

Strategies of Bachelor of Secondary Education Major in Mathematics Students in Learning Calculus Online

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Abstract: This study explored various strategies for Bachelor of Secondary Education major in Mathematics students learning Calculus online. The research participants were the six third-year students of Saint Columban College who were officially enrolled in Calculus online classes during the school year 2021-2022. A single case study was utilized. The study was supported by the collective data from multiple sources, such as interview guide questions answered by the research participants, the calculus instructor, and the researchers' observations from the recorded class discussions. The researchers found that participants had strategies such as browsing in Google, utilizing online calculators, watching YouTube videos, asking the help of classmates, and relying on given related examples by the Calculus instructor. The participants mentioned that they rely on the positive feedback from the Calculus instructor and gaining good grades as to describe effectivity of their strategies in learning Calculus online. The research participants identified the following demands: negative attitude of the students during the discussion with the Calculus instructor, students' difficulties in answering the worksheets, unstable internet connection, and students' breakdown during online classes. The research participants also stated that finding a place with stable internet connection, having an online collaboration with peers, relying on related worksheets and YouTube videos posted online, and motivating each other were their means of dealing with these different demands in learning Calculus online. The researchers recommended that students must be resourceful in finding sources and must adapt appropriate strategies in learning Calculus online so they can easily manage the difficulties in performing the necessary solution in every problem. The suggested recommendation could help the plans of the Commission on Higher Education on quality education and to numerous studies and researches.

Keywords— *Strategies; Online Calculus Classes; Online Learning*

1. INTRODUCTION

The global higher education sector has been severely impacted by the coronavirus 2019 (Covid-19) pandemic. The World Health Organization (WHO) has warned about the virus's risks and raised the risk of transmission from a global level to a maximum or very high degree of preparedness. The current pandemic has altered the process of social interaction in society, affecting all aspects of daily life, including education, including universities. Residents have been prohibited from gathering, large-scale social contacts, maintaining social distance, becoming physically touch, washing hands, and wearing masks, among other measures implemented by the authorities. From the most basic to higher education, all learning must be done online, virtual, or distance learning by March 2020, according to the government (Khasanah et al., 2020).

The learning delivery system is an issue that should be addressed as we go towards fighting the pandemic Covid-19, which impacts not just the Philippines but all countries across the world. Furthermore, there are many controllable factors that influence learning, such as anxiety, which are often unknown to students and their instructor. Students must be strategic in their will, skill, and self-regulation, as well as adapt well to their academic environment to take charge of their learning, according to Weinstein's Model of Separation Learning (2007).

Calculus has received attention in the field of mathematics education due to its wide-ranging importance and usefulness in college/university education. A significant amount of research has been done to study this subject with respect to a variety of aspects, from reforming the Calculus curriculum to the teaching and learning of specific topics in the subject. Researchers in mathematics education have concentrated on Calculus for a variety of reasons, including the fact that it is widely regarded as the gateway course that students need to pass through in order to successfully complete their degree programs. Students indicated that instructors did not demonstrate an understanding of relationship between the amount of material to teach/learn and the constraint of time allotted to do so, according to Ellies et al., (2014), who specifically analyzed the difference between students' and instructors' perception of instructor's pedagogical activities in teaching Calculus.

In this research study, the researchers aimed to explore strategies of Bachelor of Secondary Education Major in Mathematics Students in Learning Calculus Online in line with the New Normal System of Education adaptation. The researchers were interested to find out the various strategies of learning Calculus online, their different demands, and their ways to cope with those demands.

1.1 Perspective of the Researchers

The researchers were Kimberly M. Apiag, the daughter of Mr. and Mrs. Jose C. Apiag, and a resident of

Barangay Pantad, San Pablo, Zamboanga del Sur. And Alfe Escandallo, the son of Mr. and Mrs. Fernando L. Escandallo and a resident of Prk. Peña, Poblacion, Pitogo, Zamboanga del Sur. Also, Alpha Raidin O. Salibo, the son of Mr. and Mrs. Badrocin T. Salibo and a resident of Barangay Tapodoc, Labangan, Zamboanga del Sur.

The researchers were Third-Year college students taking up the Bachelor of Secondary Education Major in Mathematics at Saint Columban College.

The researchers were very motivated to study the strategies of Bachelor of Secondary education major in mathematics students in learning Calculus online. With this new normal form of education nowadays, they wanted to describe the different demands in learning Calculus online and how it must be dealt. The researchers aimed to give additional guidance to future BSED-Mathematics students that these strategies in this study are significant in learning Calculus in an online class modality.

The researcher also adopted the Constructivist's Philosophical Paradigm. It usually seeks to understand how individuals make sense of their everyday lives in their natural settings, either in the local or working environments. Thus, this study aimed to seek how the students determine their strategies in learning Calculus in the new normal. This kind of philosophical Paradigm is Paradigm described as an approach in that people construct their understanding and knowledge of the world by experiencing things and reflecting on those experiences (Honebein, 1996). It is based on how people can build much if they learn through experience (Cashman et al., 2008; Hein, 1991).

1.2 Theoretical Framework

Students are encouraged to be active, self-directed individuals who process information and develop knowledge through strategic learning (Weinstein, 1998). Skill refers to the various actions or thinking processes related to the recognition of key concepts and processes and how meaning is constructed. Will. involves individual learning attitude, motivation to concentrate and make efforts, and anxiety towards one's own learning performance. Self-Regulation (Zimmerman, 1990) describes how individuals manage their personal learning process, especially how to plan, monitor, focus on, and reflect upon their own learning. Strategic learning is defined and categorized by the above three components that include any thoughts, behaviors, beliefs, or emotions. Skill. Skill is a controlled component of the MSL in which students learn techniques to help them "know what to do" and "how to do it. Will is described as the want to employ learning abilities and resources (Weinstein et al., 2004), and it encompasses other ideas such as goal setting, attitude, motivation, and anxiety. Each of these variables, according to the Model of Strategic Learning, can influence a student's learning behavior. Self-Regulation. Self-regulation entails being conscious of one's own learning and actively managing it.

Collaborative learning has a significant feature of a learner's social context and support. Collaborative learning

refers to a variety of small-group activities, such as cooperative learning and Team Based Learning. The size and duration of groups, evaluation of the group process (both teacher-led and student-led), graded group work, assigned tasks, demographics of group makeup, and peer assessment are all examples of differences between the approaches (Boekaerts & Minnaert, 2006).

Another theory framing this study is the Constructivism Theory. This theory's idea is that learning does not just happen from traditional teaching methods, such as lectures. Learning occurs when the learner discovers knowledge through the spirit of experimentation and doing (Kalender, 2007). Constructivism theory teaches the learners to have the keen ability to make constructive arguments about issues and draw conclusions about certain phenomena. Many constructivist philosophers believe that if a learner fully engages and experiences a sure thing, they can discover knowledge and new things during the entire learning process.

The researcher used this theory as another basis for their theoretical framework because of its primary characteristics. Each individual interacts with each other with their experiences and their ideas. There are numerous Constructivist learning theories, but the common core that unites them is that learning is an active and unending process. It is unique to any individual and consists of constructing relationships of concept and meaning from information and experiences in the individual's repertoire. The principle of this theory is to provide reasons for learning within the learning activities.

1.3 Statement of the Problem

The purpose of this study was to determine the strategies of Bachelor of Secondary Education major in Mathematics students in learning Calculus online. This study sought to explore the following questions;

1. What are the different strategies of BSED-Mathematics students in learning Calculus online?
2. How do the BSED-Mathematics students describe the effectiveness of their strategies in learning Calculus online?
3. What are the different demands in learning Calculus online?
4. How do the BSED-Mathematics students deal with these demands in learning Calculus online?

1.4 Scope and Limitations of the Study

The study focused on the strategies of bachelor of secondary education major in mathematics students in learning Calculus online in line with the adaptation of the New Normal Education System and find its rightful place in the vast and varied field of educational research.

Subject Matter. This study should focus on strategies of Bachelor of Secondary Education major in Mathematics students in learning Calculus online.

Research Environment and Timeline. The study was conducted at Saint Columban College that adapted online class as a trend in 2021-2022.

Research Participants. The participants of this study were the third-year college students who enrolled in Saint Columban College S.Y. 2021-2022.

Research Design. This study used Qualitative Research Design and the paper objects to describe subjective experiences, interpret meanings, and understand concepts. Notably, Case Study because the study attempts to understand a group of people's behaviors, attitudes and skills.

Research Methods. This research utilized the Single Case Study Research by Sharan B. Merriam to understand a group of people's behaviors, attitudes, and experiences through multiple data sources.

1.5 Significance of the Study

The findings of this study would redound to the benefit of students in terms of knowing the strategies of Bachelor of secondary education major in mathematics students in learning calculus online in this new trend of learning. Specifically, this study is deemed to be very significant to some individuals:

Students. This research gave benefits to the students because they were the respondents of this study. The outcome of this study would help them in determining the strategies of bachelor of secondary education major in mathematics students in learning calculus online.

Teachers. This research could serve as the basis for how BSED-Mathematics students learn calculus online.

School Administrators. The study would help the administrators to sense what specific support must be provided to the BSED Mathematics students in learning calculus online.

Other Researchers. This study would guide future studies and be moved to replicate this study in new research setting with more respondents to consider.

1.6 Definition of Terms

The following terms would be used extensively in this study and shall be taken according to the definition given below:

BSED Mathematics Students. Also known as learners, they are considered a person who is learning about a particular subject on how to do something.

Calculus. Prior to the Leibniz-Newton inventions, the word "calculus" referred generically to any type of mathematics. Following their innovation, it came to mean the study of infinitesimal differentiation and integration. Newton developed his version of calculus in response to issues he perceived pertaining to his physics (Herres, 2015).

Mathematics. Mathematics is the science and study of quality, structure, space, and change. Mathematicians seek out patterns, formulate new conjectures, and establish truth by rigorous deduction from appropriately chosen axioms and definitions (Tennessee Tech University, 2022).

Online learning. Online learning is education that takes place over the Internet. It is often referred to as "e-learning" among other terms. However, online learning is just one type of "distance learning" - the umbrella term for any

learning that takes place across distance and not in a traditional classroom (Joshua Stern, Ph.D., n.d.).

Saint Columban College. SCC is the acronym of the school. It is a private Catholic academic institution in the City of Pagadian, Zamboanga del Sur, Philippines where the research study is conducted.

Strategy. In the opinion of (Alex & Dess (1996), "Strategy is a set of plans or decisions made in an effort to help organizations achieve their objectives."

1.7 Structure of the Thesis

The study consists five chapters: Chapter 1 The Problem, Chapter 2 Review of Related Literature, Chapter 3 Research Method, Chapter 4 Presentation, Analysis and Interpretation of Data, and Chapter 5 Summary of Findings, Conclusions and Recommendations.

Chapter 1 includes the introduction, statement of the problem, significance of the study, scope and limitation of the study and definition of terms. This chapter gave an overview of the research problem and the theoretical framework used in the investigation.

Chapter 2 discusses the review of the related literature. It discusses the relevant information connected to the current study.

Chapter 3 covers the research method, research design, research environment, research participants, research instruments, data gathering procedures and data analysis, and Ethical considerations in research. It presents in detail how the data was gathered and analyzed.

Chapter 4 includes the presentation, analysis, and interpretation of data. As the data are gathered then analyze and interpret in such that the results can be used for drawing conclusions and recommendations.

Chapter 5 contains the summary of findings, conclusions, and recommendations of the study.

2. METHOD

2.1 Research Design

The study used qualitative research design because the paper objects to describe subjective experiences, interpret meaning, and understand concepts. It utilized the Single Case Study Research Method and data triangulation. It tried to comprehend the person's actions and attitudes (Ortiz, 2006).

This study focused on the strategies of Bachelor of secondary education major in mathematics students in learning calculus online. Therefore, Sharan B. Merriam's Case Investigation methodology was preferred in this study. The chosen model's attributes are Specification, Descriptiveness, and Heuristic (Merriam, 1998). It is particularistic since it concentrates on a certain circumstance or phenomenon. The rapid transition from traditional face-to-face instruction to online learning is the specific issue in this study. The in-depth reports in this study were constructed using data from several sources. Additionally, Heuristic in the way it enlightened readers' or other researchers'

comprehension of the issue under study. The researcher sought to draw attention to previous studies and scholars who had an interest in this study was new. The model followed specific steps, including conducting a literature review, developing a theoretical framework, identifying the research problem, formulating standards on crafting and honing research questions for data collection, such as using interview guides, setting clear objectives before the interview, consistently interacting with the interviewee, recording, and evaluating data. Triangulating data from multiple sources improves the validity of a study by reducing any bias resulting from a single attempt and aiding in the establishment of facts (Beverland & Lockshin, 2003). Additionally, data sources are triangulated to determine how facts, interpretations, and perceptions converge, so confirming the validity and reliability of the study (Hammersley, 2008).

2.2 Research Environment

This study was conducted in one of the private educational institutions run by the Roman Catholic Diocese of Pagadian in Pagadian City, Philippines. The school was established in 1957, and it is the largest among the Diocesan Schools of Pagadian, offering complete basic and tertiary education.

2.3 Research Participants

The study's participants were the six college students in Saint Columban College with the degree of Bachelor of Secondary Education – Major in Mathematics who are officially enrolled in Online Learning Modality of the S.Y. 2021-2022. The six participants experienced having an online class in calculus 1, calculus 2 and calculus 3 with the same instructor. Two of them were consistent dean's lister. Some of the research participants were excellent in Calculus class. Some research participants were also active in Calculus online class discussion.

2.4 Research Instruments

The main instrument of this study were the researchers, aided by an interview guide. Aside from the Interview Guide Questions for the students, the researchers served to be the first source of data that the researchers conducted. Integrated with two other sources of data coming from the Calculus instructor and observation of the researchers to the recorded online class discussions were integrated. The intent of having a triangulation of data sources is to increase the study's validity and reliability (Decrop, 2004). Having multiple instruments in gathering information is a good practice, primarily if a researcher conducts a Case Study Research Design (Merriam, 2018).

The tool being used in this study is the Interview method, otherwise perceived as Oral Questionnaire. It entailed a procedure where a researcher solicits data or information from the research participants through verbal interaction (McLeod, 2018). The researchers developed questions for the interview during the course, basically to seek the opinions of individuals. The questions are validated before the beginning of gathering essential data. The researchers

ensured that the verified instrument must not be bogus so that the collected data could give substance to the study. The researchers asked the interviewees if they wanted the questions to be translated into their most convenient language. The content of items indeed has responses that can be directed to the central problem and sub-questions. The involvement of the Calculus instructor of the participants is believed to be essential to this study, for they are the direct person who can provide immediate feedback.

2.5 Data Gathering procedure

Since the participants involved in the study were from Saint Columban College, the researchers requested authorization from the Schools Deans to run the study. Upon approval, the researchers informed and asked the participants about the study's nature and purpose. Triangulation of data was applied in this study to make sure that the results were well supported. The researchers provided consent and administered Interview Guide Questions to the selected participants. The Interview Guide Question for the participants and the Calculus Instructor were well-validated before dissemination as data sources. The researchers personally administered the instrument to the participants to encourage them to answer the questions wholeheartedly. The research participants were instructed to answer each question in oral form. During the process, there was an Audio Recorder to document every word that would stand as evidence for the vitae. The audio recording of the whole process of the interview was under the approval of the research participants. The researchers make sure to collect the Informed Consent before the start of the interview process to make sure that there was an acceptance of terms and understanding of the nature of the study. The trustworthiness of results is the bedrock of high-quality qualitative research (Birt, 2016). The researchers must check to have accuracy and resonance of thoughts and words. In other words, after putting recorded responses into writing, the researchers came back to the research participants. The research participants validated whether the transcription of their responses was accurate, valid, and meant to express what they wanted to express in the very first place. A countersign on each page indicated that they are satisfied, and what had been written and what they wanted to mean coincided. In this situation where we have a pandemic, the researchers follow a standard health protocol. The researchers gave big thanks to the participants as an expression of gratitude for cooperating and participating in the study.

2.6 Data Analysis

The researchers gathered all possible descriptive data from the responses of Research Participants, and Participants' Calculus Instructor. The results could be directed to the central question that tackles students' experiences in the new normal of using online classes. Since the utilized Case Study model is Sharan B. Merriam, the researchers then provided a holistic description, interpretation, and analysis of a case, such as the experiences of a group of people that belongs to a social unit. The summary's content described the study's primary features since the case study model involved

interpreting what the research participants had said and what the researchers had written.

2.7 Ethical considerations

Under the ethical consideration in qualitative research, this study protects the participants by non-exposure of identity. To achieve non-exposure, the researchers would not include their identities in interpreting the data from whom certain data came from. Additionally, the researchers would provide a consent form that consists of information regarding the discussion that would happen and their willingness to participate in the completion of the study. The researchers also designed a letter addressed to each participant and to the authorized individual assigned to the research study for further formality and authentication. Furthermore, this study would not fabricate and falsify data, findings, or conclusions to provide and promote truth, which is the goal of research.

The researchers would give the utmost emphasis to protecting and ensuring the participant's privacy in accordance with the Data Privacy Act of 2012 (DPA). Anyone would have limited access to the data, and if a data security problem occurred, it would be reported and documented in accordance with the law.

Ethical Principles in Research

In addition to adhering to the ethical management procedures outlined below and conducting research that satisfies the scientific standards in Education, the researchers is responsible for protecting research participants from any danger or damage related to participation in the study. Assuring that all participants in this study adhere to generally acknowledged standards for the ethical, professional, and scientific conduct of the study's design about the implementation, dissemination, and reporting is one of the study's objectives.

Reach agreement on Gatekeepers. According to Eide & Allen (2005), Gatekeepers are crucial in social research because they protect their members from harm and the sensitive subjects being studied. It serves as a go-between between a researcher and potential subjects. Potential research volunteers can request access or not, depending on the gatekeeper. Thus, before the researchers conducts the study, the researchers make sure to secure letter permission from CTEAS dean of Saint Columban College, Pagadian City. The researchers also attached the letter of permission and the informed consent form then gave to the research participants and the Calculus instructor. In this manner, it built a social relationship between the researchers and research participants including the Calculus instructor.

Informed Consent. According to Kristinsson (2007) informed consent means obtaining honest permission by avoiding deception and coercion, without necessarily promoting personal deliberation and decision-making. Thus, the researchers ensure that research participants should read the Informed Consent first before they affix their names and signatures. Their printed names and signatures signify

acceptance of terms and understanding of their rights and the nature of the study.

Anonymity. Before there was the adjective "anonymity", there was the noun "anonymous." According to Ferry (2002), the word "anonymous" was introduced into the English language during the sixteenth century. Meaning "without a name" or nameless, it was borrowed from the Greek and referred to writings whose authors were unknown or concealed. Without gaining any personally identifying information, data collection is meant. In order to conceal the participants' identities, the researcher purposefully decided to use an audio recorder to capture their comments. The participants are reminded that it is optional for them to write their names or maintain their anonymity before the aforementioned interview.

Respect for Research Participants. The study is voluntary and legal participation is required. The protection of the participants becomes a major responsibility of the researcher when using human subjects in study. As a result, the researchers explained before the interview that the participants were not required to respond if they did not want to and reminded them of their right to discontinue answering the questionnaire at any time. If they choose not to, they are not compelled to respond to the questionnaire. The participants' identities will likewise remain a secret and not be shared with anyone.

3. RESULTS AND DISCUSSION

This chapter presented, analyzed, and interpreted data gathered from the selected third-year students at Saint Columban College. They were officially enrolled in this school year 2021-2022, which conducted full online classes. This study aimed to discover strategies of Bachelor of Secondary Education major in Mathematics students in learning Calculus online.

3.1 BSED- Mathematics Students' Different Strategies in Learning Calculus Online

The following themes were based on the BSED-Mathematics students' responses during the focus group discussion, Calculus instructor's responses during the face-to-face interview using the validated interview guide, and the Researchers' observations from the recorded discussions in Calculus classes. These themes were *Browsing in google; Utilizing online calculator, Watching YouTube videos, asking the help of classmates, and Relying on the given related examples by the Calculus instructor.*

Browsing in Google. The research participants browse in Google to look for possible solutions and additional information regarding Calculus problems.

Most of the participants mentioned that they browse in google to find related solutions to their worksheet.

"usahay muadto sa google para mag lantaw2x ug solutions" [Sometimes I

will go to google to look for solutions] – Participant 1

“susihon ang mga problem nga ge hatag ni maam sa worksheets dayun mangita sa google if naa bay kapareha”. [Examine the problem that the instructor had given in the worksheets then go to google if there is related]. – Participant 3

“usahay if maglibog ge unsa ni maampag gama sa solution mangita dayug kaparehag porma sa google”. [Sometimes if having difficulties how the calculus instructor made the solution, the remedy is to look in google if there is the same format as what the instructor did]. – Participant 4

The instructor of the research participants also mentioned the browsers which can help students in learning calculus online.

“mangita mo og mga related worksheets sa google nga mapareha sa ako ge assign sa inyo”. [You will find related worksheets in google thatb is the same to what I assigned to you]. – Calculus Instructor

Based on the researchers` observation of the recorded online class discussion, one of the students asked the instructor that he found some solution on the internet and clarify it to the teacher if it is correct or appropriate to what they had discussed.

The net generation (Oblinger & Oblinger, 2005) and digital natives are using the Internet to voice their requests for help. Students are participating in topic specific, free, open, asynchronous Web-based forums for help with homework problems and answers to questions. These e-help communities may be the only recourse some students have for receiving help outside of the classroom on homework assignments or on studying for examinations.

Utilizing Online Calculators. The research participants mentioned that they utilized online calculators to look for possible solutions and additional information regarding Calculus problems.

Most of the participants responded that they utilized online calculators that provided additional information regarding Calculus problems.

“usahay makagamit ug mathways (online calculator) kaso lang diretso2x na ang mga solutions.” [Sometimes we can use mathways (online calculator) but its solutions are shortened]. – Participant 2

“e sulay lang ug tuplok ang solution na nakabutang sa worksheet didto sa mathways pero ang uban dili lang magpareha kung e compare2x sa ge unsa ni maam sa example”. [Try to type the solution that is on the worksheet to mathways but some are not coinciding to

what is given by the instructor in the example]. – Participant 3

The instructor of the research participants also mentioned the online apps which can help students as they are still adapting to the new trend of learning until now.

“I think pod nga nag gamit mo og mga online apps pareha sa online calculators kay naa man katong mga free nga online calculators.” [I think that you use online apps such as online calculators and there are some of which are free]. – Calculus Instructor

Based on the researchers` observation of the recorded online class discussion, some of the examples that are being shown by the instructor in the discussion are of the same with the answer that is being given to what is the Calculus students are showing in the class when being questioned by the instructor.

According to Hunter (2011), graphing calculators in a calculus class benefited students the best out of all the different types of technology. Graphing Calculators can be used in a variety of ways to teach and understand calculus principles. In an experimental study using a graphing calculator to teach probability, students were able to improve their mathematical conceptual knowledge and problem-solving skills by using the calculator as a thinking tool.

Watching YouTube Videos. The research participants mentioned that they watch youtube videos to look for possible solutions and additional information regarding Calculus problems.

Most of the participants revealed that they watched YouTube videos that was related to the worksheet given by their instructor.

“usahay mu lantaw sa youtube ug videos about sa ge hatag ni maam nga worksheet. [Sometimes, watching youtube videos about the given worksheet by the instructor]. – Participant 1

“sa youtube kay usahay kay diretso2x na ang explanation kay nag assumed na sila nga nakabalo naka sa ubang steps”. [In YouTube some are not in detailed manner because some of the explanations are skipped for, they already assumed that the viewer knew what that particular step is]. – Participant 4

The instructor of the research participants also mentioned the online apps such as YouTube which can help students as they were still adapting to the new trend of learning until now.

“mangita mo ug related worksheets sa youtube dayun balikbalikon ninyo ug lantaw unsaon o kaha kopyahon ba ninyo kung unsa

ang nakabutang didto." [You will find related worksheets in youtube then you will watch it repeatedly or you will just copy what is being showed]. – Calculus Instructor

Based on the researchers' observation of the recorded online class discussion, the Calculus instructor sometimes presented videos coming from YouTube for us to easily understand the lesson for it explained the needed information to clarify some procedures of the calculus problem. Also, it was observable that the students can easily catch up the point of the video because they can answer the question that the instructor was asking and asking of its link.

For a freshman undergraduate calculus course, Kay & Kletskin (2012) developed a series of 59 problem-based podcasts in which they covered some important concepts including operations with functions, solving equations, linear functions, exponential and logarithmic functions, and trigonometric functions. They posted all podcasts to the course website for a 21-day time span and tracked the number of students' video podcast visits. Their results illustrated that approximately 67% of the undergraduate students visited the video podcasts and they stated that this method was useful, easy to follow, and the video podcasts helped their understanding of new concepts.

Asking the Help of Classmates. The research participants mentioned that they asked the help of classmates to look for possible solutions and additional information regarding Calculus problems.

Most of the participants mentioned that they seek for the help of their classmates or peers in finding possible solutions regarding Calculus problems.

"magtinabangay mi sa kung unsaon pag solve ni nga problem". [We will help each other on how to solve the problem]. – Participant 2

"mangutana if naa bay idea kung ge unsa na pag solve ni maam nang naa sa iyahang example". [Ask classmates if they have idea on how to solve the given example given by the instructor]. – Participant 3

"among e compare among nabuhat nga solution dayun ddto mi sa kung unsay anggid anggidsa kangmaam". [We will compare each other's solution then we will prefer those solution that coincided to what is the instructor had given]. – Participant 4

The instructor of the research participants also mentioned the help of classmates which can help students as they are still adapting to the new trend of learning until now.

"siguro pud usahay based sa inyong answers, magtinabangay mo sa kung unsaon pag solve ang naa sa worksheet" [Maybe

sometimes based on your answers, you will collaborate to each other on how to solve the worksheet]. – Calculus Instructor

Based on the researchers' observation of the recorded online class discussion, it was observable that the calculus students are helping each other on how to find answer in the given worksheet in the discussion because they will somehow tell the other classmate that this must be done and this is the one that is appropriate.

The contribution of friends in cooperative learning activities involving help-seeking is crucial for the formation of academic beliefs and conduct. When learning challenges are beyond their capabilities, students frequently turn to peers for assistance (Shin, 2018).

Relying on the Given Related Examples by the Calculus Instructor. The research participants mentioned that they rely on the given example by the calculus instructor to look for possible solutions and information regarding Calculus problems.

Most of the participants revealed that they rely on the given related examples by the Calculus instructor during online classes discussion.

"usahay maulaw mi mag ask ni maamkung ge unsa mao nang maglibog mi inag mag review mi balik sa iyahang discussion". [Sometimes we will be shy on asking the calculus instructor that is why sometimes we will get confuse when we will about to review the discussion]. – Participant 1

"lantaw lantawon nako ang kanang sa example ni maam kaso mag libog ko kay malimot ko ge unsa nga part ni maam sa discussion mao nang balik balikon nako lantaw". [I will look to the example that the instructor gave but I will get confuse because I forgot how the instructor did that part that is why I will watch it repeatedly]. – Participant 4

The instructor of the research participants also mentioned that the calculus students are relying on the given example which can help students as they are still adapting to the new trend of learning until now.

"Based sa akong na observe kopyahon jud ninyo tas ang given ra ang ma change aron ang line sa argument inyuhang masunod inig solve sa problem." [Based on my observation, you will merely copy then only the given will be change so you could follow the line of argument when it comes to solving the problem]. – Calculus Instructor

Based on the researchers' observation of the recorded online class discussion, it was observable that the Calculus students were relying on the example being given by the instructor because when they were being asked by the instructor a certain question, they will request for the slide that shows the solution.

Some students do utilize the online lectures as part of their deep strategy to learning, which is related to better performance in the course. In addition, many students did indeed utilize the online lectures, some watching over half of their lectures online. Clearly the presence of online lectures provides a great convenience to students and thereby enhances their satisfaction with the learning experience (Bassili & Joordens, 2008).

The findings of this study concede the Model of Strategic Learning by Weinstein (1998) claims that the learner is at the center of the Model of Strategic Learning (MSL), which is surrounded by three dynamic components that explain successful learning: skill, will, and self-regulation.

3.2 The Effectiveness of Different Strategies in Learning Calculus Online

The research participants stated the effectiveness of different strategies in learning calculus online, and two themes emerged. These themes are *Positive feedbacking from the calculus instructor and Students gaining good grades.*

Positive Feedbacking from the Calculus Instructor. All the participants responded to the question in the same manner by describing the effectiveness of different strategies in learning calculus online. Their answers were rooted in positive feedbacking from the calculus instructor.

The research participants mentioned that they root in positive feedbacking from the calculus instructor.

"Ang feedbacking man gud ang maoy makapatell if sakto raba among ge solve or sakto raba among strategies nga ge apply sa pagsolve. [Feedbacking will tell us if we do right in solving and if our applied strategies are appropriate in solving]. – Participant 2

"Kay sa feedbacking ma koreksyonan mi sa kung unsay sakto nga buhaton para makabalo jud mig solve sa mga problema sa calculus." [In feedbacking we will be corrected on what is the need action for us to know how to solve the problem in calculus]. – Participant 3

The instructor of the research participants mentioned the effectiveness of the strategies of the calculus students through positive feedbacking.

"Effective kaayo ang inyong strategy nga mag suon-suon sa examples nga related sa mga worksheets sa mga online apps kay ma sakto raman pud." (Your strategies are surely effective because you merely copy the given related

examples online towards answering your worksheets.) - Calculus Instructor

Based on the researchers' observation of the recorded online class discussion, the Calculus instructor was observed to give additional hints and motivation to what was the needed idea on how to strengthen the ways of students in solving calculus problems.

The evaluation, e-feedback, and e-rubric provided by the lecturer to the students at the end of each learning module worked as a feedback loop closing for a quality online course. It is not only providing space for students to reflect on their learning which might be helpful in reviewing the process and prove for their ability in an active learning environment, but also gives a chance for the lecturers to practice continuous improvement in their pedagogical skills (Al-Hamad & Mohieldin, 2013).

Students Gaining Good Grades. All the participants responded to the question in the same manner by describing the effectiveness of different strategies in learning Calculus online. Their answers are rooted through gaining good grades.

The research participants responded that they root by gaining good grades in describing the effectiveness of different strategies in learning calculus online.

"Through grades jud kay if dako mi ug grado means effective to nga strategy nga among ge buhat para maka solve sa mga problem." (It is through good grades that we can conclude if our applied strategy in learning calculus is surely effective) Participant 2

"sa grado ra jud mi mag base ani if effective ba among strategy or sakto ba to among ge buhat pero makakuha rapud biya mig nndot nga grado". [We will only base the effectiveness of our strategy or if we did it rightfully in our grades and luckily, we still manage to gain good ones]. – Participant 4

The instructor of the research participants mentioned the effectiveness of the strategies of calculus students through gaining good grades.

"sa karun, mag base ra jud ko sa inyong ge pang submit nga activities kay wala may face to face interaction ug diha na dayun mahibal an ang inyong performance sa ma generate nako nga grado, pero dagko raman sab mog grado." [Nowadays, I will only base my grading in your submitted activities because there is no face-to-face interaction then, by that we will know the state of your performance by the grades you get, but somehow, you

manage to get good ones]. – Calculus

Instructor

Based on the researchers' observation of the recorded online class discussion, it was observable that the instructor motivated the students that they got good grades on past Calculus classes and congratulate them wishing that in graduation, they will get latin honors.

The evaluation, e-feedback, and e-rubric provided by the lecturer to the students at the end of each learning module worked as a feedback loop closing for a quality online course. It is not only providing space for students to reflect on their learning which might be helpful in reviewing the process and prove for their ability in an active learning environment, but also gives a chance for the lecturers to practice continuous improvement in their pedagogical skills (Al-Hamad & Mohieldin, 2013).

The findings of this study conceded the Collaborative learning by (Boekaerts & Minnaert, 2006) claims that it has a significant feature of a learner's social context and support. The size and duration of groups, evaluation of the group process (both teacher-led and student-led), graded group work, assigned tasks, demographics of group makeup, and peer assessment are all examples of differences between the approaches.

3.3 The Different Demands in Learning Calculus Online that the BSED-Mathematics Students Encountered

The participants provided the following responses about the demands they encountered in learning Calculus online. These themes were the *Negative attitude of the students during the discussion with the Calculus instructor*, *Students' difficulties in answering the worksheets*, *Students experience a low internet connection*, and *Students experiencing a breakdown during online classes*

Negative Attitude of the Students during the Discussion with the Calculus Instructor. The research participants mentioned that sometimes they did not pay attention to the calculus instructor during discussion.

Most of the participants revealed that during the online discussion they did not listen carefully to their Calculus instructor.

"naay time nga inig paminaw naku kay makatulog ko. [There's a time that I felt sleepy while listening to the discussion]. – Participant 1

"di ko ka maminaw tarung kay mag scroll2 ko sa Facebook or sa Tiktok" [I am not listening. Sometimes cannot be avoided to scroll down and up on Facebook and TikTok.] -Participant 2

"dili ko maminaw, usahay." [Sometimes I'm not listening] – Participant 3

"usahay sab dili ko maminaw ka nay laing gebuhat." [Also, sometimes I'm not listening because I have other things to do] – Participant 4

The Calculus instructor also asked about the demands encountered by the students in learning Calculus online. Below is her response:

"There are many demands, first is kanang mu follow gyudmo. There is a need for you to listen carefully. Dayon ga assume jud ko nga, when I discuss or every time mag discuss ko musunod jud na sa inyuhang mata. [There are many demands, the first is that you always follow me. There is a need for you to listen carefully. Then, I assume that when I discuss or every time I discuss you are following.]– Calculus Instructor

Based on the researchers' observation of the recorded online class discussion, it was observed that the students are not responsive to the Calculus instructor during the online class discussion.

According to Renukadevi (2014), the main challenge in listening is maintaining the listener's attention. The inability to focus is seen as a serious issue because even a brief lapse in concentration can seriously harm cognition. The listeners required time to comprehend the information they received.

Students' difficulties in answering the worksheets. Research participants mentioned that they encounter difficulties in answering the worksheet.

Most of the research participants mentioned that they encounter difficulties in answering their worksheets in calculus, especially in this new normal.

"Bintaha sa una katong calculus 1 og 2 karon jud kay lisod na kaayo" [Calculus 3 become more difficult than Calculus 1 and 2]-Participant 6

"lisod kaayo ang pag answer jud kay dili man dayon naku ma gets inig human discuss" [It's not easy to answer the worksheet because I cannot quickly understand what the instructor discussed] - Participant 1

"kanang sa exam na gani jud koy malaktawan kay lisod tapos hapit na due time" [During exam there were items that I leave it as blank because it's too difficult and the due time is approaching]. - Participant 2

"lisod jud kaayo man ron kay online mag answer man gud lahi ra jud sa face to face" [In our situation right now having online classes is more difficult compared to face-to-face classes]. - Participant 4

The Calculus instructor also experienced difficulties which was why she did her best to have a detailed discussion during classes.

“kita tanan galisod jud tungod sa pandemic. Maong I tried my best nga ma detailed ang pag discuss kay lahi ra ra ba sa Youtube og sa online apps kay dili muhatag og detailed solution” [All of us struggled during this pandemic. That is why I tried my best to have a detailed discussion because Youtube or other online apps is different, it doesn't contain a detailed solution]. – Calculus Instructor

Based on the researchers' observation of the recorded online class discussion, it was observed that the students have difficulties in answering the worksheet and they cannot pass it on time.

It is understood that problem solving does not only include and require computation, but there is a need to understand and analyze the problem, and students must comprehend the problems (Salma & Rodrigues, 2012). It is said that most of the problems are challenging to solve, and no detailed explanation is provided. However, most students are not capable of studying independently (Dangle & Sumaoang, 2020). They cannot easily follow the instruction written in the modules, and concepts are hard to understand without teachers' assistance.

Students' Experience on Low Internet Connection.

Having a low internet connection was one of the challenges that students encounter during an online class, especially for those who lived and stay in rural areas.

Most of the participants experience a low internet connection during online classes

“usahay gani si Ma'am kay mawala, mag putol2”. [Sometimes our instructor loss her internet connection]- Participant 2

“naa jud time nga lag kaayo ang signal” [There were times that the signal is lag]- Participant 1

“sa amua gani nga naa na gani wifi kay mawala gihapon ang connection” [In our area even if we have our own wifi we still loss our internet connection]. - Participant 5

The Calculus instructor also mentioned that they also experience a low internet connection during the online class discussion.

“isa sa ila problema nga ako na observe kay ang low internet connection. Kay kami gani sab naka experience jud mismo” [One of the problems that I observe and also experience is having a low internet

connection how much more on the other places.] -Calculus Instructor

Based on the researchers' observation of the recorded online class discussion, the research participants' way of dealing with these demands in learning Calculus online is that some participants find places that have a strong signal on internet. Additionally, students also inform the Calculus instructor that the signal is not stable so that the instructor will be aware of such a problem and fix it.

Irfan & Iman (2020) argue that online learning is unproductive and carried out in an ineffective manner. They show this by citing a variety of problems, including inadequate internet access, teachers' incapacity to incorporate online learning, and parents' lack of collaboration. The adoption of online education in the Philippine setting is challenged by the lack of faculty preparation for running online classes and the issue of historically bad internet connections in the nation. Teachers, students, and parents have faced concerns and challenges while attending school from home (Burzynska & Contreras, 2020).

Students' Breakdown during Online Classes. Some of the research participants mentioned that during this pandemic they experience a breakdown, especially during an online class.

Research participants stated that having breakdowns is one of their challenges having this new normal

“naa jud time nga maghilak ko kay wala naku kabalo unsa buhaton.”- [Sometimes I just cried, because I don't know what to do]. -Participant 1

“kapit ra jud ko sa akong will, kay no choice naman jud.” [I hold on to my will, because I don't have any choice.]- Participant 2

The research participant's instructor mentioned that there were lots of demands that the students encounter during online classes hence, they need to give time for their studying.

“daghan jud demand ma encounter ang mga studyante. Ma bored, ma stress. Maonang dapat jud maningkamot hatagan jud og time ang pagtuon sa mga lessons” [There are lots of demands for the students. They feel boredom or stress. That is why there is a need for them to give an ample time in studying their lessons]. – Calculus Instructor

Based on the researchers' observation of the recorded online class discussion, it was observed that some of the students are not active and not responsive during the online discussion.

Many students encounter challenges, including boredom, worry, and stress in learning during school from

home, according to various research (Kartika, 2020). Nurul Haidah et al., (2020) agree that students should take advantage of opportunities to study, improve interpersonal skills, and improve their capacity to adapt to new technology.

The findings of this study contradict to the Constructivism Theory by Kalender (2007) states that learning is an active and unending process, and it occurs when the learner discovers knowledge through the spirit of experimentation and doing.

3.4 BSED-Mathematics Students' Ways in Dealing with the Demands of Learning Calculus Online

These are the coping mechanisms that the research participants mentioned in dealing with those demands in learning Calculus online, and several themes emerged. *These are the following themes: Finding a place where the internet or mobile data is stable, Having an online collaboration with peers, Relying on related worksheets and Youtube videos posted online, and Motivating each other and hold on to their will.*

Finding a Place where the Internet or Mobile Data is Stable. The research participants experience a low internet connection. The way they deal with this demand is finding a place where the internet connection or mobile data is stable.

Most of the participants mentioned that they find a place where the connection is stable, especially during the class discussion and exams.

"tungod kay lag ang signal mangeta jud lugar nga aha nag mas kusog2." [Due to low signal we find a place]. -Participant 5

"usahay gani kanang na ko sa bukid. kay manugo na lang ko sa ako classmate pa send sa akong answer especially sa exam kay ma close san unya ko." [When I am in the province, I ask for help to my classmate to send my answers especially during examination before it will be closed]. -Participant 1

The Calculus instructor stated that the conditions of access networks that are not stable require students to find a place where internet access in order to follow the lecture.

"mangeta jud mo og lugar nga kusog og signal especially katong naa sa bukid. [You find a place where the signal is stable, especially for those who live in the province]. -Calculus Instructor

Based on the researchers' observation of the recorded online class discussion, it was observable that some of the students informed their Calculus instructor that they cannot attend the virtual discussion on time since they need to find first, a place where the internet is stable.

There are still students who are constrained to follow online learning because internet access is not stable, and the ability to buy the internet package. This affects the readiness

of the student in following the lectures online. Most importantly, students who had home Internet access were found to positively perceive online education (Alaugab, 2007). Tekynarslan (2008) found that students who have home Internet access had significantly more positive attitudes toward the Internet than students who do not have Internet access at home.

Having an Online Collaboration with Peers. The research participants experienced difficulties in answering the worksheets. Most of the participants collaborate with their peers to deal with the demands they encounter in learning calculus online. They need them to ask their partners to learn and answer the worksheets.

Most of the research participants revealed that they collaborate with each other through messenger chats to answer the worksheets.

"Naa jud time nga mu chat ko sa friends naku especially kung wala pa ko ka answer kay mangutana pod ko sa ilaha. Kay wala ko kabalo og unsaon pag answer. Dayon kasagara jud pareha mi wala pa ka answer" [There were times that I would chat with my classmates especially if I still don't have an answer because I will ask them about it, I will ask how to do it. Sometimes, we are in the same situation; both of us don't have an answer yet]. Participant 3

"usahay kay mag chat ko sa isa dayon sa isa na pod kay mag compare sa answers" [Sometimes I chat with my friend and other friends to compare our answers] -Participant 4

"mag chat gani pod ko Ms. A. kay mag ask ko og geunsa" [I will chat with A. to ask how she answered it]- Participant 2

"Mag chat sa akua si S. dayon wala pa koyma answer maoto mag chat na pod ko ni Ms. A." [Mr. S. will chat me and them I still don't have an answer, so I will chat Ms. A.] -Participant 1

The Calculus instructor also observed that the participants collaborate each other in answering the worksheet.

"magtinabangay man jud mo sa pag answer sa inyong worksheets" [You help each other to answer your worksheets]. -Calculus Instructor

Based on the researchers' observation of the recorded online class discussion, it was observed that the students collaborate each other during the discussion and in answering their worksheet.

Help-seeking is another example of a metacognitive action that involves observing or assessing one's

comprehension of one's own learning (Chu et al., 2018). The contribution of friends in cooperative learning activities involving help-seeking is crucial for the formation of academic beliefs and conduct. When learning challenges are beyond their capabilities, students frequently turn to peers for assistance (Shin, 2018). Asking for help is one of the metacognitive actions for understanding instructional materials and performing learning tasks (Chu et al., 2018).

Relying on Related Worksheets and YouTube Videos, Posted Online. The research participants experience difficulties in answering the worksheets.

Research participants mentioned that they rely on the worksheets or YouTube videos posted online as their other source of learning the lesson and guide in answering the worksheet.

"Kay dugay man mi maka gets sa ka Ma'am mag taan aw na lang mi og Youtube videos. [Because we don't easily get the instructor discussion, so we watch Youtube videos] – Participant 1

"usahay sab kay mangeta mi og mga examples nga mga worksheet or assignment nga e post sa google." [Sometimes we find related examples, worksheets, or assignments, posted on google] -Participant 3

"ako gani kay kanang mag gamit ko og apps ba pareha sa mathway kay direct na and answer" [I usually used online apps just like Mathway because it gives direct answers] -Participant 4

"mutan aw jud ta og youtube tungod kay gusto man tag direct answer ka Ma'am kay malibog ko usahay man gud sa ka Ma'am." [I watch Youtube videos because it provides a direct answer. Sometimes I get confused on our instructor discussion] -Participant 5

"naa sab gani usahay nga dili mag suit ang Youtube og kay Ma'am mao maglibog ta. Kay diay mas detailed jud ka Ma'am makuha man nato siya basta balikon lang og tan aw." [Sometimes the instructor discussion and the Youtube videos did not match that is why we get confused. Instructor discussion I more detailed compared to Youtube and we can understand it if we watch the recording repeatedly] -Participant 6

The calculus instructor of the research participants also mentioned the online apps which can help students as they are still adapting to the new trend of learning until now.

"I think naggamit pod mo og mga online apps katong mga free" [I also think that you use online apps that are free] - Calculus instructor

"Mao ra nay sekreto diha, usahay. Dayon, mangeta ka og mga worksheets or Youtube videos og mga lecture notes." [That's the secret sometimes. Then, you find worksheets or Youtube videos and lecture notes] - Calculus Instructor

Based on the researchers' observation of the recorded online class discussion, the research participants' way of dealing with these demands in learning Calculus online is that relying on the related worksheet and watching YouTube videos posted online. They also observe that the instructor provides the link to be watched by the students after the discussion.

YouTube is a unique platform designed to create, save, share, visualize, and evaluate online audiovisual material (AVC), according to Dolcemáscolo (2016). It's interesting to observe how frequently young people use the platform in terms of users. They prefer YouTube over other services provided by large companies like Google or Bing because they believe that YouTube is a place where they can find any kind of content (Scolari, 2018).

Motivating Each Other and Hold on to their Will. The research participants experienced breakdown during online classes. They motivated each other and some hold in their will, as their ways in dealing it.

Most of the research participants motivate each other to do and answer their given tasks as they experience breakdown during the online classes.

"naa man jud time nga wal naku kabalo unsa buhaton tas maoto nga mu chat ko ni Ms. L. dayon LABAN LANG jud mao masulti" [There were times that I will chat Ms. L because I don't know what to do anymore. The word that we can say is FIGHTING!] -Participant 1

"naa time nga maguol ko pero ako jud ibutang sa ko huna2 nga makaya dayon hold jud ko sa ako will" [Sometimes I feel sadness but then I will just put in my mind that I can do it and I also hold into my will] – Participant 2

"Wala jud tay laing choice man maong e motivate jud nato atong self dayon padayon lang jud ta" [We don't have a choice that is why we keep on motivating ourselves and just continue] -Participant 4

The research instructor also motivates and praise the research participants after the online discussion.

"galisod jud ta sa online class pero make efforts lang jud mo. Mga bright mani sila. Kaya ra lagi na. basin kamo ang

sunod na cum laude" [Having an online class is not that easy. But you need to make efforts. You also excel. You can all do it. Maybe, you will be the next candidate for Cum Laude] -Calculus Instructor

Based on the researchers' observation of the recorded online class discussion, the research participants' way of dealing with these demands in learning Calculus online is that participants motivate each other after the discussion with their instructor. The instructor also gives praise to the students and motivates them to do the best they can.

The level of a student's learning achievement is heavily influenced by his or her level of motivation. In mathematics, learning motivation has an impact on learning outcomes (Fitriati, 2017).

Moreover, the responses of the participants in this study strongly agree that they need assistance from their peers, rely on the online apps and related worksheets, and motivate themselves. It concedes with the Model of Strategic Learning by Weinstein (1998) claim that each of these variables, according to the Model of Strategic Learning, can influence a student's learning behavior. Collaborative learning by Boakkerts & Minnaert (1998) stated that it is not only provides students with a new way to learn the topic but it also enriches their learning experience by allowing them to access additional resources, assistance, and abilities from their peers.

4. Implications of the Study

The findings of the study determined the strategies of BSED-Mathematics students in learning Calculus online. It explained to students that in order to learn Calculus online more effectively, strategies were essential factors since it assisted them to create better study habits and self-confidence.

However, this study also made teachers aware of the necessity to adapt their teaching methods to the needs of each individual student. When teaching Calculus online, teachers must offer a clear and comprehensive solution after each topic discussion. Additionally, they must keep an eye on their students by continually reminding them to complete their worksheets and provide feedback on the students' works. Teachers must also ask students about their level of knowledge regarding the subject before class even begins.

Last but not least, for the school, provisions of seminars and workshops for the teachers are essential for them to have knowledge and skills on how to handle the situations regarding the difficulties in understanding the lesson, especially that classes happen online. Notwithstanding the given situations they are facing, they must continue the learning continuity plan by CHED and achieve the learning development of the students.

5. CONCLUSION

Based on the summary of findings, the researchers concluded that the research participants used strategies and described their effectiveness in learning Calculus online. They also stated that they experienced different demands in learning Calculus online and how they dealt with it.

The research participants also faced different demands in learning Calculus online such as their negative attitudes during the discussion, their difficulties in answering the worksheets, unstable internet connection and breakdown during online classes. They have dealt with these demands by finding a place where the internet or mobile data is stable, having an online collaboration with peers, relying on related worksheets and YouTube videos posted online, and motivating each other.

Despite the difficulties in dealing with online classes, the research participants could still adapt and continue to be more equipped with knowledge and skills with their learning strategies such as browsing in Google, utilizing online calculators, watching YouTube videos, asking the help of classmates, and relying on the given related examples by the calculus instructor.

Thus, the researchers concluded that teachers are truly needed to monitor students by continually reminding them to complete their worksheets and provide feedback on the students' work as an example to build a better learning atmosphere.

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