforms. Different classroom environment affects the level of efficacy of students with regards to mathematics. Thus, more online and modular learning activities in mathematics subjects should be facilitated in the future.

Based on the review of related literature, it has been found that there is no clear significant difference between the three variables. Hence, this study is proposed to focus on finding out if there is a significant difference in the students' learning efficacy in mathematics in online and modular modes of learning.

2.1 Research Design

This study employs a Descriptive Quantitative Design. According to Formplus Blog (2021), descriptive research designs are useful in conducting a study where it aims to identify characteristics, frequencies, trends, correlations and categories. Descriptive research used to describe a population, situation or phenomenon that caught the interest of the researchers and it focuses on answering the how, what, when and where queries (Formplus Blog, 2021). As mentioned by Fluet (2020), descriptive research is considered as conclusive and is used to test specific hypothesis and describe characteristics or functions. As studied by Mittal (2010), descriptive design uses survey method, cost and data analysis technique. The descriptive research approach is a basic research method that examines the situation, as it exists in its current state. The current study included data in the form of statistical figures and tables. The researchers have chosen this research design to determine the extent of the differences between two or more variables using statistical analysis appropriate to the study's aim. It describes the differences between the modular and online modes of learning to the students' learning efficacy.

2.2 Research Environment

This research was conducted in one of the higher educational institutions in Pagadian City, Zamboanga Del Sur. The researchers chose this environment because the schools' learning platform from the face-to-face learning environment drastically changed to the modular and online learning mode. The sudden change was due to the significant impact of the COVID-19 pandemic. They are among those many educational institutions in Pagadian City's locality that temporarily swiftly distances learning to implement safety protocols to avoid the virus's spread.

2.3 Research participants

The research participants in this study were the Junior High School students in one of the higher educational institutions in Pagadian City, Zamboanga Del Sur. Of the 205 students, 136 were chosen as participants for this study who are enrolled in modular and online learning modes.

2.4 Research instruments

The instrument that the researchers used to gather data was a Likert scale questionnaire. The questionnaire presented by the researchers was adapted from the work of Balbalosa (2010). The researchers made two questionnaires, one for the students who chose modular learning and one for the students who chose online learning. In the questionnaire for online learning, there was one question given by the researchers. The questions are about the student-related factors; students will rate their interest, study habits and their internet access in learning mathematics. Then, for the questionnaire for modular learning, the questions are about the student-related factors; students will rate their interest, study habits and their modules' content in learning mathematics.

The researchers would give the students questions to answer and the students' answer scores through the scales provided in the questionnaire. They wanted to know the possible things that can affect the students' learning in mathematics to the different learning methods, specifically in online and modular learning modes.

2.5 Data gathering procedure

The researchers gathered data by first writing permission to conduct the research study via a formal letter addressed to the School Principal and the respondents' class adviser of the said higher educational institution. After permission was granted, the researchers handed consent forms to the participants to be signed by their parents or guardian and returned to the researchers at the beginning of the data gathering process. The permission and consent letter's content were solely to get the approval to conduct the quantitative research study entitled "Students' Learning Efficacy in Mathematics in an Online and Modular Modes of Learning" in the said school. The permission to conduct research addressed to the school principal was obtained, the researchers got the list of participants in their respective adviser. After receiving the list of the participants, the researchers contacted the selected respondents from the modular and online learning mode to answer the Likert scale questionnaire through google forms. Questions were designed to gather information regarding general information about the indicators of the study. It was facilitated to identify the efficacy of the students learning in mathematics based on the indicators. Then document analysis was conducted by the researchers right after gathering the data. Document analysis was used to collect the data for the existing file of the participants' responses.

The document give clarity to the hypothetical statements anchored in the study that was tested using the 0.05 level of significance:

1. There is a significant difference between the online mode of learning and students' learning efficacy in mathematics.

2.6 Statistical Treatment

The type of data in this study was ordinal. It was a kind of categorical data that was determined via scale, data that flows naturally. The test conducted in the study was the Independent Sampling T-Test statistical analysis used to figure out if there was a significant difference between the means of two groups which tests the hypothesis by making inferences from the data gathered before determining the significant difference between the three variables.

2.7 Ethical considerations in research

The researchers followed all the ethical and legal procedures in conducting the survey. Participants were informed by presenting the permission letter for their voluntary participation and informed consent for the participants' involvement. The participants were assured of the confidentiality of their identity. The following principles were observed in the study:

Full consent. The participants should approve it before the study. That means the respondents should participate based on informed consent. It must contain appropriate information and assurance regarding full participation, respondents should not be forced to participate, and any pressure or coercion should be prohibited. Voluntary participation is highly considered. In that way, participants have the right to withdraw from the research study at any given time if they wish to do so.

Anonymity. The educational institution and participants in the research study must be ensured and considered greatly important. It should examine an appropriate level of confidentiality of the research findings. Any misleading information, as well as primary data findings in a subjective way, must be avoided.

Citation. It should take maintenance of objectivity in the analysis of data. That includes the proper citation of works of other authors used in any part of the study to avoid copyright infringement and must be written in an APA format.

3. RESULTS

This study presents, analyses, and interprets the Modular Mode of Learning, Online Mode of Learning, and Student's Learning Efficacy in Mathematics. The indicators for Modular Mode of Learning are Interest, Study Habits, and Module's Content. The indicators for Online Mode of Learning are Interest, Study Habits, and Online Learning.

3.1 Modular Mode of Learning

The interpretations of the indicators in the modular mode of learning and the corresponding weighted means of the students' responses to their interest, study habits, and module content in learning and performing mathematics in the modular mode of learning indicated that the students gave a unifying response on their learning efficacy in mathematics in a modular mode of learning. The overall weighted mean of study habits is 3.73. This means students have a *High Efficacy* in their mathematics subject despite the new normal learning environment. According to Malik (2012), modular mode of learning has proven to be an efficient and effective learning method to help learners learn. The indicators may differ in components but are shown systematically by identifying key questions for effective learning so that students can reflect on their own experiences and skills on modular instruction. Sadiq (2014) supported this contention by saying that for modular instruction to be effective, it has to be related to new ideas to previous existing knowledge, structured in a balanced student workload, can provide clear explanations and cognizance base knowledge to students and provide opportunities to students as well for them to pursue topics in depth so that they can understand the material for themselves.

3.2 Online Mode of Learning

The overall weighted mean of online learning is 3.56, indicating a high level of efficacy in student learning. This suggests that students generally feel confident in their ability to succeed in an online learning environment.

When analyzing the questionnaire items, it is noteworthy that the students reported a high level of confidence in their ability to achieve good grades in mathematics. This finding reflects the positive perception students have regarding their mathematical skills and their belief in their ability to excel in this subject within the online learning context.

However, it is important to consider that the act of working on mathematics activities appears to be a significant source of stress for students. This finding suggests that while students feel confident in their ability to perform well in mathematics, they may still experience challenges or difficulties when actively engaging with mathematical tasks in an online setting.

The results find support from the study of Cortes (2020). The study agreed that video tutorials, PowerPoint, studying at home, validation of the teachers, combining virtual and actual lectures, can all be beneficial. The data is similar to the findings of the related literature since the students present high efficacy in learning mathematics through online mode of learning despite the instances that they have encountered. He added that on average, the students “agreed” that they learn more in video tutorials but they still need validation from their teacher (Cortes, 2020). He proved that 63% of the students believe that virtual classes are good as classroom lectures. In this study, the higher the value is, the learning efficacy is higher. The results indicated that the Online Learning in mathematics impacted high efficacy to the students.

4. DISCUSSION

Based on the data gathered, the overall mean response of the students in an online mode of learning in mathematics is 3.73 which is interpreted as high efficacy. While, in modular mode of learning, the overall mean response is 3.72 which is also interpreted as high efficacy. The result indicated that there is no significant difference in students’ learning efficacy in mathematics in an online and modular mode of learning. Therefore, the researchers conclude that the Grade 10 students’ learning efficacy in mathematics in an online mode of learning is not different with the students’ learning efficacy in mathematics in the modular mode of learning.

In general, it can be indicated that the following indicators such as interest, study habits and module’s content/online learning have proved to be not significant. That is to say, according to the t-test statistical analysis result, no differences are observed in the evaluations given by the students. It should be borne in mind that these findings may be motivated by the application of the mode of learning applied. This fact, in turn, can lead to a better acquisition of mathematical concepts and results, given that being interested, having study habits, and confidence with the module’s content or online learning allows the student to increase his or her learning efficacy in mathematics, and in his or her view, to present more interest in the lessons being given on modules and discussed online. It can be concluded that the modular and online mode of learnings is effective to students who are studying mathematics, provided that it is compared with each other but has no significant difference. In this case, the high efficacy occurs for all indicators. Therefore, the use of the modular and online modes of learning are both effective for their implementation to the students who are studying mathematics in Grade 10.

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