Understanding Climate Change Material through Immersive Virtual Learning (IVL)

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Understanding Climate Change Material through Immersive Virtual Learning (IVL)

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Abstract: Immersive Virtual Learning is learning that is considered meaningful for students to study climate change material which is considered complex because of the many interactions between the systems involved in it, and is considered to be material that is quite challenging for students. It is known that there are still many students who have limited knowledge about climate change so that learning methods are needed that can help them understand the climate change material well. This study aims to see how students' understanding after learning using the Immersive Virtual Learning (IVL) learning method, compared the understanding of students using conventional learning methods. Using the Pre-Post Experiment Control Group Design design and involving 59 students who were divided into treatment and control classes, produced research data showing that students' understanding in the two classes experienced significant differences in improvement, but the increase in question was very small, even though the class treatment experienced a better increase than the control class. Based on this, it can be concluded that students' understanding has increased slightly after learning to use the Immersive Virtual Learning method. Further research is needed to develop the IVL method in order to provide better learning outcomes.

Keywords: Climate Change; Immersive Virtual Learning

Introduction

Climate change is a problem that is currently being considered seriously by various groups of people around the world, especially by the world's climate scientists. The world's population is worried about the problem of climate change. This is because the problem of climate change is considered a problem that determines the sustainability of life in the future (Dimitrov, 2010). Involving children in understanding climate change is a goal that needs to be realized for the sake of sustainable life in the future (Kolleck, 2016).

Education related to the environment, especially an understanding of global warming and climate change, needs to be a provision for students as the younger generation who will continue the lives of previous generations on this earth, so that with this they are able to make policies and decisions, as well as actions that are appropriate to the situation and conditions. in overcoming problems related to the environment, especially climate change (Cutter-Mackenzie & Rousell, 2019). However, it is very unfortunate that the knowledge of the public and students regarding the concepts of climate change is still limited (Riess & Mischo, 2016). It was further explained that the complexity of the concept of climate change is one of the causes of students' lack of understanding of the concepts of climate change. Students tend to only adequately understand one-way causal relationships in the concepts contained in the climate change system, even though the

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concept of climate change is a concept with complex system relationships. Therefore, knowledge and understanding of climate are basic things that students need to understand (Kisauzi et al., 2012).

Students' knowledge of various issues related to climate change is an important thing to note, because the level of quality of their knowledge will determine how much contribution they can make to preventing climate change, both at the personal, national and global levels (Assan, 2015). Decisions and policies taken by students are a form of participation by the younger generation in dealing with the impacts of climate change (Barab et al., 2005).

Therefore, understanding students on the concepts of climate change is essential for teachers, because the knowledge they have will be utilized in the future. Submission of the material is certainly delivered in a way that is good and easily understood by students. It is widely recognized that creative, innovative and effective learning is needed by students all over the world (Selby & Kagawa, 2010). According to (Monroe et al., 2019) in his writings explains that climate change education requires student centered concentration and focus that includes relevant, challenging, and meaningful personal contexts.

Against the background of some of these problems, the author therefore intends to provide meaningful learning to students in the form of immersive learning and is known as Immersive Virtual Learning (IVL). The Covid-19 pandemic has broadly changed the way of students study in all regions, even around the world, so that an innovative and creative learning method is needed and it becomes a meaningful learning activity that can be applied anywhere without being limited by distance. According to Markowitz et al. (2018), students' knowledge and curiosity about climate change increased after they used the IVL method in their learning. The same thing was also stated by (Parong & Mayer, 2021), besides experiencing an increase in terms of knowledge, motivation and enthusiasm for student learning has also increased. Therefore, in this study researchers want to know how students understand climate change after learning using the Immersive Virtual Learning method.

Method

The design used in this research is the Pretest-Posttest Control Group Design which is a type of research design in the Quasy Experimental Research method. The character of this design is the absence of random selection and each group is given a pretest before the treatment is given and a posttest after the treatment is given. Participants in this study consisted of 59 students from two classes in grade 7 of a junior high school in Lamongan Regency, East Java. The selection of participants could not be done randomly because the researchers followed the advice and approval given by the school.

Before learning begins, the pretest is first given to students in the treatment class and control class. After that, the treatment class will carry out learning using the Immersive Virtual Learning method, in which students carry out many learning activities, including conducting greenhouse effect experiments as an effort to understand students about the process of climate change which begins with global warming.

The students also watched the Virtual Field Trip (VFT) video shown by the teacher after they carried out the experiment. The VFT video is given to students with the intention that students can find out in real terms that there is climate change that is happening, both in an environment far from where they live, and in the environment around students. One of the contents of the video is concrete evidence of climate change, namely its impacts and causes. Together with their group members, students answer the questions in the LKPD based on the observations in the VFT video. In addition, students are also given the task of observing and observing the conditions around their homes, of course conditions related to the causes and impacts that occur due to climate change.

The teacher also held a webinar with one of the NGOs working in the field of climate care, which is called Greenpeace. The webinar is also used by teachers as a way to understand students about the concepts in climate change material. During the presentation process from the speaker the students answered the questions contained in the LKPD. This is done with the aim of guiding students to understand the material that has been delivered by speakers from NGO/Greenpeace parties. After the webinar activity is carried out, students are invited to ask questions and discuss with the presenter about the material presented by the presenter. During teaching and learning activities, the teacher also uses the lecture method as a support to explain material/concepts that are difficult for students to understand while participating in several IVL learning activities.

Meanwhile, students in the control class learn through group discussion methods carried out by students with students, and students with teachers, as well as lecture methods carried out by teachers. Students in the control class spent most of their time discussing problems arising from the impacts of climate change. Discussions carried out by students refer to the LKPD that has been provided by the teacher. The LKPD contains climate change issues that students need to discuss with their group members. The lecture method

is also applied by the teacher to provide a complete explanation to strengthen the meaning of what students are doing about climate change. After the entire series of learning activities has been completed, the teacher then gives a posttest in the treatment class and control class.

Data regarding students' understanding of climate change material obtained from the pretest and posttest were analyzed using the SPSS application. First, descriptive analysis was carried out on the pretest data. Because the pretest results showed significant differences between the treatment and control groups, the next step taken by the author was to analyze the gain value from the data for each treatment and control class to see how big the difference or improvement occurred in the two classes.

Result and Discussion

An understanding of climate change is an understanding possessed by students regarding the concepts contained in climate change material, both related to the causes of climate change, the ongoing process of climate change, and the impacts that occur as a result of climate change. Learning about climate change is considered material that is quite challenging and difficult for students to understand, because it also involves complex system interactions (McNeal et al., 2014).

The knowledge that students have about climate change is considered to be important and has an impact on students, because it will influence their attitudes in making policies on problems related to climate change, especially the increasingly worrying impacts of climate change (Assan, 2015). But unfortunately, the results of previous research conducted by Riess & Mischo (2010) shows that there are still many students whose knowledge about climate change is still inadequate. This is in line with the results of this study which show that students' knowledge of climate change is still limited, even with an increase in their knowledge after carrying out immersive learning or with Immersive Virtual Learning (IVL) and conventionally. Both showed unsatisfactory results, both in the treatment class and in the control class. The knowledge of the students in the two classes showed a not so great increase, where the average gain in the treatment class was only 15.52 and in the control class was only 09.17. The results of the data analysis are shown in more detail in Table 1.

Table 1. Pretest and Posttest Analysis Results

Data Type		Pretest		Gain	
		Exp	Control	Exp	Control
The number of students		29	30	29	30
Average		62.07	50.67	15.52	09.17
Standard Deviation		11.54	7.279	8.49	3.96
Normality test	Sig.	0.02	0.001	0.002	0.00
	Inter.	Abnormal		Abnormal	
Homogeneity Test	Sig.	0.001		0.000	
	Inter.	Inhomogeneous		Inhomogeneous	
Mann Whitney test	Sig.	0.000		0.000	
	Inter.	Significantly different		Significantly different	

The results of the data analysis in Table 1 show that the pretest of students in the treatment and control classes showed significantly different results. Therefore, the authors then conducted a follow-up test, namely testing the gain value of the student knowledge data in each treatment class and control class. The results of the calculation of the gain value then show that the two classes also have significant differences, with an average gain in the treatment class of 15.52 and 09.17 in the control class. The mean difference in these two classes shows that the treatment class experienced an increase in average scores that were greater than the control class. This means that students in the treatment class get better learning outcomes than the learning outcomes of students in the control class. This can happen because student learning in the two classes is carried out in different ways or methods.

Students in the treatment class use the Immersive Virtual Learning (IVL) method to study climate change material, while students in the control class use learning methods that are carried out daily by students and teachers in that class, namely the group discussion method and lectures by the teacher. IVL learning can provide better learning outcomes for students in treatment classes because this learning can guide students in studying the material and concepts in it effectively and efficiently (Rao & Saha, 2019), and can provide new knowledge to students in the form of visual information (Huang et al., 2020).

According to the results of previous research conducted by Petersen et al. (2020) shows that learning with the IVL method can increase the knowledge possessed by students. This is because immersive learning is designed to create an interesting, participatory and collaborative learning experience for students who apply it (Dawley & Dede, 2014), and this learning method makes it possible to show a process that takes a long time to be shorter, so that a phenomenon that takes days, weeks, even years, can be simulated in only a very short time, even up to seconds (Gee, 2000),

compared to conventional learning. This learning is appropriate when applied in teaching climate change material, where the process takes quite a long time and the concept is quite abstract.

The learning method used in the control class is considered no better for teaching climate change material, because this is proven by the increase in the average score of students in that class which is smaller than students in the treatment class. This happens because the performance of students in the group is not optimal. In fact, according to Sachmpazidi et al. (2021), Success in group work is determined by how much active participation each member of the group has. In addition, another thing that made the increase in students' knowledge in the control class no better than students in the treatment class was the questions on the LKPD. The questions the students worked on turned out to be irrelevant to the case readings provided, so students felt confused in answering these questions, and finally students who had an internet quota could find answers on the internet, while students who didn't have a quota just kept quiet. and wait for an answer from their friends, in other words those who don't have a quota will wait for an answer from their friends. Insufficient internet access is one of the factors hampering the learning process in the current modern and digital era (Handayani & Jumadi, 2021).

Even though both classes experienced an increase in learning outcomes and knowledge about climate change material, both showed not so great an increase. This shows that students' knowledge of climate change is still insufficient and inadequate. The same thing was also expressed by Lambert et al. (2012). The results of his research show that students still do not have enough knowledge about climate change, there are even some of them who still have misconceptions about basic concepts regarding climate change material (McCuin et al., 2014).

Several things are the cause of the low increase in students' knowledge in the control class one of these things is the existence of obstacles in the learning process that is carried out, so that it can affect their learning processes and outcomes (Handayani & Jumadi, 2021). The teacher experienced several obstacles, the first of which was the limited time for teaching and learning in class. In fact, teaching science to students requires sufficient and flexible time (Tan, 2018) and time has an important role and is also essential in learning, especially learning that is integrated with technology (Tawfik et al., 2021). The second obstacle is the students' lack of concentration on the teacher's explanation. This is because they play games on their gadgets when the teacher gives an explanation. (Meutia et al., 2020)said that addiction to playing games can affect students' interest in learning.

The third obstacle is that students' work in groups is not optimal. Most students in the group only rely on 1-2 people to do their group assignments, while the others only copy the work of their friends. In fact, success in achieving group work results comes from balanced cooperation between each member of the group (Sachmpazidi et al., 2021). The next obstacle is related to technical aspects of learning. Therefore, preparing learning tools and designs is an important thing for the teacher to do before learning is carried out, because according to Meutia et al. (2020) well-designed learning will be carried out well too.

The level of difficulty in working on the test questions also determines the success of students in answering the test questions. Based on the results of the analysis on the posttest data for the treatment class (Figure 1) and the control class (Figure 2), it is known that questions with cognitive levels C3-C5 found many errors in the questions in that category. Questions at the C3C5 level have a fairly high problem complexity and require higher-order thinking skills or known as HOTS. Unaccustomed to working on HOTS questions causes students to find it difficult to work on these questions. Referring to the results of the data analysis, it can be seen that students' higher-order thinking skills are still not well honed and students are considered to be less capable in solving these questions. The same results were also found by Megawati et al. (2020) in their research, where they said that the majority of students had low higher-level thinking abilities, especially evaluating abilities. According to (Irawati, 2018), This is because students are not used to working on test questions in the HOTS category.

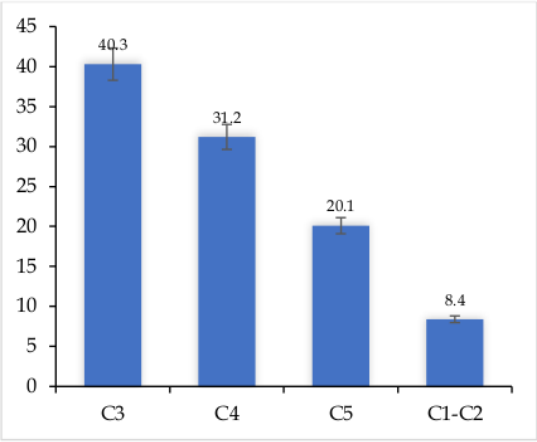

Figure 1. Proportion of Number of Errors on Experimental Class Posttest Questions

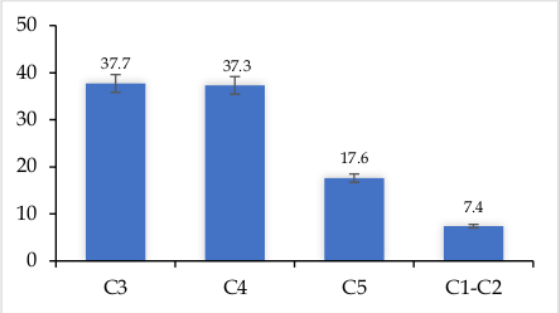

Figure 2. Proportion of Number of Errors in Control Class Posttest Questions

Students' higher order thinking abilities need to be retrained through improving their learning styles Di et al. (2019). According to Abdullah et al. (2020) in his writing explained that, technology-based learning tools can improve students' higher-order thinking skills. However, this can be realized if students can make optimal use of these technology-based learning tools (Pletz & Zinn, 2020), because in reality, in this research the use of technology in the immersive virtual learning learning method resulted in less than optimal results, especially in training students' high-level thinking skills in understanding climate change material.

The technology used in immersive learning is not certain in general that it can improve learning outcomes, but this only applies to certain fields and if the application of the technology is carried out effectively (Back et al., 2021). Therefore, it is necessary to evaluate and make special improvements that are suitable for use in the IVL learning method in order to obtain better learning outcomes in the future.

Conclusion

Based on the results of data analysis and further discussion of students' understanding of climate change material after learning using the Immersive Virtual Learning method, it can be concluded that students' understanding of climate change has increased. The increase in understanding that occurred in students in the treatment class after being analyzed was significantly different. The increase in understanding of climate change material for students in the treatment class was better compared to the increase in understanding of climate change material for students in the control class. Even though the treatment class and control class experienced an increase in learning outcomes or increased understanding of climate change material, both improvements were not that big, so it can be said that students' understanding of climate change, both in the treatment class and in the control class, is still limited and needs to be improved again through use of more effective learning methods, or use the IVL method which has been further developed and improved. There are several external factors that influence the learning process, namely the lack of time used by the teacher to teach inquiry-based climate change material. This limited time made the teacher not have the opportunity to explain in more depth about the climate change material, especially explanations related to the results of experiments conducted by previous students. The next external obstacle is technical constraints, namely the internet network and learning facilities. Both of these things are not well facilitated when they will be used in learning, so that this can affect the smooth running of teaching and learning activities so that they affect the learning outcomes obtained after the learning process has been completed.

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Author Contributions

Conceptualization of themes and content in this article was carried out by Gusti Rusmayadi and Marsella Desriyarini, research method by Gusti Rusmayadi, Marsella Desriyarini, and Nelli Roza, with Asita Al Mufida using software. The data validation was carried out by Gusti Rusmayadi, Marsella Desriyarini, Nelli Roza, and Asita Al Mufida. Writing reviews and corrections, as well as funding in research by all authors. As for administrative matters handled by Nelli Roza and Asita Al Mufida.

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Conflicts of Interest

The authors declare no conflict of interest.

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