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INTERACTIVE MULTIMEDIA BASED ON PROBLEM-BASED LEARNING TO IMPROVE STUDENTS' CONCEPT UNDERSTANDING IN PHYSICS SUBJECTS

Roslina[1], Herpratiwi[2], Rangga Firdaus[3]
[1,2,3]Master of Educational Technology, Universitas Lampung, Master's degree, Indonesia
*rlina846@gmail.com

Abstrak

Rendahnya penguasaan siswa terhadap konsep-konsep fisika kerap kali disebabkan oleh sifat mata pelajaran yang abstrak sehingga sulit dipahami serta miskonsepsi yang mereka miliki terhadap materi tersebut. Penggunaan multimedia interaktif berbasis model *problem based learning* diharapkan mampu menjadi solusi untuk meningkatkan pemahaman konsep siswa pada mata pelajaran fisika. Penelitian ini menggunakan cara kajian pustaka (*literatur review*) dengan pendekatan kualitatif dalam menganalisis keefektifan multimedia interaktif berbasis model *problem based learning* dalam proses pembelajaran fisika. Hasil kajian pustaka ini mengungkapkan bahwa multimedia interaktif memberikan kesempatan bagi siswa untuk memahami konsep-konsep abstrak melalui visualisasi seperti teks, gambar dan simulasi yang dapat memudahkan pemahaman materi dalam proses pembelajaran. Model *problem based learning* membantu siswa menghubungkan materi pelajaran dengan situasi nyata, mendorong pemecahan masalah, sekaligus meningkatkan kemampuan berpikir kritis. Dengan demikian, integrasi multimedia interaktif dan model *problem based learning* terbukti efektif dalam meningkatkan pemahaman konsep fisika, membantu siswa menerapkan konsep dalam kehidupan sehari-hari, serta membangun motivasi belajar.

Kata kunci : multimedia interaktif, *problem based learning*, pemahaman konsep, Pelajaran fisika.

Abstract

Students' low mastery of physics concepts is often caused by the abstract nature of the subject that is difficult to understand and the misconceptions they have about the material. The use of interactive multimedia based on the problem-based learning model is expected to be a solution to improve students' understanding of concepts in physics. This research uses aliterature review with a qualitative approach in analyzing the effectiveness of interactive multimedia based on problem-based learning models in the physics learning process. The results of this literature review reveal that interactive multimedia provides opportunities for students to understand abstract concepts through visualizations such as text, images and simulations that can facilitate understanding of the material in the learning process. The problem-based learning model helps students connect subject matter with real situations, encourages problem solving, while improving critical thinking skills. Thus, the integration of interactive multimedia and problem-based learning model is proven to be effective in improving the understanding of physics concepts, helping students apply concepts in everyday life, and building learning motivation.

Keywords*: interactive multimedia, problem based learning, concept understanding, physics lesson.*

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I. Introduction

The delivery of knowledge can be conveyed in various models, methods, and learning strategies, especially in physics learning (Rohmani et al., 2015); (Ridwan et al., 2021). To master concepts and develop critical thinking skills, the learning process must be meaningful. In Ridwan et al., (2021) meaningful learning is advocating the importance of understanding concepts and relationships between concepts, especially in physics learning which is one branch of science learning. The low ability to understand physics concepts, one of which is caused by the misconceptions experienced by students. These misconceptions exist because the material in physics is considered abstract material among students (Gurcay & Gulbas, 2015); (Santhalia & Sampebatu, 2020). Based on the results of Nababan et al. research, (2024) that the Problem-Based Learning (PBL) Learning Model is effective in concept understanding ability. This is similar to the results of research by Pertiwi et al., (2023) which states that the application of the problem-based learning model is very effective when applied in the learning process of students in the classroom because it can improve the critical thinking skills of high school students in physics material. The application of the problem-based learning model affects improving the critical thinking skills of high school students in physics material. In line with research conducted by Ikhwanul Muslim, Halim, and Safitri (2015) found empirical evidence that supports the problem-based learning model in improving students' concept mastery. This study found that students who used the problem-based learning model had better critical thinking skills and greater concept mastery compared to students who were taught with conventional models.

To maintain maximum learning activities, teachers must be able to design a learning approach or learning media that is appropriate for use in learning process because the learning approach and learning media are one of the most important factors in supporting learning activities, both learning that is carried out offline and learning that is carried out online (Widyastuti et al., 2017); (Faozan et al., 2018); (Pramono et al., 2017); (Audhiha et al., 2022). Based on the results of research by Ridwan et al., (2021) that students are interested in using interactive media during the learning process. In addition, learning multimedia can connect the knowledge possessed by the teacher with the concepts to be learned by students so that it is possible to facilitate learning abstract physics concepts (Smaldino et al., 2012); (Santhalia & Sampebatu, 2020).

The development of technology that is increasingly rapid has an impact on increasing the use of devices for students at the high school level. Students at the high school level are allowed to bring their gadgets to school. The results of the rapid development of technology and the emergence of applications such as games, TikTok, and so on cause students to be addicted to gadgets, especially for playing games. This has an impact on learning activities in the classroom where students are busy discussing games or TikTok while learning is in progress. Students are quicker to grasp games or TikTok movements than lessons (Audhiha et al., 2022). The existence

of interactive learning media has quite an important meaning and meaning in the teaching and learning process because in these activities the obscurity of the material conveyed can be helped by presenting the media as an intermediary (Mandasari et al., 2021). According to Rusman (2009) in Wiyono et al., (2012) interactive multimedia systems must meet the criteria, namely: (1) oriented to learning objectives, (2) oriented to individual learning, (3) oriented to independent learning and (4) oriented to complete learning.

The low understanding of the concept of physics teaching material that is often experienced by students is due to the abstract nature of the material as well as the absence of supporting media that can present the concept in a clearer picture. In addition, the inability of students to see the relationship between theoretical concepts and their application in real life causes misconceptions which will have an impact on the low achievement of student physics learning outcomes. Interactive multimedia-based learning by applying a problem-based learning model is the right solution. Problem-based learning presents a real and relevant problem situation to students so that it can encourage students to think critically and thus students will more easily understand and apply the physics concepts they can learn. Multimedia shows a concrete and interesting picture of physics concepts that are abstract so that it can help students understand it and make it more meaningful.

In this literature review, the author will analyze the relationship between improving students' understanding of physics concepts using interactive multimedia based on problem-based learning in physics subjects.

II. Research Method

The method used in conducting this research is library research using a qualitative approach Sugiyono, (2013), an approach taken by processing data by presenting data through the review of thoughts, opinions of experts or information related to the problem both in the form of books and previous research that can enrich the findings and support researchers in accessing research on the use of interactive multimedia based on Problem-Based Learning (PBL) in improving students' understanding of concepts in physics subjects. Data collection techniques are carried out by searching for sources and constructing from various sources such as books, journals, and research that has been done before. The data in the study comes from data that is directly related to the theme that has been determined and can come from appropriate journal reviews. The literacy taken is literature published within the last five to ten years (e.g. 2014-2024) to ensure the information used is up-to-date and relevant to the development of educational technology and learning methods.

The research began by collecting relevant data through Google Scholar to be analyzed. From the search, 10 relevant articles were obtained. Keywords such as interactive multimedia, problem-based learning, physics concept understanding, and other keyword combinations were used to find literature on the research topic. The

results were then examined based on the relevance and quality of the publications, prioritizing articles that focused on the application of PBL in the context of multimedia for physics education. After selecting relevant literature, the articles were evaluated to gain a better understanding of the underlying theories of PBL and interactive multimedia. It was also considered how both can be used to improve physics students' concept understanding. Analyses were conducted to gain a better understanding of how PBL-based interactive media can help students better understand what they are learning about physics and how to use it. This literature review will provide a basis to give an overview of the advantages, and challenges in implementing PBL-based interactive multimedia in physics classrooms. At the end of this research, a conclusion will be made that explains the benefits of using PBL-based interactive media to improve students' understanding of physics. In addition, this conclusion will include recommendations for additional research and how this technique can be applied to physics learning in schools. Therefore, the purpose of this research methodology is to provide a strong theoretical foundation to support the use of PBL-based interactive multimedia in physics education. In addition, this methodology also suggests practical actions that can be taken by educators and teaching material developers to improve the quality of physics learning in schools.

III. Finding and Discussion

A. Temuan penelitian

It is proven that problem-based learning media has improved students' understanding of physical learning. According to research, problem-based media helps students to be more active, creative, and analytical. Students have the opportunity to participate in more interactive and contextualized learning thanks to this technology. This is crucial for building critical thinking skills. Previous research looking at how using problem-based learning media can improve students' concept understanding in physical learning is shown in Table 1.

Table 1. Previous Research Reviewed

No	Researcher and Year	Method	Finding
1	Ramlan et al., (2014)	Research & Development (R&D)	Development of E-Material Learning Media with Problem-Based Learning Model on Temperature and Heat Material.
2	Suseno et al (2020)	Research & Development (R&D)	Development of Multimedia-based Interactive Video Mathematics Learning Media.
3	Effendi et al (2021)	Research & Development (R&D)	Development of Problem Based Learning based Maths learner worksheets in Primary School.
4	Mandasari et al (2021)	Research & Development (R&D)	Development of Interactive Learning Media for Automatic Electronic Electron Configuration for Science Subjects during the Covid-19 Pandemic.
5	Samadun & Dwikoranto (2022)	Literature Study	Improvement of Student's Critical Thinking Ability sin Physics Materials Through The Application of Problem-Based Learning.

No	Researcher and Year	Method	Finding
6	Soprihatin & Haqiqi (2021)	Research & Development (R&D)	Interactive multimedia development in assisting physics learning in the Covid-19 era.
7	Kurniawan et al (2023)	Literature Study	Implementation of problem-based learning to improve students' concept understanding.
8	Pertiwi et al (2023)	Literature Study	Problem Based Learning to Improve Critical Thinking Skills.
9	Fauziah et al. (2022)	Research & Development (R&D)	Android-based E-Modules with a STEM approach effectively help students understand dynamic fluid material and improve their critical thinking skills.
10	Yusni & Hurriyah (2024)	Classroom Action Research (CAR)	A physics wordwall game integrated with social issues is effective in increasing students' learning motivation and critical thinking skills in physics learning.

B. The Role of Interactive Multimedia to Improve Students' Concept Understanding

In Mandasari et al., (2021), the word 'media' is Latin medist which means ‘middle’ or ‘introduction’. Learning media is a tool to convey information that can be used by educators to students related to learning so that it is easily understood. Learning media is an inseparable part of learning activities in schools. Utilizing learning media to create experiences that can help the student learning process is a creative and systematic effort. To foster learning motivation so that students are not easily bored in participating in the learning process, media is needed which acts as a learning stimulus.

The definition of multimedia based on Munir (2020); and Mandasari et al., (2021), is a communication system and a combination of personal computer-based media that has a role in building, storing, delivering, and getting information in the form of text, images, audio, video, and others. Multimedia is the union of two or more communication media such as text, images, animation, audio, and video that use the characteristics of personal computer interactivity to create an interesting presentation (Mandasari et al., 2021). Learning using interactive media allows for more than one-way communication between communication components, in this case, teachers, media, and students (Suseno et al., 2020).

The role of multimedia in the learning process includes: (1) it can resolve students‘ differences; (2) it can overcome verbalism; (3) it arouses students’ interest in learning to stimulate the desire to learn; (4) it can encourage students' curiosity; and (5) it can correct the limitations of time and place (Arsyad, 2011). In this case, the role of interactive multimedia in improving the understanding of physics concepts is important, because it can turn abstract material into concrete and easy to understand. With visual elements in the form of animation, simulation, video, and interactive audio, complex physics concepts can be presented in an interesting and dynamic form, so that students can understand how physics theory is applied in real situations. This is in line with the results of Mandasari et al.‘s research (2021) which states that students’

understanding of physics concepts has also increased before and after the application of learning multimedia. Based on the results of Soprihatin & Haqiqi's research, (2021) the results obtained from validation by media experts, material experts, and responses from students state that the interactive simulation learning media based on Adobe Flash temperature and heat material is declared very feasible to support the learning process, especially in the subject matter of temperature and heat. Interactive multimedia allows students to learn the material on their own, choose the pace of learning, and explore various learning scenarios that may not be done in the classroom.

The utilization of interactive multimedia in education has had a significant impact, especially in improving students' in-depth understanding of concepts. Interactive multimedia includes various elements such as text, images, sound, video, and animation on one platform that allows students to connect directly with teaching materials. In an educational context, this interaction is very important as it captures students' attention more interestingly, provides flexibility to learn at their own pace, and increases active engagement in the learning process. This is especially helpful when understanding complex concepts, where students can learn gradually through a visual and interactive approach. One of the advantages of interactive multimedia is its ability to increase student engagement in absorbing lessons. Conventional learning that tends to be unidirectional sometimes makes students passive and less motivated. With interactive multimedia, students can become active participants in the learning process. For example, with the presence of questions, simulations, or educational games, students can directly test their understanding of the concepts they have just learned. This interaction can not only increase interest in learning but also make students more focused and enthusiastic in absorbing the information presented.

Multimedia interactive technology allows students to understand abstract concepts more visibly through concrete visualization. In complex subjects such as physics, the ideas taught are sometimes difficult to grasp just from written explanations. However, with animation, film, or three-dimensional simulation, students can see the process or phenomenon happening directly. Multimedia interactive technology allows students to learn independently, as they can access teaching materials anytime and anywhere. With this freedom, students can repeat material that has not been understood without feeling embarrassed to ask in front of their friends. In addition, features such as self-evaluation or action questions provide immediate feedback, so students can know their progress in real time. This independence in learning not only improves concept understanding but also builds students' confidence in facing academic challenges.

Interactive multimedia is based on problem-based learning, which allows students to solve real problems to improve their critical and analytical thinking skills. Therefore, interactive multimedia is an effective tool not only for improving physics concepts but knowledge as a whole.

C. Peran Problem Based Learning untuk Meningkatkan Pemahaman Konsep Siswa

Based on the results of research by Ramlan et al., (2014) stated that to get the final product in the form of e-material learning media with a problem-based learning model on temperature and heat material that meets good criteria. Based on the results of data analysis obtained from the trial stages, namely the material content expert trial, media expert trial, small group trial, and large group trial, it can be concluded that: e-material learning media with problem-based learning model on temperature and heat material that has been developed is classified as good criteria so it is feasible to be produced and used in schools with supporting facilities. Problem-based learning is also a learning model that changes the learning paradigm from teacher-centered to student-centered learning. Problem-based learning in learning starts from a problem that has been chosen so that students not only learn concepts that have a relationship with the problem and scientific methods used in problem-solving but also become a foundation in the formation of student character, that's why using a problem-based learning model it is hoped that learning will be more meaningful and useful for students in everyday life (Effendi et al., 2021).

A distinct characteristic of problem-based learning is that learning begins with presenting a problem, not teaching content (Gijbels et al., 2013). The problem-based learning model is a learning model that exposes students to real-world problems to start learning and is one of the innovative learning models that can provide active learning conditions for students. The problem-based learning model is characterized by the use of real-life problems as something that students must learn. The application of the problem-based learning model is expected to help students gain more concept-understanding skills rather than memorized knowledge (Samadun & Dwikoranto, 2022).

According to Eka (2019) in Dwikoranto (2022), the problem-based learning model has several advantages, as follows.

1) Problem-solving in problem-based learning is good enough to understand the content of the lesson;
2) Problem-solving that occurs during the learning process can challenge students' abilities and give students satisfaction;
3) Problem-based learning can increase learning activities;
4) It helps students' transfer process to understand problems in daily life;
5) It helps students develop their knowledge and helps students to take responsibility for their learning;
6) It helps students understand the nature of learning as a way of thinking, not just understanding learning by teachers based on textbooks;
7) Problem-based learning creates a fun learning environment for students;
8) Allows application in the real world;
9) It stimulates students to learn continuously.

The advantages of the problem-based learning model are that it makes education at school more relevant to life outside school, trains students' skills to solve problems

critically and scientifically, and trains students to think critically, analytically, creatively, and thoroughly because, in the learning process, students are trained to highlight problems from various aspects. The disadvantages of the problem-based learning model are that students often find difficulties in determining problems that are suitable for the student's level of thinking, besides that the problem-based learning model requires a relatively longer time than conventional learning and it is not uncommon for students to face difficulties in learning because in problem-based learning students are required to learn to find data, analyze, formulate hypotheses and solve problems. Here the role of the teacher is very important in assisting students so that it is hoped that the obstacles encountered by students in the learning process can be overcome (Pertiwi et al., 2023).

21st-century learning is characterized by Student Centre Learning with four skills developed, namely Communication, Collaboration, Critical Thinking and Problem Solving, and Creativity and Innovation. One of the learning models that can be used to develop 21st-century skills, especially critical thinking skills, is problem-based learning. In problem-based learning, there is a learning syntax that can be used to stimulate students' thinking skills, especially critical thinking (Pertiwi et al., 2023). In line with the results of research by Fauziah et al. (2022) who developed an Android-based E-Module with a STEM approach that proved effective in improving students' critical thinking skills, especially in dynamic fluid material. In addition, Yusni & Hurriyah (2024) in their CAR research found that the use of Android-based physics Wordwall games integrated with social issues was effective in increasing students' learning motivation and critical thinking skills. With the increase in students‘ critical thinking skills, students’ concept understanding of the material also increases.

In problem-based learning, students work in small collaborative groups and learn what they need to know to solve problems (Branch, 2004). The steps of the problem-based learning model according to Magued Iskander in Armela, (2019) are: 1) Learners are directed to the problem: The teacher explains the learning objectives and necessary preparations and motivates learners to engage in solving real problems that have been selected or determined. 2) Learners are organized in the learning process: The teacher assists learners in formulating or organizing learning tasks related to the problem described in the previous step. 3) Assistance with individual and group investigations: The teacher encourages learners to gather relevant information and conduct experiments to gain the understanding needed to solve the problem. 4) Development and presentation of work: The teacher assists learners in sharing tasks and planning or preparing appropriate products as a result of problem-solving, such as reports, videos, or models. 5) Analysis and evaluation of the problem-solving process: The teacher assists learners in reflecting or evaluating the problem-solving process.

Understanding is one of the factors that has the potential to influence student learning outcomes (Syafi'i et al., 2018). Concept understanding is the ability of students in the form of master a number of subject matter, where students not only know or remember a number of concepts learned, but students are able to reexpress

in another form that is easy to understand in accordance with the cognitive structure that students have (Syafei & Silalahi, 2019). Students who cannot understand the concept of the material explained by the teacher will have difficulty understanding the concept of the subject matter explained, even though students can achieve good learning outcomes, it does not mean that they understand the concepts taught. If students understand the concept well and master it, positive learning outcomes will be achieved for sure. Therefore, it is important to improve concept understanding in order to improve student learning outcomes. Concepts can be expressed in various forms, both concrete and abstract. Concepts have a very important role in helping a person organize the information or data they face. A person can obtain concepts through the process of recognizing, understanding, and formulating facts that characterize a concept (Kurniawan et al., 2023).

In that case, the role of Problem-based learning (PBL) in improving students' concept understanding is very significant. This is because problem-based learning makes students the center of learning activities, meaning that problem-based learning utilizes student figures to actively learn and work more in groups. In the problem-based learning model, the problem-solving assigned must be related to real problems related to the material being studied, so that abstract concepts are familiar and familiar so that they are applied in everyday life. With problem-based learning, students are encouraged to learn in groups, think to analyze, and find a way out to solve problems experienced collaboratively, to help understand a concept. Problem-based learning helps students improve higher-order thinking skills such as analysis and synthesis. Students are not only taught to memorize facts but also how to think and understand the relationship between concepts. Students are almost always active in searching and finding solutions so that learning becomes meaningful and able to make students have further understanding. This is in line with the results of Kurniawan et al.'s research, (2023) which states that the application of problem-based learning models on the topic of elasticity and Hooke's law can improve students' concept understanding.

Problem-based learning model is a teaching approach that focuses on solving real problems as a way to learn new concepts. In PBL, students are approached with a complex problem and must share to analyze, find solutions, and develop a deep understanding of the material related to the problem. This method encourages students to think critically and creatively and connect theoretical knowledge with its application in everyday life. Therefore, PBL is very effective in improving students' concept understanding because learning is not only theoretical but also applicable. One of the main advantages of PBL is its ability to increase student engagement in learning. In traditional approaches, students are often just recipients of information, but in PBL, they become the main actors who must identify problems, plan solutions, and implement actions. This process forces students to be actively involved in every stage of learning, from understanding the problem to implementing the solution. The

interaction between students, as well as between students and teachers, deepens their understanding, as they learn not only from theory but also through discussion, collaboration, and experimentation.

PBL helps students develop critical thinking and problem-solving skills that are indispensable in the real world. When faced with a complex problem, students must be able to deeply analyze the situation, identify the cause and effect of the problem, and develop smart alternative solutions that can be tested. This process hones students' analytical and logical skills in depth. In addition, PBL also teaches students to not only look for a single answer but also understand the various approaches that can be taken to solve a problem, which in turn enriches the understanding of concepts broadly. PBL encourages students to work together in groups, which develops good collaboration and communication skills. In each PBL project, students must share creative ideas, discuss alternative approaches, and work closely together to reach a practical joint solution. This cooperative learning not only improves their understanding of concepts in depth, but also teaches them the importance of teamwork, listening to diverse opinions, and building consensus together. This is very beneficial because, in the professional world, the ability to work together in a team and communicate clearly are key skills that are highly valued.

Empowering students to become self-directed learners is a key part of problem-based learning. PBL requires students to search for information, organize knowledge, and develop solutions based on their understanding rather than relying just on teacher directions. This independence encourages pupils to take greater responsibility for their learning and gain confidence in their capacity to face difficult obstacles. By continuously engaging in problem-solving and experimentation, students learn how to manage their time effectively, prioritize critical tasks, and work efficiently and successfully.

In modern education, enhancing students' understanding of concepts is one of the main goals that need to be achieved. To achieve this goal, various learning approaches and technologies continue to be developed, including interactive multimedia and the PBL model. Both of these methods, although different in approach, share the common goal of enhancing active student engagement in the learning process. Interactive multimedia combines visual, audio, and animation elements that allow students to directly interact with the learning material, while PBL focuses on solving real-world problems that can connect theory with practice. Both of these approaches can complement each other in creating a more in-depth and effective learning experience. Student engagement is the key to enhancing conceptual understanding. Interactive multimedia allows students to engage directly with the material through features such as quizzes, simulations, or interactive videos. These features encourage students not only to passively receive information but also to think and experiment with the concepts being studied. On the other hand, PBL encourages students to be more active in seeking solutions to the presented problems, which also requires engagement and critical thinking. With PBL, students learn to analyze problems, identify relevant variables, and design solutions based on the knowledge

they have acquired. When these two approaches are applied together, students will not only be more engaged, but they will also be able to develop deeper critical and creative thinking skills.

Understanding deep topics is frequently gained when students understand how they are used in real life. Animations and simulations assist students in visualizing abstract topics such as blood circulation mechanisms, physical principles, and chemical processes. This image allows students to better comprehend how these principles work in a broader perspective. PBL, on the other hand, allows students to apply what they've learned in real-world situations by addressing relevant and authentic challenges. The combination of these two methodologies improves students' knowledge by giving a learning experience that is based on both theory and practical application, thereby honing conceptual understanding more effectively. These two approaches not only improve conceptual knowledge, but they also play In addition to enhancing conceptual understanding, these two approaches also play a role in developing students' social skills and independence. In interactive multimedia, students often work individually, solving problems or completing challenges at their own pace. Features such as instant feedback or self-assessment allow students to learn freely and understand their strengths and weaknesses. On the other hand, PBL places more emphasis on collaborative-based learning, where students work in groups to solve complex problems. In this collaboration, students learn to communicate, share ideas, and work together to achieve the best solution. Thus, these two approaches not only enhance conceptual understanding but also help students develop social skills and independence that are very important in their future professional lives.

Although both approaches offer various benefits, several challenges need to be addressed in their implementation. One of the main challenges is the limitation of resources, both in terms of interactive multimedia technology and in terms of time and training to implement problem-based learning. For interactive multimedia, some schools may face constraints in terms of hardware and adequate internet access, which limits their ability to fully utilize the potential of this technology. Meanwhile, in problem-based learning, the main challenge lies in the difficulty of designing suitable problems and engaging students in a process that requires significant time and commitment. Nevertheless, these challenges can be overcome with careful planning and the use of supporting technology, such as online learning platforms, which can accelerate the implementation of both approaches in the classroom. The combination of interactive multimedia and problem-based learning offers great opportunities to create richer and more effective learning experiences. Interactive multimedia can enrich the problem-based learning process by providing various visual, audio, and simulation resources that help students understand the problems they face. Conversely, problem-based learning provides a practical context that helps students see the relevance of the material being studied through interactive media. When these two approaches are applied together, they form a learning ecosystem that can

significantly enhance students' conceptual understanding, equipping them with critical thinking, and creative skills, as well as the ability to work in teams and learn independently. Thus, the synergy between interactive multimedia and problem-based learning can become an innovative and effective learning model in today's digital education era. Nowadays, the development of interactive multimedia technology and the problem-based learning model complement each other to enhance students' understanding of concepts in physics lessons. Interactive multimedia is beneficial as a learning aid because it contains visual elements such as text, graphics, audio, and video that help understand and illustrate abstract structures. Interactive multimedia technology allows users to interact with the material and determine the pace of learning, as well as deepen their understanding of concepts, thereby enhancing students' comprehension. Meanwhile, problem-based learning serves as a learning framework that enhances students' understanding of solving real-world problems. Problem-based learning that presents real-life problems directly can encourage students to understand concepts more deeply by providing contextual problems from everyday life, thus making it easier to understand and apply abstract physics concepts. Problem-based learning also enhances collaborative learning activities among students. Interactive multimedia technology based on problem-based learning creates a rich and dynamic learning environment where students not only memorize a lot of information but also understand how concepts work and are applied in real life. The findings of the article also reveal that learning using interactive multimedia technology based on problem-based learning is capable of enhancing students' understanding of physics concepts.

IV. Conclusion

From the discussion of the article above, it can be concluded that interactive multimedia based on Problem-Based Learning (PBL) is very effective in enhancing students' understanding of physics concepts. The Problem-Based Learning (PBL) model helps researchers understand physics concepts that are usually abstract by simulating real problem-solving, thereby narrowing the meaning and relevance of the material to everyday life. Interactive multimedia equipped with visualizations such as animations and simulations helps to visualize complex concepts, allowing students to comprehend them very well. Interactive multimedia based on Problem-Based Learning (PBL) aligns with previous research findings that prove students who learn with interactive multimedia have a better understanding of concepts. Research results show that interactive multimedia based on Problem-Based Learning (PBL) is an effective learning solution to address the challenges of understanding abstract material while also motivating students to learn in the current digital era.

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