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Profile of Physics E-learning Activities During The Covid-19 Pandemic: Voices from High School Students and Teachers

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Abstract

E-learning is one of the trends in physics learning during the Covid-19 pandemic. However, its implementation has advantages and disadvantages that must be considered. Therefore, this study will examine the profile of e-learning physics during the pandemic from the perspective of students and teachers. The research is a mixed-method embedded design with a sample of 209 students and 9 physics teachers. Data collection techniques used were surveys and structured interviews, while data analysis techniques were carried out descriptively. The study results indicate that students tend not to find it easy to implement e-learning, with the most obstruction being network instability and the lack of internet quota. Students also do not experience an increase in learning motivation when using e-learning. Students' most frequently used platforms are Google Classroom, WhatsApp, Google Meet, and Zoom. Students rated e-learning as a whole with an average score of 6.61. Some of the teacher's responses are consistent with the student survey results. According to the teacher, planning to implement e-learning has its respective advantages and disadvantages. E-learning is one of the alternative learning activities that can be carried out during the Covid-19 pandemic or even post-pandemic, along with the increase in digitalization and information technology in the education system.

Keywords: E-learning; Physics; Student; Teacher

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INTRODUCTION

Since March 2020, Covid-19 has spread widely in Indonesia and worldwide. The current high death rate is due to the spread of the Coronavirus (Simatupang et al., 2020). The current pandemic has considerably impacted all levels of society, requiring the cessation of various activities at various educational institutions (Abumalloh et al., 2021). The impact was felt in the education field after various policies were implemented to reduce the spread of the Coronavirus (Herliandry et al., 2020).

The results of the policy of the Indonesian Minister of Education explain that all learning activities in schools and universities are carried out through applications available in their respective homes (Kemdikbud RI, 2020). The learning carried out has changed from offline to online. This change is a situation that requires the integration of information literacy into academic culture. Direct learning activities are

carried out through e-learning activities (Pratiwi, 2020). According to (Firman & Rahman, 2020; Moore et al., 2011). E-learning is learning that, in its application, uses the internet with ease, connectivity, flexibility, and the ability to display several types of correlation in learning. Various media support the implementation of e-learning, such as virtual classrooms on Google Classroom, Edmodo, Schoology (Enriquez, 2014; Sicat, 2015), and messaging applications such as WhatsApp (So, 2016).

E-learning cannot be implemented easily for all subjects. Research by Nursetiawati et al. (2020) states students' obstacles in understanding relatively long lessons, especially for subjects requiring a practicum activity or experiment in understanding concepts, such as physics. Physics is a subject that can be studied by observation, experimentation, and theory (Melinda et al., 2021; Sari & Sunarno, 2018). In physics learning, generally, there is theoretical learning and physics practicum in the laboratory, so the application of e-learning is more difficult than in other subjects. Research by (Winarti, 2021) shows that students are not fully ready to do physics e-learning because of high learning difficulties.

E-learning in physics is certainly a new challenge for teachers who are required to understand online learning materials in carrying out learning process activities and be able to create new things in the learning process so that learning objectives can be achieved optimally (Lestiyanawati & Widyantoro, 2020; Mantra et al., 2020). Therefore, all steps must be implemented to ensure a substantial increase even though learning is online (Deschacht & Goeman, 2015; Yudiawan et al., 2021).

The implementation of e-learning can increase interaction between students and teachers. Learning can be done flexibly anytime and anywhere (Pratiwi, 2020) without being limited by space and time (Wijaya et al., 2021; Zhang et al., 2020) (flexibility of time and place), easily reach students in a wide range, and simplify the refinement and archiving of educational materials (easy content updating and archiving capacity).

Previous research has been carried out by (Amin et al., 2021; Kumar et al., 2020) that e-learning or online learning is effective and can be considered for teaching and learning activities during the Covid-19 pandemic because e-learning is the only solution. E-learning also has varied responses from teachers and students because it has its strengths and weaknesses (Alsoud & Harasis, 2021; Amin et al., 2021). However, this study only examines, in general, the subjects that use e-learning. Physics is certainly different from other subjects because there are mathematical, conceptual, and practical calculations; no research examines this.

Therefore, this study will examine the profile of e-learning physics during the pandemic from the perspective of students and teachers. This research is useful for implementing e-learning physics or similar science subjects, considering that the trend of e-learning in the future will increase due to the pandemic (Djeki et al., 2022). The specific purpose of this study was to analyze the perspectives and responses of teachers and students to physics e-learning activities during the 2020-2021 Covid-19 pandemic.

METHOD

This research belongs to the type of mixed-method embedded design research. Mixed methods focus on collecting, analyzing, and combining quantitative and qualitative data into one or more studies. Using quantitative and qualitative approaches provides a better understanding to answer the problem formulation (Creswell & Creswell, 2018). The stages diagram of this study can be seen in Figure 1.

Data collection was carried out in September-October 2021 using the saturated sample method, where the entire population was sampled. The sampling technique used in this study is stratified random sampling considering that schools located near the city centre are capable of conducting e-learning compared to schools located in remote villages. The high schools used for research can be seen in Table 1.

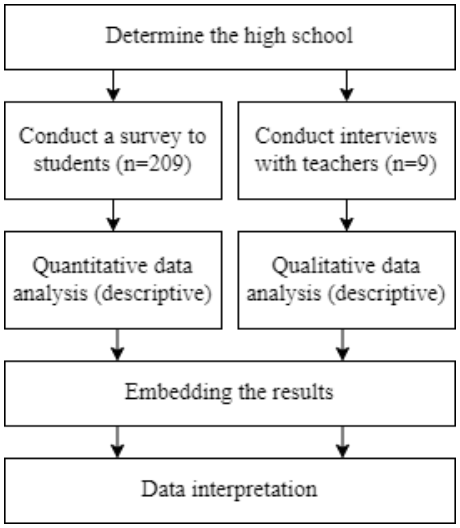


Figure 1 Research Stages

Table 1 Research Samples

Senior High School (SMA)	City/Regency	Number of Student Sample	Teacher Initial
SMAN 1 Kepohbaru	Bojonegoro	28	US
MA Bahrul Ulum Kepohbaru	Bojonegoro	15	SM
SMAN 1 Kedungadem	Bojonegoro	26	AS
SMAN 16 Surabaya	Surabaya	17	SQ
SMAN 12 Surabaya	Surabaya	11	SS
SMA Antartika Sidoarjo	Sidoarjo	35	SF
SMA PGRI 5 Sidoarjo	Sidoarjo	9	CD
SMAN 1 Taliwang	Taliwang	18	NZ
SMAN 1 Geger	Madiun	15	DD
SMAN 1 Mejayan	Madiun	17	DR
SMA Wachid Hasyim 5 Surabaya	Surabaya	1	-
SMA Hang Tuah 2 Sidoarjo	Sidoarjo	1	-
SMA Dharma Wanita 1 Gedangan	Sidoarjo	1	-
MAN Sidoarjo	Sidoarjo	1	-
SMA Katolik St. Louis 2 Surabaya	Surabaya	1	
SMAN 21 Surabaya	Surabaya	1	
Without Description	-	12	
TOTAL		**209**	**9**

The quantitative approach was carried out by surveys using google Forms on respondents 209 students. Types of student levels are selected randomly in each school. At the same time, the qualitative approach is carried out by in-depth interviews using open-ended questions by prioritizing ethical attitudes towards respondents. In-depth interviews were conducted with 9 teachers who teach physics subjects. The interview and survey grids can be seen in Table 2.

Table 2 Interview and Survey Grids

Interview		Survey	
Interview aspects	**Indicator**	**Survey aspects**	**Indicator**
Planning	Factors supporting and retarding e-learning design	Planning	Ease and difficulty of implementing e-learning physics
	The advantages and disadvantages of the e-learning media preparation process		E-learning flexibility in physics subject
Implemen-tation	The type of e-learning to apply to physics subjects	Impact	The effect of e-learning on learning motivation
	Factors supporting and retarding the implementation of e-learning	Media	The use of media in physics e-learning
Evaluation	The review results of e-learning	Evaluation	Overall assessment of e-learning physics
	Achievement of learning objectives using e-learning		
	Application of e-learning on all physics material		

The data analysis technique from the questionnaire response results in a survey was also analyzed using quantitative description by grouping google form into numerical and statistical interpretations (Apuke, 2017) to make it easier for researchers to observe the response results. Quantitative is a type of analysis in which the researcher asks specific questions based on his research and collects measurable information. Then, the author evaluates the data using statistics and objectively and analytically (Ningsih et al., 2021).

Then, the data analysis used in this research is descriptive qualitative for the results of surveys and interviews. The data collected is in the form of sentences and explanations of answers from respondents conducted by interview (Pratiwi, 2020) to obtain an overview of online learning (Firman & Rahman, 2020) in high school. Then, the translation data from the response questionnaire through the google form was analyzed through the qualitative descriptive to analyze, describe and summarize various situations and conditions from some of the data obtained as a result of response surveys and interviews from some of these schools (Suprapto et al., 2018).

RESULT AND DISCUSSION

Student Survey

Several survey results have been obtained. Figure 2(a) shows the ease of implementing e-learning during the pandemic. It can be seen that the highest score was obtained at the 3rd score, namely 88 students. This proves that most students are neutral, it does not feel easy, and it does not feel difficult to use physics learning with e-learning, and if they have problems, they can still be solved. However, if you look at the tendency, students prefer a score of 1-2 rather than 4-5. Students tend to find it difficult to carry out physics e-learning because they need a higher understanding of concepts and mathematics. According to research by (Fauza et al., 2020), during the implementation of e-learning, students tend to experience misconceptions in physics courses because of the emphasis on difficult concepts to explain through writing.

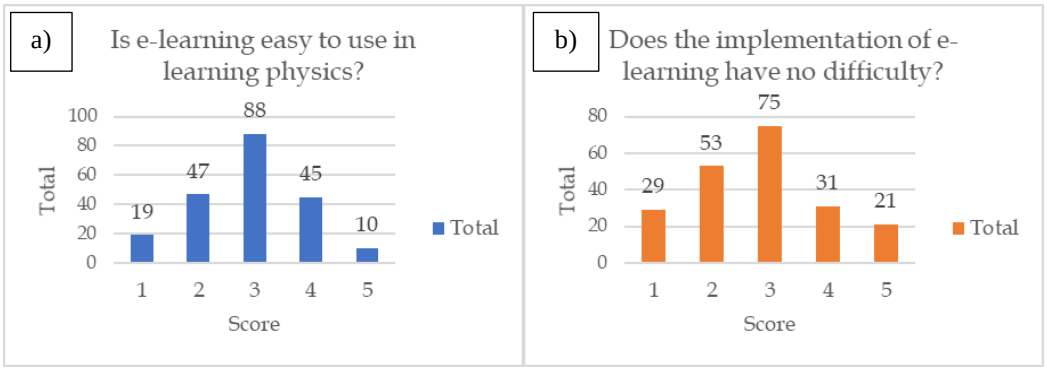
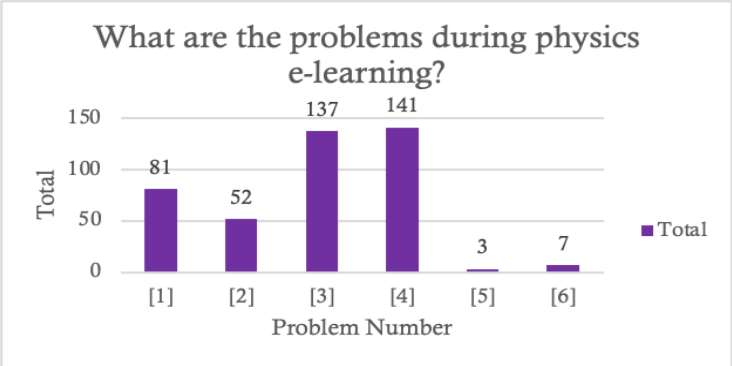


Figure 2 (a) Diagram of The Ease of Use of E-Learning Physics, (b) Diagram of The Difficulty of Implementing E-Learning Physics

Based on Figure 2(b) it can be seen the difficulties experienced in implementing e-learning in physics learning. The highest results were obtained on the 3rd score, 75 students. This proves that most students are neutral, sometimes, they experience problems when using physics learning with e-learning, but they can still be solved. When viewed from the tendency, students prefer scores of 1-2 rather than 4-5, which means they tend to have difficulty implementing e-learning physics. A follow-up survey regarding the obstacles and difficulties in implementing physics e-learning can be seen in Figure 3.



Note: [1] = high price of internet quota, [2] device not compatible, [3] difficult to understand subject/material, [4] network instability, [5] psychological problems, [6] technical problem

Figure 3 Diagram of Problems During The Implementation of E-Learning Physics

It can be seen that 141 students wrote that the obstacle was an unstable network during the implementation of physics e-learning. This problem is the main problem because students write down this problem the most. Therefore, an unstable internet network can hinder the implementation of e-learning. This problem is not only felt by students in rural areas but also by students in urban areas. This is supported by research by (Mseleku, 2020), which states that internet network instability exists in remote areas and big cities in Indonesia.

The next problem was that 137 students wrote down difficult material to understand. Internal factors can cause the difficulty of understanding this: lack of motivation to learn and the subject matter of physics is more difficult to understand, as well as external factors: the difficulty of interaction between teachers and

students. This finding is also similar to research (Dwidienawati et al., 2020), which wrote that the factors students disliked during the implementation of e-learning were inefficient delivery of material and difficulty in discussing between teachers and students, low learning motivation of students on physics material, and cannot interact with the teacher, causing the material to be difficult to understand. The third biggest problem is that 81 students feel that internet packages are expensive. The Government has annulled this obstacle through the Ministry of Education and Culture, which has distributed internet quota assistance for students and teachers starting in September 2020 (Turmuzi et al., 2021). However, the results of an interview by one of the teachers revealed that until now, his students had not received the quota assistance.

The next biggest problem was that 52 students wrote down inadequate devices, where students had to exchange gadgets with their parents or students' devices that were not compatible with the application of e-learning. In line with research (Albab, 2020), inadequate devices often cause students to experience errors in accessing learning media, which becomes one of the problems in implementing e-learning. Other problems with fewer responses are psychological problems (3 students) and technical problems (7 students).

The next survey is about increasing learning motivation and e-learning flexibility, as shown in Figure 4. In Figure 4(a), as many as 81 students chose a score of 3 that using e-learning can increase their learning motivation. This means that most of them are neutral. This is in line with research by (Na et al., 2020) which states that using e-learning on students' learning motivation is at the intermediate level. However, they tend to prefer 1-2 compared to 4-5, so they tend not to experience increased learning motivation during e-learning. In contrast to research by (El-Seoud et al., 2014) which states that e-learning implementation can provide learning motivation to students. This is because teachers are less able to understand interactive media, so students are less enthusiastic about carrying out physics learning.

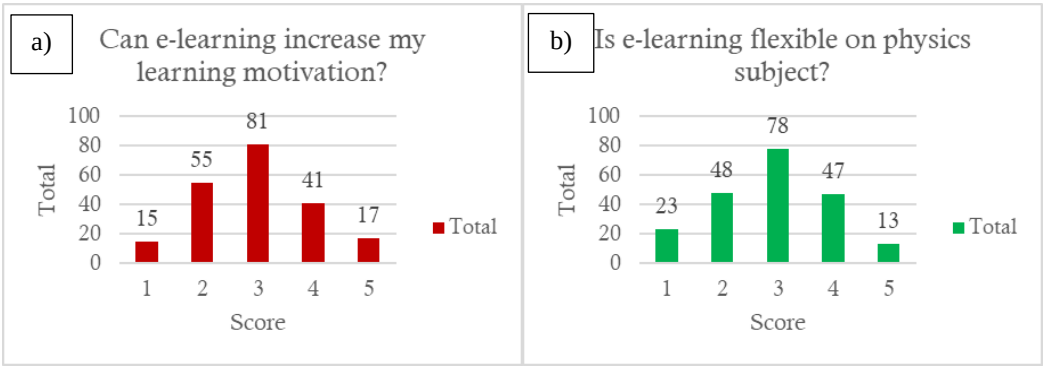


Figure 4 (a) Diagram of The Use of E-Learning on Motivation to Learn Physics (b) Flexibility of E-Learning on The Subject of Physics

In Figure 4(b) it can be seen that 78 students chose a score of 3 which means they consider e-learning flexibility neutral. However, from the tendency, students prefer 1-2 compared to 3-4, which means that students feel that the use of e-learning is less flexible for all physics materials. Physics subjects need practical or laboratory activities to improve students' psychomotor skills and abilities, but these activities have never been carried out during learning. Teachers should be able to use virtual laboratories or non-laboratory

experimental activities (at home) instead of practicum activities at school (Rizki et al., 2021).

The next survey is about the physics e-learning platform used by students, as shown in Figure 5. It can be seen that the three most frequently used learning platforms are Google Classroom (GCR) (134 students), Whatsapp (121 students) and Google Meet (71 students). . The reasons for using these three platforms are practicality, convenience, free of charge, and more familiar than other applications (Sakkir et al., 2020). Google Classroom is an LMS, Whatsapp is a communication medium between teachers and students, and Google Meet is a platform to carry out face-to-face physics learning online. Several other platforms that students less frequently use include Zoom (58 students), Quizziz (40 students), Microsoft Teams (41 students), Telegram (7 students), Quipper (7 students), Edmodo (3 students), Google Form (2 students), Youtube and Phet (1 student each).

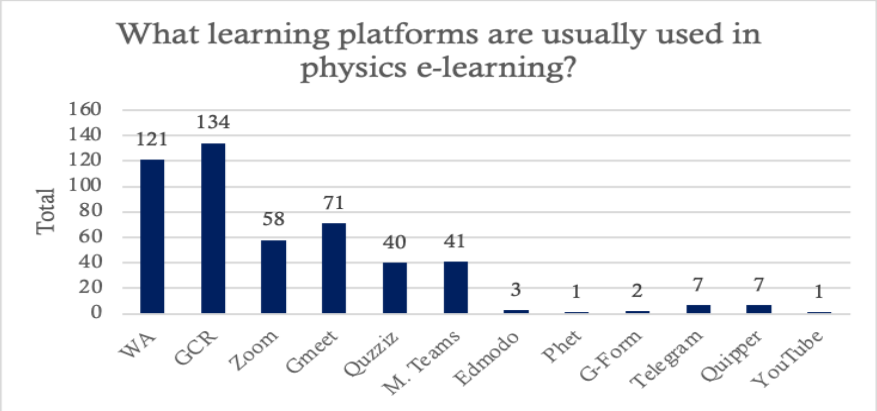


Figure 5 Diagram of The Most Frequently Used Physics E-Learning Platform Usage

The last question regarding the overall assessment of the implementation of physics e-learning according to students can be seen in Figure 6. The figure shows a division of values from 1-10 obtained from students, where a score of 1 is very bad, and a score of 10 is very satisfactory. Therefore, it can be seen that the score most chosen by students is 8 (55 students), which means that students are satisfied with the implementation of physics e-learning during the pandemic. However, if all student scores are averaged, the score is 6.61, which means that students are still quite satisfied with the implementation of e-learning with all its limitations and difficulties.

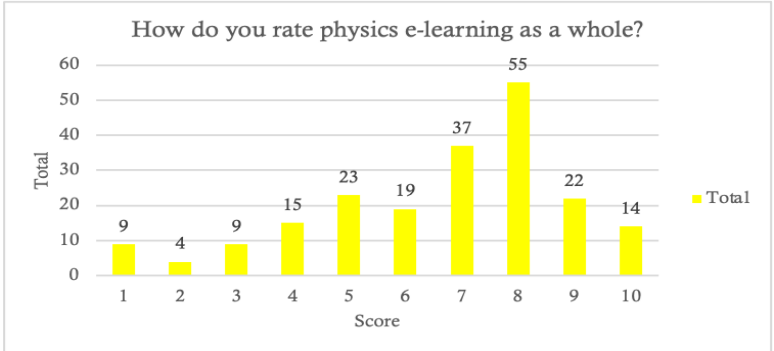


Figure 5 Overall Student Rate of Physics E-Learning

Teacher Interview

In addition to giving surveys to students, individual teacher interviews were also conducted to find out the process of learning Physics in schools from the teacher's point of view. Interviews were conducted to discover more details about learning Physics in schools and to cross-check student responses' results (Osborne et al., 2018). The first question is about the supporting and inhibiting factors in planning the implementation of e-learning physics in schools. The following are some of the teacher's comments about it.

"*The supporting factor for the design of e-learning is the online learning policy by the government, so like it or not, we have to plan the implementation of e-learning-based physics learning. While the inhibiting factor is the teacher himself who is uncomfortable and less accustomed to planning e-learning-based learning*" -SF

"*Our school does not implement e-learning, especially in learning physics, but uses limited face-to-face meetings that are carried out in shifts*"-NZ

Based on the response above, it appears that schools are implementing e-learning-based learning because of the direction from the government to carry out online learning in anticipation of an increase in cases of the Covid-19 pandemic. However, according to NZ one of the teachers at SMAN 1 Taliwang in West Sumbawa, where incidentally has relatively low Covid-19 cases compared to other areas on the island of Java. This is the basis for the implementation of limited face-to-face learning. However, E-learning planning also has several obstructions; as already mentioned, teachers are not accustomed to using digital platforms in learning. In line with research by Lassoued et al. (2020), which states that teachers who are not familiar with the use of digital technology can hinder distance learning planning.

The second question concerns the advantages and disadvantages of planning the implementation of physics e-learning in schools. The following are some of the teacher's comments about it.

"Students understand IT better, are creative and independent so that they can easily master the media for e-learning" - US

"Inadequate human resources and school facilities make planning for the implementation of e-learning media less than optimal because school conditions are still not good -SM

Based on the response above, US revealed advantages in planning the implementation of e-learning, namely, students who understand IT better and easily master e-learning media. Meanwhile, SM revealed its weaknesses, namely human resources and school facilities, which were not good, so e-learning-based learning planning became less than optimal.

The third question is regarding the implementation of learning related to the type of e-learning that is easy to apply in Physics class. One of the teachers responded as follows:

"Microsoft Teams is a supporting factor as well as a tool that is used as one of the e-learning media. Besides Microsoft Teams, I also use Whatsapp, Quick edu, rarely use Google Meet and SWAY alternatives. Then the activities are carried out using Blended learning."-SF

Meanwhile, another teacher gave the following statement:

"The type of e-learning used is to give a Powerpoint or video the night before the lesson. Then, the next day's learning uses Google Meet and asks for the material given previously. Then the learning continues via Whatsapp Group. Blended Learning learning model."-SS

The interesting thing is that SF and SS stated that learning was carried out by blended learning. Blended learning is widely regarded as an approach combining face-to-face and online learning (Bruggeman et al., 2021; Smith & Hill, 2019). Blended learning was carried out because, at that time, the pandemic conditions were still relatively uncontrolled, and learning was carried out online. This indicates a match between implementing learning in schools following government directives (online learning).

The fourth question is about the factors that support and hinder the process of implementing e-learning. One answer is: *"Because of the Covid-19 pandemic and the government implemented PSBB and PPKM. Platforms such as Zoom, Google Meet, Whatsapp Group, Google Classroom, Quipper are becoming a learning tool."*-SF

Based on the response, it can be seen that the media that have been mentioned can be a prayer to support blended learning in the classroom. This response is also by the student survey results, which show that the learning media often used are Google Meet, WhatsApp, and Google Classroom.

Then, regarding the inhibiting factors in the learning design process. The results of interviews by CD (Figure 7) and AS are stated as follows.

Figure 7 Interview with CD as a Teacher at SMA PGRI 5 Sidoarjo

"Internet quotas, because students do not receive quota assistance from the Ministry of Education and Culture. Then also network instability."-CD

"Internet access and quota, full cell phone memory, low student interest in e-learning, and difficult student assessment" -US

This statement is a situation felt by most students and teachers who use teleconferencing platforms as the main learning media. There are several online learning platforms, but some students have problems with the stability of the internet network. Another problem is the need for internet data packages that are not small in the online learning, especially when using virtual face-to-face platforms (Jauhariyah et al., 2021). This problem is also consistent with the student's statement that one of the most frequently encountered problems is the problem of internet quotas and network instability.

Other teachers also gave their opinion as follows:

"*Regarding flexibility (can be done anywhere), students are more active during PTM; while during PJJ the teacher is active. Monitoring and assessment are easier during PTM. However, the class time is assigned to 20 minutes 1 JP. Teachers feel much lack of e-learning, especially when they want to reprimand students or assess student attitudes*."-SQ

This statement is very interesting because learning is felt to be more flexible during this pandemic. Students benefit from the flexibility of e-learning in terms of time, place, and pace of study (Kokoç, 2019). The allocated lesson hours are in line with the issuance of the 'Emergency Curriculum' by the Ministry of Education and Culture through the Decree of the Minister of Education and Culture of the Republic of Indonesia Number 719/P/2020 concerning Guidelines for Curriculum Implementation in Education Units in Special Conditions. Educational units in unique circumstances can adopt a curriculum tailored to the student's learning needs. The emergency curriculum is a simplified version of the national curriculum prepared by the

Ministry of Education and Culture. (Faradita et al., 2021).

The fifth question regarding the evaluation of e-learning is a review of e-learning. Respondents answered as follows:

"Student learning outcomes when PTM and PJJ are different tend to be less good, so the number of questions is reduced during a pandemic. The value grading system (how many students do/write questions). The results are different when students are asked to write the material or not (like it or not) based on two teachers."-SQ

"*E-learning is successfully implemented, and students have no serious problems using e-learning. To improve, more training for teachers is needed*.-DR.

Based on this response, it is clear that e-learning cannot fully improve student learning outcomes during the Covid-19 pandemic. This is due to several obstructions faced during the e-learning process by both students and teachers (Andriani et al., 2021). Some of the causes are that e-learning-based learning is less interactive between teachers and students, causing students to lack motivation and meaningful learning experiences (Gherheș et al., 2021). However, according to DR, the implementation of physics e-learning at SMAN 1 Mejayan was quite successful, but there needs to be increased training for teachers in e-learning media. This is because the DR school has been implementing e-learning for a long time, so there are no significant problems if you apply it during the online learning period. Figure 8 shows the implementation of e-learning physics using PhET at SMAN 1 Mejayan.

The sixth question is related to the achievement of learning objectives using e-learning. The teacher gave the following opinion:

"It can facilitate, but the percentage of learning objectives is about 80%."-SF

"*In written results, students have higher scores, but if I believe the more real results are if the learning is done conventionally*." -DD

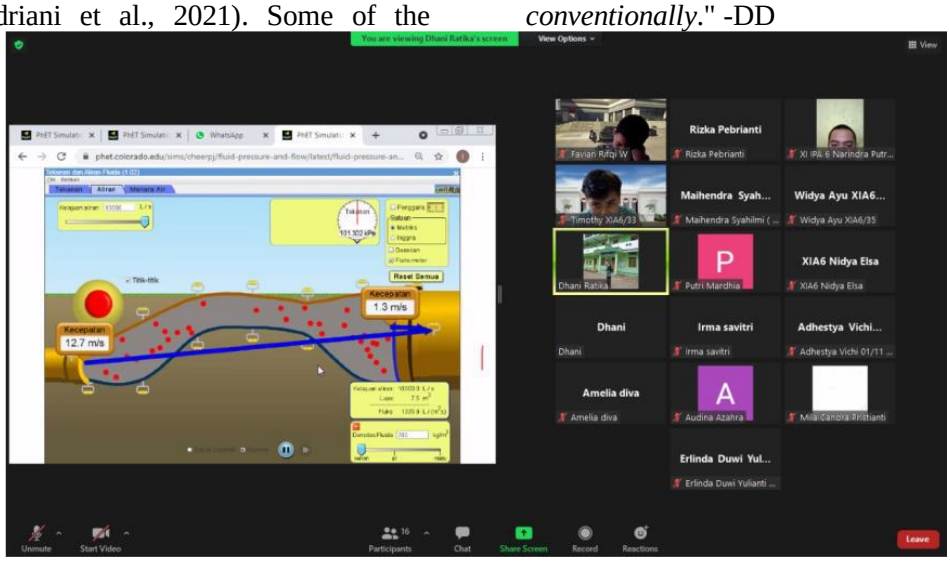


Figure 8 Implementation of Physics E-Learning Using PhET at SMAN 1 Mejayan

Consistent with the previous statement, e-learning is not entirely able to achieve or even improve student learning outcomes. This is because there are still some shortcomings and the need to familiarize the implementation of e-learning for both students and teachers.

The seventh question is related to the application of e-learning to all physics materials. The teacher expressed his opinion as follows:

"*The application in all materials can be implemented, but it is not optimal"*-CD

"*There is no problem with what material; it just depends on the setting*" - DD

Based on the interview results, from the teacher's point of view, e-learning is true and can be implemented for all materials in Physics. However, it is realized that the implementation of learning is still not optimal. One teacher also stated that the e-learning setting depends on the material taught. This means that the flexibility of e-learning on physics material is still not optimal. Following students' responses, they tend to disagree that e-learning can be applied to all physics materials.

Overall, e-learning, from the teacher's point of view, has its advantages and disadvantages in planning and implementation. Implementing e-learning is a thing the teacher should do even though the preparation tends to be less. E-learning can also achieve learning objectives in writing, but it is not yet known in terms of the original student's ability. Teachers feel that applying all Physics materials can be done, but it is still not optimal (Faulconer et al., 2018).

This research implies that it can provide an overview of the implementation of e-learning, especially in physics subjects. It reflects on the existing weaknesses so that they can be minimized and increase the advantages possessed by e-learning. Teachers can review the readiness of e-learning implementation from planning to the evaluation stage so that e-learning can be applied effectively in learning. The application of e-learning is also one of the alternative learning activities that can be carried out during the Covid-19 pandemic or even post-pandemic, along with the increase in digitalization and information technology in the education system (Palmentieri, 2022).

CONCLUSION

The Covid-19 pandemic has made e-learning a trend in online learning. E-learning physics is certainly a new challenge for teachers who must understand online learning materials in carrying out learning process activities. The results of the survey on students found that: (1)Students tend to be difficult when implementing physics e-learning because they need a higher understanding of concepts and mathematics, (2) Students tend to have difficulty in implementing e-learning physics, (3) The most significant obstruction is an unstable network, (4) Students tend to feel that they do not experience an increase in learning motivation during the use of e-learning, (5) Students feel that the use of e-learning is less flexible for all physics material, (6) The platforms most often used by students are google classroom, WA, Gmeet, and Zoom., (7) Students assess e-learning physics as a whole with an average score of 6.61, and (8) Some of the teacher's responses also support the student survey results. According to the teacher's point of view, e-learning has its advantages and disadvantages in terms of planning and implementation. The implementation of e-learning must be done by the teacher even though the preparation tends to be lacking. E-learning can also achieve learning objectives in writing, but it is not yet known in terms of the original student's ability.

However, this study has a weakness: it only uses descriptive statistics to determine student responses. In addition, the distribution of respondents in each SMA is still not evenly distributed. Therefore, further research recommends using the Structural Equation Modeling (SEM) method because the number of samples is sufficient and can provide more realistic results. Furthermore, the distribution of respondents in each school can also be more even to provide a clearer picture.

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