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Improving Understanding of Climate Change Through "Climate Change Training" for Junior High School Students

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Abstract

Climate change is an important educational issue that contributes to sustainable development. Students in urban areas play an important role as key contributors in mitigating the worsening climate change. This activity aims to increase the understanding of climate change among junior high school students in urban areas. The method used is a classical face-to-face approach with socialization and games using climate flashcards to convey information related to climate change. The evaluation results showed that the students' average knowledge of climate change reached 74.3%, but there was a lower understanding, namely 34.6%, related to adaptation and mitigation efforts. This finding shows that although the students' knowledge level is quite high, a comprehensive understanding of climate change is still lacking. Through this training, an increase in students' understanding of 93% was recorded, indicating that the socialization and game method using climate flashcards was effective in improving students' comprehensive knowledge of climate change. Therefore, this "climate change training" can be an effective model for climate change education for students.

Keywords*: climate change, training, students*

1. INTRODUCTION

Climate change is an important issue that requires the attention of all communities because of its broad impact on areas of human life. Climate change is a change in average weather patterns that occurs over a long period of time and affects the Earth's climate at local, regional, and global scales (Sumampouw et al., 2021). Climate change in the 21st century is caused by human activities that have an impact on increasing the average temperature of the Earth's surface. The quality and quantity of water, habitat, forests, health, agricultural land, and coastal ecosystems may also be affected by climate change. Climate change needs the attention of the entire community, including the world of education, one of which is students. Educating students about climate change can equip them, as a generation of people who will be leaders in the future, to adapt to and mitigate climate change as it occurs. Knowledge and information about climate change can be used for climate change adaptation mechanisms to reduce the impacts (Erekalo & Yadda, 2023).

The climate changes that occur can be seen from the occurrence of climate anomalies, one of which is El Nino. The El Nino anomaly experienced by Indonesia triggered a drought that affected various sectors. Based on (NCEI, 2024), the El Nino phenomenon, which was in the spotlight in December 2023, continues to dominate the anomalous pattern of tropical rainfall in the ocean and land with its dry conditions. 2023 was recorded as the hottest year on record, and December was also the warmest December. El Niño contributes to an increase in warm surface temperatures (in addition to its general contribution to global warming). In 2023, Asia recorded the second hottest year on record across the continent, with parts of Russia, China and southern countries drier than usual for the year; Southwest Asia experiences a very severe and widespread drought in 2023.

The occurrence of climate change is one of the causes of a potential global food crisis (BMKG, 2023) which is characterized by a decline in the production of major food crops, fluctuations in food prices, and a decline in the quality of community food security (Saefudin, 2023). The Food and Agriculture Organization (FAO) warns that there is a potential for a food crisis as a further impact of the COVID-19 pandemic, so food security needs to be improved. Very extreme climate change will have impacts such as increased incidence of typhoid, malaria, and fever; increased frequency of natural disasters; threats to water

availability; the occurrence of shifts in seasons and rainfall patterns; declines in agricultural productivity; increased temperatures; threats to biodiversity; and sea level rise (Malino et al., 2021). Global climate change must be addressed and requires collective action from all levels of society. The Climate Change Education for Sustainable Development (CCSED) program is part of UNESCO's efforts to strengthen scientific capacity, increase knowledge, and promote mitigation and adaptation in countries and communities vulnerable to climate change.

Climate change plays an important role in the world of education that contributes to sustainable development. Education or knowledge related to climate change helps people to understand and cope with the impacts of the emerging climate crisis. It can also equip them with the knowledge, skills, values and attitudes needed to act as agents of change (UNESCO, 2023). The goal of climate change education is to change long-term behaviors and develop ideas to address and provide solutions to climate change problems in the future (Rahmah, 2022). The education sector has an important role to play in mitigating increasingly severe climate change. This is because education can become a bridge between communities to equip them with knowledge related to climate change, so that in the future they can contribute to efforts to prevent and address climate change. As we know, human activity, especially in urban areas, is the largest contributor to increasing carbon emissions. Therefore, knowledge about climate change needs to be increased from an early age.

Climate change education must give hope to people who are oriented towards the future based on a critical but positive perspective, because if they are not prepared from an early age, children will experience anxiety and will not know how to mitigate and adapt to climate change (Hilander et al., 2023) .Adaptation is the adjustment of ecological, social, or economic systems in response to climate change and the reduction of the impacts of climate change or the use of new opportunities as interventions for the impacts of climate change, with the assumption that the transformation of the Earth's climate cannot be prevented and altered (Sgambati, 2023). Early climate change education is a useful starting point for long-term behavior that is an effort to improve health in the face of climate change (Kalhoff et al., 2023). Education has an important role to play in local and global efforts to mitigate and adapt to climate change (UNESCO, 2023). Supporting children and young people to have the knowledge and skills to take climate action through active participation can increase their potential to address climate change (Ritchie, 2023).

Climate change education can be built through formal education at the secondary level. Increasing students' knowledge about climate change is very important to support the SDGs related to climate change education. The role of students as agents of change in the future will have an impact on the climate in the future. Therefore, community service for students in SMP N 2 Karanganyar needs to be carried out to support climate change education with the aim of providing knowledge and education to students so that students know about mitigation and adaptation that students can do from an early age. The service team will conduct outreach and games using flashcards as a medium to deliver material to make it easier for students to understand climate change so that students' knowledge about climate change can increase.

2. METHODOLOGY

The method of this training activity is classical face-to-face and games with flashcards. The material presented includes basic understanding, the process of climate change, and mitigation and adaptation activities for the impacts of climate change. The flashcard game is conducted by forming students into 6 groups and each group discusses the causes of climate change, the process of climate change, and the impacts of climate change using working tools, namely flashcards, which are then arranged through mind mapping and ending with a presentation of the students' results.

The location for the community service study activity was conducted in SMPN 2 Karanganyar, Central Java in June 2024. The selection of the location for the community service study activity was based on the actions of concern for climate change identified at the school level from the existence of "Environmental Care" extracurricular. Moreover, this location is one of the green schools in the Karanganyar Regency area. The activity stages include preparation, such as observing initial conditions, consultation, training and implementation activities. Measuring the success of community service study activities is done using pre-test, post-test, and mind mapping. The pre-test and post-test were conducted using a structured questionnaire to determine whether there was an increase in students' knowledge about climate change before and after the socialization was conducted. The success of the idea mapping (mind mapping) will be measured by the degree of conformity of the mind mapping created by the students with the socialization that has been carried out.

3. RESULT AND DISCUSSION

Socio-demographic Characteristic

From the results of the pre-test and post-test questionnaires distributed, a total of 26 junior high school students filled in. Table 1 shows the socio-demographic characteristics of respondents in community service study activities. Based on the data collected, there were 14 male students and 12 female students. The average age of all respondents is 14.19 years. Meanwhile, the length of study or class level is junior high school students who are in grade 8. Of all the respondents, this research shows that almost all students take part in organizational or extracurricular activities outside of class with an average of at least 1 activity.

Tabel 1. Socio-demographic characteristic

Variable	Average
Number of male students	14
Number of female students	12
Student age (year)	14.19
Student education (year)	8
Organization (frequency)	1

Student Knowledge of Climate Change

Community service study activities begin with conducting a pre-test on training participants to measure knowledge about climate change. The pre-test is carried out by asking several questions and calculating the results of the answers. Figure 1-2 is a response to the pre-test that was carried out. Based on Figure 1, it shows that (92.3%) students know about climate change, then (100%) students stated that they know the impacts caused by climate change.

In general, junior high school (SMP) students have obtained and have basic knowledge about climate change. This knowledge is obtained, one of the ways, through the subjects at school which are included in the learning curriculum. They understand climate change to be an ongoing global phenomenon, characterized by rising temperatures, changes in weather patterns, and an increase in the frequency of natural disasters. This is proven by the pre-test results that (92.3%) students know about climate change.

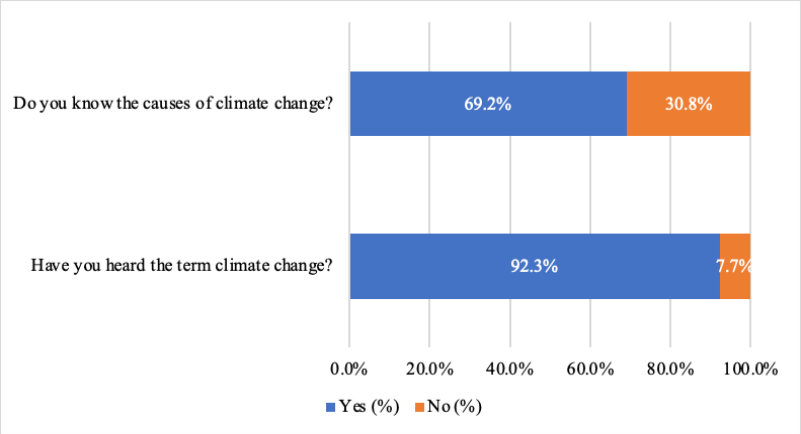

Figure 1. Pre-test result of the student's knowledge -1

"I know that climate change exists and has been discussed in previous classes. But we still don't understand how the process occurs to cause serious effects" (Student 1)

"Before it was discussed in the subject, but we only understood that climate change causes temperatures to rise and weather to change" (Student 2)

Climate change is understood not only as a phenomenon that can be felt and is happening. Students also understand the consequences of climate change. This can be seen from the responses that (100%) of the students are aware of the effects of climate change. The high level of students' knowledge about the effects of climate change is related to the many sources of information that report on disasters. From this we can see that the students know that there are impacts caused by climate change by increasing the frequency of disasters occurring, but not all students know that in this case the impacts are disasters related to climate change. The impact of climate change is interpreted as an extreme event that causes an increase in the frequency of natural disasters. This is consistent with data from 1985 to 2019, there were 10,438 floods, 6,050 landslides, 2,124 droughts and 1,914 forest fires that occurred in Indonesia (Yulianto et al., 2021).

"I can feel the effects of climate change now, hotter temperatures and unpredictable weather" (Student 3)

"During the dry season, the water source near my house dries up, and during the rainy season, it also floods" (Student 4)

The occurrence of climate change has an impact on fluctuations in rainfall and an increase in air temperature. This is evidenced by the average rainfall data, where there has been a fluctuation and increase in the average air temperature over the last few decades. In addition, changes in weather patterns and increases in air temperature cannot be separated from the influence of El Nino and La Nina events, which are weather anomalies in the Pacific Ocean near the equator that periodically affect Indonesia (Arum et al., 2023).

Based on the results of the community service studies, it shows that the high level of knowledge about climate change and its impacts (Figure 1) does not match the knowledge about the causes and the mitigation and adaptation efforts that can be undertaken (Figure 2). This can be seen from the data that only (69.2%) of the students know the causes of climate change and only (34.6%) of the students know about mitigation and adaptation efforts in

dealing with climate change. Based on these data, it is understood that there are misunderstandings regarding the climate change that is taking place.

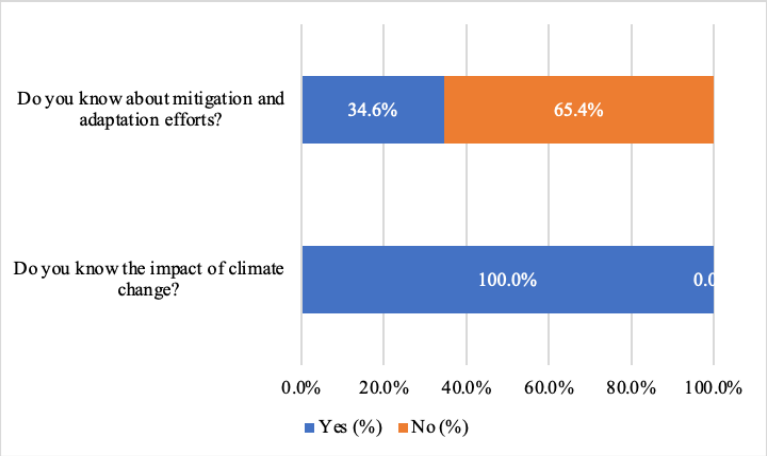

Figure 2. Pre-test result of the student's knowledge -1

"Climate change is caused by air pollution from vehicle fuels, electricity use, and factories" (Student 2)

"Climate change is caused by the earth getting hotter due to more and more pollution" (Student 4)

"I don't know which gas causes climate change, maybe CO2?" (Student 1,3)

Figure 2 shows that there are still many students who do not understand the causes of climate change. Based on the results of the interviews, the majority of students stated that the cause of climate change is air pollution, but did not understand exactly which pollutant gases contribute to climate change. In addition, the majority of students could not coherently explain how pollution can cause climate change or the process by which climate change occurs.

The next concern is that there are only (34.6%) students who understand efforts to mitigate and adapt to climate change. This low understanding is due to the lack of comprehensive knowledge about climate change. The majority of students cannot make a connection between the effects of climate change and the mitigation and adaptation efforts that can be made. This contributes to an incomplete understanding of climate change.

Socialization Activities and Climate Flashcards Games by Students

The community service activities in the "Climate Change Training" use two methods, namely classic face-to-face sessions and games using climate flashcards. These two methods are designed to comprehensively increase students' understanding of climate change. In the first method, the classical face-to-face session, students are given information on the basic understanding of climate change, including the difference between weather and climate, global warming and climate change, the process of the greenhouse effect, natural cycles and human impacts, and mitigation and adaptation in facing climate change. The classical session is not only one-way, but is followed by discussions and question and answer sessions in which students actively participate. Apart from the classical session, it is equipped with material delivered through educational videos on the process of climate change.

Figure 3. Classical face-to-face session presentation regarding climate change

The second method used to increase students' knowledge about climate change is a game with Climate Flashcards. Climate Flashcards are cards with 32 images that interpret information related to the causes, processes, and impacts of climate change events. Using Climate Flashcards, students are guided by a facilitator to organize the process of climate change in a coherent way (Figure 4). Thus, through this method, students can express a comprehensive understanding of the causes, processes, and impacts of climate change by creating Climate Flashcards (Figure 5).

Figure 4. Climate Flashcards and mindmapping game

Based on Figure 4-5, students can explain that climate change is caused by various human activities such as agriculture, livestock, and transportation. In addition, human activities leave a residue in the form of greenhouse gas pollution, including CO2, CH4, and N2O. Uncontrolled human activities cause an increase in emissions that cannot be absorbed by carbon sinks, resulting in heat being trapped in the earth. The increase in heat-trapping greenhouse gas emissions causes an increase in seawater temperature, an increase in air temperature, a rise in sea level, and the melting of polar ice. This will disrupt the rainwater cycle, causing climate disasters such as droughts, heat waves, floods, and difficulties in obtaining clean water. The widespread effects will cause many problems in various sectors such as agriculture with a decrease in crop yields, health with the spread of disease outbreaks, and the economy with an increase in poverty and inequality.

Figure 5. Results of the Climate Flashcards and mindmapping games.

Increasing Students' Knowledge and Understanding of Climate Change

In order to measure the students' knowledge and understanding after participating in the "Climate Change Training", a post-test was conducted by asking them the same questions as in the pre-test (Figure 6). Based on the results of the post-test, it can be seen that the students' knowledge and understanding of climate change has increased. In the statements related to knowing about climate change, there was an increase in the percentage of students from before (92.3%) to (100%). After participating in the "Climate Change Training" activity, all students understood and were able to explain climate change.

"After taking part in this activity, I understand more about climate change, which I had only heard about before but did not fully understand the causes, processes and impacts that occur" (Student 3)

For the second statement about the effects of climate change, the pre- and post-test results show that all students know the effects of climate change. The impact is the most dominant statement known by the students before the training. After the training activities led to increased knowledge about climate change, students' understanding of the impacts of climate change became comprehensive. An increase in the frequency of disasters and the emergence of socio-economic problems are consequences caused by the effects of climate change.

In the third statement regarding the causes of climate change, there was a significant increase in knowledge after the training activities. Based on the pre-test results, it showed that (69.2%) students knew the causes of climate change, but after the training activity, the percentage of knowledge increased by (81%). The increased knowledge about the causes of climate change is understood by the students through the socialization information provided. Apart from that, the knowledge related to the causes of climate change is strengthened by the activities through the Climate Flashcards game. Figure 5 shows that students can clearly organize the activities and processes that cause climate change.

In addition, the final statement measuring the increase in knowledge related to climate change is shown in Figure 6. Based on Figures 2 and 6, there has been a significant increase in knowledge regarding mitigation and adaptation efforts in dealing with climate change. This is shown by the increase in the percentage from (34.6%) to (92%). This significant increase in knowledge shows that the Understanding of Climate Change training provides students with a comprehensive understanding of climate change. By understanding the causes, processes, and impacts of climate change, students have a comprehensive knowledge of action efforts through both mitigation and adaptation in dealing with climate change.

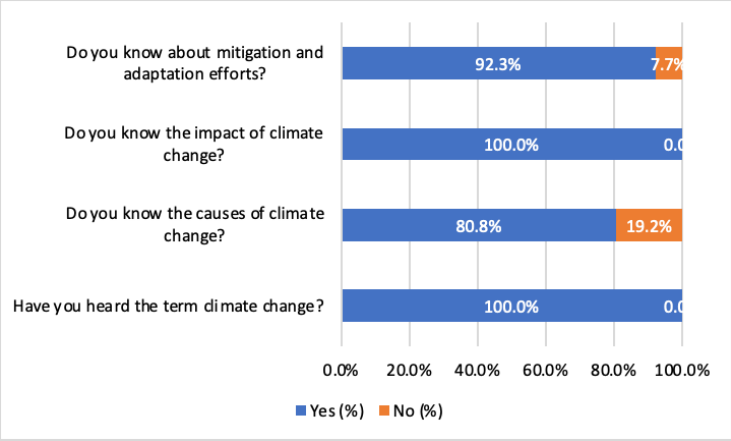

Figure 6. Results of Student Knowledge Pre-test-2

"I came to understand that activities such as not littering, using personal water bottles (tumblers), and using public transportation actually have a big impact on reducing carbon emissions and greenhouse gases" (Student 3).

"Personal actions that we can take to reduce our carbon footprint include choosing public transportation and conserving electricity. Although it is sometimes forgotten, it turns out that this has a significant impact on controlling the climate change that is occurring" (Student 1)

Students' understanding and knowledge of climate change is very important in preparing the young generation to respond to this issue, especially in urban areas. Urban areas are a major contributor to increasing carbon emissions. Through "Climate Change Training", the younger generation can be prepared and equipped with the ability to control and mitigate climate change. This aims to control the increase in disasters and social and economic events resulting from climate change, which are detrimental at both micro and macro levels in the future.

4. CONCLUSION

The Understanding Climate Change training activity has been shown to increase the knowledge and understanding of climate change among urban middle school students. This is evidenced by the increase in the students' pre-test scores (74.3%) to (93%) in the students' post-test scores as measured by four statements. The largest percentage increase was seen in the statements related to adaptation and mitigation efforts, from (34.6%) before the activities to (92.3%) after the activities. This shows that students' high level of knowledge about climate change is not balanced with comprehensive knowledge. Thus, we emphasize that the "Climate Change Training" through socialization and the Climate Flashcards game can help increase students' knowledge of climate change in a comprehensive way.

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