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Research Article

Using Blended Disaster Learning Multimedia (BDLM) for Geography Teachers Candidate: Experimental Study on Disaster Preparedness Knowledge

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ABSTRACT

Blended learning needs supporting components to be able to achieve learning objectives. The use of Blended Disaster Learning Multimedia (BDLM) is used as teaching material to support the blended learning process. The purpose of this study was to determine the effect of using BDLM on knowledge of disaster preparedness. We used a quasi-experimental design using a pretest posttest non-equivalent control group design. Data were analyzed using ANCOVA. Research participants were prospective geography teachers who are participating in the lecture program in the 2021/2022 academic year. To assess the knowledge of disaster preparedness using an essay test that is adapted to disaster preparedness indicators. The results show that BDLM integrated blended learning has an effect on knowledge of disaster preparedness. The experimental group appears to have superior knowledge of disaster preparedness with superiority in all indicators of knowledge of disaster preparedness. There is no significant effect between gender differences, because the treatment does not discriminate between gender. The interaction between BDLM learning and gender has a significant effect due to BDLM is a medium that focuses on learning activities not on the treatment of gender differences. The perceived impact is that using BDLM can increase disaster preparedness knowledge. Therefore it is necessary to apply it to prospective geography teachers more broadly.

Keywords : blended learning; disaster preparedness knowledge; gender; learning media

INTRODUCTION

Disaster events are unpredictable. Disasters cause all social and physical factors to be disturbed (Suarmika et al., 2022). In particular, Indonesia is a country with the highest threat of natural hazards. Natural disasters were recorded throughout 2021, namely 6,234 disaster events (BNPB, 2022). This can be caused by geological, geomorphological, and climatological factors

(Sumarmi et al., 2021). Therefore, it is necessary to provide disaster preparedness in every sector, including schools (Sari et al., 2020; Sari & Ridhwan, 2019).

Efforts to equip schools for disaster preparedness have been integrated into the curriculum in the World (Edey et al., 2021; Sprenger & Nienaber, 2018). The focus of this learning integration is on geography subjects (Mönter & Otto, 2018). This has been recommended in the 2007 Lucerne Declaration on Geographical Education for Sustainable Development which recommended that the topic of disaster risk reduction and climate change should be integrated into geography education curricula around the world (Eid-Heberle & Burt, 2023; Roy et al., 2022; Wu, 2021). In Indonesia, lessons for disaster adaptation and mitigation are taught in high school geography subject matter. Therefore, geography teachers are required to be able to teach students about disaster risk reduction efforts (Sakurai et al., 2018).

To be able to form qualified geography teachers, intensive training on disaster risk reduction for prospective geography teachers is required. This is confirmed by Kawasaki, et al. (2022) that educating prospective geography teachers is an effective and sustainable approach. The process of educating prospective geography teachers aims to create teachers who are ready and skilled in pedagogic, skills, attitudes, and professional aspects (Johnson & Ronan, 2014).

However, the problem that occurs is the ability to mitigate and adapt to disasters in the school environment is still low. This is evidenced in research from Ernawati et al. (2021) which stated that teachers and students have low knowledge of disaster mitigation efforts. Meanwhile, research from Sözcü & Türker (2021) stated that the knowledge of prospective geography teachers about disaster mitigation attitudes needs to be improved. Therefore, efforts to improve disaster preparedness capabilities for prospective geography teachers are needed.

To improve disaster preparedness skills, efforts must be made through increasing knowledge of types of disasters (Triastari et al., 2021). Prospective teachers must know the concept of disaster, the causal factors, and the impact of a disaster in order to be able to develop a disaster preparedness attitude (Kastolani & Mainaki, 2018). For this reason, there is a need for learning that supports increasing knowledge of disaster preparedness (Gouramanis & MoralesRamirez, 2021).

Learning at universities in Indonesia is carried out online due to COVID-19. One of the learning methods used is blended learning. Blended learning was chosen as an effective learning method to improve disaster preparedness (Sumarmi et al., 2021). Through blended learning, teachers can freely develop teaching materials and coordinate classes to conduct investigations through online classes (Finlay et al., 2022; Godlewska et al., 2019). Blended learning can also facilitate teachers to develop learning designs (Suartama et al., 2019; Sumarmi et al., 2021). Blended learning also trains students' independence in learning (Cao & Liu, 2019; Chen, 2020) and can facilitate large numbers of classes (Godlewska et al., 2019). To support this independence, innovation is needed to support blended learning (Cao & Liu, 2019; Zhang et al., 2019).

This study uses BDLM which is integrated into blended learning. BDLM can be downloaded and used offline. The use of blended supporting learning media that can be used offline can make it easier for students to learn anywhere and anytime without being limited by the existence of a network (Chen, 2020). The use of BDLM provides opportunities for students to understand the topic, so as to increase knowledge (Roe et al., 2010). In addition, BDLM is also equipped with images, photos, and videos that are integrated with disaster preparedness knowledge so that it can improve disaster preparedness (Mardani et al., 2021; Sejati et al., 2019). Learning facilities provided by using integrated media with learning activities can improve learning outcomes (Chaeruman et al., 2020).

Research on improving the effectiveness of learning using blended has drawn previous research. Research by Sumarmi et al. (2021) examined the application of integrated blended with e-modules to improve disaster preparedness and learning innovation. Research by Zhang et al. (2019) using integrated we-chat with blended learning for effective management. The research of

Gao et al. (2020) and Alsalhi et al., (2019) explain that using blended can improve learning outcomes and learning satisfaction.

Based on previous research, there are still found research gaps. The focus of previous research was carried out on the study of subjects and cognitive abilities related to learning outcomes and disaster knowledge abilities. However, no one has studied blended learning innovations using multimedia learning media. Therefore, this study aims to determine the effect of BDLM on knowledge of disaster preparedness, the study also involves the gender variable as the second problem formulation.

METHODS

Research Design

The study used a quasi-experimental pretest posttest non-equivalent control group design. The study involved the dependent variable (Disaster preparedness knowledge) and the independent variable (BDLM, Gender, and the interaction between BDLM and Gender). Based on the research design, we involved two treatment groups, namely the control group and the experimental group. The control group used blended learning without the application of supporting learning media. The experimental group used blended learning using BDLM. The research design can be seen in Figure 1.

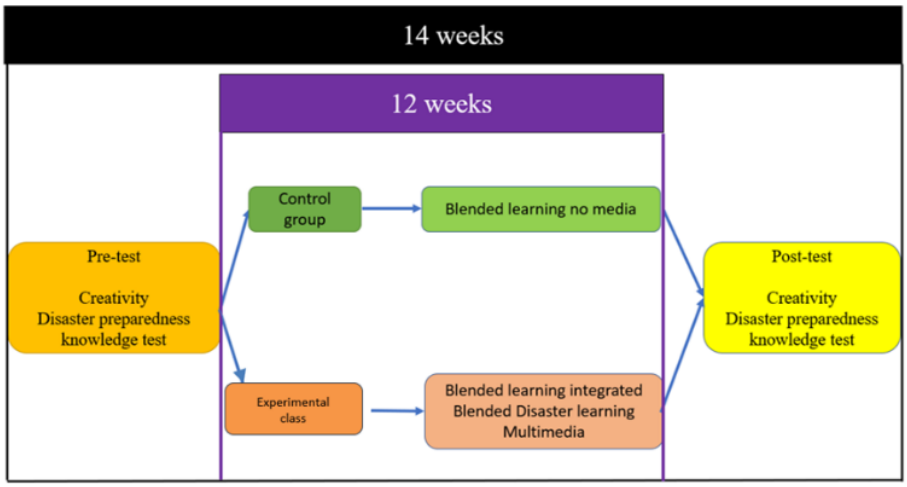

Figure 1. Research Design

Participant

This study involved students of geography education STKIP Al-washliyah. The research sample involved students from the class of 2019 for the 2021/2022 academic year. The reason for selecting the research sample is because students are taking disaster mitigation and adaptation courses. A total of 34 students were involved in the study consisting of 13 males and 21 females. Vulnerable age 18-20 years. The control group consisted of 17 students consisting of 5 boys and 12 girls. the experimental group of 17 students consisted of 8 males and 9 females (Figure 2). The selection of students is not differentiated, because the groups are selected based on the abilities they already have (viewed from the previous semester scores).

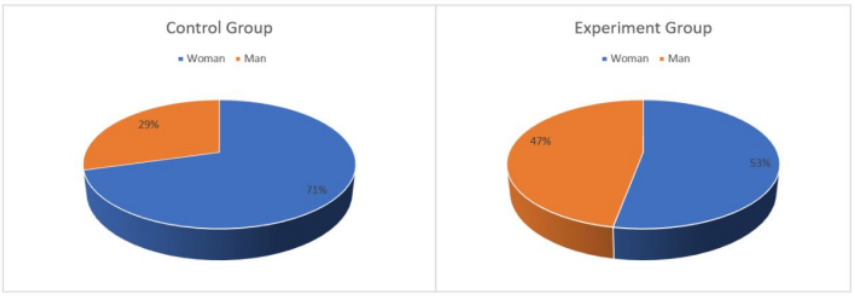

Figure 2. Participant

Instrument

We used an instrument to measure disaster preparedness knowledge to answer the research question. Measurement using essay questions amounted to 10 questions. Meanwhile, we adjusted the questions to the 4 indicators of disaster preparedness knowledge from Sari et al (2020) namely 1) basic knowledge of disaster, 2) planned activities during disasters, 3) disaster warning systems, and 4) resource mobilization. The instrument consists of two parts, namely articles related to contextual disaster case studies and part questions that require open answers to students. The article that we use as a reference in this research is "The Threat of Tsunami and Rob Flood in Banda Aceh City", we also attach a 1.56 minute video from https://www.youtube.com/watch?v=b_iwNjkKI2w. Part 2 contains 10 essay questions that lead to disaster preparedness indicators. The details of the instrument can be seen in table 1.

Table 1. Details of Disaster Preparedness Knowledge Measurement Instruments

Indicator	Number of Questions	Questions (Score)
Basic knowledge of Disaster	5	1. What type of disaster occurred according to the problem in the article? (5) 2. Explain the impact of sea level rise? (5) 3. Describe the characteristics of the tidal flood disaster? (10) 4. Describe the characteristics of a tsunami disaster? (10) 5. Explain the source of information that can be used as a reference related to the disaster article? (10)
Planned Activities During Disaster	2	6. If you were in the position of this disaster, what would you prepare? (10) 7. If a disaster occurs while you are teaching in the school, explain what you can do? (10)
Disaster Warning System	2	8. How do you know that a tsunami and tidal flood will occur? (15) 9. Explain the steps you take if you hear a warning sign when you are doing activities at school? (15)
Resource Mobilization	1	10. How do you provide knowledge or disseminate knowledge on disasters and disaster mitigation efforts? (10)

We conducted a validity and reliability test to measure the accuracy of the instrument in measuring disaster preparedness knowledge, before testing the instrument. The test was carried out on final year students because it was assumed that they had taken disaster mitigation and adaptation courses. The test results using Cronbach's alpha are 0.662, which means it is a reliable instrument and the results of the Pearson correlation test range from 0.03 to 0.53. Instruments were distributed via googleform at an agreed time. The duration of the test was 2X50 minutes. Google forms were simultaneously given to the experimental and control group students and closed when time had run out. The courses taught using BDLM are the Geography of Disaster course.

Implementation

This study involved 2 groups, namely the experimental and control groups. The control group got blended learning without any intervention. The control group was conducted for 16 meetings with 2 meetings in class and 16 times online. Students are required to use Edmodo, however the difference is that the control group learning media used a module developed by the subject lecturer.

The experimental group used BDLM which was developed by a team of lecturers. This is adapted to various types of disasters in Indonesia. The types of disasters included in the BDLM are earthquakes, tsunamis, hurricanes, landslides, forest fires (see Figure 2). The results of the development are then used in Edmodo. The lecture was held for 16 meetings consisting of meeting 1 being a pretest meeting and meeting 16 being a posttest. The 14 learning meetings were used 2 times in class and 12 online meetings.

At the 2nd meeting, the lecturer explained about the learning that would be carried out during 14 meetings. Lecturers also ask students to join edmodo classes and provide class access. Students then get BDLM in the Edmodo class and can be downloaded by every student. Previously, students were required to install Adobe Flash. At meeting 2, the lecturer also motivated students to continue to improve disaster knowledge and disaster preparedness skills as prospective teachers. At the next meeting, the lecturer also asked students to study the types of natural disasters that occurred in Indonesia.

Figure 3. Display of Menu and Material in BDLM

The 2nd meeting until the 15th meeting, students study with online meetings, both synchronous and asynchronous. BDLM is used as the main learning media for students besides students who are assigned to look for peer review articles, online news, and carry out independent tasks related to community knowledge about disasters (Meetings 3 and 4). At the 5th meeting, synchronous learning was carried out using a zoom meeting to discuss problems in an effort to build preparedness for students, teachers, and the school community. The 7th meeting was carried out independently, students were asked to collect group reports related to the results of the investigation of disaster preparedness problems. The 8th and 12th meetings were held in class. The purpose of meeting in class is to review the material and if there is anything you want to confirm

regarding online learning and disaster preparedness knowledge materials. Meetings 9, 10, 11, 13, and 14 students conducted investigations related to efforts to increase knowledge of disaster preparedness through collecting literature and conducting interviews with students, schools, and the community. The 16th meeting conducted a posttest related to disaster preparedness knowledge. Students are presented with contextual problems that require open answers from students.

Data Analysis

Data analysis was used to answer the research hypothesis. Before analyzing the hypothesis, the data must be tested for regression homogeneity, normality, linearity. The homogeneity test used the Levens test, while the normality test was tested using the Shapiro Wilk because the sample was less than 100. Furthermore, the data were analyzed using ANCOVA to answer the research questions.

RESULTS AND DISCUSSION

Before answering the research question, we describe the data score obtained from the disaster preparedness knowledge indicator. Indicators consist of 1) basic knowledge of disasters, 2) planned activities during disasters, 3) disaster warning systems, and 4) resource mobilization. The results of disaster preparedness knowledge indicators can be seen in Figure 4.

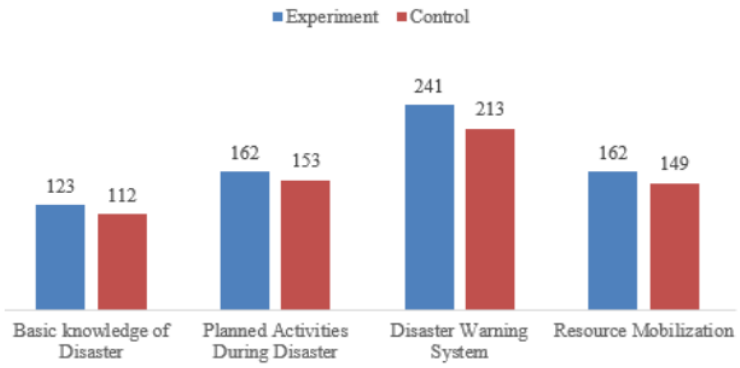

Figure 4. Disaster Preparedness Knowledge Score Result

Based on Figure 4, it shows that the disaster preparedness knowledge scores between the experimental and control classes are different. The experimental class is higher than the control class in all indicators. On the early warning system indicator, the experimental class score was higher than the control class score. Therefore, in general, the use of BDLM can increase knowledge of disaster preparedness.

The results of the study aim to answer research questions related to the effect of using BDLM on knowledge of disaster preparedness. The hypothesis proposed is "There is a significant difference between groups". Before using ANCOVA, we measured the level of normality and homogeneity of the data. The data is said to be normally distributed if the p-value > ($\alpha = 0.05$). The results of the normality test are presented in Table 2.

Table 2. Conclusion of Normality Test Results on Disaster Preparedness Knowledge Intrument Test

Group	Test of Normality			St. Dev
	Statistic	df	Sig.	
experiment	.960	17	.627	14.959
control	.920	17	.150	13.983

Based on the results of the normality test (Table 2), it is known that the significance value of p-value > (α = 0.05) means that the data is normally distributed. The results of the calculation of the normality test on disaster preparedness knowledge showed a significance value of >0.05 (90,627 for the experimental group and 0.150) for the control group. This means that the data is normally distributed. After testing for normality, we conducted a data homogeneity test using Levene's test. The purpose of the homogeneity test is to see data taken from the same variation (homogeneous). The data is said to be homogeneous if the p-value > (α = 0.05). The results of homogeneity can be seen in Table 3.

Table 3. Conclusions on Homogeneity Results on the Disaster Preparedness Knowledge Test

		Levene Statistic	df1	df2	Sig.
Disaster Preparedness Knowledge	Based on Mean	.020	1	32	.888
	Based on Median	.000	1	32	.985
	Based on Median and with adjusted df	.000	1	31.467	.985
	Based on trimmed mean	.014	1	32	.905

The results of the homogeneity test of disaster preparedness knowledge obtained p. value = 0.888, which means the p-value > (α = 0.05). Based on the results of the homogeneity test, it can be concluded that the data is homogeneous or the data variance is the same. The third prerequisite of the analysis using ANCOVA is the regression homogeneity test. The test was carried out on covariates with treatment variables. The results of the regression homogeneity test are said to be fulfilled if the p-value > (α = 0.05). Based on the results of the regression homogeneity test, the p value is 0.401, which means > 0.05. The conclusion is that the homogeneity of regression (slope) has been fulfilled. The next prerequisite is linearity test. The linearity test aims to see the linear relationship between the covariates and the variable of disaster preparedness knowledge. The data is said to be linear if the p-value < (α = 0.05). Based on the results of the linearity test, it is known that the p-value = 0.008 means <0.05. The conclusion of the linearity calculation is that the relationship is linear. Based on the results of the prerequisite test, the data analysis can use ANCOVA. The results of the ANCOVA analysis are summarized in Table 4.

Table 4. ANCOVA on Disaster Preparedness Knowledge

Source	df	Mean Square	F	Sig.	ηp2
Corrected Model	2	2404.177	11.123	.000	.418
Intercept	1	4729.792	21.882	.000	.414
Gender	1	7.883	.036	.850	.001
Treatment group	1	4711.939	21.799	.000	.413
Gender*Treatment group	2	1882.696	7.537	.002	.327
Error	31	216.152			
Total	34				
Corrected Total	33				

Note:
a. R Squared = .418 (Adjusted R Squared = .380)

Based on the results of the ANCOVA calculation (Table 4), it is known that the significant value in the treatment group is p. value = 0.000 with F = 21.799. This means that the p value < 0.05. So the research hypothesis can be accepted or there is a significant effect on knowledge of disaster preparedness between students who learn to use BDLM and students who do not learn to use BDLM. Using BDLM as a learning media to support blended learning has a large effect ηp2 = 0,413.

Using BDLM can increase knowledge of disaster preparedness because BDLM is prepared with the main objective of increasing knowledge of disaster preparedness. BDLM is structured to support learning in the "Disaster Mitigation and Adaptation" course. BDLM is a media that is arranged according to lecture activities. The results of the study (Table 2) show that the significance value is higher than that of the control class (0.627 > 0.150). The use of BDLM learning media significantly increases knowledge of disaster preparedness with a fairly high effect size value of 0.413 (Table 4). This result is in line with previous research from Yu et al. (2022) and Nie & Wu (2020) which stated that making teaching materials and learning facilities intended to facilitate learning activities will increase the effectiveness of learning outcomes. Furthermore, research from Chaeruman et al. (2020) and Sari et al. (2021) supports the results of the study by stating that the learning facilities provided by the teacher will support blended learning to run effectively.

The development of BDLM targets prospective geography teachers with the reason that later these prospective teachers will teach geography material in schools. Disaster material is one of the main materials in geography lessons (Gouramanis & MoralesRamirez, 2020; Yani, 2021). Disaster materials are important because Indonesia is a country that is prone to disasters, both physical and social (Aksa et al., 2020; Kastolani & Mainaki, 2018; Sari & Ridhwan, 2019). Therefore, BDLM is a learning media that can facilitate the transfer of knowledge that supports blended learning activities. BDLM is used to help deliver a message. In this study, the message conveyed in disaster mitigation and adaptation learning is knowledge of the types of disasters and the efforts made to deal with disasters. The function of the media is to stimulate students to learn. This is supported by findings from Yu et al. (2022) which stated that media can stimulate students to learn because of the various types such as a combination of writing, video, and audio.

The control group used blended learning without being given BDLM. In the control group really need an internet connection to study. Students are shown articles and modules on Edmodo. Meanwhile, the experimental group, apart from being given a module, was also assisted with BDLM. BDLM can be downloaded and opened offline by students so that it can be used without using internet quota. Media provides convenience to students. The use of learning media that can be used offline will make it easier for students to learn anywhere and anytime (Chen, 2020; Iskandar et al., 2018). This condition is in accordance with the characteristics of students who at the time of the COVID-19 pandemic were in their respective hometowns. The condition of the spread of students causes learning facilities (internet network) to be uneven. Research support

from Prasad (2017) and Sulistianingsih & Mukminan (2019) mentions that online learning with the help of downloadable multimedia makes it easier for students.

The material presented in BDLM is contextual material. Then the BDLM also presents an interesting animated video related to disaster preparedness efforts. The videos are presented in animated form and are rich in knowledge related to disasters and efforts to mitigate disasters. Presentation of video in the media will add to the interest. Research from Afifiy (2020) and Kramer et al., (2020) mentions that the use of video in learning will increase the attractiveness of students. Besides that, similar support from research Rafiola et al. (2020) and Chen et al. (2021) which stated that blended learning requires a variety of learning media and is presented contextually.

The results of the covariance test also showed that there was no significant effect of knowledge on disaster preparedness between men and women with a value of F = 7.883 with a significance of 0.850 (p. value > 0.05). The results of the significance effect also show that the relationship between gender and knowledge of disaster preparedness is very small (ηp2 = 0,001) (Table 4). This means that there is no difference in knowledge between women and men.

Knowledge of disaster preparedness does not differ by gender. This is due to the absence of differentiated treatments for different genders (control and experimental groups). Undifferentiated teaching strategies provide equal opportunities for all students to access learning facilities. Not discriminating between sexes makes the learning outcomes obtained will be the same. This research is supported by the findings (Sari & Ridhwan, 2022) which stated that there is no difference between men and women interaction with academic level in relation to disaster management.

We focus this research on the development of knowledge. Disaster knowledge is a cognitive aspect that is assessed. Cognitive aspects related to the theory of types of disasters and disaster mitigation efforts are the main aspects that are assessed. Therefore, if assessing the knowledge ability of women and men, of course there are no significant differences. Among men and women have the capacity to cope with disaster risk and form the same disaster resilience in their environment (Erman et al., 2021). However, the results of this study are very different when compared to disaster response attitudes and skills that require physical physical capacity. Research results from Lee et al. (2022) and Yunus et al. (2022) which explained that men's efforts in disaster mitigation are better than women's. Likewise the results of research from Yazawa et al., (2022) and Dania & Inpin (2021) stated that the level of vulnerability of women is higher than that of men.

The results also show that there is a difference between knowledge of disaster preparedness as a result of the interaction between BDLM implementation and gender with an F value = 7.537 with a significance of 0.002. (p.value < 0.05). The results of the interaction show a considerable influence on knowledge of disaster preparedness. The research that was conducted emphasized more on the different treatment between groups, not on gender. Therefore, the focus on research is disaster preparedness learning between the control group with blended learning and the experimental group with blended learning assisted by BDLM. BDLM is a learning media that can accommodate student learning styles. Successful learning media is able to answer learning problems (Lange & Costley, 2020). Futhermore, Kao & Luo (2020) stated that using learning multimedia that is integrated with learning activities can improve students' understanding of the material.

CONCLUSION

The main findings of this study describe that the use of BDLM in blended learning has a significant effect on disaster preparedness knowledge. The results showed that the experimental group's knowledge of disaster preparedness (implementation of BDLM) was better than the control group. Other research findings that there is no effect of gender differences on knowledge of disaster preparedness. This is because the treatment is not differentiated in terms of gender, besides this research focuses on knowledge, not skills that require physical capacity. The results also show that the interaction between learning using BDLM and gender has a significant

influence. This is because the use of learning media is more dominant than gender treatment. The results of this study have implications for the use of BDLM which is used in disaster knowledge material in disaster geography courses. Disaster learning is needed by using supporting technology such as combining scientific learning models in the developed learning media. As well as considering the use of suitable media in terms of the abilities and needs of students. Based on the results of the research, the authors suggest developing learning that can increase the capacity (knowledge, skills, and attitudes) of prospective teachers in disaster mitigation. Furthermore, for further research, it is suggested that additional types of disasters are focused on social disasters and disasters that are happening contextually in the research area. Furthermore, it is necessary to evaluate on learning media that is in accordance with the characteristics of prospective teachers, both gender and learning needs.

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DECLARATIONS

Conflict of Interest

The authors declared that they had no known competing interests.

Ethical Approval

The research has been approved by the Research Committee of Universitas Samudra. All research was carried out in accordance with Universitas Samudra research ethics guidelines applicable when human participants are involved.

Informed Consent

Before conducting the study, we had obtained the consent of all the research subjects involved in the study. To maintain the confidentiality of the data, the research subjects were coded or anonymous.

DATA AVAILABILITY

Data used to support the findings of this study are available from the corresponding author upon request.

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