



Needs Analysis of Cognitive Conflict Integrated with *Augmented Reality* in Alternative Energy Material

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ABSTRACT

Developing conflict-based cognitive learning models can improve students' understanding of physical concepts and address misconceptions. Teaching materials are generally organized in a comprehensive and systematic way according to the learning principles that teachers and students use in the learning process. Teaching aids are very systematic because they are arranged in order, creating favorable conditions for students to use. This study aimed to identify the need for cognitive conflict teaching materials integrated with augmented reality (AR) to enhance high school students' conceptual understanding of alternative energy materials. This type of research is preliminary research. The instrument used was a questionnaire to analyze the needs of learning devices and the performance of physical learning as well as analysis of journals to analyze students' conceptual understanding of the material. Replace power. This test was conducted with 122 students from two different schools and 2 physics teachers from different schools. The data was analyzed quantitatively and qualitatively. Research results indicate that learning in schools is still teacher-centered and teaching materials have not yet been integrated with augmented reality (AR). The results of the analysis of the student's logbook of conceptual understanding of industrial violence are still weak and there are still many misconceptions. Therefore, from the preliminary research results, it is necessary to develop conflict-based cognitive physics teaching materials integrated with augmented reality technology according to the learning needs of the 21st century.

Keywords: *Augmented Reality, Cognitive conflict, Misconceptions.*



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I. INTRODUCTION

Education is one way for humans to "survive" in order to adapt to the rapidly changing times. Education in Indonesia is listed in Law No. 20 2003, Chapter 1 Education is a planned and conscious effort to create a learning atmosphere and learning process in which students actively develop, their learning potential, bravery, personality, intelligence, nobility and necessary skills for self, society, nation and state [1]. Education can be interpreted as a person's activity in guiding and leading a person towards optimal growth and development, especially in technological advances.

Learning in the 21st century awaits a generation that welcomes information and communication technology advances in social life. Learning in the 21st century is essentially an implication of the development of society from time to time. It is clear from history that society developed from a primitive society to an agrarian society, then to an industrial society, and now it is moving towards an information society. The information society can be read in the evolution of digitalization. Then every activity shifts from offline to online company. Changes in the global society towards digitalization will force learning in schools to follow these technological developments [2]. *Augmented reality* technology can help the world of education in understanding theories that require certain simulations in accordance with actual conditions. Technology can also help teachers in the learning process to achieve physical learning goals. The application of *augmented reality* in textbooks as a refinement of the book's weaknesses so far [3].

Educational materials are important for teachers and students. The use of *Augmented Reality* (AR) integrated teaching materials will facilitate students in learning, operating the system based on experience in the real world [4]. Instructional materials are essential and vital learning resources needed for the

learning of school subjects to promote teacher effectiveness and enhance student achievement. Teaching materials make learning more fun, practical and practical. The objectives of the development of educational materials, namely: (1) provide instructional materials appropriate to curriculum requirements that take into account the needs of the student, school, and region; (2) help students obtain alternative instructional materials; and (3) help teachers carry out their learning [5].

The physics learning process remains by adjusting the independent curriculum [6]. Educational goals, a curriculum that facilitates the educational process is needed. Free learning aims to liberate education by being free to think and free to innovate. The right education policy can be seen through the implementation of the applied curriculum. The independent curriculum is a rearrangement in the national education system in Indonesia, suggesting that the statement is in order to welcome the changes and progress of the nation in order to adapt to changing times [7]. *Augmented Reality* (AR) technology is a technology that combines images, video, audio, and text into a real environment such as two dimensions and three dimensions.

The curriculum needs to be perceived as a tool for systematic reconstruction of knowledge [8]. The curriculum also contains objectives, content and learning materials that aim to achieve quality education. Achieving physics learning objectives can improve students' concept understanding and reduce misconceptions in physics learning.

Most misconceptions occur due to misunderstanding during the learning process [9]. However, the initial concepts (preconceptions) obtained by students when interacting with the environment, and these concepts are brought into the classroom when learning takes place. That is, before entering the classroom students have made concepts that they believe in themselves. According to previous researchers, the development of cognitive conflict-based learning models can improve understanding of physics concepts and remediate student misconceptions [10a]. Therefore, making teaching materials based on cognitive conflict can improve students' understanding of concepts and reduce misconceptions in students. Misconceptions can hinder learning progress [10b]. The background that has been described, the objectives of the study are 1. Knowing the teaching materials needed by schools, 2. Knowing the learning media needed by schools, and 3. Knowing students' concept understanding of alternative energy material. This designed cognitive conflict-based learning model has four syntaxes (phases/stages), to know: (1) Triggering Preconception and misconceptions, (2) Presenting cognitive conflicts, (3) Exploring concepts and equations, (4) Reflecting [10c]. Improving students' concept understanding can also be applied to 21st century learning. 21st century learning can be characterized by the students in one of Padang City High Schools development of digital information.

II. METHOD

The type of preliminary research is observational and analytic research, which is the initial stage of developmental research. The Plomp model has three phases, namely the preliminary phase, the development phase, and the evaluation phase [11]. In this initial stage, the researcher aims to collect information about existing teaching materials at school and analyze journals. Needs analysis instruments from distributing questionnaires to teachers and students. The preliminary research stage through *needs analysis* [12]. This step was completed by distributing questionnaires to teachers and students from two different schools. The data was analyzed qualitatively and quantitatively. Knowing students' needs for learning media in order to improve students' concept understanding on alternative energy material. The needs analysis of learning tools was conducted on 122 students and 2 teachers from 2 different high schools. The journals analyzed consisted of 3 journals on understanding concepts on alternative energy material that had been published.

The questionnaire consists of 46 statements on alternative energy material there are 4 values to choose from where 4: Totally agree; 3: accept; 2: disagree; and 1: strongly disagree. The questionnaire indicators used in analyzing the implementation of teacher learning are as follows: (1) Use of Merdeka Curriculum at School, (2) Use of Learning Models on Alternative Energy Materials, (3) Identification of Students' Concept Understanding on Alternative Energy Materials, (4) Use of Materials and Media on Alternative Energy Materials, and (5) Use of Augmented Reality (AR) Technology on Alternative Energy Materials.

Questionnaire for students includes 40 questions about alternative energy materials, there are 4 categories, namely 4: Totally agree; 3: accept; 2: disagree; and 1: strongly disagree. Indicators of the learning device needs analysis questionnaire addressed to students are as follows: (1) Understanding Alternative Energy Materials, (2) Use of Learning Models, (3) Use of Materials and Media on Alternative Energy Materials, and (4) Use of Augmented Reality (AR) Technology on Alternative Energy Materials. Journal analysis selected 3 journals on understanding concepts about alternative energy materials that have been published.

III. RESULTS AND DISCUSSION

Results

The results of the distribution of questionnaires to two teachers showed that in different schools there were almost the same problems as shown in Table 1. In general, teacher-centered teaching was always carried out. Teachers explain teaching materials more and students less actively participate. The results of the distribution of questionnaires to two teachers showed that in different schools there were almost the same problems as shown in Table 1. In general, teacher-centered teaching was always carried out. Teachers explain teaching materials more and students less actively participate.

Table 1. Results of Questionnaire Distribution to Two Teachers in Different Schools

Indicator	Yield (%)
Teacher needs to use Merdeka Curriculum in schools	76,7
Teacher needs to use the Learning Model on Alternative Energy Material	75
Identification needs of students' concept understanding on alternative energy materials	80,5
Teacher needs to use printed teaching materials and learning media on alternative energy materials	73,6
The need for the use of Augmented Reality (AR) Technology on Alternative Energy Material	75

The results of distributing questionnaires to 122 students show that there are almost the same problems in different schools can be seen in table 2. In general, students still have difficulty in the learning process on alternative energy material, the available books are not enough to understand alternative energy material, and students need a stimulus presentation in the form of 3D visuals in the learning process.

Table 2: Results of the Learning Device Needs Analysis Questionnaire to 122 Students in Different Schools

Indicator	Yield (%)
Students' difficulties in understanding Alternative Energy Materials	81
The need for students to use printed teaching materials on alternative energy materials	75
Student Needs using Augmented Reality (AR) Technology Learning Media on Alternative Energy Material	82,1

Likert scale is used to measure the attitude or opinion of a person or some groups towards a social phenomenon in which the response to each item of the tool ranges from very positive to very negative [13]. Measured Likert scale variables are converted to transformation indices. This indicator is then used as a starting point for synthesizing the elements of the instrument which can be in the form of a statement or a question. This is the scale used in this study: 1. Disagree; 2. Disagree; 3. Agree; and 4. Strongly Agree. With a range of results: 1. Strongly Agree = 100-76; Agree = 75-51; 3. Disagree = 50-26; and Strongly Disagree = 0-25.

The results of the journal analysis included three journals related to students' conceptual understanding of alternative energy materials. The analysis results show the emergence of misconceptions among students about alternative energy materials. The results of the analysis are shown in Table 3.

Table 3. Journal Analysis Results of Students' Concept Understanding of Alternative Energy Materials

Journal	Concept Understanding (%)	Misconception (%)	Do not understand the concept (%)
Journal 1 [14]	18	24	58
Journal 2 [15]	8,38	21,59	70,03
Journal 3 [16]	16,71	59,68	23,61

Discussion

After filling out questionnaires by teachers and students by distributing questionnaires to teachers, namely a questionnaire on the implementation of physics learning and to students, namely a questionnaire on the needs of learning tools and journal analysis of understanding the concept of alternative energy material. In fact, the teacher's need to use the independent curriculum at school has been 76.7% implemented. According to teachers, the independent curriculum is suitable for implementation in schools at this time which is much different from the previous curriculum and the independent curriculum is quite effective to implement. However, this independent curriculum has obstacles in implementing the independent curriculum so that special training on the independent curriculum is needed. Students' difficulty in understanding alternative energy material is 81%. This happens because students are still not sufficient in using teaching materials and learning is only focused on the teacher.

The need for teachers to use learning models on alternative energy material 75% use the model. The learning model used is consistent with the alternative energy learning module. However, teachers do not use a special learning model to overcome misconceptions that occur in alternative energy material. Cognitive conflict learning model is a learning activity that is carried out to prevent discrepancies in student perceptions between the initial knowledge obtained in the surrounding environment with real science [17]. The analysis of the three assessments includes three groups of categories, that is, conceptual understanding, misinterpretation, and non-conceptual understanding. Log analysis obtained for alternative energy materials mainly comes from students with misconceptions, even from students who do not understand the concept. Therefore, it is necessary to determine the students' understanding of the concepts.

In the identification of students' concept understanding on alternative energy material, 80.5% has not been implemented. Teachers have not fully identified misconceptions in students. The next fact is the teacher's need to use printed teaching materials and learning media on alternative energy material 73.6%, because in the independent curriculum teaching materials there is only one book. Teachers have not used teaching materials that can overcome students' misconceptions, printed teaching materials are suitable for use in alternative energy materials. The materials used by teachers are not enough to enhance students' activities when learning about alternative energy materials. In addition, the teaching materials used have not been able to visualize alternative energy material. The teacher's need to use teaching materials integrated with *Augmented Reality* (AR) is 75%. While the need for students to use teaching materials integrated *Augmented Reality* (AR) 82.1%, because teaching materials integrated *Augmented Reality* has never been used in schools.

The reality found after filling out the questionnaire that teachers and students agree to make teaching materials based on cognitive conflict integrated *Augmented Reality* (AR). The teaching materials used have not been integrated with 3D, as well as in this independent curriculum for teaching materials are still limited because the teaching materials used are only one book published by the Ministry of Education, Culture, Research and Technology with the title Natural Knowledge book which only consists of teacher and student books. Along with era 5.0 are technological demands. Therefore, there is a need for innovation, ideas and ideas to develop technology-based teaching materials so that students are easier in the learning process. *Augmented reality as a system has three characteristics, namely the ability to combine real and virtual objects, the ability to interact in real time, and the ability to be used on 3D objects.* [18].

To help improve students' understanding of concepts through teaching materials based on cognitive conflict integrated *Augmented Reality* (AR), because there is no teaching material on alternative energy materials that use *Augmented Reality* (AR) technology. So based on the problems that occur in real conditions, researchers provide one solution, namely using teaching materials based on cognitive conflict and integrated *Augmented Reality* (AR). Because the advantage of technology is that it can make 2D images into 3D like real and the use of this technology is very interesting. After making teaching materials,

researchers hope that this teaching material can reduce misconceptions in students. One of the goals of the cognitive-conflict learning model is to improve students' understanding of concepts and to address student misconceptions. Therefore, researchers have chosen a learning model based on cognitive conflict.

The results of the three-assessment analysis have three categories: misconception, conceptual understanding and conceptual incomprehension. Alternative energy material also has many students misconceptions because it occurs from students who have brought the wrong concept into the classroom, occurs in teachers who do not master the material, occurs in textbooks that have erroneous explanations, occurs in contexts that mean student experience, and teaching methods only contain lectures and writing [19]. Misconceptions in alternative energy materials that occur are in kinetic energy and mechanical energy [20]. The results of this journal analysis can be said that in alternative energy material there are still many students who do not understand the concept even to misconceptions. Physics is closely related to matter, energy and the interactions associated with it [21].

IV. CONCLUSION

The implementation of teaching in schools using pre-printed materials that have not yet been integrated with technology. Through the independent program, it can also be seen that the educational materials are limited because the educational material used is only a book published by the Ministry of Education, Culture, Research and Technology with the title Science Book. Natural learning includes only teacher and student books. As for the learning media used, it is only in the form of *text power point* (PPT) and sometimes uses phet simulation to conduct experiments. In the school that was observed, the teacher had not identified misconceptions in students. The results of the diary analysis showed that the students' understanding level was still low, and the students still had misconceptions. Therefore, the recommendation of this preliminary study is to develop physics teaching materials that integrate with technology and be able to identify student misconceptions. So it can improve students' understanding of concepts and overcome misconceptions.

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