

INVESTIGATING THE EFFECTS OF VIDEOCONFERENCING ON STUDENTS' EXPERIENCES IN LEARNING MATHEMATICS

Hazel B. Reduca; Jenyliza T. Uchang*

Bukidnon State University Kitaotao Campus, Purok 4, Poblacion, Kitaotao Bukidnon, 8716 Philippines

Correspondence Tel.: +639365836124, *Email: redoxhazelb@gmail.com

ABSTRACT *The study investigated the effects of videoconferencing on students' experiences in learning mathematics at Bukidnon State University Kitaotao Campus during the S.Y. 2021–2022. The participants of the study were nine (9) selected Business Administration third-year students enrolled in the Business Statistics subject. Specifically, the study aimed to discuss students' experiences with videoconferencing in learning mathematics. The study also made use of a case study qualitative research design using an exploratory approach. The data gathered was based on an interview result further coded, analyzed, and compared. Results of the study revealed that students' experiences varied; they each had unique experiences, but they all agreed that taking an online class saves time, but the poor internet connection was a major drawback. These good experiences included students' experienced approachable instructors, were given recognition, felt the true essence of collaboration, can do multi- tasks, felt comfortable learning at home, being involved, can answer their modular activities, and can contribute to the class. On the other hand, students' difficulties encountered were that they were unprepared, got bored, felt sleepy, distracted, mentally blocked, don't comprehend, remained silent, left the meeting, had an internet connection that went out unexpectedly, and lacked of funds. Despite the fact that students believe math is difficult to learn without a teacher, they continue to learn during online classes.*

Keywords: *Students' experiences on videoconferencing, students' interest on videoconferencing, students' interest in learning Math, effects of videoconferencing, advantages and disadvantages of videoconferencing.*

1. INTRODUCTION

In recent years, the emergence of videoconferencing technology has revolutionized the way we communicate and collaborate, especially in the education sector. With the widespread adoption of distance learning due to the COVID-19 pandemic, videoconferencing has become an integral part of the learning process for many students and educators. This research aims to investigate the effects of videoconferencing on students' experiences in learning mathematics [1].

Bukidnon State University responds to the protocols and guidelines mandated by CHED, specifically on the continuity of education amidst the pandemic [2]. The Office of the Vice President for Academic Affairs, together with the University President, Dr. Oscar B. Cabañelez, and the Board of Regents, has issued an Academic Contingency Plan III in light of COVID-19, which was approved on June 10, 2020. Academic policies and procedures were stated pre, during, and post flexible learning implementation.

In line with this, the main campus cascaded the policies and guidelines to its 16 satellite campuses. These guidelines provided the framework for operational procedures for the re-opening of classes following the flexible learning modality. In one of BukSU's satellite campuses, specifically in Kitaotao, Bukidnon, the faculty and staff agreed that the modality to be adopted would be modular, considering that 73% of the students do not have internet connectivity at home. However, students find it difficult to answer their module all alone without the teacher's assistance; therefore, the rise of information technologies through tele-collaborative and online learning has become an essential complement to the modular learning approach. Online learning through videoconferencing is one of the modalities that makes it possible to have educational unification, connecting individuals who may be physically, socially, and/or culturally distant from each other [3].

Mathematics is a fundamental subject that requires a deep understanding of concepts, problem-solving skills, and critical

thinking abilities. However, many students struggle to learn mathematics, and traditional classroom teaching methods may not be effective for all learners [4]. Videoconferencing technology offers the potential to enhance the learning experience by providing students with access to a range of resources, including real-time feedback, multimedia resources, and virtual collaboration tools.

Videoconferencing has become an essential tool in the education sector, especially in the context of distance learning. However, it has not been without its challenges. One of the main problems that arise with the application of videoconferencing technology is connectivity and bandwidth. Poor network connectivity can result in disruptions, lag, and delays, which can impede the learning experience for students [5]. Another problem is the difficulty of maintaining student engagement and attention during virtual classes, which may lead to distractions, multitasking, and reduced participation [6]. Additionally, technical issues such as equipment failures or compatibility problems can hinder the smooth running of virtual classes. These problems require careful consideration and mitigation strategies to ensure that videoconferencing technology can be applied effectively in the context of mathematics education [3].

This research will examine the impact of videoconferencing on students' motivation, engagement, and learning outcomes in mathematics. The study will involve an interview with students who have experienced videoconferencing in learning mathematics and will analyze their responses to identify patterns and trends. The research will also explore the challenges and opportunities presented by videoconferencing in the context of mathematics education.

Overall, this research will contribute to our understanding of how videoconferencing technology can be used to enhance the learning experience in mathematics and inform the development of effective teaching strategies for educators.

2. MATERIALS AND METHODS

The procedures that were employed in this study were guided by the methodology of the case study approach by Rashid et al. (2019), which consists of four phases, namely: 1) the foundation phase, 2) the prefield phase, 3) the field phase, and 4) the reporting phase. Rashid stressed that these phases were more focused on theory than practice, and most do not provide the basic knowledge of beginners' case studies [7].

In the reporting phase, the nine (9) third-year student participants in the study were highlighted. A sample taken from a population of 111 students of the Bachelor of Science in Business Administration (BSBA) program at BukSU KC who enrolled in the first semester of the academic year 2021-2022 of the subject CBMEC 3 with the course title, Business Statistics and who were familiar enough with the Google Meet functionalities. These participants are of varying ages, ranging from 21 to 30. Participants in this study were two males, while the remaining seven were females. These participants also have different civil statuses: some were single, and others were married. Three of them were already parents with children. They were purposefully chosen based on their academic performance (high, average, or low) and interests (extreme, moderate, or low). The following are specific descriptions of each participant: Student H1 is a participant with a high level of performance and an extreme level of interest. Student H2 is a participant with a high level of performance and a moderate level of interest. Student H3 is a participant with a high level of performance and a low level of interest. Student A1 is a participant with an average level of performance and an extreme level of interest. Student A2 is a participant with an average level of performance and a moderate level of interest. Student A3 is a participant with an average level of performance and a low level of interest. Student L1 is a participant with a low level of performance and an extreme level of interest. Student L2 is a participant with a low level of performance and a moderate level of interest, and Student L3 is a participant with a low level of performance and a low level of interest.

Moreover, Rashid also identified eight steps or procedures inherent in the said phases [7]. Theme generation and coding were the most recognized data analysis methods in qualitative empirical material. The authors interpreted the raw data for case studies with the help of a four-step interpretation process (PESI). Raw empirical material, from texts to interviews, field notes of meetings, observations, and project reports, was arranged and sorted in NVivo. Since the empirical material from interviews was rich compared to other sources, an in-depth interpretation of the text was first made in interviews. The interpretation process started with the initial coding of sub-concepts, main concepts, and finally, categories. The categories developed from interviews were then triangulated with the observation of field notes and documents. The outcome of empirical material interpretation is presented in a few frames. Figure 1 provides an overview of the empirical material interpretation process followed by the authors' case studies.

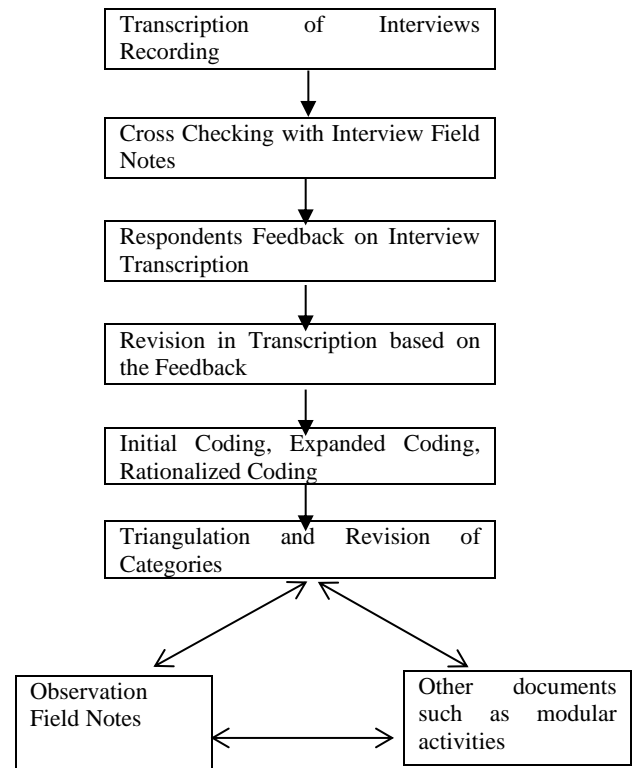


Figure 1. Empirical material interpretation process

In analyzing the data, the steps of Atkinson's 2002 study, Four Steps to Analyze Data from a Case Study Method, were used. However, NVivo was used instead of Microsoft Access. It serves to provide insights into qualitative data sets without suggesting interpretations. This method for qualitative data and text analysis makes it simple to sort, structure, and analyze large amounts of text or other data and manage the interpretations and evaluations that result. For the coding process, initial coding, expanded coding, and rationalized coding were used in the analysis of the data [8].

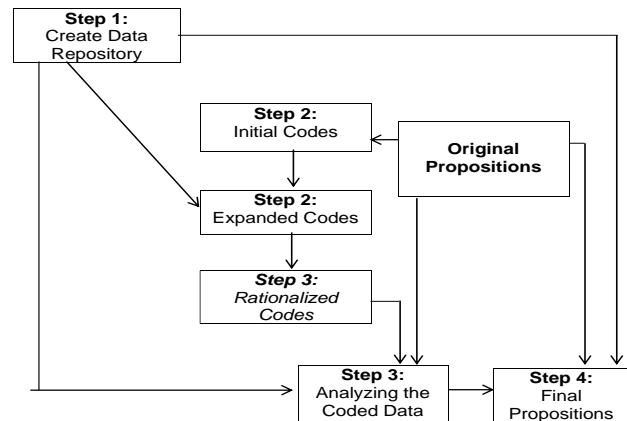


Figure 2. Case Study Structure

The semi-structured interview protocol was the main research tool used in this study. The test and the Mathematics Interest Inventory questionnaire were used only to help select the respondents. The semi-structured interview task protocol was used to delve deeper into the effects of videoconferencing on students' experiences in learning mathematics. The questions were developed based on the study's prior constructs.

Because of the in-depth nature of an intensive interview, each participant's interpretation of his or her experiences with online classes was elicited. The interviewer wants to learn more about the subject, and the interview participants have relevant experiences to share (Fontana & Frey, 1994) [9]. As a result, the interviewer asked the participant to describe and reflect on his or her experiences as a student in this new normal in response to the interviewer's questions. The interviewer's job was to listen, observe with care, and encourage the subject to respond [10]. As a result, the participant did the majority of the talking in the conversation.

A few broad, open-ended questions were asked to the participants in this case study. The interview then focused on the questions to encourage in-depth discussion of the subject. The unexpected statements and stories of the participants emerged as a result of the open-ended, non-judgmental questions. The balance between making the interview open-ended and focusing on significant statements was shaped by the combination of how the questions were constructed and how the interview was conducted.

The case study began with open questions, and the researcher presumed that she may know little about the meanings that drive the actions of the participants. The first question may suffice for the whole interview if stories tumble out. Accordingly, we seek to learn from participants what are their learning experiences in attending virtual classes. Research questions that were open, and focused on social processes were asked to answer a practical problem: what are students' experiences in learning mathematics?

The interviewer's comments and questions assisted the participants in expressing their intentions and meanings. The interviewer asked for clarification as the interview progresses in order to obtain accurate information and learned about the research participants' experiences and reflections.

The interview delves beneath the surface of everyday conversation to reexamine previous events, perspectives, and feelings. Intensive interviews allow an interviewer to delve deeper into the described experience (s); request more information or clarification on a statement or topic; inquire about the participant's thoughts, feelings, and actions; keep the participant on topic; and return to an earlier point, restate the participant's point to ensure accuracy; slow or quicken the pace; change the immediate topic; validate the participant's humanity, perspective, or action; use your observational and social skills to advance the discussion; respect the participant and express gratitude for their participation.

3. RESULTS AND DISCUSSION

Students Experiences refer primarily to the nature of students' engagement with teaching and learning through the use of videoconferencing technology. The students' experiences during videoconferencing were investigated carefully. The

data analysis revealed students' good experiences and difficulties encountered during videoconferencing sessions.

I. Students' Good Experiences on Videoconferencing

There were eight rationalized codes, as classified by the researcher based on the responses of the student participants. These good experiences include students who experienced an approachable instructor, were given recognition, felt the true essence of collaboration, can do multi tasks, felt comfortable learning at home, were involved, can answer their modular activities, and can contribute to the class.

A. Students experienced approachable instructors

Students experienced feeling welcomed during videoconferencing sessions as they had experienced approachable and friendly instructors: *"We always felt welcomed because we were not afraid when we asked our instructors; they were approachable and friendly enough."* This implies that the instructors of the students were open enough to ask if students had questions, concerns, or queries.

B. Students were given recognition Moreover, students felt welcomed as they were given recognition during meetings. Recognition means recognizing students for their exemplary academic efforts, etc. Student A2 said, *"I felt welcomed since obviously, professors are welcoming."* Indeed, giving recognition motivates students to learn more.

C. Students felt the true essence of collaboration

Students also felt the true essence of collaboration with their classmates. Student H3 mentioned, *"I like my online class since my classmates and I assisted each other in joining the class."* The pandemic shocked students with the changes in educational platforms, and thus students found out that they were helping each other, especially in manipulating their devices to attend online classes.

D. Students can do multi-tasks

It was also found out that students felt comfortable as online learning saves time, so they can multitask while attending videoconferencing. Student H1 said, *"Attending an online class saves time because you can enter your class with just one click as long as you have an internet connection, and you can do other tasks while in class."*

students felt comfortable learning at home

Also, students felt comfortable learning at home. Student H1 said, *"You can also stay in the comfort of your own home while attending class."* It was found out that they were not pressured in terms of physical preparations, even to answer, because they were just at home.

F. Students were involved

Furthermore, students experienced being involved as their instructors strategized. Student A2 said, *"During the online class, my instructor is very strategic, such as doing on-the-spot oral recitation, which I enjoy because I feel rushed and compelled to respond."* Surprised oral recitations had become a very nice strategy during online learning because they forced students to attend classes.

G. Students answered their modular activities

Students were able to answer their modules. With this videoconferencing, students somehow benefit from the modular modality adopted. Student L1: *"I have been able to contribute something to the class; for example, I have been able to participate well in online activities such as oral*

examinations." "I can respond during an oral recitation, particularly if I have studied."

H. Students contributed to the class

Students were able to participate in online classes. Student L1 said, "I have been able to contribute something to the class; for example, I have been able to participate well in online activities such as oral examinations." Also, Student L2 said, "When I grasp the issue being discussed and can answer questions and even participate in online activities, I consider it a positive experience." Moreover, Student L3 added, "I consider myself fortunate when I am able to respond to questions."

Table 1 below presents students good experiences with videoconferencing.

Table 1. Students' good experiences on videoconferencing

Initial Codes	Expanded Codes	Rationalized Codes
Welcomed	Approachable and friendly instructors	Students experienced approachable instructors
	Acknowledged during meetings	Students were given recognition
	They have helpful classmates	Students felt true essence of collaboration
Comfortable	Online class saves time	Students can do multi tasks
	Learning is just in home	Students felt comfortable learning at home
Involved	Instructors are very strategic	Students were involved
	Able to answer module	Students answered their modular activities
	Able to participate	Students contributed to the class

II. Students' Difficulties Encountered on Videoconferencing

On the other hand, students' difficulties encountered were also being investigated, and their responses were classified into the following rationalized codes: students were unprepared, got bored, felt sleepy, were distracted, were mentally blocked, didn't comprehend, remained silent, left the meeting, had an internet connection that went out unexpectedly and lacked funds.

A. Students were unprepared

Results of the analysis revealed that some students also felt frightened, especially when they were not prepared for their classes. Student L1 said, "Yes, I felt intimidated at times since I wasn't always prepared, for example, I wasn't present the previous time they had conversations, so I don't know exactly what they spoke about before, and I don't know what to talk about now or what to read ahead of time."

B. Students got bored and felt sleepy

Furthermore, students reported feeling bored and sleepy after listening to a discussion for several hours. Student L2 said, "During the online class, I felt a mix of emotions such as sleepiness, boredom, and even distraction because I was thinking about other things to do."

C. Students were distracted

It was also revealed that students got distracted by the online class and did not really comprehend. Student L2 said, "When I don't really comprehend the discussion until the session is over and I'm distracted," This implies that online classes for students are quite difficult and make it hard for them to understand the lesson in math.

D. Students experienced mentally blocked

Students leave the meeting most of the time. Student L1 said, "if I am asked a subject for which I am unprepared, I will be forced to leave the topic immediately." The students got mentally blocked and unprepared. When asked to participate, they do not talk but rather remain in silence. They do not have all the necessary equipment for online class like cellphones, and a good source of internet connection which goes out all of a sudden. Student A3 also mentioned, "Last year, when the trend of having online classes was established, I found it quite difficult to access my modules and attend online classes due to the fact that I do not have a phone" and students conduct self-learning.

E. Don't comprehend

Students find teaching math online difficult, so they said that they do not comprehend all of the concepts, especially when it comes to solving. "When I don't really comprehend the discussion until the session is over and I'm distracted" (Student H3).

F. Remained in silence

Results of the data analysis also revealed that students remain silent when they are called by their instructor, especially when they do not know the answers. Student L1 said, "I stayed muted when asked, and I don't know the answer."

G. Left the meeting

Student A3 cited, "Most of the time, especially when it's noon and the rain start to come, my internet is very low, which resulted to my leaving the meeting." Poor internet connection affects the way students learn, so they tend to leave meetings and come in.

H. Internet connection that goes out unexpectedly

Student H2 mentioned, "I was about to respond to a question when my internet connection suddenly went off. When I'm running late and won't be able to respond during the oral recitation or participation." Difficulties in internet connections affect students learning. Student H1 added, "I was in class and the connection was bad, and the topic was crucial, so I missed it since the internet went down unexpectedly."

I. Lack of funds

Lack of funds such as cellphones, laptops, loads, internet, and others also affect students' motivation to learn. Student A3 said, "Last year when the trend of having online classes was established, I found it quite difficult to access my modules and attend online classes due to the fact that I do not have a phone."

These results coincide with the study of Widodo (2020), entitled "From face-to-face learning to web-based learning: How are students' readiness?", which shows that students learning readiness in terms of online learning is still lacking. Students experiencing technical obstacles include a lack of online media mastery, no training, limited costs, and difficulties in internet connection. Most students expect online learning to stop and come back to face-to-face [11].

Table 2 below presents students' difficulties with videoconferencing,

Table 2. Students' difficulties encountered on videoconferencing

Initial Codes	Expanded Codes	Rationalized Codes
Frightened	don't have prepared for their classes felt a sense of boredom sleepy	Students were unprepared Students got bored Students felt sleepy
Distracted	distracted mentally blocked don't really comprehend	Students were distracted Students experienced mentally blocked Students don't comprehend
Disinvolved	students are asked to participate, they don't talk leave the meeting	Students remained in silence Students left the meeting
Lacked of resources	Poor internet quality Don't have cellphone	Students experienced internet connection that goes out unexpectedly Students lack of funds

The poor internet and other online activities resulted in ineffective learning for students. Student L3: *"Of course, this is ineffective; for example, if I was doing something else while taking an online class and became distracted, I would lose focus on the subject."* On the other hand, students agreed that online learning experiences are effective but still dependent on students' continuous learning. Student A1: *"I felt effective because, when I evaluate myself, I am in the midst of a learning process."*

Student H2: *"Yes, I am, especially if the instructor is going to share their experiences as well as discuss the lesson."* Student H1: *"Yes, it is effective, as evidenced by my improving grades."* Students also mentioned that they get sidetracked when anything pops up. They also use Facebook and chat to communicate with other students, such as by eating and visiting other social media sites, doing personal tasks, taking notes, and doing housework while attending classes.

Also, they disagreed that the other activities mentioned were not effective for their learning. For instance, Student L3 said, *"Not everything we talk about is related to the lessons, and it is considered a distraction."* Student H1 added, *"Because it is one of the distractions in my studies because my attention is diverted to other things rather than the class."* Student A2 said, *"No concentration on learning."* But one student said yes, it is effective because it is one way of coping with the stress of attending online classes. For instance, Student L1 said, *"Maybe because if I don't eat, my mind won't function well, such as when we had 3-hour classes, and I need to nourish my mind in order for it to function properly."* The result of the study is parallel to the study of Famularsih [12] on Students' Experiences in Using Online Learning Applications Due to

COVID-19 in the English Classroom. The investigation showed that most students considered the utilization of online learning applications in English learning to be effective and efficient in this emergency situation. However, the obstacles to using online learning applications in the English classroom were a slow-speed internet connection, too many tasks, the fact that not all teaching material can be taught through online learning, and a lack of interaction between lecturer and student [12].

3. CONCLUSIONS AND RECOMMENDATIONS

The following conclusions were drawn based on the findings of this study:

Videoconferencing has both positive and negative effects on students' experiences in learning mathematics. Students' experiences varied; they each had unique experiences, but they all agreed that taking an online class saves time, but the poor internet connection is a major drawback.

On the positive side, videoconferencing provides students with the opportunity to engage in collaborative learning activities with their peers, interact with their teachers, and access a wide range of learning resources. Videoconferencing also enables students to attend classes remotely, which can be particularly beneficial for those who live in remote or rural areas [13].

However, there are also negative effects associated with videoconferencing. Technical difficulties such as poor connectivity, poor sound and video quality, and interruptions can be frustrating and disruptive to the learning experience. Moreover, the lack of face-to-face interaction with teachers and peers can make it more difficult for students to ask questions and receive immediate feedback, which can hinder their learning progress [14].

Overall, the effectiveness of videoconferencing in learning mathematics depends on how well it is implemented and the extent to which students can engage in meaningful interactions with their teachers and peers. To optimize the use of videoconferencing for learning mathematics, it is important to address the challenges and limitations of the technology while leveraging its potential benefits [15].

In addition, to make students' learning experiences more meaningful, the teacher must encourage virtual collaboration and student participation. Teachers must not lose sight of the most important aspects of the lesson plan in order to motivate students before class, acknowledge them throughout the day to keep them motivated and be more strategic as a teacher to keep students engaged.

Academic shifts were new to everyone, and they were unprepared to transition from face-to-face classes to virtual, modular, and flexible learning environments. This topic will provide an opportunity to delve deeper into the subject to advance and improve teaching and learning. As technology advances for the benefit of more significant learning, new concepts, strategies, and techniques appropriate for diverse learners may emerge in online learning.

REFERENCES

[1] Shah, M. A., & Hasan, S., "Exploring the impact of video conferencing on education during the COVID-19 pandemic," *Journal of Education and Practice*, 12(10), 95-103(2021)

- [2] Bukidnon State University, "Institutional response to the COVID-19 pandemic: Continuity of education." Retrieved from <https://buksu.edu.ph/institutional-response-to-the-covid-19-pandemic-continuity-of-education/>, (2021)
- [3] Sjøby, M., & Skogseth, M., "The Role of Videoconferencing in Distance Learning," *Nordic Journal of Digital Literacy*, **14**(4), 224-238 (2019)
- [4] Li, Y., & Ma, X., "A meta-analysis of the effects of computer technology on school students' mathematics learning." *Educational Psychology Review*, **22**(3), 215-243(2010)
- [5] Alqurashi, E., "Blended Learning: The Effectiveness of a Flipped Classroom in the Learning of Mathematics," *Journal of Education and Learning*, **8**(1), 1-11(2019)
- [6] Palalas, A., Gouseti, A., & Papadakis, S., "Investigating the Factors that Influence Students' Engagement and Performance in Synchronous Online Learning: A Mixed Methods Study," *International Journal of Educational Technology in Higher Education*, **17**(1), 1-25(2020)
- [7] Rashid, Y., Rashid, A., Warraich, M. A., Sabir, S. S., & Waseem, A., "Case study method: A step-by-step guide for business researchers," *International journal of qualitative methods*, **18**, 1609406919862424. <https://doi.org/10.1177%2F1609406919862424>(2019)
- [8] Atkinson, J., "Four steps to analyse data from a case study method," *ACIS 2002 Proceedings*, <https://researchoutput.csu.edu.au/ws/portalfiles/portal/9635523/Four%26%2320%3BSteps> (2002)
- [9] Fontana, A., & Frey, J. (1994). Interviewing: The Art of Science. In N. Denzin, & Y. Lincoln (Eds.), *Handbook of Qualitative Research* (pp. 361-376). Thousand Oaks, CA: Sage Publication, Inc.
- [10] Sutton, J., & Austin, Z., "Qualitative research: Data collection, analysis, and management," *The Canadian journal of hospital pharmacy*, **68**(3), 226. doi: 10.4212/cjhp.v68i3.1456(2015)
- [11] Widodo, A., Nursaptini, N., Novitasari, S., Sutisna, D., & Umar, U., "From face-to-face learning to web base learning: How are student readiness," *Premiere Educandum: Jurnal Pendidikan Dasar Dan Pembelajaran*, **10**(2), 149-160. Doi: 10.25273/pe.v10i2.6801(2020)
- [12] Famularsih, S., "Students' experiences in using online learning applications due to COVID-19 in English classroom.," *Studies in Learning and Teaching*, **1**(2), 112-121. <https://doi.org/10.46627/silet.v1i2.40>(2020)
- [13] Garrison, D. R., & Kanuka, H., "Blended learning: Uncovering its transformative potential in higher education. The internet and higher education," **7**(2), 95-105(2004)
- [14] Calder, N., Jafri, M., & Guo, L., "Mathematics education students' experiences during lockdown: Managing collaboration in eLearning," *Education Sciences*, **11**(4), 191. <https://doi.org/10.3390/educsci11040191>(2021)
- [15] Hiranrithikorn, P., "Advantages and disadvantages of online learning," *In International Academic Multidisciplinary Research Conference in Berlin 2019* (pp. 14-17). <http://icbtsproceeding.ssru.ac.th/index.php/ICBTSBERLIN2019/article/download/628/614>(2019, October)