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Implementation and Barriers of Online Learning Based on TIPEC Framework: A Survey on Geography Teachers

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Abstract

Technology needs to be integrated with every learning process. Moreover, the Covid-19 pandemic situation does not allow face-to-face learning in class. Therefore, online education has become the primary choice. However, online learning itself comes with challenges from the perspective of the teachers and their students. This study aims to analyze the implementation and challenges of online learning in Senior High School on teacher perspectives. The study design adopted quantitative research with a survey approach. The respondents involved were 163 Geography Teachers from North Sumatra Province. Data were collected by using a google form questionnaire. The data were analyzed through descriptive statistics. The results showed that the implementation of online learning in geography subject utilized various e-learning platforms and learning activities. Whereas, the barriers encountered in online learning based on TIPEC framework containing technological, pedagogical, individual and enabling conditions. The most barriers as follow: bandwidth issues and connectivity (technological factor), lack of feedback (pedagogical factor), inequality in access to internet connectivity (individual factor), and security (enabling conditions factor).

Introduction

Technology is one of the foundations in implementing 21st-century learning. Learning in the digital generation undoubtedly demands the ability of teachers to organize digital technology-based learning. The power of teachers to use various innovations and ICT in learning will determine the success of learning, especially in the digital generation (Alexander et al., 2016; Berutu et al., 2019). Online learning is one form of learning that utilizes ICT. This type of learning is increasingly popular in line with the development of the internet. Two types of online learning are commonly used, namely fully online learning and partially online learning (Dhull and Sakshi, 2017). Fully online learning means that learning activities are carried out online as a whole. While partially online learning allows learning materials in print and digital, learning activities are a combination of synchronous and asynchronous activities (Liguori & Winkler, 2020).

Online learning has its advantages and disadvantages. The advantages of online learning include: providing flexible distance learning opportunities for students (Zhang, 2006), economic benefits due to lower costs (Bartley & Golek, 2004), allows collaboration and partnerships of students from various regions of origin, both at local,

national and international levels, facilitates the management of teaching materials and the process of updating learning is faster and easier (Gamdi & Samarji, 2016), in addition to studying material online education can also improve students' writing and computer skills, students can become more interactive, responsive, and share knowledge to enrich learning experiences and resources (Dhull and Sakshi, 2017). For teachers, the main advantage in online learning is the ease of sharing teaching materials in various formats such as word, pdf, video, audio and others, easy access to materials in the form of material links, web or directly distributed to WA groups, use of e-learning platforms in the form of LMS that facilitates documentation of every learning activity such as curriculum setting, attendance monitoring, assignments, learning deadlines, sending private or group messages, evaluations, and even interactions with parents to report student learning achievements.

The limitations in online learning that may often occur include the need for careful planning, learning that cannot be accessed by students who do not have supporting equipment such as computers (Selvaraj et al., 2021), Android devices, or unstable internet connections (Zhang, 2006), limited ability and experience, creativity and expertise of teachers in e-learning management, including educational abilities (Liguori & Winkler, 2020), crisis management (Bartley & Golek, 2004), difficulties in ensuring participation or controlling student activities, because students may open other websites or play games during the learning process. Obstacles to online learning on the dimensions of teachers include lack of ICT expertise, lack of experience and knowledge about online learning, teachers who find it difficult to adapt to change, development of online learning programs that require a lot of time and lack of motivation (Gamdi & Samarji, 2016; Moscinska & Rutkowski, 2011; Wardoyo & Mahmud, 2013).

Previous researches have discussed the barriers from educators' perspectives (Mercader & Gairín, 2020, Aldosemani, 2020; O'Doherty, Dromey, Lougheed, Hannigan, Last, & McGrath, 2018) regarding online learning. Several researches have revealed that many dimensions of barriers concerning the implementation online learning such as: technology infrastructure, course content (Ozudogru & Hismagnolu, 2016); technical support (Poon & Koo, 2010); lack of ICT skills, bandwidth issue and connectivity (Gutierrez-Santiuste & Gallego-Arrufat, 2016); student readiness (Unal et al, 2013); pedagogical model (Govender & Chitanana, 2016); engaging students online; lack of feedback (Guy, 2012); quality of course content (Mtebe & Raisamo, 2014); and level of knowledge of teacher (Dogan, 2015). Among these strands of study, teachers' opinion on barriers of online learning during pandemic in secondary schools in Indonesia seems to be out of concern. Moreover, the literature and empirical research concerning on barriers of online learning in geography subject was rarely found. Previous studies have discussed dimension of barriers in separate or partial studies. Therefore, the current study aims to analyze the implementation and barriers experienced by teachers in online learning based on TIPEC (Technological, Individual, Pedagogical and Enabling Conditions) framework. Findings of this research may help government and practitioners to improve education policies and responsive to facilitate online learning.

Research Question

This research explored the experiences of geography teachers on online learning including the implementation and barriers. Specifically, it sought to answer the research questions as follow:

1. How online learning implemented in geography subject during Covid-19 pandemic?
2. What are the barriers encountered by geography teachers in online learning based on TIPEC framework?

Method

This research is a quantitative study with a survey approach, specifically a cross-sectional survey. This type is very suitable for describing the characteristics of a population but not for determining cause-and-effect relationships between variables. The research took place at one point in time, observing the attitudes and opinions of the subjects of study (Creswell, 2012). A cross-sectional survey was adopted to analyze the implementation and barriers of online learning experienced by geography teachers based on TIPEC framework. The participants of this study included 163 volunteers Geography teachers who were members of the Geography Teachers Communities of North Sumatra Province, Indonesia. Participant's description can be seen in Table 1 below.

Table 1. Description of Research Participants

Gender	Frequency	Percent
Male	69	42.33
Female	94	57.67
Total	163	100
Age	Frequency	Percent
Between 20 - 30	14	8.59
Between 31 - 40	56	34.35
Between 41 - 50	87	53.37
51 and over	6	3.69
Total	163	100
Teaching Experience years	Frequency	Percent
≤ 5	6	3.68
5-10	11	6.75
11-15	58	35.58
16-20	24	14.72
21-25	45	27.61
> 25	19	11.66
Total	163	100

Convenience sampling was used in this study. This is a nonrandom sampling where participants of the target population that meet certain criteria including willingness and time availability to involve for the purpose of the research (Fink, 2011). Data collection was carried out online using google forms. The google form link was distributed to the geography teachers through WhatsApp. Teachers are given six days to answer the questions in the questionnaire. Implementation of online learning data were obtained through open-ended questions as follow:

1. What kind of platforms/tools or media that you used in the implementation of online learning in geography subject?
2. What are teaching and learning activities encountered in the implementation of online learning in geography subject?

Regarding barriers of online learning had four dimensions as follow:

Table 2. Dimensions and Categories of Online Learning Barriers

Dimensions of Barriers	Categories
Technological	7
Individual	25
Pedagogical	28
Enabling conditions	7
Total	67

The dimensions and categories of online learning barriers were adopted from TIPEC framework (Ali *et al.*, 2018). All of categories were constructed by using Likert scale which ranges from 1 (not a barrier) to 4 (a significant barrier) for barrier. Reliability of scale was determined by using Cronbach Alpha value (0.86). All item of questionnaires have been validated by a team of experts based on construct validation. The data from open ended questions regarding implementation of online learning were analyzed using deductive qualitative content analysis and presented in tables and graphs. The quantitative data were tabulated and analyzed using descriptive statistics of mean and standard deviation.

Results

Implementation of Online Learning

The implementation of online learning from home policy had only begun in mid-March 2020 due to the increasing outbreak of Covid-19. This is a new milestone in Indonesian education history because the implementation of the learning process is carried out online for the first time. Online learning can be carried out with the help of digital media, which is often referred to as a learning platform or application. Geography teachers have used various platforms or applications that support online learning simultaneously. For example, the digital media can be seen in Figure 1.

Based on the picture, the WhatsApp group's most widely used by teachers as an online learning medium (84 %). In addition, only 46% of teachers have managed to learn by using Google Classroom as an LMS in online learning. Virtual face-to-face learning is done using Zoom Cloud Meeting, but only 16 % of teachers take advantage of this virtual room. As many as 10.4% of teachers also use social media Facebook for learning. As for evaluations such as tests and exams, teachers use Quizzy, Google Form, Kahoot and Quipper applications. WhatsApp group became a support app that facilitates communication between teachers and students. This is because, in general, teachers and students already have this application installed on their cellphones.

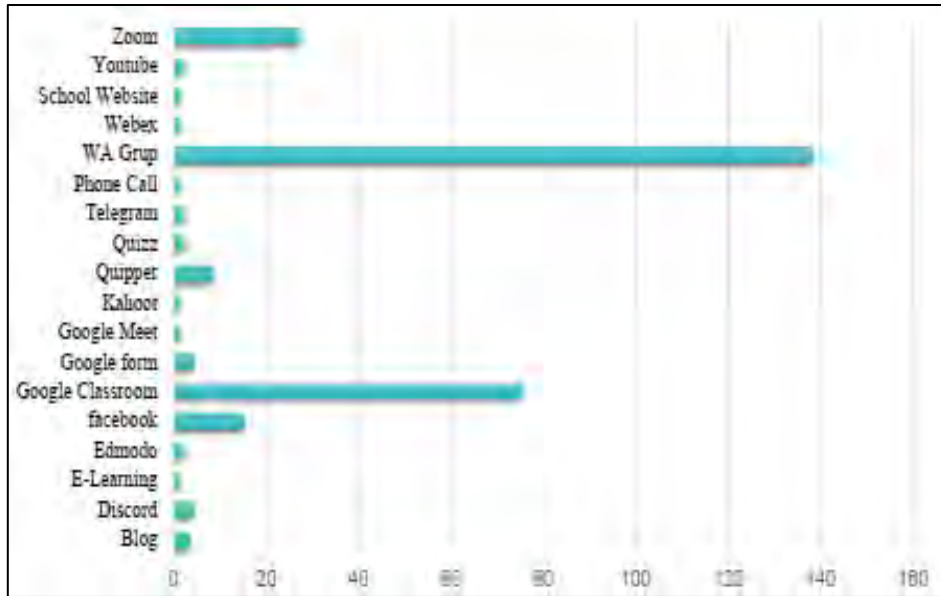


Figure 1. Online Learning Support Application

The simple way of using it and saving internet quota is why teachers choose this application both in delivering material, learning instructions and assignments. At the same time, the use of LMS such as Google Classroom and others is still limited due to the lack of teacher ability in using LMS. Likewise, virtual classes in Zoom Cloud Meetings, Google Meet and other video conferencing applications are still very rarely used.

This is due to the teacher's lack of understanding of its use. Longer time and preparation are needed, especially with the frequent occurrence of internet disturbances and the need for a more significant internet quota. Students often go in and out of class due to internet connection problems when the teacher conducts the learning process through video conferencing. Not all students can fully participate in learning activities. The forms of online learning activities carried out by teachers are shown in Figure 2.

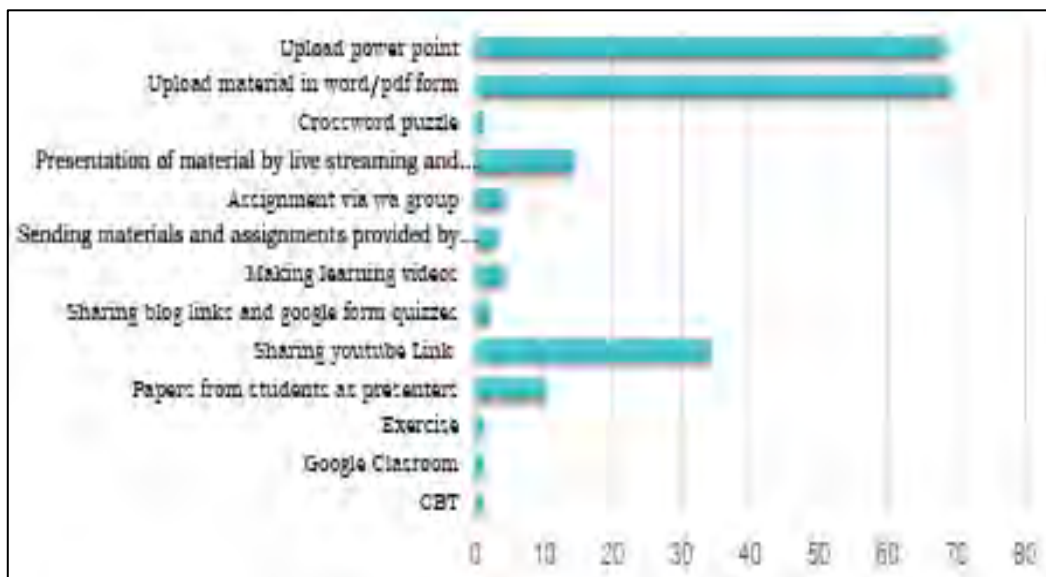


Figure 2. Online Learning Activities

Figure 3 shows that there are variations in online learning activities carried out by teachers, which include uploading materials in pdf and word formats (72,4 %), sharing material in the form of PowerPoint(41,7%), sharing material through YouTube link (37,4%), presenting material via live streaming virtual room (15,3 %) and student paper presentation (9,8 %). Based on these data, it is reiterated that the ability of teachers to manage online learning is still subpar. This is because learning activities are dominated by sharing material in word, pdf and PowerPoint files. Likewise, the management of learning activities through Google Classroom is also less than optimal. Teachers do not have experience carrying out online learning with digital media such as LMS. Teachers are already familiar with the face-to-face learning method in the classroom directly. The sudden change to online learning provides various obstacles for teachers.

Barriers of Online Learning Based on TIPEC Framework

The results obtained from scale of technological, individual, pedagogical and enabling conditions (TIPEC) framework as barriers of online learning in this study are presented following table.

Table 3. Mean Scores for TIPEC Framework

Dimensions of Barriers	Mean	N	SD
Technological	2.97	163	.83
Individual	2.84	163	.88
Pedagogical	3.12	163	.86
Enabling Conditions	2.88	163	.78

Table 3 shows the mean score per barriers based on TIPEC framework. The highest ranking are mainly the pedagogical factor (3.12) and technological factor (2.97). On details per barriers factor can be observed below.

Technological Factor

Technological factor containing seven categories was administered on 163 geography teachers. The mainly highest score was bandwidth & connectivity and technology infrastructure. The lowest mean score belong to technical support. In other word, bandwidth & connectivity and technology infrastructure were the mayor barriers and technical support was minor barriers of online learning in geography subject (see Figure 3).

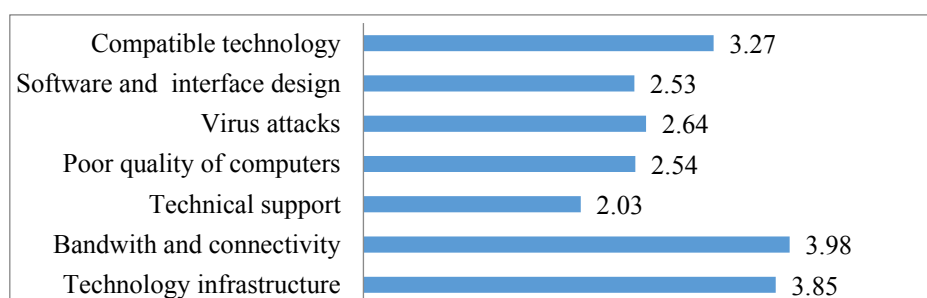


Figure 3. Mean Scores for Technological Factor

Individual Factor

Individual barriers consisting twenty-five categories relating directly to the student. The highest mean score was inequality in access to internet connectivity and the lowest was social loafing. The mean score of individual categories above 3 were inequality in access to internet connectivity (3.95); students readiness (3.86); students motivation (3.85); cost of using technology (3.84); students economy (3.66); students work commitment (3.64); inequality in acces of technology (3.62); lack of ICT skills (3.56); sense of isolation due less face to face interaction (3.28); and students support (3.04) (see Figure 4).

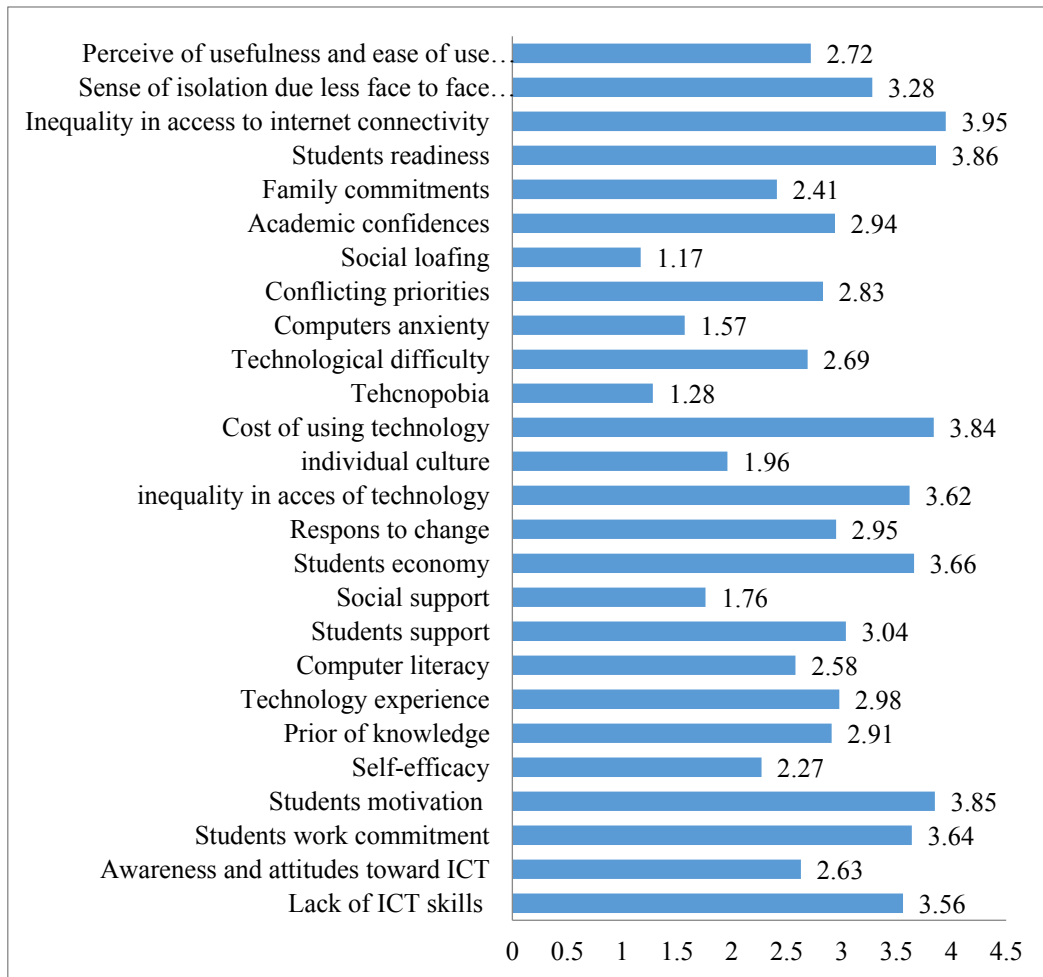


Figure 4. Mean Scores for Individual Factor

Pedagogical Factor

Pedagogical factor containing twenty-eight categories related to teachers, teaching methodology, supporting staff/school and course content or learning material. The highest mean score was lack of feedback (3.98) and the lowest mean score was pre-course orientation (2.03). Top five ranking of pedagogical barriers were lack of feedback, teachers ICT skills, course content, additional time needed to communicate with students, and Absence of real time feedback (see Figure 5). In short, these barriers were identified by geography teachers as obstacles in online learning.

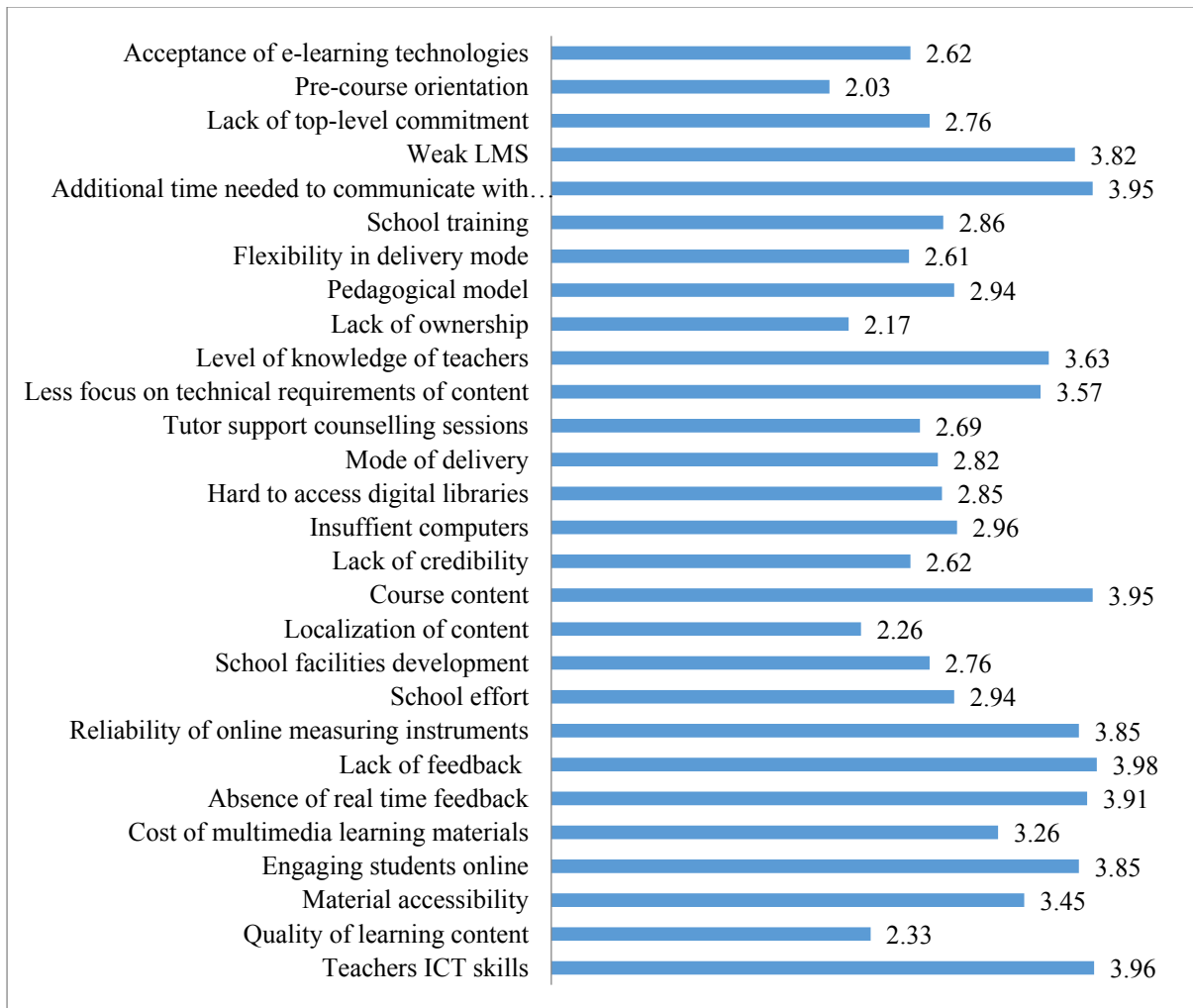


Figure 5. Mean Scores for Pedagogical Factor

Enabling Conditions Factor

Enabling conditions barriers that have overall impact on multiple T/I/P (technological/ individual /pedagogical) categories. The highest mean score was security (3.69) and the lowest mean score was load shedding of electricity (2.54). It can be observed in Figure 6.

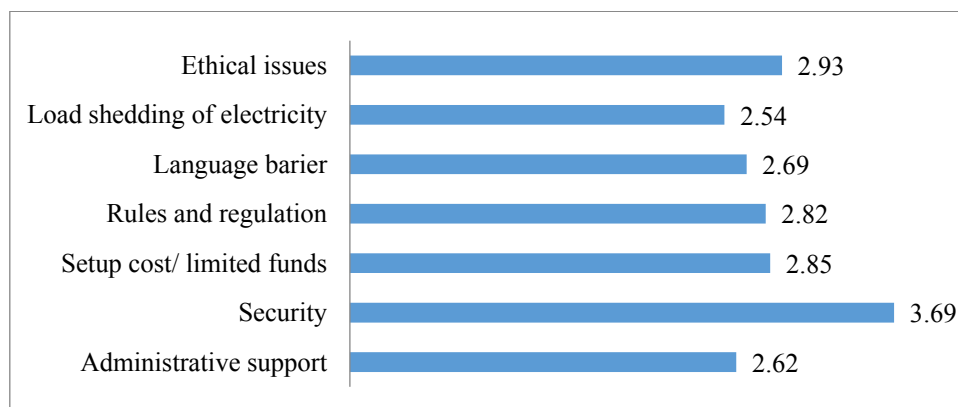


Figure 6. Mean Scores for Pedagogical Factor

Discussion

Implementation of Online Learning

Comprehensive online learning at various levels of formal education in Indonesia was first implemented during the Covid-19 pandemic. The use of online learning platforms is a virtual space for teacher and student interaction. These platforms include LMS, video conferencing applications and other applications that support teacher and student interactions. Turnbull et al., (2019) suggested Learning Management System in the form of a web-based platform or software useful for teacher interaction in online learning with various administrative features, managing activities and materials to evaluate learning outcomes. Some LMS with open-source licenses includes Moodle, Edmodo, Schoology, A tutor, Kahoot, Chamilo Claroline and many other LMS that can be used for free. However, the lack of experience and motivation of teachers related to LMS due to its sub optimal utilization. The study results evidence that the use of LMS in online learning is still low.

Online learning can also be done face-to-face virtually. Applications that support this kind of interaction include google meet, skype, Cisco WebEx, and zoom cloud Meetings. This application can also be accessed for free. Indeed, free applications have limitations, but this application is sufficient for material presentation activities and discussions directly through live streaming. However, in this study, teachers also have not used this free service in online learning. This obstacle is caused by the lack of teacher expertise in preparing and managing to learn. Not only for teachers, but students also sometimes feel uncomfortable making video calls or video conferences while knowing. Students prefer to share via WhatsApp messaging applications and do not communicate directly with teachers, resulting in low participation in learning activities (Murad et al., 2020). The most widely used supporting application for teachers is WhatsApp. Social media applications such as Facebook, Twitter, YouTube, and Instagram can also help the online learning process, especially presenting and sharing learning materials. This will enrich learning and the diversity of digital-based media forms. However, the presentation of material that is only in the form of word or pdf format files and PowerPoints will cause boredom for students.

21st-century learning has the main characteristics of using technology in education. Teachers' ability is needed to be able to use various applications or software to package material digitally. The quality of teaching materials in online learning also helps build students' cognitive abilities (Adriyanto et al., 2021). In addition to technology, teachers also need to integrate knowledge that stimulates higher order thinking skills. Teachers can provide relevant stimuli for each learning material. The presentation of the material is directed at analogies and examples that are close to the student's environment. This will foster analytical, critical, and creative thinking processes for students and build problem-solving skills.

In addition, the learning experience provided to students will be more meaningful. However, teachers also experience obstacles in reconstructing learning based on higher order thinking skills. Even though the teacher has a long teaching period and a lot of experience, it does not guarantee a high ability to design and implement HOTS learning. Teachers still find it challenging to integrate higher-order thinking-oriented learning in planning, implementing and evaluating knowledge or compiling assessment instruments (Dahlan et al., 2020).

Barriers of Online Learning Based on TIPEC Framework

Results of this study showed that the pedagogical factor and technological factor recognized as the mayor barriers in online learning. In term of pedagogical factor, the highest barriers was lack of feedback from both of teachers and students. Online learning have several limitation in time and interaction, so that feedback in learning activities was also limited (Guy, 2012). Previous study found that low interaction between teacher-student, student-student due to lack of interaction causes major problems in online learning (Li, 2009; Tryon and Bishop, 2009; Isman, 2011). As there is no teacher-students interaction in synchronous and asynchronous where there is no face-to-face communication, reactions such as opportunity to ask and answer questions directly in face to face (Birisci, 2013). Additional time was needed to communicate with students and increase interaction among teacher-student (Arabasz et al, 2003).

Lack of teachers' ICT skills and course content are also the barriers of pedagogical factor. Teachers' ability is needed to be able to use various applications or software to package material digitally. The achievement of learning objectives indicates the success of the online learning process. However, with various material characteristics, not all of them can be mastered by students well when presented online. Geography subject matter consists of formal objects and material objects. Ordinary things are in the form of a spatial approach, an environmental approach, and a regional approach. At the same time, the material objects include the study of the lithosphere, hydrosphere, atmosphere, biosphere and anthroposphere. This geography material is related to the physical environment and its interaction with the social environment (Delita et al., 2019). Materials that require practical abilities such as mapping, Geographic Information Systems, remote sensing will be complex for students to understand if they are carried out online. Next, materials that require real examples in the context field are also challenging to understand in online learning. Although students can explore material from various sources on the internet, this is not enough, and only a small number of students have the motivation to learn independently. Most students have a high dependence on the material presented by the teacher.

Bandwidth issue and connectivity are perceived as the most barrier for online learning in geography subject. This categories related to pedagogical factor (mean score: 3.98) and Individual factor from students barrier (inequality in access to internet connectivity, mean score: 3.95). It related to the unstable, slow speed of internet and high internet traffic during online learning. Internet connection is the main requirement for the implementation of online learning. Disruption of the internet network will cause online learning activities to be ineffective and inefficient. This barrier often occurs in developing countries, including Indonesia. Adnan & Anwar (2020) stated that internet connection problems are an unavoidable obstacle in online learning and have become the main issue for all teachers. Network connectivity is a significant issue in online learning (Diningrat et al., 2020).

Moreover, video conferencing learning activities require a stable internet connection and a large data quota. Teachers must choose the right network, either through Wi-Fi or internet network provider's data packages. Internet package providers in Indonesia include Telkomsel, Indosat, XL Axiata, Tri Indonesia, Axis and Smartfren. Each type of internet provider has its advantages and disadvantages. The providers used mainly by teachers are Telkomsel and Indosat. However, even though the two providers are large companies with experience

as internet network providers, network bottlenecks always occur, especially during weather disturbances such as rain and user location factors. The disruption of internet connection has an impact on increasing lesson hours because teachers need to consider students' readiness before starting lessons. The teacher waits until all students are present and follow the lecture. Internet disturbances make it difficult for students to enter online classes, especially video conferencing and LMS. In addition, the instability of the internet during learning also extends the duration of the lesson hours compared to the planned allocation. Thus, learning becomes less effective and efficient. Similar studies were also found that internet access has become the significant barrier in online learning in Australia (Fox, Diezmann, & Lamb, 2016); Brazil (Luz, Rolando, Salvador, & Souza, 2018); (Bozkurt *et al.*, 2020) and Indonesia (Delita, 2021).

Security (mean score 3.69), the highest barrier in enabling conditions related to openness of online learning systems challenging security of personal information of teachers and students. This finding is in line with finding research of Chen & Bryer, (2000), privacy perceived as major barrier. All of data in e-learning platforms such as LMS, Zoom Cloud Meeting, Google Meet, and other, during online learning has marketing potential and be open access (Bozkurt *et al.*, 2020). Therefore, cybersecurity for students and teachers' privacy is needed.

Conclusion

E-learning implementation requires facilities in the form of hardware connected to the internet and software. Hardware may be in the form of computers, laptops, smartphones, tablets and others, whereas software includes various learning platforms. Online learning platforms can exist in the form of applications, websites, social media and Learning Management Systems. Learning materials in online learning can be packaged in the form of various format such as pdf, PowerPoint, MS Word, web, blog, video, and multimedia. All of learning resources should easy to access by students.

Barriers encountered in online learning based on TIPEC framework containing technological, pedagogical, individual and enabling conditions. The most barriers as follow: bandwidth issues and connectivity (technological factor), lack of feedback (pedagogical factor), inequality in access to internet connectivity (individual factor), and security (enabling conditions factor). Various strategies can be used to overcome barriers in online learning. This strategy starts with changing the teacher's mindset on the importance of developing competence. If the teacher is aware of this, the next step is facilities. Schools can facilitate teachers in improving their competencies and provide the facilities needed in online learning. In addition, schools can involve teachers in various professional training. On a national scale, the Ministry of Education and Culture of the Republic of Indonesia can also initiate a program of debriefing and strengthening teacher competencies.

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