



## Needs Analysis Of Cognitive Conflict Teaching Integrated with Augmented Reality Global Warming Material

Mustika Hayati<sup>1</sup>, Fatni Mufit<sup>1\*</sup>

<sup>1</sup> Department of Physics, Universitas Negeri Padang, Jl. Prof. Dr. Hamka Air Tawar Padang 25131, Indonesia  
Corresponding author. Email: fatni\_mufit@fmipa.unp.ac.id.

### ABSTRACT

The development of the 21st century is marked by the increasing quality of human resources, especially in the field of science and technology. Conceptual understanding is very important to be improved in the 21st century, this is supported by the goal of an independent curriculum, namely students are able to deepen concepts and strengthen competence. In the independent curriculum, the available teaching materials are still limited, one alternative solution is to develop teaching materials based on cognitive conflict models integrated with Augmented Reality technology on global warming material in order to increase students' conceptual understanding and remediate student misconceptions. This type of research is preliminary research. The instrument used was a questionnaire which was given to 3 teachers at Padang City High School to analyze the implementation of physics learning at school. Then the questionnaire instrument was also given to 130 class X students in two different high schools in Padang City, the aim was to analyze the needs of physics learning devices at school. In addition to the questionnaire, journal analysis was also carried out to analyze high school students' conceptual understanding of global warming material. Data were analyzed quantitatively and qualitatively. Students' conceptual understanding is still low and there are misconceptions about global warming material, which is the result of an analysis of several published journals. In addition, learning in schools is still teacher-centered, teaching materials are still limited, and technology-integrated learning media is also limited. Therefore, from the results of preliminary research it is necessary to develop cognitive conflict-based physics teaching materials that are integrated with augmented reality technology.

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



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## I. INTRODUCTION

The development of the 21st century is known as the century of globalization or the century of openness. The development of this era has been felt by the world which is characterized by increasing demands for human quality, especially in terms of science and technology (IPTEK). Technological developments affect all aspects of human life, one of which is in the field of education. With the existence of technology, learning becomes varied and not monotonous from year to year. One of the impacts of technological developments in the field of education is seen by the emergence of many new innovations to support education [1]

Not only technology, but human quality is also very important to improve. Quality human beings are human beings who have a strong foundation in terms of knowledge and skills. To prepare quality human resources that are competitive, this can be done by increasing the ability, independence, and competitiveness of the nation through quality education [2]. This can be achieved if learning can be done optimally. The government continues to strive to improve the quality of education in Indonesia by presenting a new curriculum, namely the independent curriculum. The purpose of implementing the independent curriculum is so that students are able to deepen concepts and strengthen competence. Thus, one of the objectives of implementing the independent curriculum is the importance of understanding concepts in learning.

Conceptual understanding is the ability to remember and systematically convey principles or ideas into information based on relevant experience. In line with Hau's opinion that conceptual understanding is a student's ability to analyze, convey, conclude and apply a phenomenon according to its cognitive structure [3].

Understanding of concepts is an important factor in learning activities, because before students enter formal education there are many concepts they have encountered in everyday life. Appropriate understanding of concepts must be given since students are in elementary school, because an understanding of concepts is needed in understanding the concept of knowledge at the next level [4]. The success of students in studying physics is determined by their ability to understand the concepts, laws and theories contained in learning physics [5], so that they do not have to memorize formulas but simply understand the concepts [6]. Understanding the concepts obtained when studying physics will be able to foster students' critical thinking skills [7]

One way to improve students' understanding of concepts is by using learning tools such as teaching materials. The existence of teaching materials in each lesson is very important in order to create learning centered on student activities, the more students are involved with teaching materials during learning activities, the more their knowledge, attitudes and skills develop [8]. The attractiveness of teaching materials can also bring out students' attention, perceptions, feelings, intellect, imagination and encouragement from within students towards learning material [9].

One of the physics materials that examine natural objects and events is global warming. Global warming material discussing natural phenomena such as rising sea levels, depleting the ozone layer, climate change, and the greenhouse effect still causes a lot of student incomprehension [10]. Global warming material which tends to be dominated by theory requires a supportive media so that the material can be packaged more effectively and can increase students' thinking power and student understanding [11]

The new independent curriculum has been implemented for the 2022/2023 school year in several schools including high schools in the city of Padang, so that learning tools and teaching materials regarding independent curriculum material are of course not too widely available. It can be seen that what is available is teaching materials from the government called IPA which cover physics, chemistry and biology. Teaching materials are arranged systematically according to the applicable curriculum which allows students to study independently [12], with teaching materials, teachers will be more consistent in conveying material to students. Teaching materials with technological innovation will create a new atmosphere and special attraction for students. One technology that can be integrated into teaching materials is Augmented Reality (AR). AR is a technology that has the ability to project computer graphics into the real world [13]. Augmented Reality (AR) and Virtual Reality (VR) is a technology that provides a virtual world experience that feels real, not only that AR and VR technology is often used as a tool for alternative simulations and real experiments, especially real experiments that require expensive equipment and involves great risk in its implementation or experimental simulation for abstract processes [14]. It is hoped that with Augmented Reality (AR) these teaching materials will be more varied and interesting, because in general the presentation of teaching materials that only present text, besides causing boredom also makes students less imaginative and tends to forget quickly because usually they will remember something better if they see and hear it. rather than read only [15].

The teaching material that the researcher wants to develop is also based on the cognitive conflict model which consists of four syntaxes, namely the activation of preconceptions and misconceptions, presentation of cognitive conflicts, discovery of concepts and equations, and reflection [16]. The cognitive conflict learning model can have a positive impact on students in increasing conceptual understanding, correcting misconceptions, increasing positive attitudes towards learning physics and students' motivation in learning [16], as well as facilitating students in learning physics concepts, training students to think critically and creatively, as well as increasing student learning activities [17]. The background that has been described is the purpose of the research, namely 1) Knowing the teaching materials needed by schools, 2) Knowing the learning media needed by schools, and 3) Knowing students' conceptual understanding of global warming material.

## II. METHOD

This type of preliminary research is observational research and journal analysis which is the initial stage of development research. This study uses the Plomp (2013) model. The Plomp model consists of three stages, namely: (1) preliminary research, namely needs analysis and reviewing the literature, (2) development or prototyping phase, namely the stage of product design and prototype revision, (3) assessment phase, which is the testing and evaluation phase in practice [18].

In the early stages the researcher collected information about teaching materials used in schools, especially global warming material. In addition, researchers also analyzed journals regarding misconceptions that often occur in global warming material. The preliminary research stage was through a needs analysis by distributing questionnaires to teachers and students of SMA A and SMA B in Padang. The results of the data analysis are in

the form of quantitative and qualitative. This needs analysis was carried out to find out students' needs for learning media in order to increase students' conceptual understanding and remediate students' misconceptions about global warming material. An analysis of learning device needs was carried out on 72 students at SMA A Padang, and 65 students at SMA B Padang as well as 2 teachers at SMA A and 1 teacher at SMA B Padang. Journal analysis consists of 2 published journals understanding the concept of global warming material.

The learning implementation analysis questionnaire consists of 46 questions on global warming material with 4 choices, namely 1: strongly disagree; 2 : disagree; 3 : agree; 4 : totally agree. The indicators of the educator's questionnaire analysis of the implementation of physics learning on global warming material consist of 5 indicators; 1) the need for teachers to use an independent curriculum; 2) the need for teachers to use learning models on global warming material; 3) the need for teachers to identify students' conceptual understanding of global warming material; 4) the need for teachers to use teaching materials and media on global warming material; 5) the need for the use of Augmented Reality (AR) technology on global warming material.

Questionnaire of students needs analysis of physics learning tools on global warming material which has 4 indicators with 40 questions. This student questionnaire consists of 4 choices, namely 1): strongly disagree; 2) : disagree; 3) : agree; 4) : totally agree. There are 3 indicators for student questionnaires regarding the needs analysis of physics learning tools, namely, 1) students' difficulties understanding global warming material; 2) the needs of students to use printed teaching materials on global warming; 3) the needs of students to use Augmented Reality (AR) technology learning media on global warming material. The analysis of the selected journals is that there are 2 journals for understanding the concept of global warming material, [19] [20].

The results of the percentage analysis of educators' questionnaires on the implementation of physics learning and students' questionnaire analysis of the needs of physics learning tools are used in the following equation

$$percentage = \frac{acquired\ score}{maximum\ score} \times 100\%$$

### III. RESULTS AND DISCUSSION

#### Results

The results of distributing the questionnaire given to 2 teachers at SMA A Padang City and 1 teacher at SMA B Padang City, showed almost the same problems in different schools. The general problem is still applying the direct learning model, and not having a specific model to identify student misconceptions. The questionnaire given to the teacher has 5 components and can be seen in Table 2 and Table 3.

Table 2. Analysis of the implementation of physics learning at SMA A

Indicator	Yield (%)
The need for the use of an independent curriculum in schools	75,0
The need for the use of learning models on global warming material	75,0
The need to identify students' conceptual understanding of global warming material	68,18
The need for the use of teaching materials and media on global warming material	71,05
The need for the use of augmented reality technology on global warming material	70,0

Table 3. Analysis of the implementation of physics learning at SMA B

Indicator	Yield (%)
The need for the use of an independent curriculum in schools	78,57
The need for the use of learning models on global warming material	75,0

The need to identify students' conceptual understanding of global warming material	77,27
The need for the use of teaching materials and media on global warming material	78,94
The need for the use of augmented reality technology on global warming material	70,0

The results of distributing the questionnaire to 130 students consisting of 65 students at SMA A in Padang City and 65 students at SMA B in Padang City, showed almost the same problems in different schools. In general, students still have difficulties in the learning process on global warming material, this is because printed books as a learning resource in the independent curriculum are not enough. The questionnaire given to these students consisted of 3 components and can be seen in Table 4 and Table 5.

Table 4. Analysis of the needs of physics learning tools at SMA A

Indicator	Yield (%)
The difficulty of students understanding global warming material	77,54
The need for students to use printed teaching materials on global warming material	73,41
The needs of students using Augmented Reality technology learning media on global warming material	81,02

Table 5. Analysis of the needs of physics learning tools at SMA B

Indicator	Yield (%)
The difficulty of students understanding global warming material	70,15
The need for students to use printed teaching materials on global warming material	69,95
The needs of students using Augmented Reality technology learning media on global warming material	79,92

The results of the analysis of journals regarding the misconceptions experienced by students on global warming material, there are two journals. First, based on Krisna et.al's research, the material that has a lot of misconceptions is the Global warming sub-material of 75.86%, the Ozone layer depletion material is 72.41%, the greenhouse effect material is a misconception of 41.37% and the acid material rain there was a misconception of 58.62%. so that from this it can be seen that students' understanding of concepts is still low [19]. Second, based on Gungordu's research, there are many misconceptions about the ozone layer depletion sub-matter, there is an average of 47.3% misconceptions about the function of the ozone layer, the average ozone layer depletion is 73.3% while for environmental problems caused by the average ozone layer depletion of 59.55% [20]. So that it can be seen in the ozone layer depletion sub-material there are still many students who experience misconceptions.

## Discussion

After completing the questionnaire on the implementation of physics learning at school by teachers in two different schools in the city of Padang, as well as filling out the questionnaire for learning device needs by students and analyzing journals for understanding concepts on global warming material. The implementation of the independent curriculum at SMA A in the city of Padang was 75% implemented and at SMA B in the city of Padang 78.57% was implemented. The independent curriculum is a new curriculum based on one of the policies of the Minister of Education and Culture, known as Merdeka Learning Kampus Merdeka (MBKM). Supported

by the opinion of Rahayu et al. that a driving school with an independent curriculum is a school with a passion to move for a change to be achieved [21]

. This curriculum is very different from the previous curriculum, teachers also feel that there are many obstacles experienced during implementation and the need for special training in implementing the independent curriculum in schools. The difficulty of students in understanding the topic of global warming at SMA A Padang City was 77.54% and at SMA B Padang City was 70.15%. This happens because the available teaching materials are still limited and learning is still teacher-centered.

The difficulties experienced by students in the learning process can also be overcome by applying models that are appropriate to the material to be taught. The learning model is a form of learning that is presented in a unique way by the teacher illustrated from start to finish. The learning model is a frame for applying an approach, method, and learning technique [8]. The existence of learning syntax is one of the characteristics of the learning model [16]. Syntax aims to guide in achieving the goals to be achieved during the learning process. The fact is that teachers at SMA A Padang City and SMA B Padang City have implemented a learning model of 75% according to the global warming learning module. However, the teacher does not apply a specific model to overcome misconceptions that occur in global warming material. The model that is often used is Problem Base Learning (PBL), but this model cannot be applied to all learning materials. The cognitive conflict model is very suitable to be applied in learning because it can improve understanding of concepts and remediate students' misconceptions [16]. The cognitive conflict model is the process by which students find a concept when faced with conflict phenomena that exist in their minds [16]. Learning with a cognitive conflict approach can make students more motivated in learning [22]. So cognitive conflict strategies can build students' abilities and motivate students in learning to find a concept through conflict in their minds.

In identifying students' conceptual understanding of global warming material at SMA A Padang City 68.18% and at SMA B Padang City 77.27% it has not been implemented so it needs special attention. Teachers have not fully identified student misconceptions. The fact is seen from the need for teachers to use printed teaching materials and learning media on global warming material at SMA A Padang City 71.05% and SMA B Padang City 78.94%, this is because the independent curriculum of printed teaching materials on global warming material is available only one called IPA. In addition, there are no teaching materials that can overcome students' misconceptions, there are no technology-integrated teaching materials, and there are no teaching materials that can visualize abstract material. This is also supported by the needs of students for teaching materials for SMA A Padang City 73.41% and 69.95% for SMA B Padang City. According to students, the available books and media are not enough to understand global warming material, 3D stimulus presentation is needed in studying global warming, and the presence of pictures, 3D animation, or videos will make students able to remember the information being learned.

When viewed from the needs of teachers in using technology-integrated teaching materials such as Augmented Reality (AR) 70% and students' needs to use printed teaching materials integrated with Augmented Reality (AR) technology by 81.02% in SMA A and 79.92% in SMA B Padang City. This is because integrated Augmented Reality (AR) teaching materials have never been used in schools. Augmented Reality (AR) is an application of merging the real world with the virtual world in two-dimensional and three-dimensional forms projected in a real environment at the same time [23]. AR has three advantages that cause this technology to be chosen by many developers: 1) It can broaden the user's perception of an object and provide a "user experience" of the 3D objects displayed 2) It allows the user to carry out interactions that cannot be done in the real world 3) It allows for using a variety of tools (devices) according to needs and availability [24]. Not only that, AR is also a medium that can improve students' higher order thinking skills (HOTS) such as problem solving skills, critical thinking skills and creative thinking skills [25]. 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 students' understanding of concepts.

The results of the analysis of the two journals show that there are still frequent misconceptions about global warming. The misconception that occurs in global warming material is in the ozone layer depletion sub-material and global warming sub-material. Similar problems were also found in several articles including 1) Pramono, Agus & Fatni Mufit that students' conceptual understanding of global warming material was still low so an alternative solution was provided by designing cognitive conflict-based interactive multimedia using Adobe Animate CC 2019 on global warming material that was valid and can be used in the physics learning process [26], 2) Mufit, F et al., that students' understanding of concepts is still low, learning is still teacher-centered, and the integration of new literacy and disaster literacy in the learning process and teaching materials is also still low. Therefore a solution is provided for the development of physics teaching materials that integrate new literacy and disaster literacy to increase students' conceptual understanding according to the demands of the 21st century

[27], 3) Puspitasari, R et al., in their research that students' low understanding and misconceptions occur in students especially motion material, both straight motion, parabolic motion and circular motion. One of the reasons is because previous learning was dominated by the lecture method, and the teacher identified student misconceptions before starting learning [28]. One of the causes of misconceptions is that teachers have limited information in assessing students' conceptual understanding. In addition, teachers have not been maximal in implementing scientific literacy competencies in the use of assessment instruments [29].

#### IV. CONCLUSION

From the results of the data analysis that has been carried out, it can be seen that the use of the independent curriculum at SMA A Padang City and SMA B Padang City has been carried out well and is suitable for application in schools today. Teaching materials for global warming are still limited, namely the source is only one book published by the Ministry of Education, Culture, Research and Technology entitled Books of Natural Knowledge which are combined with Chemistry and Biology. Teachers do not yet have a specific model for identifying student misconceptions, for that the cognitive conflict model is suitable to be used to increase students' understanding of concepts and remediate student misconceptions. In addition, the role of technology in the 21st century is also very much needed, the media that teachers often use is in the form of power points (PPT), so that teaching materials with new innovations that are integrated with technology such as Augmented Reality (AR) can be used to attract students' interest in reading. Students also really agree and are interested if global warming teaching materials are integrated with technology. Therefore, with this preliminary research, it is necessary to develop cognitive conflict-based teaching materials integrated with Augmented Reality on global warming material to improve students' understanding of SMA/MA concepts.

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