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Analysis of Needs Design of Cognitive Conflict-Based Teaching Materials Integrated Augmented Reality on Material Sound Wave

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ABSTRACT

Teaching materials are a big important component in the learning process. In fact, teaching materials in schools are currently still very limited and there are no technology-integrated teaching materials that can improve students' understanding of concepts. One way for respons this is by to design cognitive conflict-based teaching materials integrated with Augmented Reality (AR). This study aims to present the needs analysis results of cognitive conflict materials of teaching integrated with augmented reality (AR) material of sound wave. This research is a type of preliminary research. The research subjects were 36 students and 3 teachers of physics. The instrument of this research is a questionnaire to teachers, questionnaires to students and journal analysis sheets. Analyzed for data use quantitatively and qualitatively. The research results show that the teaching materials used by students are still limited and there are no technology-integrated teaching materials that can overcome student misconceptions. The results of the journal analysis of students' understanding of sound wave material are still lack. Therefore, from the results of preliminary research, it is necessary to design cognitive conflict-based physics teaching materials that integrate augmented reality technology to increase students' understanding of concepts.

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INTRODUCTION

The science and technology development in the 21st century has brought about rapid drag in the education world (Rahayu et al., 2022). The government demands schools to equip quality students with creative and innovative learning skills, information technology and media skills, so that they are able to use their skills to deal with and master technological developments (Ariani & Ratnawulan, 2022). One of the current technological developments is Augmented Reality (AR). Augmented reality (AR) is a blend concept between reality in virtual And reality in world (Persefoni & Tsinakos, 2015). Augmented reality (AR) is very potential, interesting, and inspiring, and motivating in the education world. This is in the line

with Setyawan research, (2019) Augmented reality has unique abilities that can influence students' learning experiences. The application of this technology to the process of learning can make it more easy for teachers in the process of learning so that learning objectives are achieved, especially learning physics (Mufit & Puspitasari, 2022).

The learning physics purpose according to the independent curriculum requires students to be able to have the ability to understand concepts and principles of physics (Mufit & Fitri, 2022). Students' understanding of concepts in studying physics is revealed from the concepts they learn (Atmam & Mufit, 2023). The achievement of physics learning objectives can increase concepts understanding by students and reduce misconceptions in physics learning. Understanding of concepts can be improved in various ways, one of which is through teaching materials (Dhanil & Mufit, 2021).

Materials of teaching are a big important component in the process of learning (Magdalena et al., 2020). For teachers the use of appropriate materials of teaching can replace educators' roles from teacher to facilitator, and can make the learning process more effective and participatory. Teaching resources can help students become autonomous learners and hone the abilities they have mastered (Ardiansyah et al., 2016). An educator's success in the learning process is determined by his insight, knowledge, comprehension, and level of creativity in managing materials of teaching (Magdalena et al., 2020). The completeness materials of teaching are the main factor in increasing concepts understanding by students and can reduce student misconceptions.

Misconception is an understanding of an idea that does not correspond to scientific concepts (Yuliati, 2017). Misconceptions are caused by errors in interpreting an event (Murni, 2013). Sources of students' misconceptions are not only obtained from school, but can also be obtained outside of school, for example from films, parents, daily activities and other media (Fridatama et al., 2021). Based on the sources of these misconceptions, students create personal ideas in their own minds that are unscientific and whose truth cannot be ascertained.

One solution to increase conceptual understanding is to use a model of cognitive conflict-based learning (Riska Dewi & Mita Anggaryani, 2020). According to Mufit (2018) the syntax of the model of cognitive conflict-based learning has 4 stages: (1) preconceptions activation and misconceptions; (2) cognitive conflict presentation; (3) concepts and Equations discovery; (4) Reflection. Cognitive conflict-based learning models can improve conceptual understanding and remediate misconceptions and can increase student learning motivation (Mufit, (2018); Mufit & Fauzan, (2019)). According to previous research, namely teaching materials based on cognitive conflict on mechanical wave material (Saputri et al., 2021); interactive multimedia based on cognitive conflict on fluid material (Dhanil & Mufit, 2021); parabolic motion (Atmam & Mufit, 2023); impulse momentum (Mufit & Fitri, 2022); and Core Physics (Mufit & Fitri, 2022).

Based on the background, it can be stated that this needs analysis research needs to be carried out. The purposes of this study were (1) to find out the teaching materials needed and needed to be developed in schools, (2) to find out the learning media needed by schools, and (3) to find out students' conceptual understanding of sound wave material. The research results are expected to provide initial information and can be used as a reference in development cognitive conflict-based teaching materials.

METHODS

This research type is preliminary research. This research was conducted in the early stages of development research. The model of plomp has three phase, namely the preliminary phase, the development phase and the assessment phase (Plomp , 2013). This reasearch aims to collect information about teaching materials and learning media in schools and to reveal

the level of concept understanding by students of sound waves.

This reasearch was conducted in February 2023 located at one of the state high schools in the city of Padang. The subjects for research were three physics teachers and 36 students at one of the state high schools in the city of Padang. The needs analysis instruments for this study were a questionnaire for teachers, a questionnaire for students and journal analysis sheets. Open questionnaires are used to obtain data about the needs of teaching materials in schools, learning media in schools. Journals were analyzed using journal analysis sheets consisting of 3 journals for understanding concepts on sound wave material that had been published.

The learning device needs analysis questionnaire addressed to teachers consists of 46 statement items on sound waves material there are 4 values to choose from where 4: strongly agree; 3 : agree; 2 : disagree; and 1 : strongly disagree. The questionnaire indicators used in the analysis of the implementation of teacher learning are as follows: (1) The need to use the Independent Curriculum at school, (2) The need to use learning models in sound wave material, (3) The need to identify students' understanding of concepts in sound wave material, (4)) The need for the use of materials and media in sound wave material, and (5) The need for the use of technologyAugmented Reality(AR) on sound wave matter.

The learning device needs analysis questionnaire aimed at students consists of 40 statement items on the sound wave material, there are 4 categories, namely 4: strongly agree; 3: agree; 2: disagree; and 1 : strongly disagree. The indicators for analyzing the needs of learning devices addressed to students are as follows: (1) Students' difficulties in understanding sound wave material, (2) Students' needs for using printed teaching materials on sound waves, and (3) Students' needs for using technology learning media augmented reality (AR) on sound wave matter.

The results of the analysis of the questionnaire for teachers on the implementation of physics learning and the student's questionnaire analysis on the needs of physics learning tools are processed using percentage technique.

RESULTS AND DISCUSSION

Results

Based on the distribution results of the learning device needs analysis questionnaire to three teachers at one of the state high schools in the city of Padang, it shows that the general problems in the learning process using the independent curriculum are that there are still many obstacles experienced by teachers. Teachers are still implementing teacher-centered learning and not yet using a special learning model to identify student misconceptions. The questionnaire given to teachers has 5 components and the analysis results are presented in Table.1

Tabel 1. Table 1. Results of the Distribution of Questionnaires to Three Teachers

Indikator	Persentase (%)
The need to use the Independent Curriculum at school.	73.8
The need to use learning models in sound wave material	72.9
The need to identify students' understanding of concepts in sound wave material	67.4
The need for the use of materials and media in sound wave material	72.1
The need for the use of technologyAugmented Reality (AR) on sound wave matter.	78.7

Based on the distribution results of learning equipment needs analysis questionnaires

to 36 students at one of the state high schools in the city of Padang, it shows that in general, students still have difficulties in the learning process on Sound Waves material, the available textbooks are not sufficient to understand Sound Waves material, and students need technological learning media to add outlook. The questionnaire given to students has 3 components and the analysis results are presented in Table.2

Tabel 2. Results of the Learning Equipment Needs Analysis Questionnaire for 36 Students

Indikator	Persentase (%)
Students' difficulties in understanding sound wave material	76.50
Students' needs for using printed teaching materials on sound waves	72.41
Students' needs for using technology learning media augmented reality (AR) on sound wave matter	80.02

Based on the journal analysis results, there are three journals related to concept understanding by students of Sound Waves material. The results of the analysis showed that concept understanding by students of sound waves was very low and there were misconceptions about the material. The results of the analysis are shown in table 3.

Tabel 3. The Journal Analysis Results of Students' Conceptual Understanding of Material Sound Waves

Journal	Understand the concept (%)	Misconceptions (%)	Don't understand the concept (%)
(Setyarini et al., 2021)	17.55	64.91	15.15
(Widiastuti & Purwanto, 2018)	29.76	58.34	11.91
(Haerunnisa et al., 2022)	9.20	32.10	58.70

Discussion

After distributing the questionnaires on the implementation of physics learning in schools to teachers and distributing questionnaires on the needs of learning tools to students as well as analysis of conceptual understanding journals on sound wave material. The questionnaire analysis results shown that 70% of the implementation of the independent curriculum at SMA 15 Padang was implemented. The Merdeka curriculum is a new curriculum from a prototype curriculum launched by the Education and Culture Minister (Mendikbud) Nadiem Makarim online which took place in Jakarta on Monday, 01 February 2021. The Merdeka Curriculum aims to encourage the process of transforming educational units so that they can improve learning outcomes as a whole, from a cognitive and character perspective which will eventually produce a Pancasila Student Profile (Nur Budiono & Hatip, 2023). This curriculum is a new paradigm that is very different from the previous curriculum (Nur Budiono & Hatip, 2023), teachers also feel that there are many obstacles experienced during implementation and the need for special training in implementing the independent curriculum in schools. This also had an impact on students, students had difficulty understanding sound wave material by 76.5% because the available teaching materials were still limited and the teacher did not understand the true independent curriculum. According to previous research by Windayanti et al.,(2023) which states that in the process of implementing the Independent Learning Curriculum, it will certainly cause problems in the process of planning, implementing and assessing learning because this curriculum has just

been implemented and parties are definitely still confused about its implementation.

One solution to overcome students' difficulties in the learning process is to apply a model that is appropriate for the subject matter to be taught. The fact is that the teacher has implemented a learning model of 72.9% according to the sound wave learning module. However, the teacher still has not applied a specific model to overcome misconceptions found in sound wave material. The cognitive conflict model is well suited for use in education (Mufit & Fauzan, 2019b). This is reinforced by previous research which states that cognitive conflict-based learning models can improve concept understanding and correct mistakes (Atmam & Mufit, 2023),(Dhanil & Mufit, 2021),(Mufit & Fitri, 2022),(Mufit & Puspitasari, 2022) etc. The model of learning is the most significant component in teaching and learning activities that is used to meet the learning objectives set by the teacher while the student is studying. Thus, cognitive conflict strategies can build students' abilities through conflicts in their minds.

In identifying students' understanding of the concept of sound wave material 67.4% has not been implemented. During the process of learning, the teacher still did not identify student misconceptions. The fact is seen from the needs of teachers in the use of printed materials of teaching and learning media on sound wave material by 72.1%. This is reinforced by previous research Cahyana et al., (2021) which states There are still many teachers who find it difficult to differentiate between students who have misconceptions and those who do not understand the concept and there is no media available that can identify students' misconceptions. In addition, there are no technology-integrated teaching materials, and there are no teaching materials that can visualize abstract material. This is also supported by the students' need for teaching materials of 72.41%. According to students, the books and media available at school are not enough to improve understanding of sound waves. Therefore, It is essential to make materials of teaching in which there are pictures, 3D animation, or videos that will make student remember the information learning.

Based on the data the teacher's need results to use technology-integrated teaching materials such as Augmented Reality (AR) is 78.7% and students' needs to use printed teaching materials that are integrated with Augmented Reality (AR) technology are 80.02%. This is because there are still no teaching materials that integrate Augmented Reality (AR) at school. Augmented Reality (AR) is a method of combining the actual and virtual worlds in two-dimensional and three-dimensional forms that are projected in a real environment at the same time (Persefoni & Tsinakos, 2015). The following are the benefits of Augmented Reality: 1) More interactive; 2) More effective in usage; 3) Can be widely adopted in many media; and 4) Simple to use. While the shortcomings of Augmented Reality are: 1) sensitive to changes in point of view, 2) few manufacturers, and 3) requires a large amount of memory on the equipment installed (Mustaqim et al., n.d.). So that with the application of AR in teaching materials it is hoped that later it will attract more students' interest in learning and improve concepts understanding by students.

The results of the analysis of the three journals show that there are still frequent misconceptions about sound waves. The misconception that occurs in the sound wave material is in the sub material of sound wave velocity and the Doppler effect. Not only that, there are also misconceptions about sound waves in the organ pipe sub-material (Lailiyah & Ermawati, 2020). One of the causes of misconceptions is that teachers have inadequate data to assess students' conceptual knowledge. Furthermore, teachers have not been as effective as they may be in applying scientific literacy competencies through the use of assessment instruments (Widiastuti & Purwanto, 2019.)

CONCLUSION

The research results show that teachers still experience many obstacles when

implementing the independent curriculum and the need for special training in implementing the independent curriculum in schools. The teaching materials used by students are still limited and there are no teaching materials that can overcome students' misconceptions and the teaching materials are not yet integrated with technology. The level of understanding of students in sound waves is still low and there are misconceptions among students. As a result, the preliminary research recommends developing physics teaching materials that are integrated with technology that are in accordance with the characteristics of cognitive conflict-based teaching materials and can identify student misconceptions and can increase students' understanding of concepts.

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