Identification of Teaching Methods and Readiness on Online Learning in Mathematics

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Abstract
Teaching and learning (TnL) during the Movement Control Order (MCO) is a challenging experience. However, teaching must be implemented until the syllabus is completed. WhatsApp and Google Classroom (GC) applications are used. In addition, video conferencing such as Google Meet is also used. Various issues need to be considered on students' readiness in online learning. Therefore, this case study will identify the factors that influence student readiness and determine the appropriate online learning methods to use. Preliminary survey was conducted through 2 questionnaires, before and after online learning. A total of 49 students answered questions at the first stage in order to find out the readiness of students to accept online learning. Data were analyzed using descriptive data. At the second stage, 41 students answered a five-point Likert type of questionnaire that consists of 21 items and questions for the choice of online learning methods are asked again. Data were analyzed using descriptive data and tested by using linear regression. The findings of the study found that, in the first stage the majority of students prefer to use the WhatsApp application in online learning. However, in the second stage students choose to use a combination of methods between WhatsApp and Video Conference such as Google Meet. It can be said that student readiness in mathematics during MCO is affected by the learning environment. In conclusion, lecturers need to identify suitable methods of online learning so that students can continue to learn efficiently and smoothly.
Keywords: Teaching and Learning (TnL), Movement Control Order (MCO), WhatsApp, Google Meet, Linear Regression.

Introduction
The extension of the Phase 1 period of the MCO, which began on 18 March 2020, has influenced the process of teaching and learning, where online learning has become a must rather than an option. Information related to online learning is informed to the lecturers a few weeks in advance, including planning for teaching materials. Lecturers need to equip themselves with information technology, method of evaluation, assessment and even teaching skills.

Various issues that need to be highlighted especially those involving student affairs. Internet connectivity among students is one of the main issues. Lecturers also need to recommend

the appropriate teaching and learning approach when there are students who have such issues. The lecturer can continue the lesson by sending video lecture recordings through WhatsApp, Telegram or Google Classroom if the lecturer finds that teaching using Google Meet is not suitable.

Jaka and Hamdiah (2020) have found that direct learning, i.e. Zoom is better than learning through WhatsApp during the COVID-19 pandemic. However, Jaka et al (2020) suggested that the learning process should merge these two approaches by using Zoom and WhatsApp to make the TnL process more complete and efficient. According to Martina, Hendro and Indra (2020), WhatsApp is a more suitable application to be used during teaching compared to Zoom, Google Meet and Facebook applications. Martina et al (2020) also found that WhatsApp is a simpler and easier-to-use communications platform for all ages and backgrounds. However, this research is restricted to the study of English.

Based on the study of Mohd, Fadli and Sharifuddin (2019), the results using a t-test analysis found that students have no difficulty in continuing the online learning process. This study focuses more on students' readiness for online learning. Mohd et al (2019) also stated that the readiness of students in the online learning process is at a relatively high rate.

Briliannur, Aisyah, Uswatun, Abdy and Hidayatur (2020) found that online learning for school students is less effective due to the existence of economic constraints in terms of facilities and infrastructure. This study also found that students are not technically ready. These technology issues include access to the Internet and the lack of information resources on the usage of mobile technology today. This may be because the learning situation of school students varies from those of the higher-level students in universities, colleges and so on.

Wahyudin, Yuli, Ali and Muhlas (2020) concluded that online learning is proven to be effective during Working from Home (WFH) caused by the COVID-19 pandemic. This study recommends the importance of developing ideas in implementing online learning. Some studies also indicate the supportive attitude of students towards the use of existing applications, such as WhatsApp and Telegram. Mojtaba and Mahsa (2018) found that students have a positive attitude towards learning through WhatsApp compared to face-to-face methods. A study conducted by Siti, Maisurah, Zia and Norazah (2014) stated that WhatsApp is an effective teaching aid where students who are less active during TnL in the classroom give a positive response when using WhatsApp.

Based on the study of Forson and Vuopala (2019), they found that the factor that influences the readiness of students during online learning is a positive attitude towards online learning. Furthermore, the findings of Kaymak dan Horzum (2013) indicate that the readiness of students for online learning is related positively to their interaction in the learning environment.

The aim of this research are to identify an appropriate methods on online learning and to know the factors that give contribution in students' readiness towards online learning specifically in mathematics. Therefore, descriptive statistics and linear regression analysis are used to explore the findings for online learning.

Methodology

A total of 49 students who took the Statistics for Science and Engineers course and Calculus for Engineers were involved in this case study. These students were asked to complete a questionnaire on students' readiness on online learning. The questionnaire was conducted in two stages. At the first stage, the question consists of 4 items; Gender, Internet Access Categories, Readiness on Online Learning, and Online Learning Methods. Before students start their online classes, the data were collected and analyzed using descriptive data. It aims to identify methods of teaching that are relevant and suitable for lecturers and students.

After the 10th week of online teaching and learning, based on their respective experiences, students were asked to complete the second stage questionnaire. This questionnaires use the five-point Likert scale from strongly disagrees to strongly agree. Only 41 students answered the questionnaire compared to 49 students in the first stage. This questionnaire contains a total of 21 items consisting of 5 sections; Attitudes towards Online Learning (5 items), ICT/Internet Needs (6 items), Learning Environment (5 items) and Online Learning Readiness (5 items), which was adapted from Forson and Vuopala (2019) and was also adapted from Tuan, Chin, & Shieh (2015).

These data will be analyzed using the regression method. The reliability test is tested first before regression is done. Reliability tells how reliable and accurate the measurement made by a research instrument on a variable is. The lower the errors caused, the higher the reliability of the instrument (Ranjit, 1999). The reliability level of Cronbach's Alpha values is based on (Choi, Fuqua, & Griffin, 2001). In order to decide the appropriate methods after online learning experienced by the students, information on the learning medium option is taken again. The following is a summary of the process of identifying online teaching methods.
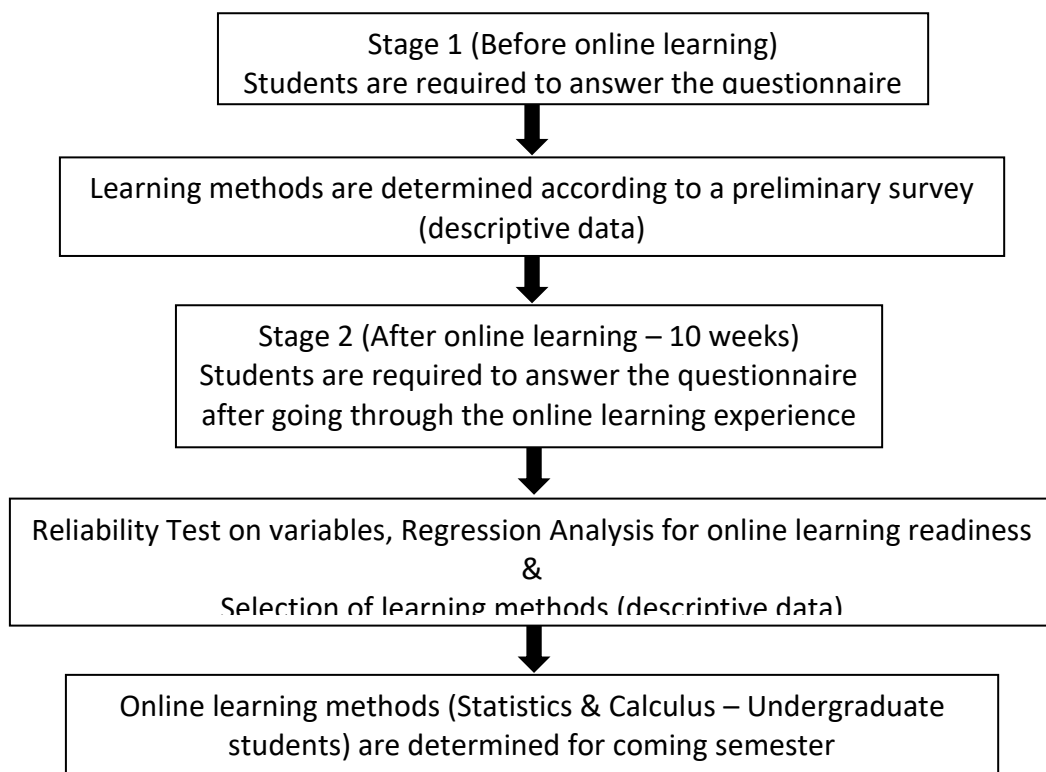
Figure 1. Flow Chart of identifying the methods on online teaching

Result and Discussion

At the first stage, the online learning method implemented is based on the choice of the majority of students. Before that, the lecturer identified the students' readiness to learn online. Figure 2 shows the percentage of students' readiness to face online learning. It was found that the percentage of students' readiness in online learning is quite high at 78% even though these students have never attended online classes.
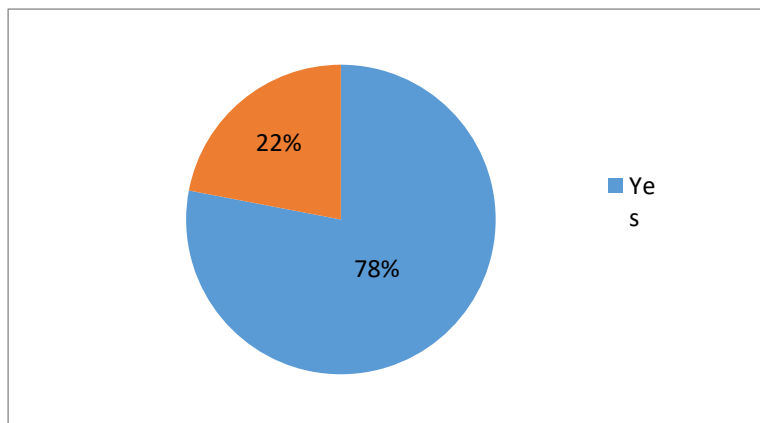

Figure 2. Readiness on online Learning

The following table 1 shows the crosstab between gender and the choice of online learning methods by students. It was found that the majority choice for both genders was video lecture recordings sent via WhatsApp. Discussions for misunderstood topics will also be discussed in WhatsApp. Only a small number of students choose Google Classroom as a learning medium. Learning through video conferencing is also a student's choice but the number of students is small.

Table 1.
Crosstab between Gender and Methods of Teaching

|		Method of Teaching				
		Video Lecture Recordings & WhatsApp	Video Conference (e.g. Zoom, Google Meet)	Google Classroom	Notes (PDF) & WhatsApp	Total
Gender	Male	19	7	1	2	29
	Female	14	2	1	3	20
Total		33	9	2	5	49

The following Figure 2 shows the percentage of learning options by students. This value is a combination for both genders.
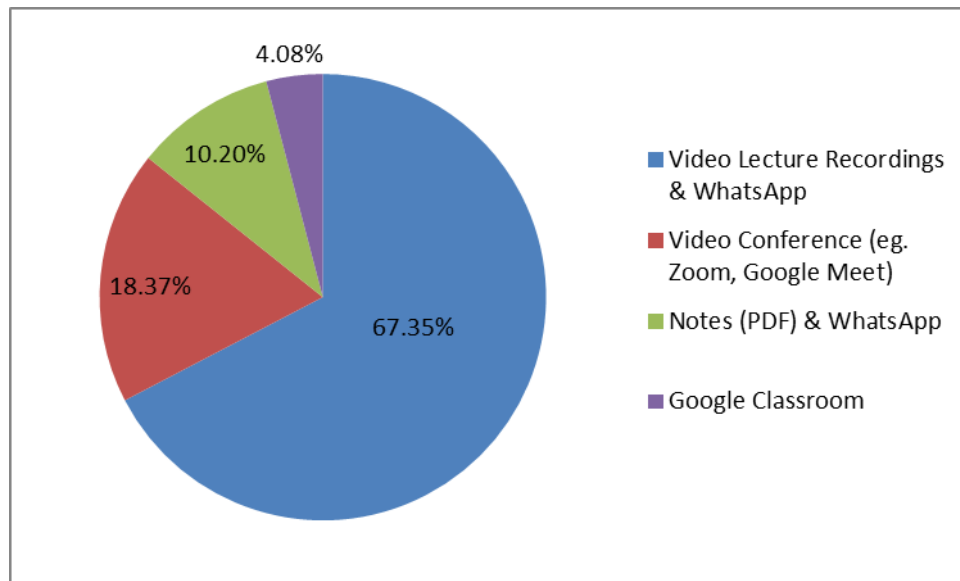
Figure 2. Percentage of learning options by students

However, the category of internet connectivity must be considered before determining the appropriate medium for the TnL process. Surveys related to this are also carried out and Figure 3 shows the categories of internet access for these students.
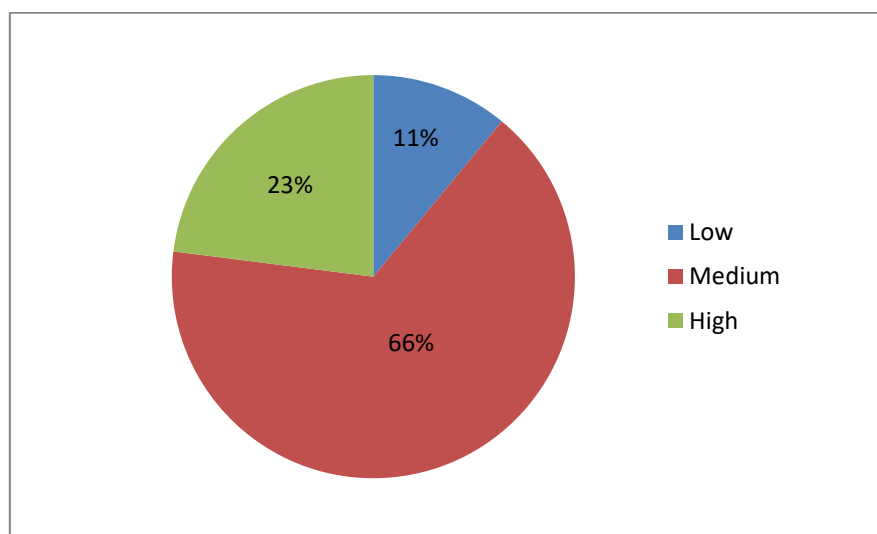
Figure 3. Internet access

In this analysis, lecturers will consider the conditions for internet access to determine the methods of online learning that will be used until the end of the semester. As not all students have good access, this should be highlighted. In order for students to continue studying well, all of these need to be considered.

Based on preliminary surveys through descriptive data, lecturers choose to use video lecture recordings sent via WhatsApp. In addition, lecturers initially plan to use the Zoom app. However, it was found that this application has a relatively high level of security because it can affect Windows devices. With this, the lecturer has chosen to use the Google Meet application. Since the majority of students' internet access is moderate, lecturers limit the use

of Google Meet. In addition, the Google Classroom (GC) application is also used especially in conducting evaluation tests and video lecture recordings are also uploaded.

Next, the analysis was performed again for the second stage; after the students going through the online learning experience. Reliability test was carried out before conducting a regression test. Based on Table 2, it is found that all Cronbach's Alpha values for each subsection (A, B, C, D) are above 0.8 which is considered excellent and reliable (Choi et. al, 2001). According to Quansah (2017), in order to better clarify the reliability of the questionnaire, the value of Cronbach's alpha for the whole question should also be emphasized. It was found that the value of Cronbach's Alpha for the 21 items tested in this case study was also worth more than 0.8 which is 0.825.

Table 2.
The Cronbach's Alpha for each Subsection

Subsection	No. of Questions	Cronbach's Alpha
A: Attitude towards Online Learning	5	0.885
B: ICT/Internet Needs	6	0.925
C: Learning Environment	5	0.831
D: Online Learning Readiness	5	0.947

The next analysis refers to the students' response of the questionnaire. The average scores for Sections A, B, C and D is 3. The mean score of 3 and above indicates student agreement, while the mean score below 3 indicates student disagreement.

Table 3 shows the mean and standard deviation for Section A. It was found that students did not agree if the university is implementing online learning (Mean = 2.85), but the mean value is not too low. All standard deviation values are not too high and this can be said that the student response is quite consistent.

Table 3.
Section A: Attitude towards Online Learning

Item No.	Statements	Mean	SD
A1	I can understand online learning.	3.12	.954
A2	Online learning makes it easy for me because the time to review is flexible.	3.00	.922
A3	I agree if the university conducts online learning.	2.85	.853
A4	I can solve tutorial questions with the help of lecturers during online learning.	3.17	.946
A5	I am satisfied with the online learning method.	3.17	.919

Based on Table 4, it is found that almost all answers to each question have a relatively high mean (above 4) and a relatively low standard deviation, except for item B6 (I have high internet access while online learning) which is slightly different where each of them has values of 3.63 and 1.019 respectively. This means that there are students who have issues with the ease of accessing the Internet if they learn online at home.

Table 4.
Section B: ICT/Internet Needs

Item No.	Statements	Mean	SD
B1	I have the basic computer skills (creating, saving, opening, transferring and deleting files)	4.37	.733
B2	I can handle the basic internet skills (search for information on the internet network e.g. google)	4.29	.814
B3	I have the skills to use social media tools (Telegram, WhatsApp, Email)	4.44	.776
B4	I can convert the Ms Word files to PDF.	4.44	.808
B5	The use of mobile phone/computer/laptop is fun throughout online learning.	4.20	.954
B6	I have high internet access while online learning.	3.63	1.019

Table 5 is Section C which is the learning environment. All mean values for each item are relatively similar. The standard deviation for item C5 (No interruptions from the family during online learning) is a bit higher than the others. This reflects the unequal score of points among students where it is possible that some students get distractions from family members according to their family background during online learning is implemented.

Table 5.
Section C: Learning Environment

Item No.	Statements	Mean	SD
C1	The home environment is conducive to online learning.	3.66	.965
C2	I am not stressed during online learning.	3.20	.928
C3	I can focus while learning online.	3.49	.711
C4	Online learning can be followed according to the lecturer's schedule.	3.73	.742
C5	No interruptions from the family during online learning.	3.46	1.002

Referring to Table 6, it is found that each item has a value above 3 and this can be assumed that students are ready to continue learning online. It was also found that the value for standard deviation is relatively low. This indicates uniformity of scores while answering the questionnaire.

Table 6.
Section D: Online Learning Readiness

Item No.	Statements	Mean	SD
D1	I am ready if online learning is conducted next semester.	3.68	.934
D2	I am willing to use any application (eg WhatsApp, Google Classroom) for online learning.	3.95	.773
D3	I am willing to use computer, mobile phone or any other technology device for learning needs.	4.00	.837
D4	I am ready for internet access needs for online learning	3.88	.842
D5	I am willing to learn new knowledge to expand my knowledge of information technology.	4.07	.721

Next, a linear regression analysis was continued to classify factors that affect student readiness in online learning. Independent variables refer to Section A (Attitude towards Learning Online), Section B (ICT/Internet Needs) and Section C (Learning Environment) while dependent variable is Section D (Online Learning Readiness). The Stepwise method is used if there are variables that need to be omitted. Only one factor was found to be significant; Learning Environment that affects the readiness of students in online learning.

Table 7.
Predictors of Online Learning Readiness

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.744	.522		3.342	.002
	Learning Environment	.620	.146	.562	4.240	.000

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.562[a]	.315	.298	.6270

a. Predictors: (Constant), Learning Environment
b. Dependent Variable: Online Learning Readiness

The readiness of students for online learning is less influenced by two other variables, which are Attitude towards Online Learning and ICT/Internet Needs. Both of these variables have been removed as the p-value is not significant. This indicates that the learning environment explains 31.5% of the variation in the readiness of students. In this case study, it was found that the learning environment factor is important in the online learning readiness model, but these factors only contribute in insignificant quantities. There are other variables influencing students' readiness to learn online, but this aspect needs to be examined in more research. As these students have different family histories, there is a possibility of pressure from certain family members. However, it can be seen that students are quite prepared to perform online learning based on item D1 (Mean = 3.68, SD = .934). Students need to be in a learning

environment such as being on campus to continue learning so that they are more focused and not stressed.

Next, an identification of the learning methods is carried out again. Based on Figure 4, the preference of the majority of students is a combination between video conference and WhatsApp which is 68.3%. It is found that students prefer if the lecturer combines these two methods so that there is direct interaction while studying. The university or the students themselves need to have high internet access if the video conference (eg. Google Meet, Zoom) is conducted on a frequent basis so that learning can run smoothly. In order for teaching to be carried out more efficiently, lecturers also need to do the same.
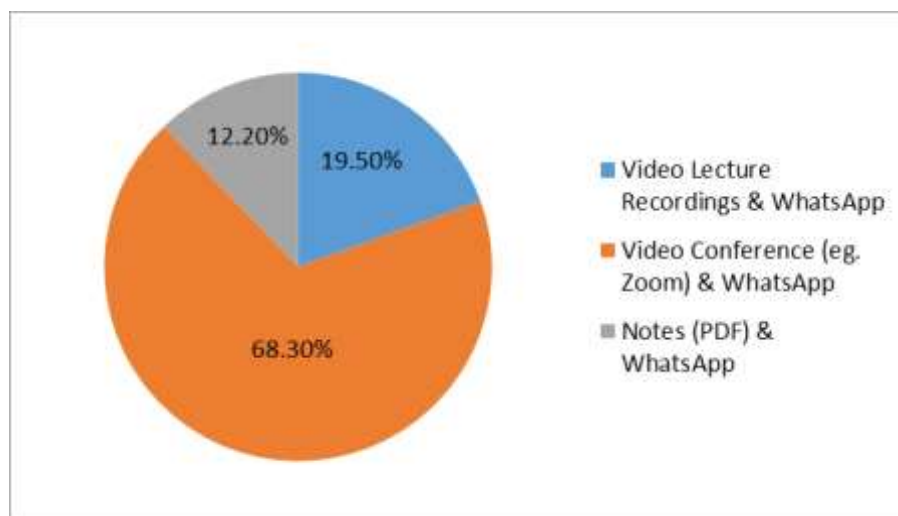
Figure 4. Learning options by students after 10 weeks of online learning experience

Based on item D4 (mean = 3.88, SD = .842), it was found that students are ready to provide internet needs. The mean obtained is quite high, which means that the student agrees with this statement. If students are on campus, high-level Internet access should also be provided by the university. So, if the lecturer uses video conferencing along with WhatsApp, it is no issue for students to continue online learning. With this, online learning will proceed smoothly and effectively.

Conclusion
Online teaching became a main element in the TnL process when the COVID-19 and MCO crisis came into force. In the information technology infrastructure, lecturers need to be prepared and awareness of information technology needs to be improved. Even students should equip themselves with knowledge of information technology. It can be concluded that the majority of students prefer Video Lecture Recordings & WhatsApp as a teaching and learning tool, based on the preliminary survey of the questionnaire. As a result, the lecturer prefers to teach by using the student's preferred method.

After 10 weeks of online learning during the MCO, the findings of the study showed that the readiness of students is influenced by the learning environment. A conducive environment for online learning is required. The learning environment is important to ensure that students will not stress and can focus as the class progresses. Students should be able to follow the

online learning schedule determined by the lecturer and there should be no interruption during the online learning session. All of these are important for online learning readiness.

An identification of appropriate methods is decided based on a second stage of descriptive data survey. This method will be used for math and statistics courses for coming semester. The main choice of students; is to use a combination of methods between WhatsApp and live learning by video conferences, such as Google Meet or Microsoft Teams.
The goal of this study is to identify the readiness of students to learn mathematics online, and the appropriate teaching methods will also be determined by this study. However, this study is limited to case studies for some students only, where researchers suggest that other researchers should take more samples of students who take all mathematics and statistics courses. The study results could be slightly influenced by this. By comparing the performance of assessment scores for various learning methods, researchers suggest that more studies investigate the effectiveness of online mathematics learning. If the effectiveness of the method used does not reach a good level, a study needs to be performed by the researcher to recommend a more suitable method.

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