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**Research Article**

# The Utility of Video Communication Applications for Virtual Teaching and Learning

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**Abstract:** Due to the rise of positive cases brought by the infection of Coronavirus 2019 (COVID-19), the schools were closed down and limited the face-to-face instruction. With all that being said, our country, the Philippines has shifted from traditional face-to-face classes to online and distance education. Video-communication applications were utilized in the midst of online education, specifically during synchronous classes. Activities and other learning tasks and materials are being delivered by means of the features installed in such applications e.g., Google Meet and Zoom Cloud Meetings, therefore determining its level of utilizations is an imperative to consider.

Through a descriptive-quantitative method, the researchers aimed to explore the following questions: (1) what are the features of video-communication applications were used by the teachers and students for their virtual teaching and learning, respectively?; (2) What is the level of utilization of these video-communication applications, for virtual teaching and learning along with: (a) Google Meet and (b) Zoom Cloud Meetings, and; (3) What video tutorial can be produced to improve virtual teaching and learning of mathematics? With the above mentioned method, responses were collected through Google forms from the respondents and were analyzed through statistical methods (frequency count, ranking, and weighted mean) and were interpreted descriptively. The results established that the use of camera, screen sharing, microphone, scheduling, laptop/PC, and hosting a meeting were highly utilized for virtual teaching while the use of laptop/PC, microphone, hand raising, chat box, and reminding feature were used often for virtual learning. Considering that only few features were highly utilized, the researchers therefore recommended that video tutorials shall be produced, in order for both teachers and students to create a variety of teaching and learning experiences.

**Keywords:** Video-communication applications, Google Meet, Zoom Cloud Meetings, Virtual Learning, Virtual Teaching.

## Introduction

The continuity of learning has become one of the paramount concerns brought about by the surge of Coronavirus 2019-related cases. The restrictions on face-to-face learning have caused difficulties in the delivery of education and even compelled most schools to close, and worse, shut down. The global disruptive effect of the COVID-19 pandemic has coerced schools to shut down and affected at least a billion and a half learners around the world (Obana, 2020) to repress and avoid the spread of the viral infections, since it can be spread through our body fluids such as saliva and body discharge by coughing and/or sneezing (WHO, n.d.).

With the data presented as of May 2021 by the United Nations Educational, Scientific, and Cultural Organization or UNESCO, about 210 million learners were affected by the closure of schools of 24

countries due to the pandemic. In the Philippines alone, about 27 million students and at least a million teaching and non-teaching personnel were impacted due to almost a year of nationwide lockdown.

All school levels, from basic to higher education were advised to shift their instructions to distance learning. This move promotes the continuity of learning (Commission on Higher Education, as cited by Joaquin *et al.,* (2020) by deploying available flexible learning and other alternative modes of delivery in lieu of on-campus learning. Such modifications on the delivery of learning include synchronous and asynchronous meetings, real-time and self-paced lectures and learning, time-based outcome assessments. However, despite the efforts provided by the educational institutions and the government agencies responsible for bridging the needs of the students and the teachers, inevitable gaps were still noticeable (Joaquin *et al.,* 2020). In a developing country like the Philippines, the internet still remains a privilege rather than a right due to the fact that many Filipinos who are experiencing poverty are not financially able to access it. As a matter of fact, internet connectivity is the backbone of online learning (Cortez, 2020) that would help students develop in an online environment. Moreover, the lack of a conducive learning environment in their respective homes is also a problem. All of these are affecting the effectiveness of online learning.

This study aimed to determine the level of utilization of video-communication applications in virtual learning and teaching for Mathematics major students and teachers, respectively, specifically as these were employed for their Mathematics and its related subjects. Moreover, the researchers aim to explore their level of utilization in terms of accessibility, implementation, and practicality and applicability. At the end of this research, the research will be able to produce supplemental materials to help the students maximize the use of these applications for their learning in a virtual learning environment, based on the gathered data after the conduct of this study.

**Methodology**

This study utilized a descriptive-quantitative approach to analyze the effectiveness of video communication applications to online learning of Mathematics major students on their specialization classes, which aims to "describe and interpret the current status of individuals, settings, conditions or events" (Mertler, 2014).

The respondents of this study will be the currently enrolled Mathematics Major from 1$^{st}$ to 4$^{th}$ year level and professors who are teaching Mathematics-related subjects in the College of Education of University Nueva Caceres. This study will use the hundred percent of the total population of the respondents, also known as complete enumeration technique.

This study used a 5-Point Likert Scale which assumes the level of agreeableness to a specific indicator is linear (McLeod, 2019) which allows the researchers to measure their responses in a quantitative method. The researchers will develop their survey-questionnaire anchored with the statement of problem, theories and references gathered and analyzed. In this survey, respondents will be responding to their level of utilization of the given features of such video-communication applications. The survey-questionnaire will be thoroughly prepared and will undergo checking and approval of the research adviser and professor. A dry-run will be done before the administration of the survey. This study employed central tendency measures, specifically using weighted mean to compute and analyze the respondents' numerical responses.

**Results and Discussion**

It was found that three (3) teachers uses Google Meet as a tool for virtual teaching mathematics and one (1) teacher uses Zoom Cloud Meetings as a tool for virtual teaching mathematics. Consequently, eight (8) students were using Google Meet and one (1) student was utilizing Zoom Cloud Meetings. This implied that both teachers and students prefer to use Google Meet in their synchronous session rather than Zoom Cloud Meetings, due to the fact that the said application offers affordable rates and

data usage. Specifically, it is convenient for those who are using prepaid internet load for them to attend and/or conduct their classes.

Similarly, Putra *et al.,* (2020) found out that Google Meet is "more accessible" for the users than of Zoom Cloud Meetings, due to its limitation to participants especially since there is no available premium access to such application and even uses a large amount of internet data.

The researchers found that the features of video-communication applications such as camera, screen recording, screen sharing, mute and unmute of microphone, being a host, scheduling a meeting, customizing background, changing layout view, using laptop/PC version of the app, chat box, and hand raising were used by all teachers participated in this study. Other features of video-communication applications such as polling, use of shortcut keys, closed captioning, and reminding feature receives a response of two (2). Breakout rooms and using mobile version of the app as a feature of video-communication applications receive a response of one (1), and none of them used premium access feature.

Hence, the researchers found out that there were key features that were commonly used by the teachers for their virtual teaching such as camera, screen recording, screen sharing, using of microphone, hosting and scheduling a meeting, customizing their background, changing their layout view, using laptop/PC for accessing the application, and hand raising, as these features allows the teachers to facilitate well in delivering their instruction via digital means, specifically video-communication applications. These features allowed them to present and share their learning materials and instructions in real-time with their students and also interact with them, which these features are favorable for their classes.

Through Connectivism Theory, which was proposed by Siemens (2004), wherein learners and learning facilitators are using such features allow them to constantly connect to nurture and maintain learning in their digital classrooms. This facilitated the researchers' result to understand how both teachers and students have adjusted with the learning set-up, as well as for the environmental context, considering that most of them are using camera, microphone, chat box, as well as diverse options to connect with each other.

Meanwhile, for virtual learning, it was found that the features of video-communication applications such as camera, mute and unmute of microphone, and chat box received a response of eight (8). The features screen sharing, changing layout view, using laptop/PC version of the app, and hand raising received a response of seven (7). Customizing background and using mobile version of the app features both received a response of six (6). The features screen recording, scheduling a meeting, and breakout rooms received a response of five (5). The 'being a host' feature received a response of four (4). The features using of shortcut keys and reminding features equally received a response of two (2). And lastly, the features polling, premium access, and closed captioning similarly received a single response.

The students were found to utilize camera, microphone, and chat box features often than other features. This implied that these features allowed them to establish connection with their classmates and their teachers, in terms of interacting with them, especially when they were discussing the lessons, presenting reports, sharing documents and links via chat, seeing their classmates and teachers virtually, and communicate with them in real-time. On the other hand, some features were found least utilized by them, such as the use of reminding feature and hosting a meeting since students are expecting their links from their professors to be sent to their respective group chats via messenger app. Lastly, it was explored also that polling feature, premium access, and closed captioning were used by only few students. These are actually costly to avail causing them to not to maximize the use of the application. Moreover, it is not demanded by the presently implemented curriculum in such Mathematics-related subjects.

With all the top features used by the students, the result was supported by Social Presence Theory, wherein Richarson and Swan (2013), which was initially proposed by Short *et al.,* (1976), argued that there are such salient features of video communication application, since this is an avenue for computer-mediated communication, to let teachers and students perceive themselves as real persons via audio and visual representation in a digital or virtual way.

Conversely, some indicators were found to be frequently used by them such as "I avail its premium access" and "I change my layout view of my co-participants of the meeting", with a mean of 3.00. Consequently, "I use recording feature on my meeting", "I customize my background such as changing or applying any graphics or just blurring it", and "I use my mobile phone for attending any synchronous class or meeting" have an average response of 2.67, interpreted as "frequently used". These features also help the teachers to provide better learning experience to their students, since these suffice the attention demands of the students, as well as to supplement the interest of the students to interact with the class.

Nonetheless, the "I use shortcut keys such as Alt + R for screen recording, Alt + M for muting all participants" (WM = 2.33) and other shortcut keys, "I used closed captioning" (WM = 2.00) were occasionally used by these teachers because they might not know such keys and they feel comfortable to select and click the features shown on their screen. On the other hand, "I use hand raising feature whenever I want to ask or inquire something" (WM = 1.33) and "I use breakout rooms" (WM = 1.33) were rarely or not used by them, since they are the ones who facilitated the lesson, meaning they do not need to raise their virtual hand to inquire about something or at least let the class know their presence in the class, since they are the ones who have hosted. Moreover, it is hard for them to create breakout rooms to divide the class, since they have considered the number of the students enrolled in their class, which only eight students are currently enrolled, forfeiting the purpose of breakout rooms to group them into several teams while having an activity.

In terms of students' usage of Google Meet, the use of laptop/PC for attending their online classes ("I use my laptop/PC for attending"), which garnered an average score of 3.75, interpreted as "used at all times". This means that they have their own equipment to use for their online classes such as laptop/PC. Consequently, the use of microphone ("I use my microphone during the meeting") was used at all times, with an average score of 3.50. As they are connected in real time, recitations and participation is evident with this finding due to the fact that they are verbally communicating their opinions, answers, and responses through microphone. Similarly, the following features were also distinguished to be "used at all times" with a weighted response of 3.38: chat box ("I use chat box in the midst of the meeting for sending links, documents, or for any other purpose"); hand raising ("I use hand raising feature whenever I want to ask or inquire something"), and; reminding feature ("I let the application remind me of the upcoming meeting"). These were able to be more often also, since these allowed them to communicate with their teachers without interrupting the speaker whenever there is a discussion on-going.

Also, reminding feature enabled them to remember their routine or sequence of classes that they are about to attend for the day, becoming an essential part of online learning. Moreover, the use of camera ("I use my camera during the meeting") and screen sharing ("I use my camera during the meeting") fell on the $6^{th}$ and $7^{th}$ on the list, with a weighted mean of 3.00 and 2.88, respectively. The use of the aforementioned features played essential roles on facilitating their participation on the class, as they were revealed to be used frequently by the students. Furthermore, changing layout view ("I change my layout view of your co-participants of the meeting") and the use of mobile phone ("I use my mobile phone for attending any synchronous class or meeting") followed the preceding features, with both an average response of 2.75, interpreted as "frequently used" by them due to the satisfaction on their visual needs to see their classmates virtually and/or for attendance purpose, as well as the use of mobile phone were noted on these findings.

On the other hand, it was also revealed that the following were occasionally used: recording feature ("I use recording feature on my meeting") and customization of background ("I customize my background such as changing or applying any graphics or just blurring it") with a weighted mean of 2.50. Hosting a meeting ("I host a meeting for the class") was also found to be occasionally used by the students, with a weighted response of 2.38. Considering their level of utilization, it is understood since the students were not frequently asked to create the meeting link and do not open their cameras for them to change their virtual backgrounds. Consequently, scheduling a meeting ("I schedule a meeting for the class") and using shortcut keys ("I use shortcut keys such as Alt + R for screen recording, Alt + M for muting all participants") were occasionally used with an average score of 2.13.

Meanwhile, the use of breakout rooms was rarely or never been used by them, with a weighted mean of 1.63. Lastly, the usage of polling feature ("I use the polling feature"), availing its premium access ("I avail its premium access"), and closed captioning ("I use closed captioning") fell last on the list, revealed to be rarely or never been used, with a weighted response of 1.50. Premium access is costly to avail, making this as the prior due for the students to limit their experience on maximizing the usage of the application.

On the similar note, Purnawati *et al.*, (2020) argued that Google Meet, as a learning medium, was beneficial for university professors which allow them to access and share resources to their student appropriately with the given features used, especially in the midst of distance learning. They also emphasized that the more the innovative the professors are using the said application, concepts shared through this medium will be more solidified, meaning, learning will be more instilled with the learners. Furthermore, Hegeman (2015) established that video-generated lectures posted online fostered better results that the students who attended text-based multimedia as their learning resource.

On the teachers' experience, the researchers examined their level of Zoom's utilization based from the features provided by the application. They revealed that teachers were frequently using the following: Screen sharing ("I share a document, presentation, window, web tab, or audio/video with the class"); Hosting ("I host a meeting for the class"); Scheduling a meeting ("I schedule a meeting for the class"); Laptop/PC version (I use my laptop/PC for attending), and; Reminding feature ("I let the application remind me of the upcoming meeting"), which garnered an average score of 3.00. As the teachers conduct their classes, it is essential for them to use such features to share their learning materials and deliver their instruction in real-time. Meanwhile, the use of camera ("I use my camera during the meeting"); microphone (I use my microphone during the meeting"), and; chat box ("I use chat box in the midst of the meeting for sending links, documents, or for any other purpose") were found to be occasionally used, with a weighted mean of 2.33. This means that there were instances that teachers were using such features when it is their time to render their inputs, send their instructions, and to entertain some queries about the lessons or reports delegated to the class, e.g., group works, class reporting, advance learning on the lessons and sharing, etc. Moreover, changing layout view ("I change my layout view of my co-participants of the meeting", WM = 2.00), and availing its premium access ("I avail its premium access", WM = 2.00) were also occasionally used by the teachers. These features were not often utilized as much as other features because of how costly is to avail premium access. Moreover, their attention on the speaker on a specific period of time of the class is much more important for them, than to see how the students will be seen on the monitor on their end. Though, changing layout view is beneficial for them especially when they are taking note of those who were present during the online class, but they were not often use by them. Conversely, using closed captioning was not highly utilized, having an average response of 1.67, which implied that they were rarely or never use such feature.

This means that this feature does not play that much role on their activities during their synchronous class, as this was not evidently used by the teachers. Similarly, the use of recording feature ("I use

recording feature on my meeting"), polling ("I use the polling feature"), customizing background ("I customize my background such as changing or applying any graphics or just blurring it."), the use of mobile version ("I use my mobile phone for attending any synchronous class or meeting"), shortcut keys (I use shortcut keys such as Alt + R for screen recording, Alt + M for muting all participants") were also found to be rarely or never been used by the respondents, having a weighted score of 1.67. Since they were found rarely or never been used, these features are utilized only if the user has premium access to the said application. This inferred that the teachers were not able to use such features due to the lack of premium access, as well as these are not necessity for every online meeting. Lastly, hand raising feature ("I use hand raising feature whenever I want to ask or inquire something", WM = 1.33) and breakout rooms ("I use breakout rooms", WM = 1.33) were also established to be rarely or never been used by them.

Indeed, Zoom Cloud Meetings can serve as a two-way avenue for sending and receiving audio and visual materials to the students with the help of all possible gadgets, as long as it can access internet, which became a "proxy to face-to-face" instruction, as Deretic *et al.,* (2020) established in their study.

On the students' level of utilization, the use of laptop/PC for attending their classes ("I use my laptop/PC for attending" was revealed to have the highest level of usage, with a weighted response of 3.75, implying that these students were able to attend their synchronous classes because of having their own gadgets to use. Moreover, it was also revealed that the use of microphone ("I use my microphone during the meeting") and chat box ("I use chat box in the midst of the meeting for sending links, documents, or for any other purpose") were used at all times, both with a mean response of 3.38. This manifested due to the fact that this serve as their avenue to communicate real-time amid the online discussions and exchange information about the topics being discussed. Screen sharing ("I share a document, presentation, window, web tab, or audio/video with the class") was used frequently by them, with an average response of 3.25. Moreover, the reminding feature ("I let the application remind me of the upcoming meeting") was also frequently used, with a weighted mean of 3.00. With the schedules provided in each class, the students were able to use this feature to keep on track with their classes. In addition, the following features were found utilized frequently by the students amid their online classes, with a weighted response of 2.88: camera ("I use my camera during the meeting"); changing layout view ("I change my layout view of your co-participants of the meeting"); use of mobile phone ("I use my mobile phone for attending any synchronous class or meeting"), and; ("I use hand raising feature whenever I want to ask or inquire something"). These features have allowed them to feel light weighted on how they can interact with their virtual class, as well as adjust with the new set-up, causing them to use these more often.

On the other hand, customizing background ("I customize my background such as changing or applying any graphics or just blurring it") was found to be occasionally used by them, garnering an average response of 2.50. They may have utilized the camera more often, but this feature was not that deemed necessary for the students for their activities, making them to be utilize not often. Moreover, recording feature ("I use recording feature on my meeting) was also occasionally used, with a weighted mean of 2.00, considering that the host, which teachers are the ones who were often assigned, can record the meeting.

Apart from this, hosting ("I host a meeting for the class") and scheduling ("I schedule a meeting for the class") a meeting were established to be rarely or never been used by the students, having 1.75 as their weighted scores. In addition, premium access ("I avail its premium access") was also rarely or never been used, with a weighted mean of 1.63. Finally, the following features had the same level of utilization, with a weighted response of 1.38: polling ("I use the polling feature"); breakout rooms ("I use breakout rooms"), and; closed captioning ("I use closed captioning"). With the high cost of premium access, some features have little to no chance to be experienced by the students that could have helped their online learning experiences.

It is indeed evident that students can use such application with minimal support (Fitch *et al.,* 2016), especially that Google Meet facilitates real-time interaction, compatible with various gadgets and Wi-Fi connection, and has the ability to record classes or sessions. However, due to technical difficulties, such aforementioned key features might not be ideal, such as lose or intermittent internet connection, as the authors suggested. In addition, the cause of inability of the students to other key features to enjoy the variety of experiencing digital learning are accessibility to teaching media, in the situation of the professors, and compatibility of tools in accessing such media, which disrupted students' participation (Agung *et al.,* 2020).

**The Math Tech Tutorials**

Project Rationale: Throughout the conduct of the study, the researchers affirmed that there were key features that were rarely used and left unutilized nor explored by both teachers and students that could have helped them to experience better in terms of their teaching and learning experiences, respectively. Based from the results of the present study, it was established that there were only few key features that were highly utilized by the respondents of this research such as camera, microphone, screen sharing, etc.

The aim of this project is to produce educational videos that shall aid the teachers and students to discover wide-range and various activities that would allow them to maximize the experiences that they can earn from using both Google Meet and Zoom Cloud Meetings, anywhere and anytime. Furthermore, the proponents of this study will be able to suggest activities that are interactive and innovative, sufficing the demands of the given subject area.

The proponents have identified the features that can help them to have better teaching and learning practices by creating video tutorials on how to use the following features presented below:

1. Google Meet
a) How to use the closed captioning feature
b) How to avail premium access and its benefits
c) The use of shortcut keys

2. Zoom Cloud Meetings
a) Opening breakout rooms
b) The hand raising feature
c) Customization of virtual background

The researchers established that these features can aid the teachers to deliver their instruction and lessons without being tormented by the challenges brought by the digital divide due to the fact that some of these features are advanced and they need knowledge and technical support on manipulating and utilizing these applications. On the other hand, the students will also be able to experience the convenience of using such features to have better learning from the mathematics-related subjects. Such features will help also not just those who are able but can also help those who are planning to implement differentiated instruction for disabled students, especially that this study was conducted amid the COVID-19 pandemic, where there are no face-to-face instructions due to the closure of schools.

**Conclusion**

The features of video-communication applications used by teachers in virtual teaching such as camera, screen recording, screen sharing, mute and unmute of microphone, being a host, scheduling a meeting, customizing background, changing layout view, using laptop/PC version of the app, utilizing chat box, and hand raising are used at all times when they are having synchronous sessions. Using the premium access feature of video-communication applications were never been used by the teachers hence received zero (0) response. The features of video-communication applications used

by students in virtual learning such as camera, mute and unmute of microphone, and chat box were used at all times during synchronous classes. The features polling, premium access and closed captioning has the lowest usage with a single response.

It is concluded that the commonly used features of video-communication applications used by teachers in virtual teaching are camera, screen recording, screen sharing, mute and unmute of microphone, being a host, scheduling a meeting, customizing background, changing layout view, using laptop/PC version of the app, utilizing chat box, and hand raising. These features help the teachers deliver their lesson well and create an engaging environment for the students. However, availing premium access of video-communication applications are not accommodating or commonly used by teachers since it is costly and the video-communication applications work just fine without using its premium access feature. It is determined that the commonly used features of video-communication applications used by students in virtual learning are camera, mute and unmute of microphone, and chat box. These features allow the students to communicate real-time to their classmates and teachers. Additionally, these features help them to be more active during class discussions and other accomplishments. Closed captioning and polling were also rarely used by the students, and as with teachers, students are also not using the premium access feature of video-communication applications due to its price and the need to pay periodically.

The level of utilization of Google Meet for virtual teaching have a general weighted mean of 2.74 interpreted as "frequently used" and the most utilized feature are camera ("I use my camera during the meeting"), screen sharing ("I share a document, presentation, window, web tab, or audio/video with the class"), use of microphone ("I use my microphone during the meeting"), hosting a meeting ("I host a meeting for the class"), scheduling a meeting ("I schedule a meeting for the class"), and using laptop/PC for attending sessions ("I use my laptop/PC for attending") with a rank of 3.5 and a weighted mean of 4.00 interpreted as "used at all times". The least utilized features of Google Meet for virtual teaching are raising hand ("I use hand raising feature whenever I want to ask or inquire something") and breakout rooms ("I use breakout rooms") that ranked 17.5 with a weighted mean of 1.33 interpreted as "rarely/never been used".

Meanwhile, the level of utilization of Zoom Cloud Meetings for virtual teaching have a general weighted mean of 2.14 interpreted as "occasionally used" and the most utilized feature are screen sharing ("I share a document, presentation, window, web tab, or audio/video with the class"), hosting a meeting ("I host a meeting for the class"), scheduling a meeting ("I schedule a meeting for the class"), using laptop/PC for attending synchronous sessions ("I use my laptop/PC for attending"), and reminding feature ("I let the application remind me of the upcoming meeting") with a rank of 3 and a weighted mean of 3.00 interpreted as "frequently used". The least utilized feature of Zoom Cloud Meetings for virtual teaching are hand raising and breakout rooms with a rank of 13.5 and a weighted mean of 1.67 interpreted as "rarely/never been used".

The level of utilization of Google Meet for virtual learning have a general weighted mean of 2.58 interpreted as "frequently used" and the most utilized feature is using laptop/PC of the application ("I use my laptop/PC for attending") for attending synchronous classes that ranked 1 with a weighted mean of 3.75 interpreted as "used at all times". The least utilized features of Google Meet are breakout rooms ("I use breakout rooms"), polling ("I use the polling feature"), premium access ("I avail its premium access"), and closed captioning ("I use closed captioning") with a rank of 17 and a weighted mean of 1.50 interpreted as "rarely/never been used". On the other hand, the level of utilization of Zoom Cloud Meetings for virtual learning have a general weighted mean of 2.44 interpreted as "occasionally used" and the most utilized feature is also using the laptop/PC version of the application ("I use my laptop/PC for attending") when attending synchronous sessions with a weighted mean of 3.75 interpreted as used at all times and a first place in ranking. The least utilized features of Zoom Cloud Meetings for virtual learning are polling, breakout rooms, and closed captioning that ranked 17 with a weighted mean of 1.38 understood as "rarely/never been used".

The researchers recommend making more video tutorials for the upcoming new features of Google Meet and Zoom Cloud Meetings. Also, aside from video tutorials, the researchers recommend to make other media contents such as blogs, vlogs, and web pages, infographics, journals, and other kinds of source of information that talks about the improvement of virtual teaching and learning of mathematics that may be helpful in synchronous conventions.

**Conflicts of interest**

There is no conflict of interest of any kind.

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