PROBLEMS
OF EDUCATION
IN THE 21st CENTURY
Vol. 82, No. 1, 2024
102

TEACHER EDUCATION STUDENTS' EXPERIENCES IN UNDERGRADUATE ONLINE MATHEMATICS COURSES

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Abstract

Having been shifted from traditional to online learning due to the community quarantine implementation, it is valuable to determine students' views about taking courses online. This research aimed to explore the teacher education mathematics major students' experiences with taking undergraduate mathematics courses online, precisely the benefits and challenges they encountered, and in what way they dealt with these challenges. The design used in this study is qualitative exploratory research by distributing open-ended questions to selected Bachelor of Secondary Education in mathematics students (N = 76) from a state university in the province of Bulacan, Philippines. Data were explored through thematic coding. The results indicated that among the gains of taking mathematics courses online, the students mostly gained from a convenient study time to access applicable web-based references and resources. In spite of unpredictable internet networks, limited teacher and peer interaction, vague learning content and discussions, some distractions, and a lack of satisfactory learning resources, independent and self-paced study paired and fired with enough self-motivation are suggested.

Keywords*: mathematics courses, online learning, online mathematics, teacher education, thematic coding*

Introduction

In mathematics, educators have long identified the advantage of active student participation in supporting deep learning of key mathematical ideas and procedures. This mainly positions students in beneficial situations to acquire relevant experiences. Accordingly, the concept of educative experience has been critical in conceptualizing how students come to join and focus on an activity. Experiences are educational when they encourage students to boost their vigor and complement their improvement (Christodoulou, 2009). In this twenty-first century era, information and communication technology (ICT) has been influential in education to support learning and flexibility and efficiency of curriculum delivery (Bhattarai, 2019). ICT offers excellent possibilities for education, especially in the way in which students can access and interact with information. Using this has turned into a way of life, with the convenience of a decent internet signal reachable to anybody with a digital device. As a result, online learning has become prevalent as a substitute for usual face-to-face classes (Fung et al., 2014).

The onset of the COVID-19 pandemic has forced a significant number of teachers and school institutions to operate with online education technologies. However, even before the pandemic hit the entire globe, mixed views of the benefits of online learning were observed. According to Sutherland (2008), "When faced with a new technology, we make sense of this in terms of our experience with older technologies" (p. 4). Some students perceived that online learning did not offer a true reflection of their effort (Brown & Lally, 2018). Others perceived OL to establish "... its effectiveness throughout the years, mainly because of its flexibility

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PROBLEMS
OF EDUCATION
IN THE 21st CENTURY
Vol. 82, No. 1, 2024

exhibited at different levels: pedagogical design, learning scenario, learning content, online tutoring" (Stoytcheva, 2018, p. 1).

A Need for Online Learning (OL)

The United Nations (UN) last 2015 set off a worldwide agenda for sustainable development by 2030. At its essence are the seventeen Sustainable Development Goals (SDGs), with goal 4, which aim to safeguard equitable and inclusive quality education and provide lifelong learning opportunities for all (Annan-Diab & Molinari, 2017; Owens, 2017). Unfortunately, as the COVID-19 pandemic spread, most countries declared the temporary closure of schools, impacting a higher fraction of students worldwide. As for the UN (2021), school closures affected by the pandemic produced damaging costs for students' learning. And so, special efforts are looked for to recover learning losses. To lessen these apparent losses that may accrue in education, many schools offer distance learning to their students. However, this alternative is only accessible to some (United Nations, 2020). The Commission on Higher Education (CHED), through CHED Chairman De Vera (2020), released Memorandum Order No. 4 series of 2020 for the implementation of flexible teaching and learning in higher education: "It has become an urgent need to explore other innovative modalities that will facilitate migration from traditional to flexible teaching and learning options" (p. 1). FL is established to the students' needs, permitting flexibility of time, access, schedules, and innovative assessments (Cassidy et al., 2016; De Vera, 2020).

As a response, Bulacan State University (BulSU) (2020; 2017a; 2017b), the largest state university in the Central Luzon region and one in the Philippines with over a thousand faculty members and thousands of students across five campuses, proposed three possibilities for FL modalities to its community: Synchronous Online Learning (SL), Asynchronous Online Learning (AOL), and Remote Print Learning (RPL). SL is a kind of learning that happens in real-time; AOL occurs at their own pace, and RPL is for those who prefer printed learning materials. Most of the students in the BulSU community favored SL and AOL. As a rule, SL students are required to regularly meet their teachers online and be involved in any of the online-related activities posted [initially] through the GSuite applications, particularly Google Classroom and Meet [which then migrated to MS 365 applications, mainly MS Teams]. Teachers have to send carefully planned pre-recorded activities. AOL students, on the other hand, meet their teachers at least twice a month, and synchronous meeting schedules vary on the majority's online availability. The teachers have to set up e-modules, video lessons, and innovative assessment tasks to assist students. OL has primarily been the mode of instruction delivery for a number of years in the university. For this reason, the present researcher, a faculty member from the College of Education at BulSU, as led by SDG4, desires to explore and record students' insights and experiences in OL as most school institutions are being stirred to practice and move toward more online and/or, at least, blended courses to meet student needs and safeguard equitable and inclusive quality education. BulSU Educators faced a sudden shift to digitalization.

Some Reported Challenges in OL

Positive implementation of teaching and learning in OL settings in higher education entails overwhelming challenges (Moore & Fisher, 2017). In the study by Kim, Liu, and Bonk (2005), the majority of Master of Business Administration (MBA) students affirmed that OL is more complex than learning in classroom-based classes. The delayed teacher feedback due to the absence of real-time interaction with the teacher was challenging to their OL. A study further reveals that teachers' lack of feedback is a considerable barrier to effective online collaboration in higher learning institutions (Muuro et al., 2014). In a medical education

PROBLEMS
OF EDUCATION
IN THE 21st CENTURY
Vol. 82, No. 1, 2024

setting, students expressed a need for more instant, direct, and real-time teacher feedback to confirm that their understanding and energies were on the correct route. The typical challenge was the asynchronous communication setting and lack of face-to-face communication with peers, which resulted in problems with establishing collegial interactions and tracking progress (Dyrbye et al., 2009). In a study by Meyers and Bagnall (2016) with ten undergraduate learners of at least forty-five years of age, the OL challenges fell into three different but interconnected factors: technology use, hypermedia use, and independent learning. Concerns about technology use occurred remarkably from the lack of familiarity with the technology and its complexity. Problems with hypermedia use occurred from locating appropriate hypermedia-based resources from various web resources. The most noticeable issues about independent learning were their knowledge deficits and the related preferences for cognitive reinforcement: individual tutoring, group-based, and work-based collaborative learning. As a consequence, in both synchronous and asynchronous online instructions, although considered to be profoundly innovative pedagogical modalities, a teacher needs to develop novel competencies, particularly regarding technology use and the capability to inspire e-students (Leo et al., 2009).

Some Reported Advantages of OL

The advantageous feature for them is that the format offered them learning flexibility and opportunities for more interaction with teachers outside of real-time online meetings. That is to say, the OL provides students and teachers with a stage for shared discussion outside the classroom, permitting them to organize their thinking by viewing recorded instructional videos (Kim et al., 2005; So, 2012). The online role of the faculty is redefined as a facilitator who makes a space for learners to be involved (Bishop et al., 2018). The synchronous online meeting where undergraduates can see their learning is urged. Student enjoyment supports becoming a determined online learner (Tempelaar et al., 2012), promoting elaboration and metacognition (Artino & Jones, 2012). In the study of Zembylas, Theodorou, and Pavlakis (2008), for several students, the anxiety level related to OL was high at the start of the course, but then it slowly reduced, specifically when the students became more acquainted with online communication and started to develop a more solid sense of emotional connection among themselves via numerous communication measures, e.g., asynchronous discussions, phone calls, and emails. For successful online communication, it is vital to keep channels for both synchronous and asynchronous interactions (Cividino, 2009).

In line with the experience-based and literature-based review, it can be articulated that there are some advantages and challenges in the implementation of OL. This situation may also be the case in the BulSU community. With this in mind, as a faculty from BulSU College of Education, I realized the value of exploring OL experiences of teacher-education students, in particular, for mathematics majors, as it can explain the educative experiences of students. As a response, this study aimed to explore the experiences of teacher-education mathematics major students taking mathematics courses online. In particular, it sought to address the following : (1) the advantages the teacher-education mathematics major students see in taking their undergraduate mathematics courses online; (2) the difficulties the teacher-education mathematics major students have met in taking their mathematics courses online; and (3) the manner in which the teacher-education mathematics major students address their difficulties in understanding mathematics lessons when delivered online. This paper contributes to the body of knowledge of what really takes place during the OL setup in a Philippine setting.

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PROBLEMS
OF EDUCATION
IN THE 21st CENTURY
Vol. 82, No. 1, 2024

Research Methodology

General Background

The researcher viewed himself with a social constructivist worldview with a critical realism research philosophy. As per Creswell (2009), social constructivists seek insights into the realm where they work and live, dependent on the participants' opinions of the situation being explored, to make a sound judgment of the meaning others say about the world. A critical realist argues that, as researchers, what occurs in the social sphere can be known if they know the social forms that offer growth to the experiences they seek to comprehend (Saunders, 2019). With this in mind, this study used qualitative-exploratory research (Stebbins, 2008, p. 327). Researchers explore when they hold little or no scientific understanding about what they desire to study but still have reason to think it includes elements worth discovering. The researcher first defined the objectives. Next, the researcher identified the target population. The researcher selected the teacher-education mathematics major students in the College of Education, Bulacan State University, enrolled in the 2021–2022 school year. Then, the researcher chose the mode of data collection. The researcher strategically collected the data through open-ended questionnaires. Afterward, the data was explored and analyzed via the transcripts. In the sorting process, the researcher shaped descriptive concepts and abstractions, connecting each transcript to see common properties, and melding them into concepts and generalizations.

Participant

The target population for this study was the teacher education students enrolled in the Bachelor of Secondary Education (BSEd) mathematics program of Bulacan State University College of Education, Philippines, who had taken online undergraduate mathematics courses for at least one semester. The total target population is 189. This study was conducted during the second semester of the school year 2021–2022. Stratified sampling was used to determine the samples. A stratified sample is gained by dividing the population into subgroups and randomly selecting representatives from each subgroup (Fraenkel & Wallen, 2009). The preservice mathematics teachers were divided into sections. The researcher produced five subgroups—one section each from the first year to the third year and two sections from the fourth year, for a total of 100. An education expert at the Far Eastern University Institute of Education carefully chose the number of samples as enough to be the basis of all qualitative data. The researcher then selected twenty from each section by means of a randomizer app. These 100 individuals were invited to join in the study. Of the 100 likely participants, only seventy-six ($N = 76$) responded voluntarily. During this second semester, the fourth-year participants had already taken eight (8) mathematics courses online, the third year with eleven (11), the second year with seven (7), and the first year with three (3) mathematics courses online (see Table 1).

Table 1
Mathematics Courses Already Taken by the Participants

Year Level	Mathematics Courses Already Taken	
	via Face-to-Face	via Online
First Year	0	3
Second Year	0	7
Third Year	4	11
Fourth Year	11	8

Note: There are 20 mathematics courses in the BSED Mathematics curriculum

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PROBLEMS
OF EDUCATION
IN THE 21st CENTURY
Vol. 82, No. 1, 2024

Data Collection

To collect the data for the study, the researcher used an unstructured survey questionnaire. The items are open-ended, requiring the respondents to write information, comments, and feedback freely (Efron & Ravid, 2013) on the perceived benefits of studying undergraduate mathematics courses online, the accompanying difficulties, and how they deal with them.

The instrument was validated by a research expert from the Far Eastern University Institute of Education. The validation process progressed through a series of email exchanges and consultation meetings. It was advised to utilize unstructured responses in answering the research questions. After some alterations, the researcher was able to finalize the set of open-ended questions to be included in the instrument. The Google Forms version of the instrument has also been noted and approved. The instrument was administered to the respondents via Google Forms since this is in the pandemic days when the movement of people is strictly monitored. The Google Forms has two (2) major sections: Section 1, the Informed Consent section, and Section 2, the actual open-ended questions. Section 2 has two (2) parts: Part 1, the profile of the respondents, and Part 2, the key questions. Only data from target participants who had confirmed voluntary involvement and replied within a week after administration were compiled and stored in a spreadsheet.

Data Gathering

The researcher asked for approval from the college dean to conduct the study and, after getting permission, moved to the actual survey. The questionnaires were distributed via Google Forms. As for the ethical considerations, informed consent, respect for confidentiality and anonymity, and voluntary participation were strictly observed. The researcher clarified all vital matters about the study in the first section of the Google Forms survey and asked to confirm voluntary involvement. The students were given ample time to reply. The data were transferred in a spreadsheet afterward for further analysis.

Data Analysis

To analyze the responses, thematic coding analysis was used. "Coding is a way of indexing or categorizing the text to establish a framework of thematic ideas" (Gibbs, 2007, p. 38). Due to the nature of the qualitative data gathered, the researcher used line-by-line coding. In line-by-line coding, the researcher pays close attention to what the respondent is saying and creates codes that reflect respondents' experiences and perceptions (Gibbs, 2007, p. 52). Thus, it should remain grounded in the data. After transferring the data to a spreadsheet, each student was assigned a unique ID number. The data were transformed into readable text via the MS Word application. The researcher immersed himself in the data and identified set categories, looking for themes within each category. Finally, the researcher read the data slowly and carefully and divided them into subthemes (Efron & Ravid, 2013).

Research Results

Advantages of Taking Mathematics Courses Online

The first research question was to find out what advantages students see in taking mathematics courses online. To answer this research question, the respondents were asked what benefits they gained from taking online mathematics courses based on their experiences during the past months. They were surveyed to list up to three distinct benefits. The responses were

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PROBLEMS
OF EDUCATION
IN THE 21st CENTURY
Vol. 82, No. 1, 2024

analyzed via thematic coding analysis. Based on the results of the thematic coding, students' perceptions of the benefits of taking mathematics courses online are categorized under four (4) main themes from seventy-six (76) respondents.

Table 2
Main Themes Distribution of Students' Perceptions of the Benefits of Taking Mathematics Courses Online

Main Themes	*f*	%
Accessibility of time	42	55.26
Accessibility of resources	37	48.68
Opportunities for better critical thinking	38	50.00
Demonstrated self-motivation	21	27.63

Table 2 shows the main themes distribution of the students' perceptions of the benefits of taking mathematics courses online. It can be seen that 42 (55.26%) of the total respondents are categorized under the main theme of *accessibility of time*, 37 (48.68%) are categorized under *accessibility of resources*, 38 (50.00%) are categorized under *opportunities for better critical thinking*, and 21 (27.63%) are categorized under *demonstrated self-motivation*.

It can be noticed that the three (3) topmost main themes in the distribution in Table 2 were *accessibility of time*, *opportunities for better critical thinking*, and *accessibility of resources*. This suggests that the respondents were able to see the benefits of the accessibility or availability of time, resources, and opportunities for better critical thinking from taking mathematics courses online. On the other hand, the main theme in the distribution with the lowest frequency was the *demonstrated self-motivation*.

Table 3
Subthemes Distribution of Students' Perceptions of the Benefits of Taking Mathematics Courses Online

Main Themes	Subthemes	*f*	%
Accessibility of time	More time for posted activities	8	19.05
	More time for studying specific topics	9	21.43
	More time for practice	4	9.52
	Flexible and convenient study time	19	45.24
	Managing time more efficiently	10	23.81
Accessibility of resources	Access to web resources	28	75.68
	Access to recorded discussions	9	24.32
	Access to devices and applications	8	21.62
Opportunities for better critical thinking	Foundation skills	17	44.74
	Analytical skills	14	36.84
	Problem-solving skills	14	36.84
	Metacognitive skills	9	23.68
Demonstrated self-motivation	Pleasure	13	61.90
	Utility	9	42.86

PROBLEMS
OF EDUCATION
IN THE 21st CENTURY
Vol. 82, No. 1, 2024

Table 3 shows the subthemes distribution of the students' perceptions of the benefits of taking mathematics courses online. Under the main theme, accessibility of time, there are five subthemes: *more time for posted activities* (19.05%), *more time for studying specific topics* (21.43%), *more time for practice* (9.52%), *flexible and convenient study time* (45.24%), and *managing time more efficiently* (23.81%). Under the main theme, accessibility of resources, there are three subthemes: *access to web resources* (75.68%), *access to recorded discussions* (24.32%), and *access to devices and applications* (21.62%). Under the main theme, opportunities for better critical thinking, there are four subthemes: *foundation skills* (44.74%), *analytical skills* (36.84%), *problem-solving skills* (36.84%), and *metacognitive skills* (23.68%). And under the main theme, demonstrated self-motivation, there are two subthemes: *pleasure* (61.90%) and *utility* (42.86%).

For the main theme, accessibility of time, the subtheme with the top frequency is *flexible and convenient study time*. For the main theme, accessibility of resources, the subtheme with the top frequency is *access to web resources*. For the main theme, opportunities for better critical thinking, the subtheme with the highest frequency is *foundation skills*. This indicates that students primarily see the benefits of having flexible and convenient study time, as well as the availability of web resources while taking mathematics courses online and being able to acquire the foundation skills. Having a flexible and convenient study time, combined with the ease of use of web resources, provides students with a better chance of adequately absorbing and retaining the information, at least for foundation skills. Although the foundation skills may not be sufficient to progress to higher levels of thinking, these skills are still necessary, like any other mathematics skill. This gives the impression that they essentially adopt self-paced learning.

> Aside from what the instructor gave us, we can search for more information and examples, which can help us to better understand the lesson. – R47
> I can study and learn mathematics whenever it is convenient for me. – R74
> I gained more knowledge even though it's online. – R48
> I became familiar with the formulas. – R4

In contrast, for the main theme, demonstrated self-motivation, *utility* is the subtheme with the smaller frequency. This suggests that, given the accessibility of time and resources, only a few students see the usefulness of taking mathematics courses online and are self-motivated by it.

> I have gained personal people I can rely on and ask because
> I can express myself online. – R13

Difficulties in Taking Mathematics Courses Online

The second research question was to determine what difficulties the students met in taking mathematics courses online. To answer this research question, the respondents were asked what difficulties they encountered when they attended online mathematics courses. They were surveyed to list up to three distinct difficulties. The responses were analyzed via thematic coding analysis. Based on the results of the thematic coding, the difficulties of taking mathematics courses online are categorized under five (5) main themes from seventy-six (76) respondents.

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PROBLEMS
OF EDUCATION
IN THE 21st CENTURY
Vol. 82, No. 1, 2024

Table 4
Main Themes Distribution of Student Difficulties in Taking Mathematics Courses Online

Main Themes	*f*	%
Technical Issues	56	73.68
Communication Issues	30	39.47
Learning Environment Issues	30	39.47
Subject Matter Issues	37	48.68
Motivation Issues	14	18.42

Table 4 shows the main themes distribution of the student difficulties in taking mathematics courses online. It can be seen that 56 (73.68%) of the total respondents are categorized under the theme of *technical issues*, 30 (39.47%) are categorized under *communication issues*, 30 (39.47%) are categorized under *learning environment issues*, 37 (48.68%) are categorized under *subject matter issues*, and 14 (18.42%) are categorized under *motivation issues*.

It can be noticed that the four (4) topmost main themes in the distribution in Table 4 were *technical issues*, *subject matter issues*, *communication issues*, and *learning environment issues*. This indicates that the respondents mainly encountered various technical, subject matter, communication, and learning environment issues in taking mathematics courses online. On the other hand, the main theme in the distribution with the lowest frequency was *motivation issues*.

Table 5
Subthemes Distribution of Student Difficulties in Taking Mathematics Courses Online

Main Themes (Issues)	Subthemes	*f*	%
Technical	Unstable internet connection	53	94.64
	Lacking adequate learning resources	14	25.00
	Electric power interruption	3	5.36
Communication	Limited teacher support	18	60.00
	Difficulty in conveying solutions	13	43.33
	Poor peer interaction	3	10.00
Learning Environment	Some distractions	21	70.00
	Difficulty focusing on lessons	12	40.00
Subject Matter	Vague learning content	26	70.27
	Vague lecture discussion	13	35.14
Motivation	Poor time management	7	50.00
	Lack of stimulating tasks	3	21.43
	Feelings of overwhelm	7	50.00

Table 5 shows the subthemes distribution of the student difficulties in taking mathematics courses online. Under the main theme, technical issues, there are three subthemes: *unstable internet connection* (94.64%), *lack of adequate learning resources* (25.00%), and *electric power interruption* (5.36%). Under the main theme, communication issues, there are three subthemes: *limited teacher support* (60.00%), *difficulty in conveying solutions* (43.33%), and

PROBLEMS
OF EDUCATION
IN THE 21st CENTURY
Vol. 82, No. 1, 2024

poor peer interaction (10.00%). Under the main theme, learning environment issues, there are two subthemes: *some distractions* (70.00%) and *difficulty focusing on lessons* (40.00%). There are two subthemes under the main theme, subject matter issues: *vague learning content* (70.27%) and *vague lecture discussion* (35.14%). Under the main theme, motivation issues, there are three subthemes: *poor time management* (50.00%), *lack of stimulating tasks* (21.43%), and *feelings of being overwhelmed* (50.00%).

For the main theme, technical issues, the subtheme with the highest frequency is an *unstable internet connection*. The subtheme with the higher frequency is *vague learning content* for the main theme, subject matter issues. The subtheme with the highest frequency is *limited teacher support* for the main theme, communication issues. For the main theme, learning environment issues, the subtheme with the higher frequency is *some distractions*.

Unstable internet connection was the most prevalent among all subthemes relating to technical issues. This caused the students to miss some parts of the discussion, such as the solving part, making them confused about a topic or giving them a hard time understanding the whole lesson, requiring them to rewatch the recording if it is available. While vague learning content appeared to stem not from the delivery mode but from the content itself, students revealed that a struggle they faced was the vagueness and difficulty of understanding the learning content, especially when they could not absorb the lessons discussed on a specific period.

> Other technicalities, such as a poor internet connection, prevent me from getting what the teacher discussed, especially when the audio becomes choppy. – R66
> I can't concentrate sometimes, especially when my internet connection is unstable. I need to rewatch the recording. Unlucky for me, [if it] wasn't recorded. – R42
> Sometimes, I feel left behind, as if all of my classmates already agreed that
> they understood the topic, while I'm still puzzled about where those things came from. – R66

With limited teacher support, students had difficulties asking relevant questions such as feedback or whenever they met difficulties in the lessons or topics they could not grasp. Some of them were shy to ask questions as they might distract the flow of the discussion online. For some respondents, it was draining to know that whenever they could not understand lessons, they could not inquire about anyone when studying. Similarly, due to distractions in the learning environment, the respondents argued that their surroundings were not suited for mathematics learning and not as conducive as the school environment due to the noise and other distractions their environment at home brought.

> If I have questions or concerns, I can't have my answer right away. – R73
> Some parts are not clear to me, which I do not ask the teacher anymore because I am shy. – R57
> The environment I have at home is not totally suited for mathematics learning. – R18
> The background noise around is very loud, so I can't focus most of the time
> while listening to difficult topics. – R64

In contrast, the subtheme with the smallest frequency is the *lack of stimulating tasks* for the main theme, motivation issues. To a few, online learning was not engaging as they felt sleepy and unmotivated to attend the class, for they were used to the face-to-face modality.

> I sometimes have no motivation to attend the class because
> I am used to the face-to-face modality. – R42

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PROBLEMS
OF EDUCATION
IN THE 21st CENTURY
Vol. 82, No. 1, 2024

Addressing the Difficulties Encountered in Taking Mathematics Courses Online

The third research question was to determine how the students addressed the difficulties in understanding mathematics lessons when delivered online. To answer this research question, the respondents were asked how they dealt with the difficulties they faced in taking Mathematics classes online. They were surveyed to list at least one for each difficulty they listed in survey question 2. The responses were analyzed via thematic coding analysis. Based on the results of the thematic coding, students dealt with the difficulties they encountered in taking mathematics courses online in various ways and were categorized under five (5) main themes from seventy-six (76) respondents.

Table 6
Main Themes Distribution of How Students Address Difficulties Encountered in Taking Mathematics Courses Online

Main Themes	*f*	%
Addressing Technical Issues	36	47.37
Addressing Communication Issues	25	32.89
Addressing Learning Environment Issues	23	30.26
Addressing Subject Matter Issues	42	55.26
Addressing Motivation Issues	15	19.74

Table 6 shows the main theme distribution of how students address difficulties in taking mathematics courses online. It can be seen that 36 (47.37%) of the total respondents are categorized under the theme of *addressing technical issues*, 25 (32.89%) are categorized under *addressing communication issues*, 23 (30.26%) are categorized under *addressing learning environment issues*, 42 (55.26%) are categorized under *addressing subject matter issues*, and 15 (19.74%) are categorized under *addressing motivation issues*.

On Technical Issues

Checking the devices and the internet connection before the online mathematics class was a preemptive step for students. To avoid the devices running slow, links to the applications were used, and not installing the actual apps. Deleting unnecessary files to free space to lessen the lag or delay was performed. For respondents who lack adequate resources, they use the phones of their siblings, relatives, or even neighbors when possible.

In the absence of a Wi-Fi connection, the respondents generally pay for loads to have mobile internet data that they can use to surf the web, mainly to attend mathematics classes online. They attempt to connect to the online mathematics class via the data connection in the occurrence of an unstable internet connection, or at least as a backup plan. When necessary, they try to connect with others' data connections through mobile hotspots, either to house members or neighbors; or find a location or avail phone sim card with a better internet signal. For some, mobile internet data was used exclusively for online mathematics classes to save or not consume too much data. When the internet connection gets lost during online mathematics class, they try to connect as much as possible. They try to refresh the internet, and hence having long patience is of the essence. And if they cannot make it or handle the issue, they notify the teacher that they were unable to connect. When the internet connection becomes stable, they rewatch the recorded discussion if available. They also ask their peers about the lesson when necessary.

PROBLEMS
OF EDUCATION
IN THE 21st CENTURY
Vol. 82, No. 1, 2024

I make sure to have backup data whenever the internet connection collapses.
I also notify my instructor of the situation and rewatch the recorded video of the discussion once the internet connection stabilizes. – R40
I just take advantage of my long patience when I have poor connections. Sometimes, my siblings let me connect to their phones' hotspots. – R54
For technical issues, I always check my gadgets before an online class starts. – R12

On Communication Issues

The respondents try to start interacting with their teachers by cautiously communicating sensible information by virtually raising their hands to get their attention. This is to ask them for more illustrations, demonstrations, or simulations when needed or to respond to their queries. The respondents answered their teacher's queries by sending their solutions via the chatbox. If this is not practicable, they took screenshots of their solutions, copied and pasted them into the MS Word application, and then sent them to the online platform to show their answers decently. Due to the scarcity of mathematical characters on the keypad and when the mathematics teachers call for an immediate response, the respondents simply type in the mathematical symbols in words and explain them in the chatbox. When the respondents could not immediately interrupt or ask the mathematics teachers while in the online class, they asked their classmates who knew the lesson to explain things they could not grasp or understand to ask for help when they had questions. They send their queries to their classmates via private messages to get precise information and not to distract their teacher's flow of discussion. For some shy type students, they ask their classmates to ask their questions to teachers on their behalf. For respondents who could not finish online classes for valid reasons, they responsibly asked their classmates about what they had missed. Generally, they asked their classmates or teachers privately.

In some cases, respondents wait for the discussion to end before asking their teachers about their concerns. Some of them wait for their teachers to provide a presentation copy and/or return their activity outputs. On the incidence of limited interaction with teachers or peers, the respondents, more often than not, supplement it by reading relevant web resources and watching videos pertinent to the topic in mathematics.

I screenshot it or copy and paste it into MS Word whenever I want to show my answer in a good way. Sometimes, I type the symbol (in words) and explain it in the chat section. – R33
Because I cannot ask my professors immediately while we are in the class, sometimes I send them a private message for my queries, and gratefully, they respond to my questions. – R30
I do research and consult with my other classmates. – R57

On Learning Environment Issues

The respondents usually find a quiet place, try to calm down, and practice concentration to be less distracted. They do this by closing the doors and windows of their room or moving from one room until they find the best place for online study. Some of them wait until everybody sleeps before watching the recorded video lessons. They usually clean their surroundings when reviewing mathematics lessons to be less distracted. They politely ask their family members to keep quiet and reduce noise, or in some cases, they go to neighbors' houses with peaceful environments.

To focus more, the respondents avoid opening social media accounts, hold a pen and paper, write important notes during online discussions, and, if possible, participate in the discussions to understand the lesson more.

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PROBLEMS
OF EDUCATION
IN THE 21st CENTURY
Vol. 82, No. 1, 2024

I sometimes went to my auntie's house because there were minimal interruptions to study. – R20
I talk to the people who are making noises since we don't have a silent area to study. I log out of my Facebook account, or I turn on the 'do not disturb' mode on my phone so that I will not get any notification. – R56
I keep myself focused by getting a pen and paper and writing the important notes my professor is saying. – R24

On Subject Matter Issues

During online mathematics classes, they try to solve and answer the problems provided by their teachers on their own. At the rate of vague content and discussions, the respondents mostly conduct extensive research, browse for more information, and review almost all night. To wipe out vagueness, they watch relevant video lessons and tutorials, e.g., YouTube or Google, or find other sources on the web, especially when they feel the class lessons were so hard and could not be learned quickly through the online discussion. They read related materials and solve similar exercises found on the web for better insight. They keep on reading, again and again, mathematics problems until they understand the idea. They also search for problems that were not heavily discussed. This serves as their reviewer. They study the lesson until they get how it is done.

After the online mathematics class, they typically search for other references to supplement the discussion, from the easy ones to the most difficult ones. They do this to clarify confusing parts of the discussion or things they come across after the online class which cannot be answered right away by the teacher. Although they undoubtedly watch and rewatch the teachers' recorded discussions, they do not basically rely on them. They try different approaches to learning things and mix them with an amount of practice. Likewise, they jot down notes while attending the class discussion and even after it via the recording, as if they were in a face-to-face classroom. In some cases, they ask their classmates or hire a tutor to guide them at home.

I play the recording of our class which serves as my reviewer, especially If I can't follow the steps being discussed. I researched and watched more related discussions on YouTube and read some articles on Google. – R30
After class, I always review some information that is hard to understand in one time reading. I searched on YouTube to add references. I focus first on easy things and then proceed to difficult ones. – R11

On Motivation Issues

The respondents try to manage their time efficiently by taking notes on what they should be doing in the day and what they have to accomplish to keep themselves motivated. To overcome procrastination, some enter the online meeting as early as ten minutes before the actual schedule to discipline themselves. They try to prioritize and focus on school by always seeing that no tasks are left unanswered. Even if, at some point, they struggle in adapting to new situations, they basically get over it through time by adjusting themselves and trying to cope no matter how difficult it is for them. Some of them go back to the sample problem and solve it independently. They try to build more confidence. They inject into their hearts and minds why they have to pursue this journey and continue with the mathematics course online, the people behind their goals–their family.

I am trying to remember why I am continuing this journey, the people behind my goals, and my goals. With that, I am able to regain my motivation and continue the course. – R42
I keep myself motivated despite learning online. – R62

PROBLEMS
OF EDUCATION
IN THE 21st CENTURY
Vol. 82, No. 1, 2024

Discussion

The study showed that among the benefits of taking mathematics courses online, convenient and flexible study time to access relevant web resources to provide themselves with at least foundation skills opportunities mainly were coded (Kim et al., 2005; So, 2012). This assumed an advancement in students' potential to perform independent learning. Similarly, although taking mathematics courses online is reported as beneficial in providing opportunities for better critical thinking, the respondents do not primarily engage in metacognitive processes but gain more from the benefits of the convenience of time and web resources. In line with Yang and Chou (2008), in this era of internet and information, where there is much untrustworthy and incomplete information waiting to be processed, educators should [have started to] think about how to nurture students' critical thinking disposition. Results also showed that among the difficulties met by the students in attending mathematics courses online, unstable internet connection, vague learning content, distractions, and limited teacher support were the most frequent ones (Leo et al., 2009; Meyers & Bagnall, 2016).

Results further showed that to be able for them to deal with technical issues on the internet and other learning resources, they typically check their devices and internet connection before the online class, set up a backup plan to pay for loads to acquire mobile internet data, and free enough space for their devices so as not to lag or slow down, respectively. To deal with the communication issues, they either communicate with their teachers or peers after class or interact with them privately (Cividino, 2009; Zembylas et al., 2008). Due to the lack of mathematical characters on the keypad, they simply type in the mathematical symbols in words and explain them in the chatbox when asked to respond to the teacher's call. To address the learning environment issues, they usually find a quiet place, try to calm down, and practice concentration to be less distracted. To wipe out vagueness in both learning content and discussions, they watch relevant video lessons and tutorials or find other sources on the web, especially when they feel the lessons were so hard and could not be learned quickly through the online discussion. From the results, accessing relevant web-based resources took place as their means of coping with the learning deficits caused by the difficulties they had met (Cividino, 2009; Kim et al., 2005; So, 2012; Zembylas et al., 2008). And to motivate themselves, they try to manage their time efficiently and inject into themselves why they have to pursue and continue all these mathematics courses online.

For the study limitations, this research was a small-scale qualitative-exploratory research and considered only a small number of participants from a state university in Bulacan, Philippines, from the Central Luzon region. At the same time, data transcripts were collected online.

Conclusion and Implications

It has been determined that the prevalent advantages of taking mathematics courses online are the accessibility of web resources and the convenience of time. Although there are various difficulties that the students have met, the above benefits may resolve and act as a remedy to settle these challenges. Knowing that there was this availability of time and web resources, the students were able to cope with this situation. There is still hope for this transitory situation through independent, self-paced study, particularly when paired with enough motivation. Consequently, it highlights the need to strengthen the students' self-motivation. Even though it was found that students perceive the benefits of online learning as providing a venue to demonstrate self-motivation, it still needs to be strengthened as it is way too far from the other perceived benefits. Similarly, teachers should provide or introduce a broad set of relevant web-based references and resources that students can explore with ease of time to help them operate independently in the self-paced study. Lastly, it is proposed that teachers provide space for

students to aid them in strengthening the perceived pleasure and utility of online learning, enhancing student's self-motivation and so for students to be involved.

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