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Challenges in GIS practice in Geography teacher training during COVID 19 pandemic: Students' perspective from private Islamic university in Indonesia

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Abstract

During the COVID 19 pandemic, a vast number of universities need to limit their face-to-face teaching activities, including laboratory access. For Geography education students, this situation forced them to use Geographic Information System (GIS) as a major skill set in a virtual learning model, even only with minimum infrastructures such as laptops, mobile phones, and unstable internet connections. In the current study, the perception of undergraduate students from the Geography teaching program at Universitas Muhammadiyah Purwokerto, Central Java, Indonesia, about the effectiveness and readiness of online learning platforms as the impact of the global pandemic were examined. The results showed that students were relatively satisfied and motivated in GIS online learning modules, although classical learning was still preferable. Nevertheless, some students were facing electricity and unstable internet connectivity issues. Finally, in the future, distance learning for GIS teaching programs should be integrated at the national level with sufficient infrastructure support, including supporting training on developing modules and evaluation to increase the student learning experience.

Keywords: GIS practice; Geography teacher training; COVID 19; students' perspective

1. Introduction

The global pandemic of COVID 19 has occurred throughout the globe. Until December 2020, the World Health Organization (WHO) recorded more than 100 million confirmed cases, with around 2 million deaths (World Health Organization, 2021). Countries have executed massive positive measures regarding its excessive human-to-human transmission, including lockdown, strict implementation of social distancing, and medical precautions (Hoang, 2020). Furthermore, schools and universities have transformed their activities into virtual teaching and learning to avoid enormous spreading among the students (Adnan & Anwar, 2020; Khan, Nabi, Khojah, & Tahir, 2020; König, Jäger-Biela, & Glutsch, 2020). This severe pandemic has also brought challenges in teaching, learning, and research collaboration, especially in higher education institutions (Mok, Xiong, Ke, & Cheung, 2021). Accordingly, information technology becomes the primary support for education access during the pandemic period with limited preparation and training (Bubb & Jones, 2020; Henriksen, Creely, & Henderson, 2020). The establishment of digital online teaching and learning at the university level has been boosted through massive infrastructure development using internet connectivity (König et al., 2020; Tang et al., 2020).

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In Indonesia, the pandemic also forces the teachers, as primary intellectual resources, to transform their teaching material into virtual modules. However, the minimum support for Information and Communication Technology (ICT) in the education development policy has been reported as the central issue in this sudden transformation(Khan et al., 2020; Srirahayu & Premananto, 2020). On the other side, the teacher must also accommodate all students with different social-economic conditions, affecting the learning infrastructure's accessibility. The recent primary devices, such as computers, laptops, and smartphones, have been fully utilized for educational purposes in all courses, including Geography. In contrast to other courses, Geography has differed in material content and pedagogical techniques (Schultz & DeMers, 2020). Geography generally combines classroom and outdoor activities, including some particular skills in using maps and geospatial technologies.

In university, Geography course covers various topics, including the physical process of the earth, the interrelation between humans and the environment, as well as mapping skills using geospatial technology such as cartography, remote sensing, and Geographic Information System (GIS) (Demirci, 2011; Lloyd, 2001). The GIS has been extensively learned in Geography courses, including in the courses for Geography teacher training programs to amplify students' spatial thinking (West, 2003). However, this course requires sufficient hardware, software, and data (Lloyd, 2001). This technical factor is commonly resolved by ensuring the availability of a computer laboratory with a relatively adequate specification for GIS, especially in universities. Before the pandemic, GIS is practiced in a classical format, consisting of teacher illustration, different steps in GIS explanation, text learning, various video tutorials, and so forth (Vojteková, Tirpáková, Gonda, Žoncová, & Vojtek, 2021). In many places, GIS teaching is still implemented in the computer laboratory. However, in the COVID-19 pandemic situation, this practical course has been avoided to prevent the infectious virus from spreading among the students(Adnan & Anwar, 2020; Aristovnik, Keržič, Ravšelj, Tomaževič, & Umek, 2020; Murdaugh, Hausknecht, & Herbst, 2020). Thus, the lecturers have mostly transferred the modules into remotely-distance learning platforms that have been accommodated by the university's local program (Adnan & Anwar, 2020; Dewangga, Ihsan, & Dina, 2020; Schultz & DeMers, 2020).

Many studies report the advantages and challenges of recent e-learning initiatives from the perspective of various stakeholders (Aristovnik et al., 2020), including in Geography teaching (Chang, 2020; González, 2021; Huber & Helm, 2020). Thus, this current study focuses on the use of GIS applications in online learning during the pandemic situation, particularly on the challenges of distance learning. It aims to gather students' perspectives to identify their learning experience and motivation in this online course.

2. Method

This exploratory case study involved undergraduate students from a single-class of Geography teaching study program at Universitas Muhammadiyah Purwokerto (UMP), one of the private Islamic universities in Central Java, Indonesia. This exploratory case study was selected to reveal the perception of the students on GIS learning, as an example of a small group population, especially during the pandemic. In this current study, about 31 students who had taken part in the GIS application course (2 credits) were involved. These participants had been previously informed about their voluntary participation. The GIS course was carried out from 29 September 2020 until 20 January 2020, online, using an official learning portal (LMS) developed by the university called Onclass UMP. Meanwhile, The data collection itself was

conducted in November 2020. As the main LMS platform, all instructional activities were prepared through Onclass UMP (can be accessed at https://onclass.ump.ac.id/). Figure 1 illustrates the appearance of the Onclass UMP platform that has been used as part of learning modules, even before the pandemic. The GIS course consisted of 14 virtual meetings, one mid-semester, and a final exam. The meetings were held once a week at 8.30 AM local time. As the pandemic rose globally during this period, the university facilities were closed, and most of the students returned to their hometowns.

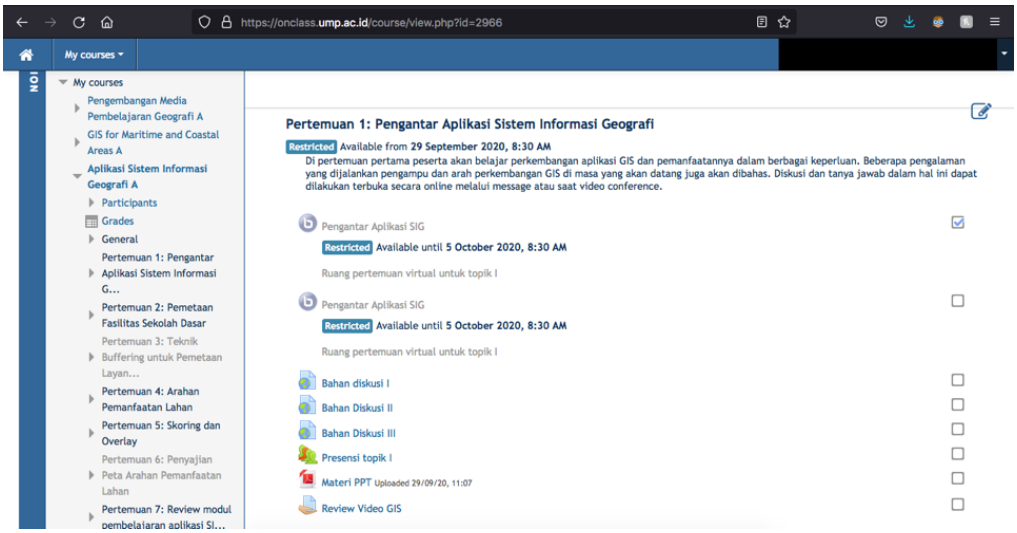

Figure 1. Official LMS Platform Used in UMP (accessible at https://onclass.ump.ac.id/)

Before the pandemic, this course was delivered through a face-to-face meeting, consisting of theoretical concepts and practical activities in the GIS laboratory. The current GIS technology is an integrated system to create and visualize thematic maps by using spatial data or even a spreadsheet (Wiegand, 2001). Students usually access this computer-aided laboratory to get fully access GIS infrastructure, including licensed software such as (ESRI) ArcGIS, ENVI, and ER-Mapper, or open-source platforms such as QGIS, through sufficient hardware and internet connection. Additionally, some support from teaching assistants and educational staff is also provided for technical problems. During the pandemic, most students stayed in their hometowns, dormitories, or with their relatives. Consequently, students sometimes have to deal with limited IT infrastructure, including a laptop with low specification, mobile data connection, or even electricity (Mohalik & Sahoo, 2020).

In the study, an online questionnaire through Google Form was established to obtain primary data on the students' level of facility, learning situation in the hometown, perception toward the adapted learning material, and perceptions towards online teaching, especially on the use of modules and online teaching platform. The questionnaire was anonymous and sent to the student learning account. They were given two weeks to respond and submit their responses. As main tools of data collection, the questionnaire used five-level Likert scale: 1) 1= strongly disagree; 2) 2=disagree; 3) 3=neutral; 4) 4=agree; and 5) 5=strongly agree. This online form was distributed through Onclass UMP. Additionally, this type of instrument was useful to measure non-physical phenomena that could be observed and quantified (Harpe, 2015). Some questions related to the condition of the students' learning facility, including their laptops, smartphones, and internet connectivity, were addressed in the online survey as well. Within

the questionnaire, some questions were modified to optimize the consistency of the answer. Ultimately, descriptive analysis was taken to describe the student perception based on the survey results and visualized into tables and graphics processed with Microsoft Excel.

3. Results and Discussion

3.1. Background Overview

During the data collection, this research also gathered students' preliminary information, consisting of the general information on their gender, PC or laptop ownership, type of internet connection, and the duration of daily online learning. Based on the current research, a vast majority of the students were female (71%), with only 29% of them being male. In terms of the central learning infrastructure, most of the students own individual PC or laptops used for remote learning. However, they added that their smartphone could also be used in online teaching activities. Additionally, 97% of the students have a PC or laptop for daily activities, while the other 3% do not have the devices. During the pandemic, almost all teaching processes were carried out online using the internet. Therefore, students needed to purchase an internet connection. About 22 students (71%) have to buy mobile data connections from local providers. Besides, the university and the Ministry of Education also provide internet connection subsidies. Meanwhile, nine students (29%) used Wi-Fi connections during distance learning.

Further, most students need to spend more than eight hours per day on online learning, including the instructional process and completing the assignment. While only a few students spend two until four hours per day and four until six hours per day for online lectures and other learning activities. Table 1 describes the basic information of the students.

Table 1. Basic Information About Students and Their Needed Online Learning Facilities

Basic information	Frequency (N=31)	Percentage
Gender type		
Female	22	71
Male	9	29
Total	31	100
PC/Laptop ownership		
Own	30	97
Doesn't own	1	3
Total	31	100
Type of internet connection		
Mobile data connection package	22	71
Personal ISP/Wi-Fi connection	9	29
Public Wi-Fi connection	0	0
Total	31	100
Time spent on online learning per day		
Less than 2 hours per day	0	0
2 - 4 hours per-day	5	16
4 - 6 hours per-day	5	16
6 - 8 hours per-day	6	19
More than 8 hours per-day	15	49
Total	31	100

3.2. Perception of GIS Online Learning Material

Our findings show some positive students' responses during the implementation of GIS distance learning. Several topics, including GIS for education, land management, and thematic mapping using Digital Elevation Model (DEM), have encouraged the students to learn both theoretical and technical analysis using the hardware and software. The lecturer team distributed all data for practice and modules on the online LMS. The adopted questionnaire focused on numerous aspects, including the perception of the materials' difficulties, the instruction of the modules, the virtual teaching method, and stress level in completing the individual assignment. Those aspects were represented in the following five questions, while Figure 2 illustrates students' responses to those questions.

Q1. Do you agree that the GIS module facilitates your distance learning?
Q2. Do you agree that the tutorial on the GIS is sufficient to support independent practice?
Q3. Do you agree that the GIS course in the online format is more effective?
Q4. Do you agree that the virtual teaching method supports your study?
Q5. Do you agree that the GIS course in online format increases your stress level?

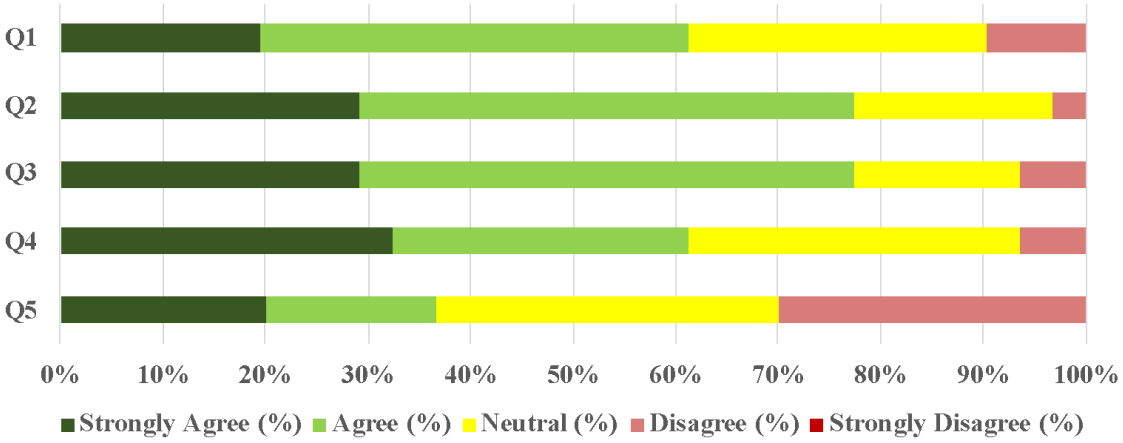

Figure 2. Students' Perception of GIS Online Learning Material

Based on the students' responses, the GIS application facilitates students learning during the quarantine. There are 19.4% and 41.9% of students express their strong agreement and agreement for transferring offline courses to online courses (Q1). However, about 9.7% of students experience difficulties during the online learning of GIS. Parallel to this, about 29% and 48.4% of the students have strongly agreed that the course's designated tutorial has facilitated them to learn independently (Q2). For this course, the lecturer team had prepared offline tutorials in an electronic book or PDF format to minimize the required internet connection and financial costs. This offline tutorial also accommodates some students with the insufficient computer or laptop specifications and inadequate internet connection (Kapasia et al., 2020; Widodo & Riandi, 2013). Additionally, some students also admit that they borrow laptops or PC from their relatives to access virtual learning. Online learning activities can reach larger groups and reduce time and space limits. For the effectiveness of the online GIS course, the students agreed on the online learning's efficacy, as 29% and 48.4% of the students strongly agreed and agreed with the effectiveness of the prepared online course. In

comparison, 6.5% of the respondents disagreed that the online method was useful, and 16.1% remained neutral.

Some methods have been adapted as well to overcome this sudden transformation during the pandemic. However, collaborative problem-solving skills in specific conditions remain challenging to be trained in the online system (Tsai, 2013). However, interactive discussion and group presentations have been initiated during the learning process. Besides, the internet connection problem, especially during the rainy season, has been the main issue. There were 32.3% and 29% of students who strongly agreed that the virtual teaching method enhances their learning, while about 6.5% of students disagreed, and 32.3% of them were undecided or neutral. During the learning period, students commonly stay in front of the laptop for hours to attend online lectures, literature, and assignments.

In some cases, the students have to cope with the stress and are overwhelmed by these unavoidable changes (Mohalik & Sahoo, 2020). For this course, the Q5 was provided to identify the students' stress levels due to online learning implementation. The current study found that about 19.4% of students strongly agreed that online learning increased their stress level, while about 16.1% agreed with the statement. Further, about 29% of the students do not feel pressure with this learning format transformation, while 32.3% tend to be neutral. As the study does not probe the cause of this stress, several problems related to the financial situation, the workload of the study, and limited infrastructure were assumed to be the cause of students' high-stress levels.

3.3. The Perspective of Students on GIS Online Learning Experiences

Schultz and DeMers (2020) state that online learning is the well-designed, planned approach to creating deep virtual learning experiences without physical interaction in a real classroom environment, including a design phase that potentially lasts for several months in advance of the course. In this case, the online system was implemented to follow health protocol to minimize human contact as a preventive measure in the global pandemic. In some other disciplines, online teaching leads students into isolation, missing social communication (Baber, 2020), and dissatisfaction with the learning process (Sit, Chung, Chow, & Wong, 2005). The students' experience in using the GIS online course was explored through the following questions. Meanwhile, Figure 3 describes the students' responses with the Likert scale.

Q6. Do you feel satisfied with the GIS course format for the current situation?
Q7. Do you feel that you gain a new experience during the GIS course online?
Q8. Do you agree that you have less interaction with the teacher or lecturer during GIS online course?
Q9. Do you agree that you have less peer interaction in this online learning?
Q10. Do you feel more excited about the learning interaction in the online course?
Q11. Do you feel more excited and motivated with the assignment for this GIS online course?
Q12. Do you agree that this online course can be implemented permanently after the COVID-19 pandemic?

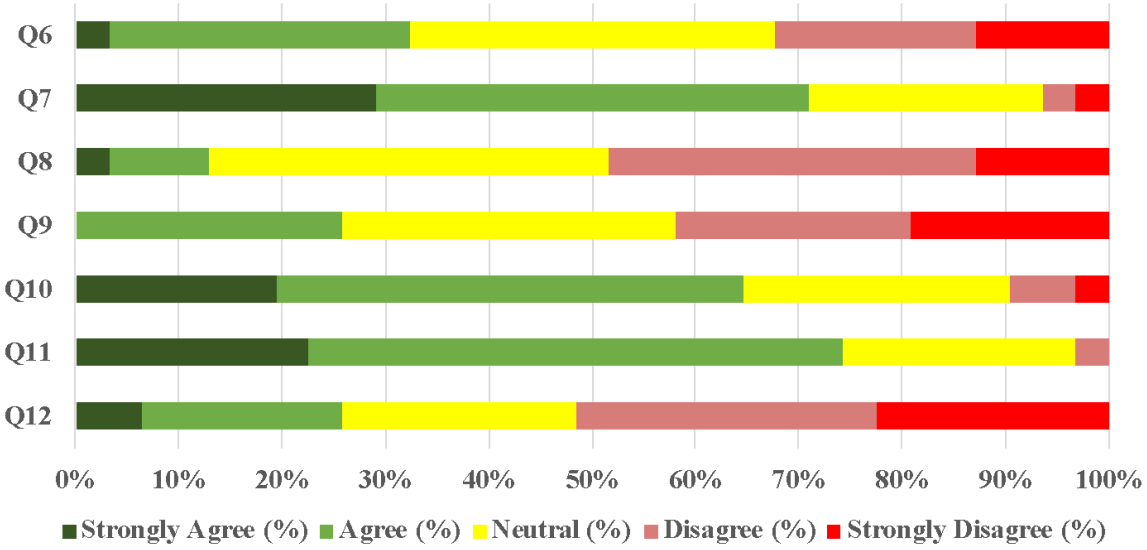

Figure 3. Students' Perception of GIS Distance Learning Experiences

The online questionnaire examines students learning experience in the GIS online course during the pandemic. Regarding the course's satisfaction level (Q6), about 3.2% of students feel strongly satisfied with online learning, while 29% feel satisfied. Contrarily, about 19.4% of students feel unsatisfied with this online course's design, while 12.4% of students were strongly unsatisfied. In terms of new learning experiences (Q7), most students feel that they have gained new knowledge during the online course from several delivered topics since 29% and 41.9% of students strongly agree and agree that they learned some new experiences. Only a small number of students have not learned new experiences in this online course. Meanwhile, 22.6% of the students have mixed feelings about the changes in the setup.

The online questionnaire also covers the online interaction within the course. Question Q8 asked student perspective on their learning interaction with the teacher or lecturer. The results signify that only a small number of students (3.2%) feel that the learning was significantly less interactive, and 9.7% experienced less interaction with the lecturers. On the other side, many students, 35.5% and 12.9% experienced more interaction with the lecturer team during the learning activities. Some students agreed (25.8%) that they had less interaction with their classmates since the LMS had minimum group activities interaction. In comparison, the opposite, around 22.9% disagree with the statement. The responses to question Q10 reveal that many of the students felt excited (45.2%) with the interaction during the online course, where the lecturer organized open discussion, seminar, and practicum.

Meanwhile, 3.2% of the students felt disappointed with the exchange in this course. For the perception of assignments asked in question Q11, most students feel excited and motivated in the individual or online group assignment, including in preparing thematic maps for education service, land management, and specific use of DEM. About 51.6% of students were excited and motivated, leaving only a limited number of students feeling not excited and motivated with their assignments (3.2%). Even though the online teaching for GIS was exciting for many students, only a small number of the students agree that this online course should be permanently implemented in the future. There were only 3.2% of the students strongly agree

that this course should be carried out online, while 29% and 22.6% of students disagree and strongly disagree with the full distance learning format.

3.4. Perspective on the External Condition During Distance Learning

External conditions of the learning activities carry effects on students learning effectivity, including housing environment (Bradley & Putnick, 2012), course period (Tetteh, 2017), and family members' disruption (Di Pietro, Biagi, Costa, Karpiński, & Mazza, 2020; Duraku & Hoxha, 2020). In this questionnaire, we used three questions to examine external conditions' during the online course. Meanwhile, the students' answers to those questions are illustrated in Figure 4.

Q13. Do you feel that your home or environment supports you in attending this online course?
Q14. Do you feel that the GIS course period is suitable for you?
Q15. Do you feel that your parents, family, or relatives support you in attending this online learning?

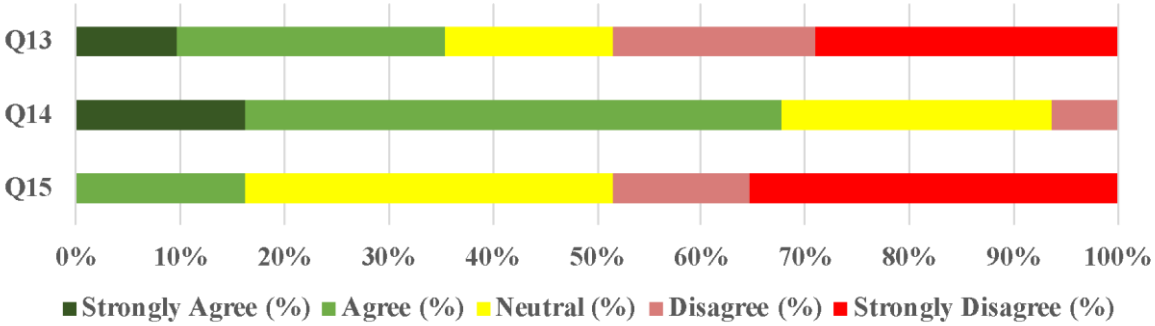

Figure 4. Students' Perception of the External Condition During Remote Learning

Most of the students' problems are related to their physical and emotional aspects and outside situations, especially during the quarantine period when most students spend their time with parents, families, or relatives. In question Q13, the results revealed that many students felt that their home or environment did not support their learning during the quarantine. Our results show that 29% of students felt very uncomfortable with their environment, while 19.4% feel uncomfortable. On the other side, 25.8% of students felt comfortable with their home and atmosphere during online learning. Additionally, for the study schedule asked in question Q14, most of the students were comfortable with the study time scheduled at 8.30 AM local time. About 51.6% of the students agreed with the schedule, and 16.1% agreed. During this period, the internet connectivity is relatively stable due to limited usage, while in the afternoon, the internet connection has decreased caused of the maximum use. During the study, the family members can be a supporting circle for students. But at the same time, they can bother the students in certain circumstances, such as the siblings. In the current study, about 35.5% of students agreed that at some level, they felt significantly disrupted by their families during online learning. Some students had to share the computer or laptop with the other siblings simultaneously, and some felt disrupted (12.9%). On the other side, about 16.1% strongly agreed that their family had good support for them during their learning during the pandemic situation, while 35.5% of students acknowledged that there was nothing changed in their family.

4. Conclusion

This study concluded that the COVID 19 pandemic had impacted the GIS teaching in the Universitas Muhammadiyah Purwokerto, Indonesia, where students had to transform the learning activities into the online format by using official LMS (Onclass UMP). The platform also offered a virtual meeting, material access, and open discussion. Besides, the study also concluded that most students were pleased by this sudden transformation and relatively enjoyed the learning process mainly conducted through the official learning portal and online tutorial. The students appreciate the lecturer team's learning process, although they prefer the conventional model in the upcoming time. Further, the students were still motivated by the learning transformation. This study also concluded that environmental conditions, including house and family, were relatively supportive in this emergency situation. At the same time, some students face problems with their home conditions that may affect their learning. Besides, some students also face the difficulty in accessing proper learning infrastructure, including laptops or PC, since some of them have to share the computer with their siblings. However, generally, the family members' emotional support for students is essential during the pandemic period.

This study recommends the optimization of the online platform that can accommodate all students with various infrastructures. The government or university should increase the data connection package and improve students' accessibility to literature and online platforms, such as Zoom, Google Meet, and WebEx. Further training in online teaching development and evaluation is also crucial to increase the quality of the learning process, especially in GIS-related subjects that require 'high-end' computer infrastructure. However, the study was held in a small population, so it was unable to represent the general condition in GIS teaching Islamic universities in Indonesia. Therefore, we propose a further study to consider the teacher perspective in the GIS teaching during a pandemic with additional analysis correlated to the student results. Comparison study of the learning infrastructure accessibility during pandemic and students results. Finally, we also recommend future studies to compare the implementation of GIS teaching in private and public universities with a bigger population and sample.

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