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## Teachers' Perceived Barriers to Technology Integration during Online Learning

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### Abstract

The COVID-19 pandemic has had a significant impact on education, forcing schools to close and move to remote learning. Prospective math teachers are particularly challenged by technology integration. This is because mathematics is a subject that is often taught in a traditional, lecture-based format. It can be challenging for prospective math teachers to find effective ways to use technology online to demonstrate teaching and learning mathematics. In this study, the researchers investigated the perceived barriers to technology integration experienced by prospective math teachers during emergency remote learning. This study used a descriptive correlational survey design given to fifty-one (51) respondents enrolled at Surigao del Norte State University (SNSU). Data analysis was performed using SPSS. Moreover, the researchers utilized descriptive statistics such as frequency distributions and measures of central tendency, and non-parametric tests such as Fisher's exact tests to treat the data. The results showed that the respondents demonstrated moderately positive beliefs regarding the appropriateness of curriculum content for the technology used and the complementarity of technology and content in the course. Second, the respondents generally had a high level of commitment to attending synchronous online learning sessions. Third, gender, age, and income class do not play a significant role in determining respondents' perceived barriers to technology integration. Lastly, there was no significant relationship between respondents' perceived barriers to technology integration and their self-reported attendance ( $p = 0.099$ ). However, the p-value was close to the conventional threshold for statistical significance ( $p < 0.05$ ), suggesting that there may be a weak association between these two variables.

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### Introduction

Remote learning has been widely practiced in today's education. The idea behind remote learning is to offer students the opportunity to learn at a distance. Though it may seem to have its beginning recently, its concept was put into practice in the middle of the 19th century (The History of Online Schooling, 2020). Remote learning occurs when there is a physical or geographical separation between the students and teachers, in contrast to traditional learning. Hence, remote learning happens outside the traditional classroom setting.

Recently, the world has been shaken by the COVID-19 pandemic, disrupting education in over 150 countries (Rodriguez et al., 2021). Schools were closed as a result of the World Health Organization's (WHO's) declaring the Coronavirus disease a PHEIC or Public Health Emergency of International Concern due to an increase in confirmed human-to-human infections (World Health Organization, 2020). This prevented teachers and students from meeting physically and limited the risks of being infected with the virus. And indeed, based on a study done earlier by (Hens et al., 2009), school closure is a preventive measure against the spread of newly emerging viruses since it limits students' physical interaction. However, these closures affect almost half of the population worldwide who are of school age (Abuhammad, 2020). Since students were not permitted to attend school, learning had become nearly impossible for them. Hence, the education system had to change dramatically.

Higher education institutions, particularly in the Philippines, have made the health of students, faculty members, and others their primary concern in response to the situation. Thus, with the implementation of community quarantine, classes were immediately suspended (Chedro, 2020). Therefore, innovative learning modalities were taken into consideration. Hence, emergency remote learning was implemented (Chedro, 2020) and this was to prevent students from having setbacks during the temporary school closures (Morgan, 2020). Also, encourage students to study from their homes. By all means, at that time, remote learning became the best option (Basilaia & Kvavadze, 2020).

Technically, remote learning simply means distance learning. Its implementation does not require digital technology, nor for it to take place in an online platform (What Is Remote Learning and How Effective Can It Be, 2020). However, since online platforms provide flexible scheduling and the opportunity for teachers to conduct both synchronous and asynchronous learning sessions, most educational institutions have implemented remote learning through online platforms. Thus, digital technology becomes essential.

With the aid of digital technology, remote learning has become more sophisticated and accessible. In 2020, a state university in northern Mindanao was forced to adopt the emergency remote learning approach after the CHED's memorandum due to the COVID-19 pandemic. The said university conducted its emergency remote learning through online platforms such as Google Classroom and Google Meet. So, students, including prospective math teachers, continued their studies using these online platforms.

Despite the increased reliance on technology during emergency remote learning, students might have faced barriers that limit their access to and use of technology, which could impact their academic performance, particularly in the context of mathematics education. These barriers most likely hampered the learning among students, including prospective math teachers, during the emergency remote learning (Abuhammad, 2020). Therefore, it is crucial to understand prospective math teachers' perceptions concerning barriers during emergency remote learning, particularly in terms of accessing technology, since, in doing so, educational policymakers will be able to develop solutions to reduce or remove these barriers (Abuhammad, 2020).

Given the unprecedented circumstances that led to the implementation of emergency remote learning, it is imperative to study its impact on the quality of education and identify potential areas for improvement. This is

particularly important in the field of mathematics education, where remote learning may present unique challenges for both students and teachers. By understanding the barriers to accessing technology faced by prospective math teachers, we can develop strategies to improve their learning experience and ensure that they are equipped to deliver quality education to future generations of students. Ultimately, this research aims to contribute to the ongoing conversation on how to optimize remote learning in the face of global crises and ensure that no student is left behind.

## **Literature Review**

With the COVID-19 pandemic, challenges among higher education institutions emerged. These challenges ranged from unstable internet connectivity to students' mental health struggles (Rotas & Cahapay, 2021). Also, particularly in the unexpected adaptation of emergency remote learning (ERT), both faculties and students were unprepared for this. Yet, the COVID-19 pandemic and this sudden shift have also presented opportunities for educational institutions to upgrade their learning modalities (Toquero, 2020). With the aid of emerging technologies, indeed, "what we once thought as the future is now past. The ability to connect and learn in the comfort of our homes, once seen as long in the future, is now part of our everyday experience" (Vivolo, 2017).

While technology has enabled the continuity of education during emergency remote learning (ERT), it has also created barriers that affect the quality of learning (Rahiem, 2020). Especially in developing countries, such as the Philippines, as Kohn et al. (2010) stated, knowledge transfer with e-learning in these countries often fails. Thus, studies were conducted aiming to understand and mitigate these challenges. Since there is a lack of published articles regarding prospective math teachers' perceptions of technological barriers during emergency remote learning, this literature review examines previous studies on students' and teachers' perceptions of barriers to accessing technology.

### **Students' Perceived Technological Barriers**

Several studies have identified technological barriers during emergency remote learning (ERT). In a study by Gillis and Krull (2020), the authors found two major technological barriers: Internet connectivity and limited technological access. Yet, these are not necessarily surprising; students believed that these barriers had a significant impact on their success and learning. Limited access to technology, such as laptops and tablets, has been reported to cause difficulty for students in attending online classes and submitting assignments (Lipton, 2021). Although these challenges were more experienced by students who live in peri-urban communities, (Mukuka et al., 2021)) also asserted that even students who live in cities experienced challenges such as a lack of access to ICT and electricity.

### **Digital Inequality**

In addition, Bakker & Wagner (2020) stated that the COVID-19 pandemic presented challenges concerning educational equity. Stewart (2021) also highlighted difficulties and challenges, including the socioeconomic

disparity among people, including students. During emergency remote learning (ERT), digital inequality among students had become more apparent, as not all students have equal opportunities for access to digital technology (Belet, 2018). This digital inequality can worsen the impact of other barriers and negatively affect students' academic performance (Gillis & Krull, 2020). Those with secured access to technology are most likely to excel (Rahiem, 2020). Despite the opportunity for education sectors to change their mode of transferring knowledge, Matarirano et al. (2021) stated that the COVID-19 pandemic has also exposed societal inequalities.

### **Attitudes toward Digital Technology**

Students' attitudes toward digital technology appear to have a significant impact on their learning (Mulenga & Marbán, 2020). Donham et al. (2022) stated that classroom environment, student availability, and students' emotions and comfort are barriers that challenge students during remote learning. Also, the anxious use of online platforms such as videoconferencing or learning management systems has been a key issue since full orientation to technological platforms is required (Jowsey et al., 2020). Students were also less motivated due to a lack of physical interaction (Gillis & Krull, 2020; Mukuka et al., 2021).

### **Teachers' Perceived Technological Barriers**

In a previous study by Nikolopoulou and Gialamas (2016), the authors found that teachers experienced major technological barriers such as internet connectivity, lack of funding, outdated and unreliable computers, and a lack of technical support. Hashemi (2021) asserted that these technological barriers have also been a major challenge for teachers during emergency remote learning (ERT). In addition, Donham et al. (2022) highlighted that these barriers range from teachers' technological access to academic integrity.

(Polly et al., 2021) stated that the primary barriers were the amount of time needed to adapt to learning technologies in the context of teaching. Also, in a study by Rodríguez-Muñiz et al. (2021), the authors found that despite teachers demonstrating adequate technological, pedagogical, and content knowledge (TPACK), teachers reported that they needed more preparation when implementing emergency remote learning. The abrupt implementation of emergency remote learning (ERT) shows how important teacher training or professional development is (Stewart, 2021). Thus, Hashemi (2021) concluded that continuous training for teachers should be taken into consideration to provide better opportunities for online education during emergencies such as the COVID-19 pandemic. During the COVID-19 epidemic, both educators and learners are dealing with issues that are essentially the same (Donham et al., 2022; Yeh & Tsai, 2022). Despite these challenges, teachers are encouraged to make use of technological advancements to enhance learning opportunities and develop distinctive learning environments (Rahiem, 2020). Yet there are still obstacles, particularly in terms of access to technology.

## **Method**

### **Research Design**

In pursuit to understand the experiences of prospective math teachers during emergency remote learning, this

study utilizes a descriptive correlational research design. Essentially, to describe the qualities of specific person, group, or population, descriptive research serves as a method to discover fresh insights, describing what exists, or organize information into categories (Dulock, 1993). Moreover, descriptive correlational research aims to describe the relationship between among variables rather than to infer cause and effect relationships (Dulock, 1993; Lappe, 2000). In this event, it is focused on addressing the technological barriers experienced by prospective math teachers during emergency remote learning.

### **Research Environment**

This study was conducted at Surigao del Norte State University's (SNSU) main campus which is located at Narciso street, Surigao City. The university offers Bachelor of Secondary Education major in Mathematics under the College of Teacher Education department. Currently, there are 24 3rd year and 29 4th year students enrolled in the said program.

### **Research Participants**

The respondents of the study were twenty-two (22) 3rd year and twenty-nine (29) 4th year BSED-Mathematics students of Surigao del Norte State University (SNSU) for the academic year 2022-2023. These fifty-one (51) students have experienced the transition from face-to-face to emergency remote learning during their study at the university. Moreover, they are the students who passed the university's retention policy for the education programs. Thus, the researchers chose them as their respondents of this study.

### **Research Instruments**

This study utilized a questionnaire that includes three sections (see Appendix A): A demographic background questionnaire, a researcher-developed questionnaire, and an existing questionnaire titled The Perceived Barriers to Technology Integration scale (PBTI) (Basarmak & Hamutoglu, 2019)" which was already used in previous studies. Demographic Background questionnaire was designed to collect relevant background information, such as gender, age, and income class. The researcher-developed questionnaire is a single-item Likert scale measuring the level of agreement of the respondents regarding self-report attendance. A questionnaire developed by Basarmak and Hamutoglu (2019) to measure teachers' and students' attitudes regarding the integration of technologies in teaching and learning is called the Perceived Barriers to Technology Integration Scale (PBTI). There are 14 categories or constructions in the survey. The following categories were chosen as the four most pertinent for this study: (1) three questions assessing views about teaching and learning activities; (2) two items measuring beliefs on technological self-efficacy; and (3) four items linking technology to learning material.

### *Validity*

It underwent expert assessment to confirm the legitimacy of the content and face (Basarmak & Hamutoglu, 2019). Additionally, EFA and CFA were used to explore the scale's structural validity, and the normalcy, outlier, multi-

collinearity, and linearity presumptions that serve as the basis for analyses were looked at (Basarmak & Hamutoglu, 2019). Convergent and divergent validities were examined in order to determine whether the scale accurately captures the four-factor construct (Basarmak & Hamutoglu, 2019).

### *Reliability*

Cronbach's alpha was used to assess the internal consistency of the modified questionnaire. For each construct, Cronbach's alpha was high (Basarmak & Hamutoglu, 2019). But the researchers also tested the trustworthiness of the data after it had been collected. Additionally, Table 1 displays Cronbach's alpha for the modified constructions.

Table 1. Representation of Cronbach's Alpha for Each Construct

<b>Constructs</b>	<b>Cronbach's Alpha</b>
Beliefs towards Learning-Teaching Activities	.846
Technological Self-Efficacy Beliefs	.879
Content	.807

### **Data Analysis**

In this study, data analysis was performed using SPSS. Since no normality was found in any distribution according to the Kolmogorov-Smirnov test, the researchers utilized the following statistical tools to treat the data collected: The data were evaluated, and the first three issues were addressed using descriptive statistics such as frequency distributions and measures of central tendency. On the other hand, to determine whether there is a significant relationship between respondents' demographic background and perceived barriers to technology integration and whether there is a relationship between perceived barriers to technology integration and attendance in the majority of synchronous online learning sessions, non-parametric Fisher's exact tests were used.

### **Results**

This section presents the descriptive results of the respondents' profiles, the perceived barriers to technology integration, and the extent to which the respondents attended the majority of synchronous online learning sessions during emergency remote learning. Moreover, this section also presents the results of non-parametric analysis, namely the Fisher's exact test, to test whether there is a significant relationship between variables. The results are organized into subsections following the five research questions.

#### **Respondents' Profile**

Demographic background of the respondents in this study was analyzed and summarized in [Table 2](#). A total of 51 respondents participated in the study, with 12 (23.5%) identifying as male and 39 (76.5%) identifying as female. Regarding age distribution, the majority of respondents fell within the 20-25 age range, accounting for 94.1% (48 individuals) of the total. A smaller proportion of respondents, 3.9% (2 individuals), were between 26 and 30 years

old, and only 2.0% (1 individual) were in the 31-35 age range. When it comes to income class, the majority of respondents, 72.5% (37 individuals), fell into the low-income category. Meanwhile, 27.5% (14 individuals) were classified as middle income. There were no respondents in the high-income category.

Table 2. Demographic Background of Respondents

	Frequency	Percentage
<b><u>Gender</u></b>		
Male	12	23.5%
Female	39	76.5%
<b><u>Age</u></b>		
20-25	48	94.1%
26-30	2	3.9%
31-35	1	2.0%
<b><u>Income Class</u></b>		
Low Income	37	72.5%
Middle Income	14	27.5%
High Income	0	

**Perceived Barriers to Technology Integration**

Table 3 shows the descriptive results of perceived barriers to technology integration and categorizes the barriers into three constructs: beliefs towards learning-teaching activities, technological self-efficacy beliefs, and content.

Table 3. Descriptive Results of Perceived Barriers to Technology Integration

Construct	N	Mean	Mode	SD
<b>Beliefs towards Learning-Teaching Activities</b>				
I believe that the use of technology in learning-teaching activities enhances learning.	51	4.04	4	0.937
I believe that it is easy to design learning activities by using technology.	51	4.04	4	0.824
I believe that technology facilitates my work just like a teacher.	51	3.71	4	1.006
<b>Technological Self-Efficacy Beliefs</b>				
I worry about using technology in my courses.	51	2.41	2	1.004
When I need to use technology in my courses, I feel afraid of doing it wrong.	51	2.57	2	1.136
<b>Content</b>				
I have the appropriate curriculum content for the technology I use in the course.	51	3.67	4	0.792
I think that the technology to be used in the course and the content to be taught complement each other.	51	3.84	4	0.834



In terms of beliefs towards learning-teaching activities, the respondents demonstrated a high belief in the enhancement of learning through the use of technology, with a mean score of 4.04 (SD = 0.937). Similarly, the respondents expressed a strong belief that designing learning activities with technology is easy, with a mean score of 4.04 (SD = 0.824). They also moderately believed that technology can facilitate their work, just like a teacher, with a mean score of 3.71 (SD = 1.006). Regarding technological self-efficacy beliefs, the respondents, on average, disagreed with the statement "I worry about using technology in my courses", with a mean score of 2.41 (SD = 1.004). This suggests that they did not exhibit significant levels of concern or worry when it comes to utilizing technology in their courses. Similarly, for the statement "When I need to use technology in my courses, I feel afraid of doing it wrong," the respondents, on average, disagreed with the statement with a mean score of 2.57 (SD = 1.136). This indicates that participants did not experience substantial levels of fear or apprehension about making mistakes while using technology in their courses. Concerning the content aspect, the respondents moderately believed that they have appropriate curriculum content for the technology used in their courses, as evidenced by a mean score of 3.67 (SD = 0.792). Additionally, they expressed a moderate belief that the technology and content in the course complement each other, with a mean score of 3.84 (SD = 0.834). These findings suggest that the respondents generally held positive beliefs towards the use of technology in learning-teaching activities and found it easy to design learning activities using technology. Also, findings suggest that the participants had a relatively positive technological self-efficacy outlook, as they did not report high levels of worry or fear related to using technology for education. Furthermore, the respondents demonstrated moderately positive beliefs regarding the appropriateness of curriculum content for the technology used and the complementarity of technology and content in the course. The variability in responses indicates potential differences in perceptions among the respondents regarding these barriers to technology integration (see Table 4).

Table 4. Summary of Barriers at Each Construct

Construct	N	Mean	Mode	SD
Beliefs towards Learning-Teaching Activities	51	3.93	4	0.922
Technological Self-Efficacy Beliefs	51	2.49	2	1.07
Content	51	3.76	4	0.813

### **The extent to which the respondents attended the majority of synchronous online learning sessions during emergency remote learning.**

When ask about the extent they attended the majority of synchronous online learning sessions during emergency remote learning, on average, the respondents reported attending the majority of synchronous online learning sessions with a mean score of 4.49. This suggests that, overall, the participants were actively engaged and present during these sessions. Additionally, the mode of 5 indicates that the most common response was indicating full attendance or attending all of the sessions as shown on Table 5.

Table 5. Descriptive Results of Self-report Attendance

Item	N	Mean	Mode	SD
I attended the majority of synchronous online learning session.	51	4.49	5	0.750

The relatively low standard deviation of 0.750 suggests that there was not a significant amount of variability in the participants' responses. This indicates that most participants reported similar levels of attendance, with minimal deviation from the mean. These findings suggest that the participants generally had a high level of commitment to attending synchronous online learning sessions, which can be seen as a positive indication of their engagement and dedication to their education in the online learning environment. However, it is important to consider that this data shows self-reported attendance, which can be subject to personal bias or overestimation.

**Significant relationship between respondents' demographic background and perceived barriers to technology integration.**

No statistically significant relationship between demographic variables and perceived barriers to technology integration in several items of the instrument as shown on Table 6. For this analysis, researchers transformed Likert-derived data into dichotomous data (i.e. Agree/Disagree) due to the low frequency. Also, negatively worded items were reverse coded.

Table 6. Significant Relationship between Respondents' Demographic Background and Perceived Barriers to Technology Integration

<b>Variables</b>		<b>P-value</b>
Gender	Perceived Barriers to Technology Integration	1.000
Age		0.812
Income Class		0.305

Based on the analysis of the data presented in Table 6, it appears that there is no significant relationship between respondents' gender and perceived barriers to technology integration. The p-value of 1.000 suggests that any observed relationship between gender and perceived barriers is likely due to chance or random variation in the data. Similarly, the analysis indicates that there is no significant relationship between respondents' age and perceived barriers to technology integration. The p-value of 0.812 further supports the notion that any association between age and perceived barriers is not statistically significant. Furthermore, the analysis reveals that there is no significant relationship between respondents' income class and perceived barriers to technology integration. The p-value of 0.305 suggests that any observed connection between income class and perceived barriers is not statistically significant.

**Significant relationship between the respondents perceived barriers to technology integration and the extent of their attendance in the majority of synchronous online learning sessions during emergency remote learning.**

Also, no statistically significant relationship between perceived barriers to technology integration and self-reported attendance have found. Based on the analysis of the data presented in Table 7, there is no significant relationship between respondents' perceived barriers to technology integration and their self-reported attendance. The p-value of 0.099 suggests that there may be a weak association between these two variables, but it does not

reach the conventional threshold for statistical significance set at 0.05. The p-value of 0.099 indicates that there is a 9.9% chance of obtaining the observed relationship between perceived barriers to technology integration and self-reported attendance by random chance alone. While this p-value falls just short of statistical significance, it suggests that there may be a trend or tendency for individuals who perceive higher barriers to technology integration to have lower self-reported attendance. However, further investigation or a larger sample size may be needed to confirm the relationship definitively. It is important to note that a p-value of 0.099 still provides some evidence that the relationship may exist.

Table 7. Significant Relationship between Perceived Barriers to Technology Integration and Self-reported Attendance

Variables		P-value
Perceived Barriers to Technology Integration	Self-Reported Attendance	0.099

**Significant relationship between the respondents’ demographic backgrounds and the extent of their attendance in the majority of synchronous online learning sessions during emergency remote learning.**

Table 8. Significant Relationship between the Respondents’ Demographic Backgrounds and Self-reported Attendance

Variables		P-value
Gender		0.235
Age	Self-Reported Attendance	1.000
Income Class		0.275

The results of the statistical analysis revealed that there was no statistically significant association between gender and self-reported attendance in the online synchronous learning sessions ( $p = 0.235$ ). This suggests that the difference in attendance between genders is likely due to chance rather than being influenced by gender itself. Similarly, age was found to have no significant relationship with self-reported attendance ( $p = 1.000$ ), indicating that attendance across different age groups is not likely influenced by age. Additionally, income class was not significantly associated with self-reported attendance ( $p = 0.275$ ), suggesting that the difference in attendance among income classes is likely due to random variation rather than income class itself. These findings indicate that gender, age, and income class do not appear to be strong predictors of attendance in the online synchronous learning sessions. However, it is important to consider other potential factors that may influence attendance and acknowledge the limitations of the study design or data collection methods.

**Discussion**

The results of this study shed light on the perceived barriers to technology integration experienced by prospective math teachers during emergency remote learning. The COVID-19 pandemic has had a significant impact on education, necessitating the closure of schools and a shift to remote learning. This transition has posed particular

challenges for math teachers due to the traditional, lecture-based format in which mathematics is often taught. Finding effective ways to use technology to demonstrate teaching and learning mathematics online can be a daunting task for prospective math teachers.

In this study, the researchers aimed to investigate the perceived barriers to technology integration among prospective math teachers. The sample consisted of 51 respondents enrolled at Surigao del Norte State University (SNSU), and a descriptive correlational survey design was employed. The data analysis involved the use of SPSS, descriptive statistics, frequency distributions, measures of central tendency, and non-parametric tests such as Fisher's exact tests.

The study findings revealed that the respondents held positive beliefs towards learning-teaching activities and the integration of technology. They expressed a high belief in the enhancement of learning through technology and found it easy to design learning activities using technology. They also had a moderate belief that technology can facilitate their work as teachers. The respondents demonstrated a relatively positive technological self-efficacy outlook, showing minimal worry or fear about using technology in their courses. They believed they had appropriate curriculum content for the technology used and perceived a moderate level of complementarity between technology and content. These findings suggest that prospective math teachers recognize the potential of technology to enhance mathematics education.

Additionally, the study revealed that the respondents exhibited a high level of commitment to attending synchronous online learning sessions. This indicates their dedication and engagement in the learning process despite the challenges posed by remote learning. The consistent attendance reported by the participants emphasizes the importance of synchronous online sessions in maintaining student involvement and interaction. Regarding the relationship between demographic factors and perceived barriers to technology integration, the results indicated that gender, age, and income class did not play a significant role. This suggests that the challenges faced by prospective math teachers in integrating technology are not influenced by these demographic variables.

Furthermore, the study examined the relationship between perceived barriers to technology integration and self-reported attendance. Although the statistical analysis did not reveal a significant relationship, the p-value of 0.099 was close to the conventional threshold for statistical significance ( $p < 0.05$ ), suggesting a weak association. These results indicate that while there may be a trend suggesting that individuals perceiving higher barriers have lower attendance, further investigation or a larger sample size is needed to confirm this relationship definitively.

Lastly, the statistical analysis revealed no significant associations between gender, age, and income class with self-reported attendance in online synchronous learning sessions. Gender, age, and income class are not strong predictors of attendance. Other factors and limitations in the study design should be considered.

Overall, the findings of this study highlight the importance of addressing the perceived barriers to technology integration among prospective math teachers. By identifying and overcoming these barriers, educators can better equip themselves to effectively incorporate technology into math instruction during emergency remote learning

or other educational contexts. Future research should focus on exploring specific strategies or interventions that can support prospective math teachers in utilizing technology to enhance teaching and learning in mathematics.

## Conclusion

Based on the findings, the following conclusions are drawn:

*Demographic Backgrounds:* The study sample consisted of 51 participants, with a majority of them being female (76.5%) and the remaining identifying as male (23.5%). Most participants (94.1%) fell within the 20-25 age range, with only a small proportion in the 26-30 (3.9%) and 31-35 (2.0%) age ranges. In terms of income class, the majority of participants were categorized as low-income (72.5%), while the rest were classified as middle income (27.5%). No participants belonged to the high-income category.

*Perceived Barriers to Technology Integration:* Participants expressed a high belief in the enhancement of learning through technology and considered designing learning activities with technology as easy. They moderately believed that technology can facilitate their work. Participants showed low levels of worry or fear related to using technology in their courses, indicating a certain level of technological self-efficacy. They also held moderate beliefs regarding the appropriateness of curriculum content for the technology used in their courses and the complementarity of technology and content.

*Attendance in Synchronous Online Learning:* Participants reported attending the majority of synchronous online learning sessions during emergency remote learning, with high levels of commitment and engagement. The low standard deviation suggests consistent attendance among participants.

*Relationship between Demographics and Perceived Barriers to Technology Integration:* There was no statistically significant relationship between gender, age, or income class and perceived barriers to technology integration. The lack of significance indicates that any observed relationships between demographics and perceived barriers are likely due to chance.

*Relationship between Perceived Barriers and Self-Reported Attendance:* There was no statistically significant relationship between perceived barriers to technology integration and self-reported attendance. While the p-value suggests a weak association, it does not reach the conventional threshold for statistical significance. Further investigation or a larger sample size is needed to confirm the relationship definitively.

*Relationship between Demographics and Self-Reported Attendance:* Gender, age, and income class were not significantly related to self-reported attendance in online synchronous learning sessions. This suggests that attendance in online synchronous learning sessions is not influenced by gender, age, or income class.

Overall, based on the findings, gender, age, and income class do not appear to be strong predictors of attendance or perceived barriers to technology integration in online synchronous learning sessions. Participants generally had

positive beliefs about technology and reported high levels of attendance and engagement in synchronous online learning.

## **Recommendations**

Based on careful analysis of the findings and conclusion of the study, the following recommendations are presented:

1. University Faculties. Review the study findings and incorporate them into administrative practices for better preparedness in implementing remote learning during emergencies or unforeseen events. Develop comprehensive emergency response plans, enhance infrastructure for remote learning, and provide faculty members with training and resources for effective online teaching.
2. Prospective Math Teachers. Integrate the research insights into math teacher education programs. Provide training and support to prospective teachers on effectively integrating technology in math education, preparing them to navigate challenges during emergency remote learning.
3. Students and their Families. Utilize the study findings to develop student-centered strategies that enhance engagement, motivation, and achievement in math education across different learning contexts. Provide resources, technological support, and targeted interventions to address specific challenges and ensure student success.
4. Future Researchers. Build upon the study findings to further investigate technology integration and remote teaching and learning. Explore additional factors, interventions, and long-term impacts to contribute to the advancement of knowledge in the field.

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## References

- Abuhammad, S. (2020). Barriers to distance learning during the COVID-19 outbreak: A qualitative review from parents' perspective. *Heliyon*, 6(11), e05482. <https://doi.org/10.1016/j.heliyon.2020.e05482>
- Bakker, A., & Wagner, D. (2020). Pandemic: Lessons for today and tomorrow? *Educational Studies in Mathematics*, 104(1), 1–4. <https://doi.org/10.1007/s10649-020-09946-3>
- Barron Rodriguez, M., Cobo, C., Munoz-Najar, A., & Sanchez Ciarrusta, I. (2021). *Remote Learning During the Global School Lockdown: Multi-Country Lessons*. World Bank. <https://doi.org/10.1596/36141>
- Basarmak, U., & Hamutoglu, N. B. (2019). Developing and Validating a Comprehensive Scale to Measure Perceived Barriers to Technology Integration. *International Journal of Technology in Education and Science*, 4(1), 53–71. <https://doi.org/10.46328/ijtes.v4i1.53>
- Basilaia, G., & Kvavadze, D. (2020). Transition to Online Education in Schools during a SARS-CoV-2 Coronavirus (COVID-19) Pandemic in Georgia. *Pedagogical Research*, 5(4). <https://doi.org/10.29333/pr/7937>
- Belet, M. (2018). The Importance of Relevance to Student Lives: The Impact of Content and Media in Introduction to Sociology. *Teaching Sociology*, 46(3), 208–224. <https://doi.org/10.1177/0092055X17730113>
- Bond, M., Bedenlier, S., Marín, V. I., & Händel, M. (2021). Emergency remote teaching in higher education: Mapping the first global online semester. *International Journal of Educational Technology in Higher Education*, 18(1), 50. <https://doi.org/10.1186/s41239-021-00282-x>
- CHEDRO. (2020, October 19). *Online Public Orientation on the CHED Memorandum Order (CMO) No. 4, series of 2020, "Guidelines on the Implementation of Flexible Learning."* <https://chedro3.ched.gov.ph/2020/10/19/online-public-orientation-on-the-ched-memorandum-order-cmo-no-4-series-of-2020-guidelines-on-the-implementation-of-flexible-learning/>
- Donham, C., Barron, H. A., Alkhouri, J. S., Changaran Kumarath, M., Alejandro, W., Menke, E., & Kranzfelder, P. (2022). I will teach you here or there, I will try to teach you anywhere: Perceived supports and barriers for emergency remote teaching during the COVID-19 pandemic. *International Journal of STEM Education*, 9(1), 19. <https://doi.org/10.1186/s40594-022-00335-1>
- Dijk, J. A. G. M. (2017). Digital Divide: Impact of Access. In P. Rössler, C. A. Hoffner, & L. Zoonen (Eds.), *The International Encyclopedia of Media Effects* (1st ed., pp. 1–11). Wiley. <https://doi.org/10.1002/9781118783764.wbieme0043>
- Dulock, H. L. (1993). Research Design: Descriptive Research. *Journal of Pediatric Oncology Nursing*, 10(4), 154–157. <https://doi.org/10.1177/104345429301000406>
- Gillis, A., & Krull, L. M. (2020). COVID-19 Remote Learning Transition in Spring 2020: Class Structures, Student Perceptions, and Inequality in College Courses. *Teaching Sociology*, 48(4), 283–299. <https://doi.org/10.1177/0092055X20954263>
- Hashemi, A. (2021). Online teaching experiences in higher education institutions of Afghanistan during the COVID-19 outbreak: Challenges and opportunities. *Cogent Arts & Humanities*, 8(1), 1947008. <https://doi.org/10.1080/23311983.2021.1947008>
- Hens, N., Ayele, G. M., Goeyvaerts, N., Aerts, M., Mossong, J., Edmunds, J. W., & Beutels, P. (2009). Estimating the impact of school closure on social mixing behaviour and the transmission of close contact infections

- in eight European countries. *BMC Infectious Diseases*, 9(1), 187. <https://doi.org/10.1186/1471-2334-9-187>
- Jowsey, T., Foster, G., Cooper-Ioelu, P., & Jacobs, S. (2020). Blended learning via distance in pre-registration nursing education: A scoping review. *Nurse Education in Practice*, 44, 102775. <https://doi.org/10.1016/j.nepr.2020.102775>
- Kohn, T., Maier, R., & Thalmann, S. (2010). Knowledge Transfer with E-Learning Resources to Developing Countries: Barriers and Adaptive Solutions. In M. H. Breitner, F.
- Lappe, J.M. (2000). Taking the mystery out of research. Descriptive correlational design.
- Lehner, J. Staff, & U. Winand (Eds.), *E-Learning 2010* (pp. 15–29). Physica-Verlag HD. [https://doi.org/10.1007/978-3-7908-2355-4\\_2](https://doi.org/10.1007/978-3-7908-2355-4_2)
- Lipton, J. (2021). Teachers' experiences with emergency remote teaching during the COVID-19 pandemic. Wilkes University.
- Matarirano, O., Yeboah, A., & Gqokonqana, O. (2021). Readiness of Students for Multi-Modal Emergency Remote Teaching at A Selected South African Higher Education Institution. *International Journal of Higher Education*, 10(6), 135. <https://doi.org/10.5430/ijhe.v10n6p135>
- Morgan, H. (2020). Best Practices for Implementing Remote Learning during a Pandemic. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas*, 93(3), 135–141. <https://doi.org/10.1080/00098655.2020.1751480>
- Mukuka, A., Shumba, O., & Mulenga, H. M. (2021). Students' experiences with remote learning during the COVID-19 school closure: Implications for mathematics education. *Heliyon*, 7(7), e07523. <https://doi.org/10.1016/j.heliyon.2021.e07523>
- Mulenga, E. M., & Marbán, J. M. (2020). Prospective Teachers' Online Learning Mathematics Activities in The Age of COVID-19: A Cluster Analysis Approach. *Eurasia Journal of Mathematics, Science and Technology Education*, 16(9), em1872. <https://doi.org/10.29333/ejmste/8345>
- Nikolopoulou, K., & Gialamas, V. (2016). Barriers to ICT use in high schools: Greek teachers' perceptions. *Journal of Computers in Education*, 3(1), 59–75. <https://doi.org/10.1007/s40692-015-0052-z>
- Polly, D., Martin, F., & Guilbaud, T. C. (2021). Examining barriers and desired supports to increase faculty members' use of digital technologies: Perspectives of faculty, staff and administrators. *Journal of Computing in Higher Education*, 33(1), 135–156. <https://doi.org/10.1007/s12528-020-09259-7>
- Rahiem, M. D. H. (2020). Technological Barriers and Challenges in the Use of ICT during the COVID-19 Emergency Remote Learning. *Universal Journal of Educational Research*, 8(11B), 6124–6133. <https://doi.org/10.13189/ujer.2020.082248>
- Rodríguez-Muñiz, L. J., Burón, D., Aguilar-González, Á., & Muñoz-Rodríguez, L. (2021). Secondary Mathematics Teachers' Perception of Their Readiness for Emergency Remote Teaching during the COVID-19 Pandemic: A Case Study. *Education Sciences*, 11(5), 228. <https://doi.org/10.3390/educsci11050228>
- Rotas, E. E., & Cahapay, M. B. (n.d.). *Difficulties in Remote Learning: Voices of Philippine University Students in the Wake of COVID-19 Crisis*.
- Stewart, W. H. (2021). A global crash-course in teaching and learning online: A thematic review of empirical Emergency Remote Teaching (ERT) studies in higher education during Year 1 of COVID-19. *Open*




- Praxis*, 13(1), 89. <https://doi.org/10.5944/openpraxis.13.1.1177>
- The History of Online Schooling*. (2020). <https://www.onlineschools.org/visual-academy/the-history-of-online-schooling/>
- Toquero, C. M. (2020). Challenges and Opportunities for Higher Education amid the COVID-19 Pandemic: The Philippine Context. *Pedagogical Research*, 5(4), em0063. <https://doi.org/10.29333/pr/7947>
- What is Remote Learning and How Effective Is It? A Definition. (2020, July 10). GradeCam. <https://gradecam.com/2020/07/what-is-remote-learning-and-how-effective-can-it-be/>
- World Health Organization. (2020). COVID-19 Public Health Emergency of International Concern (PHEIC). Global research and innovation forum: towards a research roadmap.
- Vivolo, J. (2017). *Active learning interaction, diversity, and evolution in online learning*. In R. Ubell, *Going online perspectives on digital learning* (pp. 1-106). Routledge Taylor & Francis Group.
- Yeh, C.-Y., & Tsai, C.-C. (2022). Massive Distance Education: Barriers and Challenges in Shifting to a Complete Online Learning Environment. *Frontiers in Psychology*, 13, 928717. <https://doi.org/10.3389/fpsyg.2022.928717>

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