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Development of Interactive Multimedia Climate Change Course (CCC) to Improve Students Understanding of Climate Change Material

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Abstract

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Climate change is a global issue that demands education capable of raising young generations' awareness in understanding its impacts and seeking concrete solutions. Geography, as one of the school subjects, plays a significant role in explaining this phenomenon through spatial analysis and environmental consequences. However, climate change material is often considered abstract, making it difficult for students to comprehend. This study developed a product called Climate Change Course (CCC) based on interactive multimedia using Adobe Captivate to address these challenges. The product is equipped with animations, interactive maps, 360° videos, and automatic assessment features that provide direct feedback. The research method applied was Research and Development (R&D) with the ADDIE procedure, covering the stages of analysis, design, development, implementation, and evaluation. The results of this study indicate that CCC is feasible to be used as a learning medium with positive student responses. CCC is considered effective in enhancing students' motivation, independence, and understanding of climate change materials in geography learning.

1. Introduction

Education holds a very important role in equipping the younger generation to be ready to face various global problems, one of which is the phenomenon of climate change. Climate change is not merely seen as an ordinary natural phenomenon, but is a multidimensional crisis that impacts environmental, social, and economic aspects of society. Therefore, education about climate change is not enough to just present theories, but also needs to develop skills, values, and attitudes that enable students to act as responsible agents of change (Reid, 2019). Through well-planned learning, the younger generation is expected to be able to raise awareness, foster concern, and be encouraged to take real steps in mitigation and adaptation efforts to the impacts of climate change. In the formal education system, geography occupies a strategic position as a medium for learning about climate change issues. Geography provides a spatial analysis framework that can help students understand the connection between natural factors, human activities, and the environmental consequences they cause.

With a geographical approach, students not only acquire theories but are also invited to examine spatial patterns, interaction dynamics, and the consequences of climate change in various regions of the world. This makes geography a very relevant entry point for studying global environmental issues while connecting them to phenomena that occur at the local level. However, the reality in the field shows that climate change material is often perceived as difficult to understand. Its abstract and complex characteristics make it difficult for many students to visualize the important concepts within it (Beck, 2019). This condition causes students to tend to memorize

terms without understanding the substance or the connection of concepts with real phenomena around them. This situation creates a gap in learning, so innovation is needed in the form of media that can serve as a bridge between abstract material and students' concrete experiences.

In line with technological developments, various learning innovations have been widely developed. One form of innovation that is increasingly gaining attention is the use of interactive multimedia in the teaching and learning process. This type of learning media has been proven to provide a more engaging, easy-to-understand, and effective learning experience (Lusiana & Maryanti, 2020). Student involvement in learning increases because interactive multimedia allows them to interact directly with the material. In addition, another advantage of this media is its ability to present real illustrations through images, animations, and 360° videos that present a more concrete visualization of abstract phenomena. Not only that, interactive multimedia also offers automatic assessment features that can provide immediate feedback to students, making the learning process more independent and focused on learning outcomes.

This research produces the Climate Change Course (CCC) product, which was developed using Adobe Captivate software. The CCC is designed as an interactive multimedia learning tool for climate change material in geography subjects. This product integrates various superior features, such as animations, interactive maps, 360° videos, and automatic evaluation. The presence of CCC is expected to be able to overcome the limitations of conventional learning methods that tend to be abstract and monotonous, as well as increase students' learning

motivation (Reichert & Print, 2018). With an attractive and interactive appearance, this media can foster interest and encourage students to be more independent in understanding the material.

Although multimedia-based learning media have been widely developed, research specifically focused on the topic of climate change is still relatively limited. Furthermore, the use of Adobe Captivate as a platform for developing learning media has not been widely utilized in geography learning (Rejeki & Mukminan, 2020). Therefore, this research provides a new contribution by presenting CCC as an innovative solution that is in line with the needs of today's students. Based on the background description, this research aims to develop the Climate Change Course (CCC) as an interactive multimedia learning tool using the ADDIE development model. The research focus is directed at the validity, feasibility, and student response to the developed product, so that it can provide a comprehensive overview of the effectiveness of this media in improving the quality of geography learning.

2. Literature Review

2.1. Climate Change Education in Geography

Climate change is one of the biggest global challenges that continues to receive serious attention from various groups, including scientists, governments, and the general public. This phenomenon has a very significant impact on various aspects of human life, ranging from environmental degradation, a decline in the quality of natural resources, threats to economic sustainability, to the emergence of complex social problems. In other words, climate change is not only related to the rise in the

earth's temperature but also concerns the survival of the present and future generations. Therefore, education is seen as the main key to equipping the younger generation to have an adequate understanding and the ability to face the challenges posed. Tibola da Rocha et al. (2020) emphasizes that climate change education should not only function as a means of knowledge transfer, but also must be directed to form positive attitudes, instill sustainability values, and train the skills needed so that students can play an active role as agents of change.

In this regard, education has an important mission to build critical awareness, foster concern, and encourage real action in climate change mitigation and adaptation. In the academic realm, geography has a strategic role in supporting this process. As a discipline that emphasizes spatial analysis, geography provides a framework for understanding the relationship between physical and human factors. Through learning geography, students can study the distribution patterns of climate phenomena, analyze the impact of climate change in various regions, and examine the complex interactions between human activities and their environment. Unfortunately, the abstract nature of climate change material often poses an obstacle for students. Without the support of concrete visualization, the concepts learned tend to be understood superficially

2.2. Interactive Multimedia and Learning Innovation

Innovation in the world of education is developing rapidly along with technological advances. One innovation that is increasingly being utilized is the use of interactive multimedia in learning. This media is designed to increase student engagement through a combination of text, images, animations, audio, video, and

interactive simulations (Priyakanth et al., 2021). Previous research has shown that interactive multimedia can strengthen conceptual understanding, increase learning motivation, and encourage student independence (Wang et al., 2018). The advantage of interactive multimedia lies in its ability to display abstract phenomena visually. For example, the use of animations and 360° videos allows students to understand the process of climate change that cannot be observed directly. In addition, the automatic evaluation feature provides real-time feedback, so students can immediately know their level of mastery. Thus, interactive multimedia functions not only as a tool but also as an independent learning partner.

In this context, the Climate Change Course (CCC) was developed using the Adobe Captivate application. This application offers flexibility in creating animations, embedding videos, and compiling interactive quizzes with results that can be directly accessed by students. Alabay and Bastürk (2021) research states that the use of Adobe Captivate in learning is able to provide a more interesting and effective learning experience compared to conventional methods. However, research that specifically uses this platform to develop geography learning media, especially on the topic of climate change, is still limited. Therefore, the development of CCC provides a new contribution to the use of learning technology that is relevant to the needs of the digital generation of students.

3. Methods

This research uses a Research and Development (R&D) approach with the ADDIE development model which consists of five stages, namely Analysis, Design, Development, Implementation, and Evaluation. The selection of the ADDIE model is based on its systematic and flexible advantages for producing valid, practical, and effective learning products. The analysis stage was carried out to identify learning needs for climate change material. At this stage, a study was conducted on students' difficulties in understanding abstract concepts, the characteristics of students, and the availability of existing learning media. The needs analysis showed that most students have difficulty understanding the relationship between human activities and climate change due to the absence of media that presents concrete visualization.

The design stage includes the formulation of learning objectives, the preparation of material, and the selection of an appropriate media format. At this stage, it was decided that media development would be carried out using the Adobe Captivate application, because it has the ability to integrate various types of learning elements, starting from text, images, animations, 360° videos, and interactive quizzes that can provide direct feedback to students. The initial design also contains a tutorial-based learning flow that guides students step by step in understanding the concept of climate change. The development stage was carried out by realizing the design into the initial product of the Climate Change Course (CCC). This product contains climate change material presented in the form of interactive maps, animations, 360° videos, and automatic evaluation exercises. At this stage, validation was carried out by media experts and material experts to ensure the quality of the

product in terms of content, language, and technical aspects. This validation is the basis for making improvements before the product is tested in the classroom.

The implementation stage is to test the product on students. The fifth stage is evaluation, which is carried out both formatively and summatively. Formative evaluation is carried out at each development stage to correct the shortcomings found. Meanwhile, summative evaluation is carried out after implementation to assess the overall feasibility and effectiveness of the product. The evaluation results showed that the CCC media was suitable for use as a learning tool with a positive student response of who stated that they were interested and helped in understanding climate change material. Thus, the R&D method through the ADDIE model allows for the development of learning media that is in accordance with student needs and has been proven effective in supporting the geography learning process, especially on complex and abstract climate change topics.

4. Results and Discussion

This research resulted in the Climate Change Course (CCC) product which was designed as an interactive multimedia learning tool with the main goal of supporting students' understanding of climate change material in geography subjects. This product was developed using the ADDIE development model which includes five stages: analysis, design, development, implementation, and evaluation. Each stage was carried out systematically so that the resulting media is not only valid in terms of content, but also practical, attractive, and in line with the needs of students in the classroom.

At the analysis stage, it was found that the majority of students still have difficulty when learning about the topic of climate change. This is due to the characteristics of the material which tend to be abstract and complex, making it difficult to understand if only delivered with conventional methods, for example, teacher lectures or verbal explanations. In practice, students are often only able to memorize definitions or terms without truly understanding the cause-and-effect relationship or the real impact caused by climate change. This difficulty is in line with the results of Bentz (2020) research which confirms that the topic of climate change requires concrete visualization to be more easily understood by students. In other words, without the support of relevant media, students only reach the stage of surface knowledge and have not yet achieved a deep understanding.

Based on these needs, this research designed an interactive multimedia-based learning media by utilizing Adobe Captivate as the main platform. Adobe Captivate was chosen because it has the ability to integrate various types of learning elements, from text, images, animations, audio, 360° videos, to interactive quizzes that can provide a more complete and enjoyable learning experience. The developed CCC product is in the form of a tutorial that guides students step by step in understanding climate change material. The structure of the material presented includes the definition of climate change, the causal factors of climate change, the impact of climate change on human life and the environment, and mitigation and adaptation efforts that can be carried out in various regions (Fawzy et al., 2020).

To strengthen students' conceptual understanding, this media is also equipped with an interactive map that displays spatial data related to the phenomenon of

climate change (Eggert et al., 2017). For example, the distribution of areas vulnerable to disasters due to global warming can be clearly visualized through the map. In addition, animations were also added to illustrate scientific processes such as the greenhouse effect, polar ice melting, and sea-level rise. This animation has been proven to be more effective than verbal explanations alone because students can see the process that occurs directly. This media is also enriched with 360° videos that show a real simulation of the impact of global warming, such as melting polar ice, coastal tidal floods, and forest fires due to extreme temperatures. With the integration of various forms of visualization, abstract material becomes more concrete and easier to understand.

In addition to presenting the material, the CCC product also provides an automatic evaluation feature in the form of an interactive quiz. This feature allows students to work on problems directly through the media, then get feedback on their level of success. The existence of this instant feedback helps students evaluate their learning achievements, as well as motivates them to correct their mistakes. This finding is in line with Priyakanth et al. (2021) research which shows that interactive feedback in multimedia can increase student motivation and understanding. In other words, CCC does not only present information, but also functions as an independent learning media that encourages learning independence.

The media development stage was continued with expert validation, both material experts and media experts. The validation results showed that CCC was considered valid and feasible for use from various aspects, including content, language, visual design, and interactivity. Several revision suggestions were given, for

example, simplifying the language to be more suitable for the understanding level of high school students, and adjusting the display layout to be more attractive and easy to understand. After the revisions were made, the media was then implemented in the classroom learning process. The majority of students rated this media as much more interesting than conventional methods because of its attractive appearance, ease of use, and accessibility on both computers and mobile phones. Students also admitted that it was easier to understand climate change material which was previously considered difficult and confusing. They assessed that the presence of animations and 360° videos was very helpful in visualizing abstract phenomena. This is in line with the findings of Hanif (2020) research which states that interactive multimedia has been proven to be able to increase conceptual mastery and the effectiveness of the learning process.

In addition to facilitating understanding, data from the questionnaire also showed an increase in students' self-confidence in answering questions after using this media (Astutiani & Isnarto, 2021). This indicates that CCC not only improves the cognitive aspect, but also has a positive impact on students' affective and motivational aspects. In terms of motivation, students appeared more enthusiastic about participating in learning. This media is felt to be in line with the characteristics of the millennial and Generation Z who are familiar with digital technology. With flexible accessibility through mobile devices, CCC can be used not only in the classroom, but also independently at home. Thus, the scope of learning becomes wider, not limited to face-to-face interactions, but includes a flexible digital learning experience. This finding is consistent with the opinion of Wang et al. (2018) who

stated that an attractive multimedia display can increase student engagement and foster learning motivation.

Furthermore, the use of CCC also provides important affective implications. Through simulations of the impacts of climate change, students not only learn to understand concepts cognitively, but also feel the urgency of environmental issues emotionally. When they see simulations of melting polar ice or forest fires due to global warming, students feel a closeness to the issue and are encouraged to care more. This has the potential to foster environmental awareness and a caring attitude towards real global problems around them. Thus, CCC has a dual function strengthening conceptual understanding while also instilling the value of environmental care.

However, this research is not without limitations. First, the trial was only conducted in one 90-minute meeting, so the long-term impact on students' learning outcomes could not be measured comprehensively. Second, the number of research samples was limited to only one class, so the generalization of research results still needs to be tested through further research by involving more schools and variations in learning contexts. Third, the research evaluation still focuses on students' responses to the media, while the measurement of the quantitative increase in learning outcomes through pre-tests and post-tests has not been carried out in depth. However, the research findings still show that CCC has great potential as an innovative learning media. This product has been proven to be able to answer the main problems in learning climate change material which has so far been considered abstract and difficult to understand. With an interactive multimedia approach,

students can understand concepts more easily, are more motivated to learn, and are more independent in evaluating their learning achievements.

The discussion of the research results confirms that the use of interactive multimedia based on Adobe Captivate is a very relevant learning strategy in the current digital era. Innovations such as CCC can not only be applied to climate change material, but also have the potential to be developed for other geography topics that are abstract in nature, and even across subjects such as biology, physics, or environmental science. With increasingly sophisticated technological advances, education has a great opportunity to move towards a more interactive, attractive, and meaningful learning model. Therefore, this research opens up a new space for the development of digital learning media that can answer the challenges of 21st century education. By emphasizing the integration of technology in learning, teachers no longer only act as information conveyers, but also as facilitators who provide meaningful learning experiences. Ultimately, the existence of media such as CCC is expected to help students not only understand the material, but also foster awareness, attitudes, and skills that are relevant to facing increasingly complex global issues.

5. Conclusion

This research successfully developed the Climate Change Course (CCC) as an interactive multimedia learning media based on Adobe Captivate which was designed for climate change material in geography subjects. The results of the

development show that CCC meets the criteria of being valid, feasible, and effective for use in learning. This media is equipped with interactive maps, animations, 360° videos, and automatic quizzes that provide instant feedback, so it is able to overcome students' difficulties in understanding the abstract concepts of climate change. The assessment of CCC as an interesting, easy-to-operate, and helpful media in understanding the material. These findings show that CCC not only increases learning motivation, but also encourages independence and strengthens conceptual understanding.

In addition, the use of this media also helps form an environmental care attitude because students can see a real illustration of the impact of climate change through visual simulation. Nevertheless, this research still has limitations because the implementation was only carried out in one meeting and the sample was limited to one class. Further research needs to be carried out to measure long-term effectiveness with a wider scope. Overall, CCC has the potential to be an innovative digital learning media that is relevant to the characteristics of the millennial generation and can be a development model for other geography topics or subjects that are abstract in nature.

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