Implementation of Problem-Based Interactive Learning Media in Electronic Circuit Subjects in Vocational High Schools

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Abstract

Learning media is a means of transferring or conveying messages containing the aims and objectives of learning to help students acquire new concepts, skills and competencies. In this research, the implementation of problem-based learning media was used in electronics circuit subjects in vocational high schools. The method used is quantitative descriptive with research subjects divided into two groups, namely class (A) with 12 students and class (B) with 20 students. Next, the learning media developed is tested to see the effectiveness and response of students through the media, materials and benefits. The results of the analysis show that the level of effectiveness of the problem-based learning media developed for class (A) is in the good category or suitable for use and integrated into electronic circuit subjects and for class (B) it is in the category quite effective for use. Furthermore, students' responses to the problem-based learning media used in class (A) were in the good category, while for class (B) they were in the quite effective category.

Keyword: Learning Media, Schools, Effectiveness

INTRODUCTION

Learning media is the important tools to transfer knowledge and helping the students to understand new concepts and develop their skills and competencies. Furthermore, the complex function of learning media requires the well design. The development of learning media aims to present material systematically and easily understood by students. The characteristics of good learning media are that they present concrete material and encourage the formation of students' enthusiasm for learning (Boari et al., 2023). Interactive learning media can help increase student activity.

The development of interactive learning media begins with a study of the problems faced. In other words, media development is based on problems in several previous periods. According to Barrow in Sakir Kim (Sakir & Kim, 2020), the problem-based learning model is learning that is obtained through the process of understanding the resolution of a problem. Samadun & Dwikoranto (Samadun & Dwikoranto, 2022) also stated that problem-based learning uses real world problems as a condition for students to learn problem solving, think critically, gain real knowledge and concepts from the subject matter. Problem-based learning is a learning innovation that aims to provide opportunities for students to learn and develop critical, creative and innovative thinking. Therefore, the problem-based learning model makes students learn to solve problems before entering the world of work and can be applied in vocational high schools.

Furthermore, advances in information technology are supporting the creation of interactive media. Interactive learning media are tools or facilities that can enable students to interact with the media in practicing skills, receiving feedback on the material presented, referring to digital products and services to support the learning process and motivation. This view is in line with Sutarti (Hadi et al., 2022) that interactive media utilizes software and hardware as intermediaries in conveying material content from material sources to students and providing feedback. Interactive learning media is also technology that can carry information for learning purposes, a tool for conveying messages or communication so that it can attract students' attention to learning (Bian & Ji, 2021). Interactive learning media is a tool or means of conveying information using technology to attract attention, provide feedback, motivate and improve student learning outcomes in following the learning process.

Learning in electronic circuit subjects in vocational high schools also experiences various problems such as the lack of student response when asked by the teacher. This condition indicates that students are less enthusiastic about participating in lessons. The process of evaluating study results also shows that the data is not encouraging. Most students do not understand the material well. For this reason, teachers create effective learning modes to stimulate students' enthusiasm for learning.

Teachers create digital-based learning media with the hope of easy access for students. The Learning media supported by smartphone technology allows students to access material in any location even if not within the school environment. The learning material in the form of a script reviewed by Microsoft Word was developed using Adobe Animate software so that it can be accessed with an Android application that contains text, images, audio, animation and video.

As an introduction, this media begins with an opening page which is presented in attractive colors. Furthermore, this media gives students access to select the desired information with the home feature. At home there are several menu options, namely the instructions, references, materials and developer profile menu. To be able to open each menu, simply click on the navigation button according to the student's wishes. Learning media is also accompanied by instructions to guide students in utilizing the module. The learning media used is accompanied by attractive images, so that students feel comfortable in exploring the material (Figure 1).

Fig. 1 Display of materials in interactive learning media

The application of interactive learning media to electronic circuit subjects requires data support about its effectiveness. Effective learning media produces student responses and assessments of the media. In general, problem-based learning media has advantages and disadvantages. The advantages of implementing the problem-based learning model are: First, knowledge is more durable because students are involved in learning activities, so that their knowledge is really well absorbed. Second, learning outcomes have a good transfer effect. This is related to students' ability to acquire knowledge and skills from various sources; and third is that this learning can improve students' reasoning through group activities in solving problems. But on the other hand, problem-based learning media also has shortcomings. Previous researchers explained that problem-based learning is easy to apply to active students. However, students with low motivation are not effective enough, so learning objectives cannot be achieved and require a long time. Therefore, the lack of problem-based learning can be an obstacle to achieving learning success.

Research Method

The quantitative study of students' responses and assessments of media began with its application to two groups of students. The first group involved 12 students and the second group involved 20 students. The test was carried out using a questionnaire on the two variables studied. The questionnaire consists of various questions that provide five answer choices. The level of student perception which is very good is assessed as 5 and which is very poor is assessed as 1.

Table 1. Presents the Aspects and Indicators Assessed in Student Responses

Aspect	Indicator
Media	1. The appearance of the application is attractive 2. Ease of using media 3. Attractive media design 4. The font type and size are clear 5. There are no technical errors when using the media
Topic	1. The language used is easy to understand 2. Interesting material 3. Problem 4. Discussion 5. Language
Benefits	1. Curiosity 2. Improve understanding 3. Motivating 4. Think critically

Analysis of effectiveness data through a comparison between the respondent's answer value and the maximum value. The comparison results are presented in pictures to facilitate data interpretation.

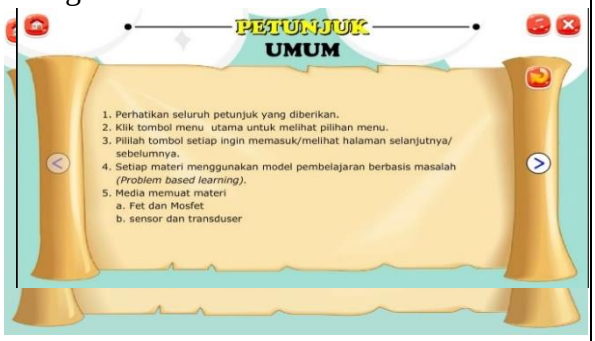
Result and Discussion

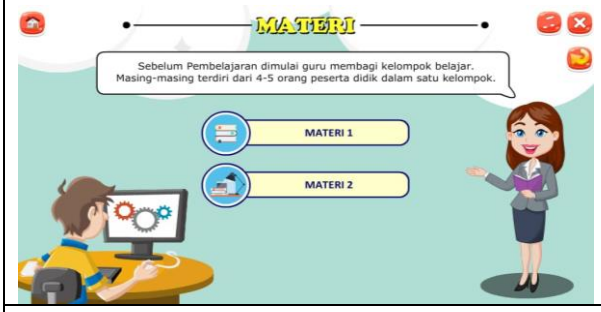
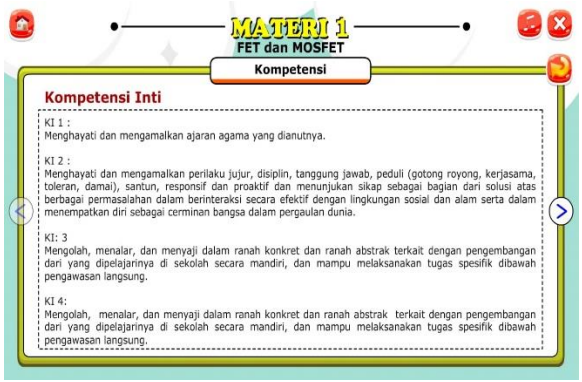
Learning Media Development

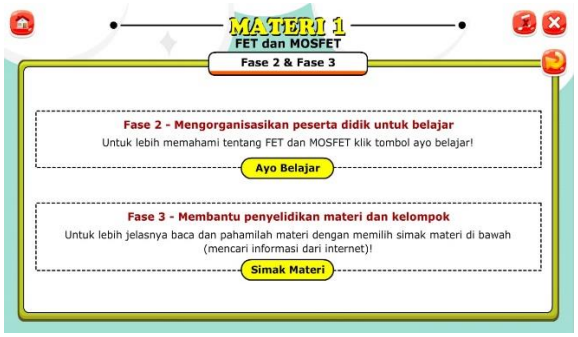
Material development using Adobe Animate software and the results in the form of an Android application using a problem-based learning model. This application contains text, images, audio, animation and video. The development of this material has been validated by two expert validators and after going through several suggestions and revisions to the results. After carrying out revisions, the validator stated that problem-based interactive learning media products in electronic circuit subjects were very suitable for use.

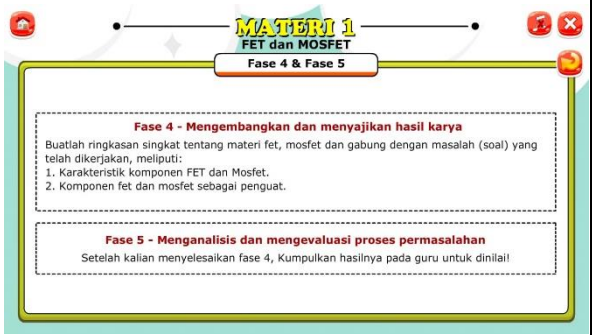
The following are the results of the development of problem-based interactive learning media in electronic circuit subjects:

Table 2. Results of Learning Media Development

Results	Description
Cover 	The cover is the opening page of interactive learning media. If you want to start learning, click the "enter" button. Apart from that, it is also equipped with a welcome greeting to interactive learning media based on problems in the application of electronic circuits, images, audio and exited buttons.
Home 	Home is the main menu after clicking "enter" on the previous cover page. At home there are several menu options, namely the instructions, references, materials and developer profile menu. To be able to open each menu, just click the navigation button as desired.
Using Guide 	The user guide image is one of the first menus to open before using the media so you can understand the next steps.

Results	Description
Page of Topic 	The page of topic is a place to select the material to be studied. Apart from that, there is important information that must be done before starting learning, namely the teacher divides study groups. Study groups consist of 4-5 students in one group.
First Topic 	The display of the first topisc (FET and MOSFET) which will be studied in one meeting. Material display 1 is equipped with competencies which include core competencies, basic competencies, indicators of competency achievement and learning objectives. Then, the phases include: phase 1, phase 2 & 3, phase 4 & 5 which will be completed by students in one group.
Competence  	Learning media contains competencies, namely core competencies, basic competencies, indicators of learning achievement and learning objectives.

Results	Description
Video  	The video is a brief explanation of the material to be studied. Students can press the red button to view the video, but there are instructions before playing the video to turn off the sound (audio).
1st Phase 	Phase 1 is the first step in the problem-based learning model. In this phase, students are required to be able to create questions based on observations that have been made as an orientation to the problem towards the next phase.
2nd and 3rd phase 	The second step in the problem-based learning model, namely organizing students to learn by pressing the let's learn button. The 3rd is a step in the problem-based learning model, namely helping to investigate the material and groups by pressing the menu to listen to the material by pressing the button to read the material.

Results	Description
Let's Learn 	Let's learn with questions that will be answered by each group.
Reading of Material 	The image to the side is a display of reading the material to find answers to questions in phases 1 and 2.
4th and 5th phase 	The 4th Phase is developing and presenting the results of the work by preparing the results of the information obtained, presenting the results of the information obtained and collecting the information obtained to the teacher. The 5th is analyzing and evaluating the problem process by collecting the results of group work to the teacher.

Evaluation

The results of the evaluation analysis for both classes were obtained during the learning process to see the effectiveness of the learning media and students' responses to the learning media being developed. The following is a description of the effectiveness of learning media for class (A).

Table 3. Effectiveness Class (A)

Category	Average	Ideal Score Average	Percentage
Media	4.1	5.00	82%
	3.6	5.00	72%

Category	Average	Ideal Score Average	Percentage
	3.71	5.00	74%
	4	5.00	80%
	3.78	5.00	76%
	4.13	5.00	83%
Average			**78%**
Topic	3.81	5.00	76%
	3.91	5.00	78%
	3.23	5.00	65%
	4.1	5.00	82%
	3.66	5.00	73%
	3.72	5.00	74%
Average			**75%**
Benefits	3.49	5.00	70%
	3.8	5.00	76%
	3.26	5.00	65%
	3.31	5.00	66%
Average			**70%**
Ideal Score Average			**74%**

Based on the results above, the effectiveness of problem-based interactive learning media by subject teachers applying electronic circuits for class (A) found that the average value of the media aspect was 78%, the material aspect was 75% and the benefits aspect was 70% and the total average was 74%. These results indicate that the learning media applied to electronic circuit subjects is in the effective category. The following is a graph showing the level of effectiveness for all aspects of class (A).

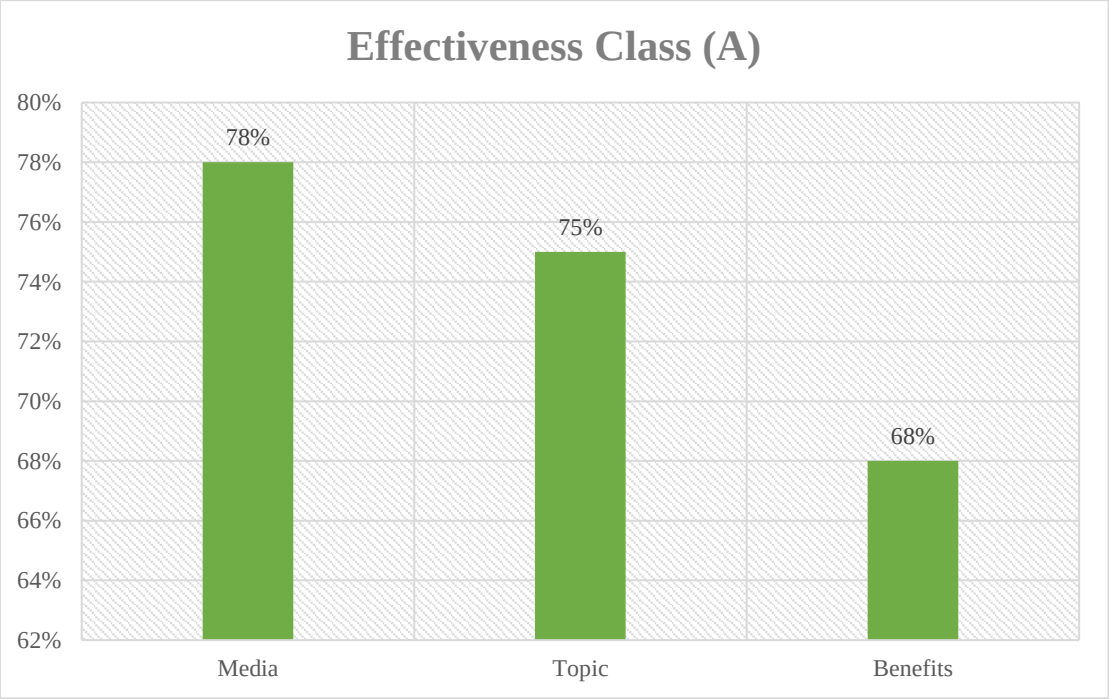


Fig. 2 Effectiveness Class (A)

Furthermore, a description of the effectiveness of learning media for class (B).

Table 4. Effectiveness Class (B)

Category	Average	Ideal Score Average	Percentage
Media	2.39	5.00	48%
	2.56	5.00	51%
	2.9	5.00	58%
	3.1	5.00	62%
	2.77	5.00	55%
	2.61	5.00	52%
Average			**54%**
Topic	2.2	5.00	44%
	2.98	5.00	60%
	2.63	5.00	53%
	2.19	5.00	44%
	2.8	5.00	56%
	2.17	5.00	43%
Average			**50%**
Benefits	2.62	5.00	52%
	2.3	5.00	46%
	2.79	5.00	56%
	2.43	5.00	49%
Average			**51%**
Ideal Score Average			**52%**

Based on the results above, the effectiveness of problem-based interactive learning media by subject teachers applying electronic circuits for class (B) found that the average value of the media aspect was 54%, the material aspect was 50% and the benefits aspect was 51% and the total average was 52%. These results indicate that the learning media applied to electronic circuit subjects in the category is quite effective. The following is a graph showing the level of effectiveness for all aspects of class (B).

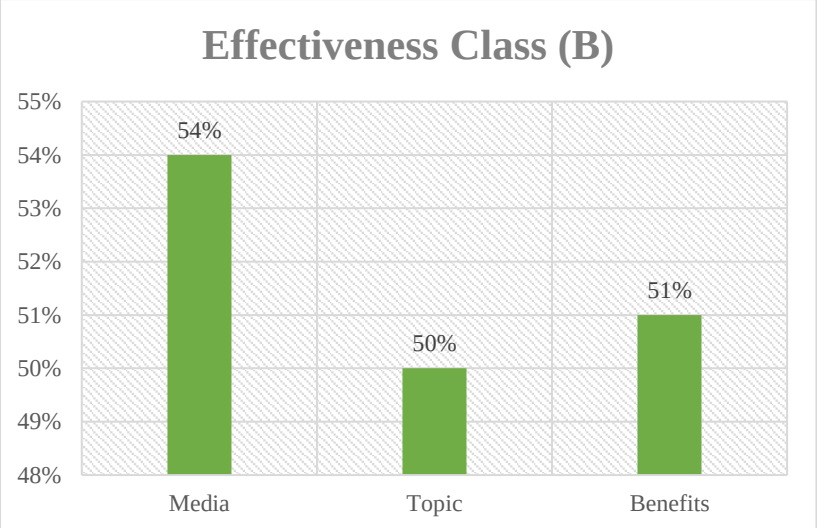


Fig. 3 Effectiveness Class (B)

Apart from looking at the level of effectiveness of the learning media, researchers also looked at students' responses to the learning media being developed. The following is a description of student responses to learning media for class (A).

Table 5. Student Responses Class (A)

Category	Average	Ideal Score Average	Percentage
Media	4.12	5.00	82%
	4.1	5.00	82%
	4.33	5.00	87%
	4	5.00	80%
	4.4	5.00	88%
	4.19	5.00	84%
Average			**84%**
Topic	4.74	5.00	95%
	4.21	5.00	84%
	4.44	5.00	89%
	4.27	5.00	85%
	4.31	5.00	86%
	4.48	5.00	90%
Rata-rata			**88%**
Benefits	4.08	5.00	82%
	4.30	5.00	86%
	4.51	5.00	90%
	4.67	5.00	93%
Average			**88%**
Ideal Score Average			**87%**

Based on the results above, students' responses to problem-based interactive learning media by teachers in the subject of applying electronic circuits for class (A) found that the average score for the media aspect was 84%, the material aspect was 88% and the benefits aspect was 88% and the total average was 87%. These results indicate that the learning media applied to electronic circuit subjects is in the effective category for increasing students' interest in learning. The following is a graph showing student response levels for all aspects of class (A).

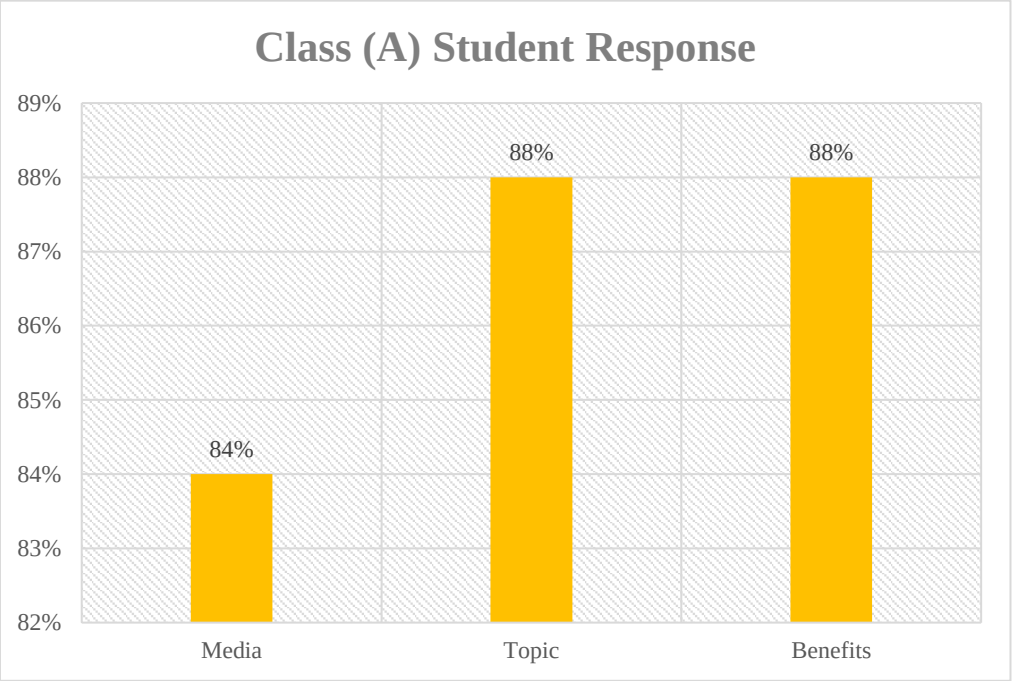


Fig. 4 Student Responses Class (A)

Furthermore, a description of student responses to learning media for class (B)

Table 6. Student Responses Class (B)

Category	Average	Ideal Score Average	Percentage
Media	3.19	5.00	64%
	2.89	5.00	58%
	2.77	5.00	55%
	3.05	5.00	61%
	2.56	5.00	51%
	2.92	5.00	58%
Average			**58%**
Topic	2.71	5.00	54%
	2.18	5.00	44%
	2.87	5.00	57%
	2.91	5.00	58%
	2.77	5.00	55%
	2.63	5.00	53%
Average			**54%**
Benefits	2.9	5.00	58%
	2.69	5.00	54%
	2.66	5.00	53%
	2.94	5.00	59%
Average			**56%**
Ideal Score Average			**56%**

Based on the results above, students' responses to problem-based interactive learning media by teachers in the subject of applying electronic circuits for class (B) found that the average value of the media aspect was 58%, the material aspect was 54% and the benefits aspect was 56% and the total average was 56%. These results indicate that students' responses to the learning media applied to electronic circuit subjects are in the quite effective category. The following is a graph showing student response levels for all aspects of class (B).

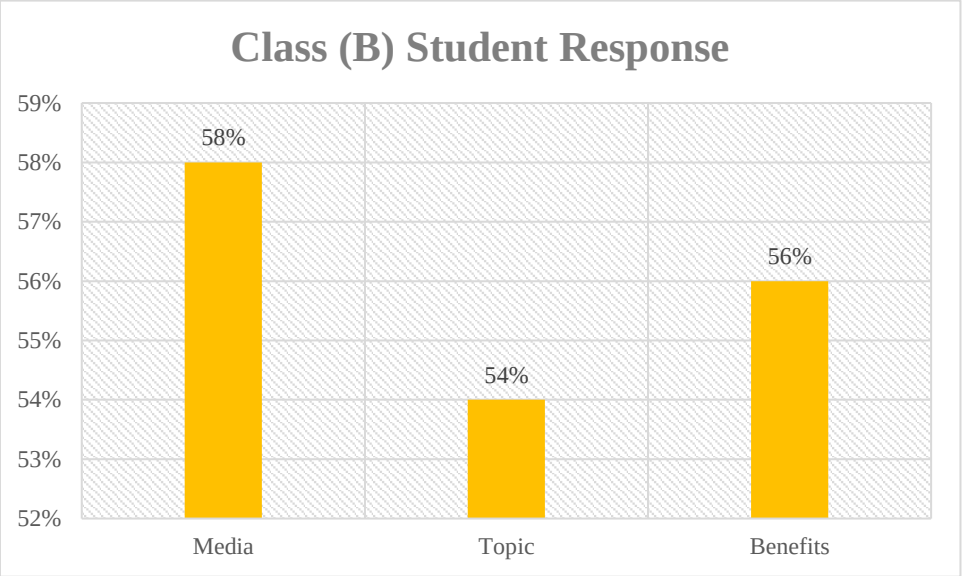


Fig. 5 Student Responses Class (B)

Student assessments of learning media show good results. class (A) assessment of learning media is better than class (B) assessment. This assessment is related to the characteristics of the media containing images, text, audio, animation and learning videos that can be accessed offline using Android. In addition, there are navigation buttons that students can use to interact with the media. Students assess that the problems found in conventional learning media can be overcome well. This assessment illustrates that learning media makes it easier for students to study in groups and learning can be student-centered.

Conclusion

The results of the effectiveness test show that Problem-Based Interactive Learning Media gives a good score in class A. The highest effectiveness is achieved in the material aspect. Meanwhile, the best response in class A is based on the suitability of the topic and the benefits of the media. Class B indicates an effectiveness level of 51% or the sufficient category. The responses of students in class B also showed the sufficient category. This group assesses that learning media can be applied to the learning process.

References

1. Bian, J., & Ji, Y. (2021). Research on the teaching of visual communication design based on digital technology. *Wireless Communications and Mobile Computing*, *2021*(1), 8304861.
2. Boari, Y., Megavitry, R., Pattiasina, P. J., Ramdani, H. T., & Munandar, H. (2023). The Analysis Of Effectiveness Of Mobile Learning Media Usage In Train Students' Critical Thinking Skills. *Mudir: Jurnal Manajemen Pendidikan*, *5*(1), 172–177.
3. Hadi, W., Yuksafa, R., Yarmi, G., Safitri, D., Lestari, I., Suntari, Y., Umasih, A. M., Marini, A., Sudrajat, A., & Iskandar, R. (2022). Enhancement of Students' Learning Outcomes through Interactive Multimedia. *Int. J. Interact. Mob. Technol.*, *16*(7), 82–98.

4. Sakir, N. A. I., & Kim, J. G. (2020). Enhancing students' learning activity and outcomes via implementation of problem-based learning. *Eurasia Journal of Mathematics, Science and Technology Education*, *16*(12), em1925.
5. Samadun, S., & Dwikoranto, D. (2022). Improvement of student's critical thinking ability sin physics materials through the application of problem-based learning. *IJORER: International Journal of Recent Educational Research*, *3*(5), 534–545.