# The Effect of Online Learning on Motivation to Learn Abstract Algebra and Analysis of Learning Difficulties during Online Learning

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***Abstract*—After the pandemic, lectures can be held fully face-to-face and need to develop by mixing online and face-to-face learning by considering various aspects such as the nature of the course, student conditions, and so on. It is necessary to evaluate online learning by looking at the obstacles faced by students during online learning and comparing student's learning motivation in online and face-to-face learning. The research's purpose is to see the differences in students' learning motivation to learn Abstract Algebra during face-to-face and online lectures and the obstacles students face during online lectures using Microsoft Teams and Moodle. Research methods by quantitative methods. Data was collected from 31 mathematics education students by questionnaires and closed interviews. Student motivation data is processed using non-parametric tests with *Wilcoxon test* and closed interviews on the difficulties and obstacles faced by students during online learning analyzed descriptively. The results showed that there was no difference in students' motivation to learn Abstract Algebra online and face-to-face, despite many obstacles faced by students and students preferred face-to-face lectures. Students realize these courses are important because are their foundation in teaching school mathematics and they are also concerned with their learning outcomes. The obstacles experienced by students during online lectures are limited communication with lecturers and classmates, not easy to understand the material because limited to ask questions, limited devices, and internet connection. In future learning, students' needs are to provide students with space to grow in their knowledge and attitudes which can help them to be able to interact with lecturers and other students.**

***Keywords*—learning difficulties, online learning, learning motivation**

## I. Introduction

The condition of the COVID-19 pandemic has changed the Indonesian education system which previously lectured face-to-face but required lectures to be carried out online. At the beginning of the pandemic in Indonesia, face-to-face lectures were not at all. These changes have a major impact on the world of education in Indonesia. Ready or not, learners and educators must adapt to online learning despite the many obstacles faced [1–3]. In online lectures, digital technology used during lectures is particularly useful and plays a significant role [4–6]. Before the pandemic, there were many applications on smartphones and laptops such as social media, YouTube, WhatsApp which were commonly used by students and educators who could change the way of life, and communicate with each other, even in teaching [7]. The availability of internet access that is easily accessible, as well as technological advances such as cloud or drive, can help in the flexibility of the learning process and complement learning to better include face-to-face learning [8]. So that when learning is required online, many applications or platforms can be used during online lectures. However, in Indonesia, the distribution of internet access has not been evenly distributed. There are still areas that have difficulty accessing the internet where students come from various regions including areas that have difficulty accessing the internet where during the pandemic students return to their respective areas and attend online lectures from there.

With the availability of internet access and communication applications before the pandemic, it should make it easier for educators and students to attend online lectures. The availability of learning management systems, namely Moodle and Office 365 as learning platforms that were available and used during lectures before the pandemic at Pelita Harapan University, Faculty of Education, is one of the supports for readiness to carry out online lectures. However, there are obstacles experienced during online learning. Mathematics Education students of Pelita Harapan University, Faculty of Education return to their respective regions in various parts of Indonesia with equal distribution of technology and diverse Internet access, it is common for students to have difficulty accessing the internet even though there is an adequate online learning platform.

During online lectures, the platform that researchers can use is limited to using Moodle and by using Microsoft Teams. Microsoft Teams supplies well-integrated teaching and learning features that can be used in face-to-face online lectures. In addition, Microsoft

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Teams can also be used in uploading files needed in lectures and discussion rooms that can support online learning [9–12]. Moodle is helpful in lecture activities such as assignments and helps with online exams. In addition, Moodle makes it easy to share videos, discussion forums, and share files. The results of [13] show that the use of Microsoft Teams can help students access information and learning resources, have a good impact on their knowledge construction and critical reflection, and overall have a positive learning experience. The convenience provided by Microsoft Teams encouraged students' learning during online lectures and many responded with positive responses [14, 15].

After the COVID-19 pandemic was overcome, learning could be done face-to-face but education is still adopted online and face-to-face education. Because after online learning during the COVID pandemic, all parts of education see that there are good things and there are not good things in the education system that are done online. Not everything is good and not everything is bad and influenced by several factors. So that after the end of the COVID pandemic, the implementation of education for the lecture level was carried out in a hybrid learning because of the advantages of online lectures, but it was still carried out onsite learning also because of the advantages of face-to-face lectures. Research findings [16] revealed that most learners have a positive response to synchronous learning and their online platforms are beneficial, although it was found that poor internet signal is a dominant inhibiting factor for them to learn online.

There are many factors to consider in hybrid learning, including the level and readiness of students and educators. In addition, course content and support of internet facility also need to be considered. Specific courses really require face-to-face, for example, lectures in the lab, so it is necessary to adjust the comparison of face-to-face and online lectures. Likewise, Abstract Algebra courses in Mathematics Education students. In studying Abstract Algebra courses, more complex mathematical skills such as proof, reasoning, and other mathematical abilities are needed. The Abstract Algebra course is a course that requires high enough competence in proof skills on the condition that students are still familiar with the ability to calculate as they usually do at the high school level. So, it is common for students to have difficulties in learning it and need to get a more detailed explanation that can help students understand.

The student's difficulties, both difficulties understanding the topics and their obstacles during lectures can have an impact on their learning motivation. Difficulties in learning lecture topics during online learning and their obstacles during online lectures can reduce student learning motivation. The learning outcomes of Online learning are not better than face-to-face learning [17]. Students in online learning need to adapt to stay engaged during learning. However, online learning can attract the attention of students with low motivation [18, 19]. So, it is necessary to see the motivation of student learning during face-to-face lectures and after online lectures due to the COVID-19 pandemic.

After lectures can be carried out fully onsite, it is necessary to develop better learning with combination of online and onsite learning that is more beneficial for students by looking at the factors that affect it. So, it is necessary to evaluate online learning by considering the student's difficulties and obstacles during online lectures and aspects of student's motivation in learning. The development is expected to improve future learning more optimally. Considering the problems above, the goal of this paper is to see the differences in students' learning motivation to learn Abstract Algebra during face-to-face lectures and online lectures as well as the obstacles experienced by students during online lectures using the help of Microsoft Teams and Moodle.

## II. Literature Review

Learning motivation affects the achievement of learning outcomes. High learning motivation will affect learning goals. Learning motivation can be influenced by internal and external factors. One of the internal factors is the desire to succeed as well as the encouragement of learning needs and hopes and ideals, while the external factor is one of the conducive environment and fun and interesting activities [20]. During online learning, learning motivation is something that needs to be considered because it will affect the online learning process. Student learning motivation can change due to the change in learning from face-to-face to online. The indicators of learning motivation include: a) the desire to succeed, (b) the existence of encouragement and need in learning, (c) the existence of hopes and aspirations for the future, (d) the existence of rewards in learning, (e) the existence of an interesting desire to learn, and (f) the existence of a conducive learning environment [21].

## III. Research Methods

The research method used is a quantitative method to see differences in student learning motivation during face-to-face and online lectures using Microsoft Teams and Moodle in Abstract Algebra courses. Data was collected from 31 mathematics education students who joined Abstract Algebra courses using questionnaires and closed interviews. Before the pandemic, lectures were carried out face-to-face, but during the pandemic, lectures were carried out online. Student's learning motivation data is processed using non-parametric tests using the *Wilcoxon test* with the help of SPSS. Meanwhile, data from closed interviews about the difficulties and obstacles faced by students during online lectures were analyzed descriptively. During face-to-face learning, students of Pelita Harapan University-Mathematics Education live in dormitories with adequate internet facilities, but during the pandemic students must return to their respective areas where most students are constrained by learning devices and inadequate internet networks.

## IV. Result and Discussion

Before the pandemic, half of the lecturing was held by face-to-face learning, but since the pandemic lecturing was held full online. The questionnaire data during face-to-face lecturing compared with data during online learning. While online learning all the lecturing using Microsoft Teams and Moodle. Share files and synchronous video conferences used by Microsoft Teams, but share video, assignment, discussion, or other asynchronous activities using Moodle. The data from the questionnaire was processed to see the effect of online learning using Microsoft Teams and Moodle on student learning motivation in learning abstract algebra. There is difference in motivation from Table I which the mean data during face-to-face lectures was 52.67 while during online lectures was 51.67, and from Table II, we can see positive mean rank more than negative mean rank. Testing statistics using the *Wilcoxon test*, there is significant value of the difference in learning motivation during face-to-face and online lectures was 0.33 > 0.05 (Table III). Although it seems to be declining, the test results show that the difference is not significant, so null hypothesis is accepted, it means that there is no difference in learning motivation during face-to-face and online lectures. Although students have experienced many difficulties when the lecture changes from face-to-face lectures to online, online learning does not affect student's motivation. Although the conditions have changed, their motivations do not change. Here are the descriptive statistics and test statistics of student motivation in face to face and online learning:

TABLE I. Descriptive Statistics

| Learning | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Face-to-face | 31 | 41 | 63 | 52.67 | 5.264 |
| Online | 31 | 43 | 58 | 51.67 | 3.875 |

TABLE II. Ranks

| Ranks | | N | Mean Rank | Sum of Ranks |
|---|---|---|---|---|
| Online – Face-to-face | Negative Ranks | 13[a] | 10.08 | 131.00 |
| | Positive Ranks | 7[b] | 11.29 | 79.70 |
| | Ties | 4[c] | | |
| | Total | 31 | | |

[a] Online < Face-to-face
[b] Online > Face-to-face
[c] Online = Face-to-face

TABLE III. Test Statistics[a]

| Test Statistics | Online – Face-to-face |
|---|---|
| Z | −0.975[b] |
| Asymp. Sig. (2-tailed) | 0.330 |

[a] Wilcoxon Signed Ranks Test
[b] Based on positive ranks

Student learning motivation is no different during onsite and online learning because students realize that the material learned in abstract algebra courses is their foundation in teaching school mathematics. From Fig. 1, all students agree that Abstract Algebra material becomes the foundation in teaching school mathematics. As prospective mathematics teachers, students realize that they need to learn abstract algebra because it is related to school mathematics, related to everyday life and abstract algebra courses are truly relevant to them as prospective teachers. Students all agree that abstract algebra courses are truly relevant to them as prospective educators at various school levels from elementary to college. Since the beginning of lectures, students have always emphasized the importance of learning abstract algebra. During online learning, students do their project to explore the application of Abstract Algebra material in daily life, mathematics school, and various fields. Students are invited to relate what they learn to school mathematics and invite students to reflect on mathematical abilities that develop in themselves while learning abstract algebra. Fig. 1 is the result of a student questionnaire that abstract algebra courses are their foundation in teaching school mathematics.

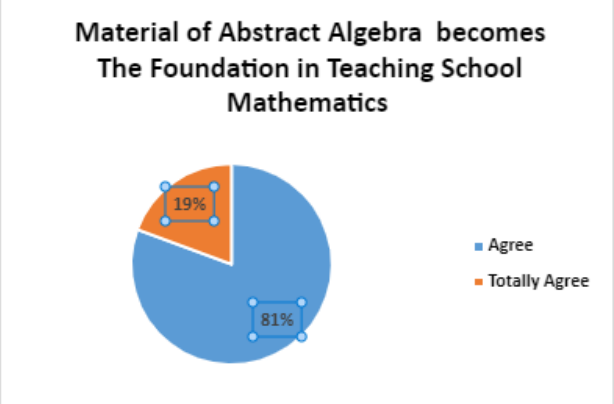


Fig. 1. Data of students' perceptions about Abstract Algebra course be foundation in teaching school mathematics.

In addition to learning conditions, student learning motivation is also influenced by student understanding of the importance of the material they learn. Online or onsite learning conditions do not reduce their motivation to learn when students understand that it is important to learn abstract algebra. In addition, students also stay motivated to learn because students focus on their learning outcomes. Students overall agree that students feel anxious when their learning outcomes are low. This shows that the learning outcome is still their concentration on learning. This is because the demands of their learning outcomes must meet the standards because all students in the mathematics education study program are scholarship students. Fig. 2 describes all students worried about their learning results. Here are the results of the questionnaire statement about students' concerns about their learning outcomes:

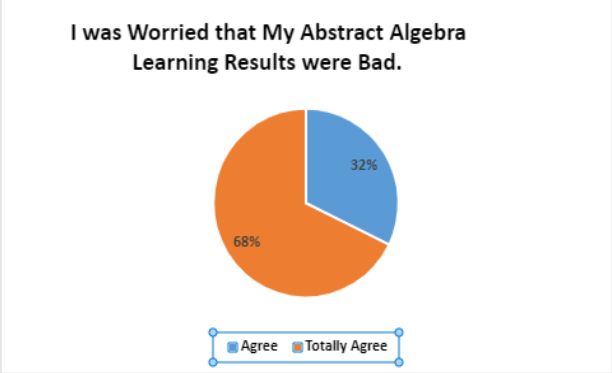


Fig. 2. Data of students' worries about their Abstract Algebra learning result.

From the results of the questionnaire in Fig. 3, data was obtained that 51.6% of students strongly agreed that they preferred face-to-face lectures compared to online lectures, while 35.2% agreed but only 3.2% disagreed. This shows that students prefer face-to-face over online lectures. Students prefer onsite rather than online lectures for several reasons, such as they want to spend time with their friends, not be limited by different time to learn with others. The research result of Ref. [22] shows that satisfaction is relevant during online learning and the need to interact with others. While during the pandemic students are faced with a sudden loss of daily routine due to limitations in interacting physically. The following is the data from student questionnaires about online and face-to-face lectures.

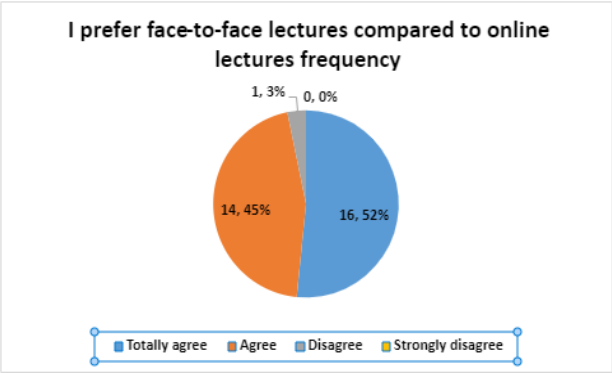


Fig. 3. Compare face-to-face lectures and online lectures frequency.

During online lectures, students are expected to be more active in learning to build their knowledge with the opening of various accesses and students can learn independently during online learning. In line with the research results of Alcaide [23] from the perspective of students, they consider that traditional teaching is still more effective than hybrid teaching through the Microsoft Teams application.

From the results of closed interviews that are the differences between online and onsite lectures from the students' views include: during face-to-face lectures, explanations from lecturers about learning topics are very helpful for students understanding learn abstract algebra, because they can be interactive and freer to ask questions with lecturers and learning activities that involve students in lectures such as doing exercises in front of the class or expressing questions or ideas that can be directly completed without being limited by many things. However, in online courses, students get more assignments, and must be more independent in finding out the material being studied, while Abstract Algebra topics are difficult for students. Asking directly to lecturers is limited because questions can arise at any time, so students can only discuss with their friends. The surrounding environment also makes students easily tempted and can make students sleepy during online lectures. During online lectures, when lecturers explain students still find video and sound less clear due to network instability. So that it affects the understanding of the material explained by the lecturer. This is in line with the findings of Ismail [24] who found limited student feedback during online classes as well as lack of interaction with friends and lecturers can lead to social isolation with lack of communication often leading to mental problems such as anxiety and negative thoughts.

The obstacle faced by students in understanding Abstract Algebra material while using online learning is communication, if they do not understand and ask their friends but they can late reply, maybe because the internet network in their area is unstable. This is in line with the research result of Ref. [25]. The understanding of the material more less because it is not explained directly, and it makes that student's understanding will be different from the actual concept of the material. There are many difficulties for students to understand the material because the book is not explained, even searching on YouTube does not necessarily get an explanation that suits their needs, sometimes they do not find the solution to solve the problem, so it is exceedingly difficult to understand. Students feel that Abstract Algebra material is too difficult, abstract and requires a detailed explanation from the lecturer directly. In addition, there are students who have difficulty in independent learning, they need to discuss with friends or lecturers directly. Students often find classmates who have not been able to understand the material or problems to be solved, busy classmates. There is no confirmation from lecturers about the material studied forced to study independently, so there are some things that are poorly understood. In addition, other obstacles include: the number of assignments with short due dates, books used during lectures in English, even though students are trying to find other sources, unstable internet networks, laptops conditions that sometimes lag if overheated, electricity conditions that in some areas often experience power outages, weather such as heavy rain will have impact the difficulties internet connection and limited internet quota. Weather and internet connection, sometimes noise because a friend does not turn off the microphone. And that all is in line with the results of research [26] that student interest in online learning is lower because of communication constraints, internet connection, and home conditions that are not conducive.

However, there are things that help during online lectures, such as: being able to find other sources during online lectures so that students' minds about Abstract Algebra are more completely and many insights they get

when students look for other references such as YouTube, journals, books, websites, and others. Students have a lot of time to understand the topics. Some students enjoy studying with small groups, tasks to help review material more deeply, and support from classmates and family. Lecturers willing to take the time to be asked when material is not understood. Book references given by lecturers and peer tutors through group learning are quite helpful in understanding the material in the lecture. Students can also set their own study time, can explore which material first they want to learn in a limited time. Fig. 4 describes how 58% of students can use their time more efficiently during online courses. Here the data of student can use time more efficiently:

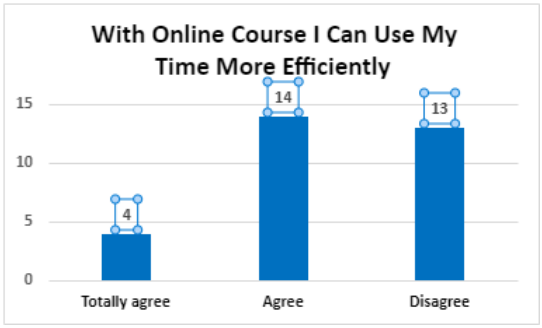


Fig. 4. Data of students can use time more efficiently.

The student expectations if the lecture is fully online in the future are not giving too many assignments, being able to provide explanations through interactive videos that can be accessed at any time because not all students are in the same time zone, extending assignment collection time and opening of student question and answer forums with lecturers as widely as possible. More is added to explain the material, because abstract Algebra content cannot be learned just by watching videos from YouTube or reading an article there needs to be something to explain. The quantity of teaching video calls with Microsoft Teams is expanded to answer students' confusion in obtaining new material. The material is reduced and explained directly by lecturers through video conferences that can be watched repeatedly by students. Fig. 5 shows that 94% of students find it difficult to understand course material during an online course. Here is data of students' difficulties to understand course material because of online courses:

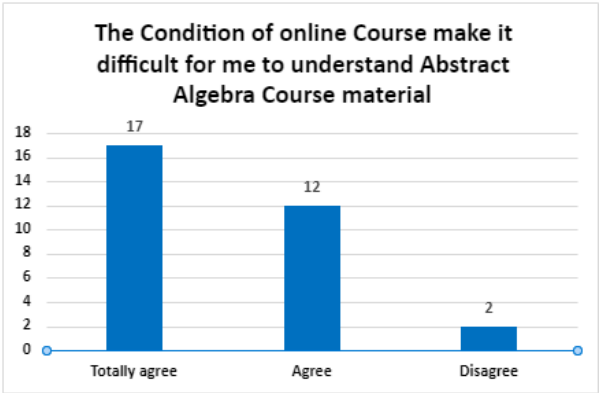


Fig. 5. Data of students' difficulties to understand course material because of online course.

Obstacles faced by students during online exams using Moodle are unstable internet network, the answer selection system of multiple choice so cannot see the process, if they choose false then the score is zero. Here describe of adequate internet access of student:

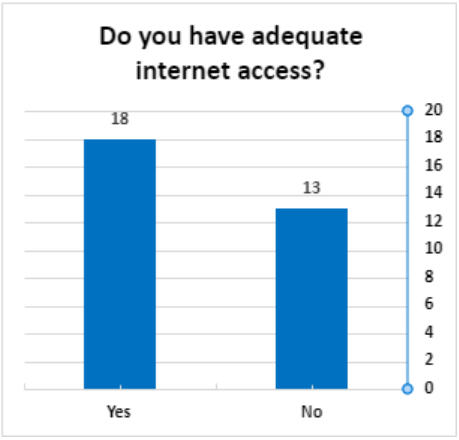


Fig. 6. Student's adequate internet access.

From Fig. 6, there are 41.93 % of students have inadequate internet access, which makes students difficult to learn well.

## V. Conclusion

During full face-to-face and full online lectures, there is no difference in student motivation to learn Abstract Algebra even though there are many obstacles faced by students even though students prefer face-to-face lectures. Students realize that Abstract Algebra material is essential and becomes their foundation in teaching school mathematics. In addition, students are concerned about their learning outcomes, making them stay motivated in learning without being influenced by online or face-to-face conditions. The obstacles faced by students during online lectures using Moodle and Microsoft Teams are limited communication with lecturers and friends, understanding of the topics is not optimal because they are not free to ask questions such as face-to-face lectures, limited device and internet connection and difficulties to understand the lecture material. The learning that students need in the future is learning that provides space for students to grow in their knowledge and attitudes and that can help them to be able to interact well with lecturers and other students. Lecturers need to consider their needs to supply the best learning for students. Rahman [27] finds that if online learning is to be cultivated, it is important to improve the educators' skills to ensure that extremely high interaction needs are met during courses.

## Conflict of Interest

The authors declare no conflict of interest.

## Author Contributions

Melda J. Saragih conducted the research, analyzed the data, and wrote the paper; Tanti Listiani helped in the research, analyzed the data, and wrote the paper; both authors had approved the final version.

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