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From medals to modules: A retrospective study of mathematics learners' pandemic experience

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Abstract
Mathematics is considered a critical life discipline that all learners must pass. For the past two years, the system of education from traditional setting is shifted to distance learning due to the COVID-19 pandemic. New normal Mathematics education is the new way of teaching and learning Mathematics employed to address the educational needs of students. Many studies have found the positive results of blended learning, and also a positive impact of blended learning on student achievement has been shown. This research utilized the qualitative approach – explanatory case study design which is designed for the researcher to gather data about the factors that influence the performance of selected Grade 10 students in learning mathematics. The case to be studied includes students who usually do well in school during face-to-face setting but got low grades in the times of pandemic. Results showed that the performance of students in learning mathematics can be influenced by factors such as learner competence, self-efficacy, learning environment, digital inaccessibility and teacher competence. The main reason of this problem is the mode of delivery which is the online delivery mode of learning. Therefore, it was necessary for the students to establish a routine in studying math. Students need more engaging activities to motivate them.

Keywords: Pandemic, online learning, factors, mathematics performance

Introduction

For the past two years, the system of education from traditional setting is shifted to distance learning due to the COVID-19 pandemic. New normal Mathematics education is the new way of teaching and learning Mathematics employed to address the educational needs of students during the pandemic. Although research studies in online learning have risen significantly in the last years, much is still unknown regarding factors influencing learner achievement in these online learning environments utilizing LMSs. In this day and age, technology affects almost every aspect of our lives and continually change the way we learn, teach, and work on the information. With the help of the Internet technologies, e-learning or online learning that makes new instructional practices convenient for students, which was not possible in traditional classroom settings due to time and space constraints, has become a noteworthy method (Cigdem, 2015). [3] With this, the researcher focused the study on identifying the factors affecting the readiness of Grade 10 students' learning in Mathematics in St. Mary's Academy. The goal of the study is to investigate how these factors affect the students in their journey of learning Mathematics and how they cope with these challenges.

Distance learning is a learning delivery mode where interaction takes place between the teacher and the students who are geographically remote from each other during instruction. This means lessons will be delivered outside the traditional face-to-face setup. In the Philippines, it is transitioned to a blended type of learning in which students learn through electronic and online media as well as traditional learning. It is a more personalized approach to learning, giving students control over the time, place, path and pace of their learning. This is so called the "new normal".

Many studies have found the positive results of blended learning, and also a positive impact of blended learning on student achievement has been shown (Lee, Yoon, & Lee 2009) [9]. Escobar-Rodriguez and Mongo-Lozano (2012) [5] claimed that learning-teaching process has become better by using MOODLE. COVID-19 pandemic has affected all levels of the education system. Educational institutions around the world in (192 countries) have either temporarily closed or implemented localized closures affecting about 1.7 billion of student population worldwide. Many parents and educators thus share a common worry. When the pandemic subsides, students will return to school with lower achievement. There are also concerns that the gap between high and low achieving students will become larger.

Online learning readiness can be described in three major features: choices for online learning as opposed to face-to-face learning instructions; competence and confidence in using the technological tools; and ability to learn separately (Tang & Lim, 2013). [20]

Research studies show that student's academic performance depends on many factors. The performance of students in academics is not only influenced by their own characteristics gifted by the nature but also various factors are involved in these achievements. For the economic and social development of the society, it is necessary to provide our children with the quality education.

According to Cavas (2011), motivation is a fundamental education variable as it helps previously learned skills, strategies and behaviors to promote new learning and performance. Without motivation, proper curriculum and good instruction are not enough to guarantee the success of students (Dornyei and Csizer, 1998). Motivated learners are attributed to have low latency and high perseverance about task engagement (Artino & Stephens, 2009), [1] and therefore, their motivational orientation towards a task has significant influences on their performances (Hung *et al.* 2010). [8]

With these new modalities in the education sector, there are questions raised concerning the readiness of the learners. At this time of pandemic, it is a must to know how the

educators handled the situation in facilitating learning and the challenges that are faced in this transition while abiding to the protocols of IATF.

Methodology

This research utilized the qualitative approach – explanatory case study design which is designed for the researcher to gather data about the factors that influence the performance of selected Grade 10 students in learning mathematics. A case study is a research approach that is used to generate an in-depth, multi-faceted understanding of a complex issue in its real-life context. The case study facilitates the exploration of a real issue within a defined context, using a variety of data sources (Baxter *et al*., 2008). An exploratory case study design is used to develop an initial understanding of the program or phenomenon of interest. The focus is on discovery for the purpose of obtaining an empirically based introduction to the structure, dynamics and context of the subject of interest.

The research locale of this study is St. Mary's Academy (Oslob, Cebu), Inc.. This school is located in Jose P. Rizal Street, Barangay Poblacion, Oslob, Cebu. It is a private, co-educational Catholic school institution owned and operated by the congregation founded by Venerable Ignacia del Espiritu Santo known as the Religious of the Virgin Mary or RVM. Its core values are faith, excellence and service. It is an Ignacian Marian school committed to provide quality Catholic education for the development of persons. SMA-Oslob was officially established in 1949 in Oslob, Cebu. As an RVM institution, it centers its education to developing the Catholic faith of students, especially cultivating Ignacian- Marian values. It is an RVM educational institution witnessing to the loving compassion of Jesus. The researcher is an educator of the said school that is why the study will be conducted here. The school's vision includes empowerment of learning communities, that's why students need to be competent in learning mathematics.

This study utilized a teacher-made respondent's profile form to be used for the profiling of the students as the research respondents. This form enables the researcher to identify the respondents' information such as name, age and gender. The study also utilized interview guide as its main instrument. The interview guide is in the form of a table which contains the different questions to be answered. These are research questions which help the researcher identify the factors that affect the students' learning in Mathematics. Each research question contains one opening, one content and one closing question. This interview guides are given to the selected students.

The researcher used purposive sampling method. In this method, participants were selected purposively because they have characteristics that the researcher need in the sample. Participants are selected based on who can provide an informative answer to the research questions and those who can enhance understanding of the phenomenon under study (Kuper, *et al*., 2012). The participants of the study are students who do well in Mathematics before pandemic but got low grades during pandemic. To identify them, the researchers compared their grades before and after the pandemic. The main participants are the students from Grade 7 to 10. There will be 6 participants of the study.

Before data gathering, a letter was sent to the School Principal of Saint Mary's Academy as well as to the Campus Director of Cebu Technological University – Argao Campus. This letter contains the request to conduct the study in Saint Mary's Academy. After the approval of the principal, the researcher asked the permission from the adviser of the students. Lastly, the researcher asked the permission from the subject teacher in Mathematics.

To commence the data gathering, after the request had been granted, the researcher distributed the forms and start the interview. The respondents were asked through the research questions and if needed, follow up questions were given. An in-depth interview happened. Afterwards, the researchers collected the tools which were used for data gathering.

After data gathering, the gathered data were tabulated, analyzed and interpreted. Explanation of results was done. The researcher interpreted the data and make a conclusion. It is made sure that the information gathered is dealt with much confidentiality.

Data in the study were analyzed using the analytical framework of Braun and Clarke (2006). Data for this study were thematically analyzed. Thematic analysis is an approach for detecting, analyzing, and reporting patterns (themes) within data (Braun & Clarke, 2006.) Thematic analyses employ analytic practices such as sorting and sifting through the data set to find comparable words and/or links.

Results and Discussion

This chapter presents the results, analysis and discussion of data gathered. The responses from the interviews were recorded, transcribed, analyzed and evaluated. The presentation sequence was aligned with the order of the specific problems as indicated in the first chapter. The results are displayed through figures and tables for analysis and discussion.

Factors Affecting the Students Performance in Mathematics

The first table shows the learning experiences of the students which reflect five themes with corresponding categories for each theme.

Table 1: Factors Affecting the Students Performance in Mathematics

Themes	Categories
Learner Competence	• Student's Learning Capabilities • Self-Awareness
Self-Efficacy	• Self-Management • Learner's Attitude
Learning Environment	• New Mode of Learning (HYBRID) • Physical Environment
Digital Inaccessibility	• Internet Connection Problems • Accessibility
Teacher Competence	• Teaching Method • Availability of the Teacher

For the first problem, there are five themes with two categories each. One of these themes is learner competence. Under the learner competence, the two categories are the student's learning capabilities and self-awareness.

Self-management and learner's attitude are the two dominant categories under the self-efficacy. This refers on the student's belief in his or her capacity to execute his or her behavior. On the learning environment factor, the dominant factors are new mode of learning and physical environment. Some students are adapting to the new mode

of learning. The fourth factor is digital inaccessibility which includes internet connection problems and accessibility as its two dominant categories. To attend online classes, students need to connect to the internet. Some can't attend due to its poor internet problems. The last factor affecting the student's performance in mathematics is all about the teacher competence. Two of its categories include teaching method and availability of the teacher. Other factors include social problems in which one of the students is hesitant to ask her teacher.

The first research question talks about the factors that affect the student's performance in learning mathematics. The first factor is the competence of the learner. Learner competence is defined as the "mastery of learning by students through their demonstration of knowledge, attitudes, values and skills, and behaviors (Gervais, 2016).

According to the 21st century learning skills, these skills are often called as the 4 Cs. These are critical thinking, creative thinking, communicating and collaborating. These skills enable students to learn which are very essential in school and beyond. The critical thinking of the students is not fully developed. Through this critical thinking skill, students tend to expand the perspectives from which they view the world and increase their ability to navigate the important decision in learning. The absence of the teacher's physical presence during the instruction made the students not capable in their learning. Students finds it difficult to communicate with the other students and teachers online, making online learning more challenging than face-to-face learning.

According to an Australian professor, Bill Lucas, [12] in his article, capabilities are useful in education and in life, so need to be treated with the same respect that is applied to general subjects. Education has a long and wide-reaching history of growing capabilities and character in young people. These capabilities not only help students engage with learning, they can be the difference between simply knowing a factor or a skill and being able to use that in a job or a social setting. Learning capacity can be defined as ways that individuals recognize absorb and use knowledge (Henley, 2014).

According to Vocabulary.com (2014), the word capacity means the ability to do something. Learning capability is the ability to learn. During the pandemic when modules and online classes were the means of instruction, students found it difficult to grasp what is really taught during that time. It takes a hard time for them to understand every lesson especially in the subject, Math. Cognitive theory states that learning capacity is what going on inside student's mind. Since students are at home, it is inevitable that they'll focus more on others rather than answering their tasks and activities. Learners who have positive teacher-student relationships may have the feeling of closeness, warmth and positivity which will increase their learning ability (Hamre & Pianta, 2001). But some students have no confidence in asking their teachers about their concerns.

Self-awareness, on the other hand is your ability to perceive and understand the things that make you who you are as an individual, including your personality, actions, values, beliefs, emotions, and thoughts. Essentially, it is a psychological state in which the self becomes the focus of attention.

During pandemic, online learning is the only way of learning without interruption. Students with a high level of self-awareness can perceive online learning and maintain their willingness to continue using it. In the case of Kyla, she belongs to most of the students whose willingness and motivation were lost during that time. Self-awareness contributes to better decision and making and team performance (Dierdoff & Rubin, 2015), [4] increased leadership success (Showry & Manasa 2014), [18] and more opportunities for career advancement. It is very essential to be aware of oneself. A person's attitude affects the learning process and the desire for education throughout life. Most of the students are aware that they are struggling a lot and having difficulties in learning mathematics.

Greene, Yu, and Copeland (2014) studied how self-regulation influenced student's learning in digital environment. The student's learning capability generally dictates the pace at which he or she can learn. Students should be aware of themselves on how they will deal with their learning. Self-awareness is the ability to focus on yourself and how your actions, thoughts, or emotions do or don't align with your internal standards (Betz, 2022). Self-awareness can be broadly defined as the extent to which people are consciously aware of their internal states and their interactions or relationships with others (Trapnell & Campbell, 1999).

The second table shows how these factors influence the student's performance in learning mathematics.

Table 2: How these Factors Influence Student's Performance

Themes	Categories
Disengaged in Learning Mathematics	• Lack of Productivity • Loss of Interest
Low Academic Performance in Mathematics	• Poor Literacy • Poor Performance

These factors of the main respondents had led them to be disengaged in learning mathematics and low academic performance in mathematics. Under the disengaged in learning mathematics includes lack of productivity and lack of interest. Since some of the students are not motivated to learn mathematics, they tend to be unproductive in their studies and they had lost interest in learning. Low academic performance in mathematics is also the effect of these factors. They didn't understand the lessons well. As a result, they had poor performance in mathematics. They got low grades.

After a long process of interview among the six interviewees, the researcher asked them on their say about the interventions so that they can learn mathematics better.

The second research question is, "How do these factors influence the students' performance in learning mathematics?"

The experiences of our six respondents were carefully analyzed to fully understand how these factors affect their performance in learning mathematics. The first theme is "disengaged in learning mathematics". Disengagement in learning mathematics means disinterested and disengaged from the subject, perceiving it to be boring. Under this theme are the two categories, lack of productivity and loss of interest. Because of a lot of factors, the students weren't interested anymore in learning.

Learning loss occurs due to the lack of quality and facilities for online learning as well as the ability to use online learning systems (Donnelly & Patrinos, 2022). Therefore, it has an impact of decreasing learning achievement. Learning loss is the loss of basic competencies that students should

learn. This learning achievement gap causes students to not master the competencies needed because they are unable to follow the material or lose basic competencies that should be learned (Fitriani, Bandung, & Kadri, 2020). The learning process carried out in uncomfortable conditions will never be effective. Furthermore, this will affect the psychology of students which has an impact on their motivation and interest in learning. Loss of interest means students see little value in the course or its content. Students do not believe that their efforts will improve their performance and they are demotivated by the structure and allocation of rewards.

Most of the students struggle with the way distance learning is being implemented. The sudden shift to distance learning was one of the most significant adjustments students had to make. Nenko *et al*. (2020) [16] found similar outcomes regarding student experiences during the COVID-19 pandemic and distance learning as overall negative. With studying at home, children are also stressed and helpless for a long time so learning loss arises as a manifestation of the loss of children's opportunities to learn due to the demands of the applicable standards and curriculum. Online learning activities have turned into offline learning resulting in students needed more motivation to come to class to learn. This reduces the abilities and learning activities of students. In a broad sense, learning loss is generally caused by internal gaps in the student's education.

The second theme talks about low academic performance in mathematics. Academic performance is the measurement of student achievement across various academic subjects. Academic performance is important for students as a result of educational experience in colleges to represent knowledge, skills and attitudes. It becomes one of the key factors in determining students' success in their future careers. Under this theme are the two categories, poor literacy and poor performance. Bringula et. al (2021) stated in their study that the students have a positive and negative mathematics self-concept during this online learning which is influence by the challenges they are facing. Students who have low literacy are more likely to get bad grades, have more school absences and display behavioral issues.

The third table shows how the coping strategies of the participants.

Table 3: Coping Strategies of the Participants

Themes	Categories
Conducting Engaging Activities	• More activities • Active learning
Instructional-based interventions	• Self-Regulation • Self-Management

The third table summarizes the coping strategies given by the main respondents on how to learn mathematics better. The respondents suggested more interesting and engaging learning activities to make them more interested on the subject. They also suggested to help them manage their time well so that there will be routine on what they are doing.

The third research question talks about the interventions suggested by the respondents. An intervention is a specific strategy used to meet a specific goal to address a problem or behavior. One theme under this is conducting engaging activities. Engaging activities play a vital role in promoting mental and emotional well-being, combating isolation, maintaining routine, fostering skill development, supporting physical health, stimulating creativity and learning. Conducting engaging online activities is the first theme. Under this theme are the categories, more activities and active learning.

Engaging in math learning activities ensures that students continue to build and reinforce essential mathematical skills. During the pandemic, it is very essential to note that students really need these activities to motivate them to answer. In fact, many researchers who endeavored to develop educational games for learning mathematics have shown that their games could facilitate mathematics performance, enjoyment and self-efficacy (Ku *et al*. 2014). [9]

It is essential that schools put in place policies to ensure that students continue to access high-quality and rigorous learning, that student's basic needs are addressed, and that their social, emotional, and mental health needs are met. Students should receive high-quality, technology-enabled learning experiences focused on inquiry, collaboration and content creation. Before any changes to instructional modality, schools should engage teachers, staff and families in a proactive, accessible and ongoing planning, implementation, and continuous improvement process that include frequent communications about what roles and responsibilities everyone will play.

As part of the intervention, it is necessary that teachers provide rigorous instructional materials, including online content, that appropriately meet students where they are in order to meaningfully engage, enrich, challenge, and support them in effectively continuing their academic progress toward proficiency and beyond. To support students with disabilities, schools should ensure all materials are accessible and must facilitate access to instruction and content. High quality learning while students are temporarily unable to attend school in-person includes both daily live interaction between students and their teachers and daily and frequent live interaction between students and peers in order to support student well-being and maintain strong school relationships.

Active learning refers to a broad range of teaching strategies which engage students as active participants in their learning during class time with their teacher. Active learning methods ask students to engage in their learning by thinking, discussing, investigating and creating. In class, students practice skills, solve problems, struggle with complex questions, make decisions, propose solutions, and explain ideas in their own words through writing and discussion.

The other theme under this research question is all about instructional-based interventions. Instructional based interventions are strategies and techniques used in education to enhance learning and improve outcomes for students. These interventions are designed to provide targeted support and instruction to address specific learning challenges or to enhance overall educational experiences. Self-regulation and self-management are the two of its categories.

Conclusion

The performance of students in learning mathematics can be influenced by a lot of factors. The main reason of this problem is the mode of delivery which is the online delivery mode of learning. Learning mathematics in the new normal was really challenging. Therefore, it was necessary for the students to establish a routine in studying math. Lack of self-discipline enabled them not to perform their tasks

properly. Time management also mattered. With the different temptations technology may bring, students should learn to be focused and consistent on what they're doing. On the other hand, teachers have to implement different strategies that will cater the needs of the students while they are working and studying at home. These learning strategies will surely help the students lessen their difficulties and disengagement in math. The presence of the teachers, too, online was in need to reach out the students and answer their concerns. The researcher conclude that students need more engaging activities to motivate them to learn the lessons. Students need guidance of teachers in their work. Teachers need to allocate more time re-aligning their learning materials to make them suitable for the digital instruction.

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