The Importance of Improving Students' Decision-Making on Socio-scientific Issues about Climate Change

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Abstract: Decision-making is one of the important skills that must be possessed by students in the 21st century. One of the topics that require the right decision to be made for each challenge and the impact it will cause is climate change which has already occurred. This study aimed to find out how students' decision-making and the importance of improving these decision-making skills, especially in making decisions on socioscientific issues about climate change. Data collection was carried out for one day through questionnaires that were distributed directly to students. In total, 44 junior high school student respondents filled out the questionnaire in this study. The results showed that students made decisions based on their personal feelings and there were indicators of good decision-making that had not been trained in students. Meanwhile, students' knowledge of issues related to climate change was still in the low category. The findings above have implications for teacher strategies in training students' decision-making skills that must be optimized to forge the next generation who can accomplish the problems and make good decisions, especially on issues related to climate change.

Keywords: Students' decision making, Socio-scientific Issues, Climate Change

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Introduction

In the 21st century, science and technology continue to experience rapid development. Everything that was previously thought to be impossible, can now be realized due to the development of science and technology (Yılmaz, 2021). Current technology makes it possible to obtain information easily and quickly, so this is a challenge in itself to produce individuals who can keep up with the rapid spread of information. To help individuals with various challenges in the 21st century can be done through an educational process.

Various types of competencies must be mastered by individuals to survive during the onslaught of the 21st century. Competencies that are expected to be mastered are in the form of soft skills such as creative thinking, innovation, critical thinking, problem-solving, communication, and collaboration (Tuzel-Iseri, 2018). The future of education in the global context has two main goals (The Organization for Economic Cooperation and Development, 2021). First, education needs to be better prepared for the ongoing transformations in the economic, social, and technological fields. Education must develop to realize its mission of supporting individuals to develop as individuals, citizens, and professionals. A good understanding of how global conditions are today is the key. Second, education must be able to assist individuals in achieving the competencies needed to survive in this global era. Therefore, learning in the 21st century must be able to assist students in achieving the competencies needed to face global challenges, where these abilities are technology-oriented and high-order thinking skills.

Based on several competencies that must be mastered by students in facing the challenges of the 21st century, there are important competencies to be trained in students in the learning process, namely decision-making skills. Information in the digital era, which is very abundant and easily accessible, is a powerful tool for making decisions (The Organization for Economic Cooperation and Development, 2022). However, some problems arise, this fast and abundant access to information is a challenge in itself to be able to sort out correct and appropriate information. Therefore, training students in decision-making activities that involve the ability to filter information is very important.

In this modern and global era, it is very necessary to prepare a future society that cannot only be effective in preventing unwanted situations at the individual level but also be part of a society that can make fair decisions about how to reach an agreement on various issues on a large scale. locally or globally (Fang et al., 2019). Decision-making requires high-level skills and strategies that not everyone can develop naturally (Hsu & Lin, 2017). Therefore, it is very important to train decision-making skills for students because, in the 21st century, many problems require quick decisions and are accompanied by careful consideration. Decision-making ability is a process of identifying problems, integrating various information, and choosing the best option from the existing alternatives (Luan et al., 2022).

This decision-making ability requires higher-order thinking skills (Bayram-Jacobs et al., 2019; Kinslow et al., 2019). The decision-making process requires skills in gathering correct information about issues or phenomena and skills in critical and creative thinking so that they can solve problems with solutions. Thus, it is very important to train decision-making skills from an early age to prepare students to face future challenges that require the ability to be able to make the right decisions when facing a problem.

This decision-making ability is important to master to solve controversial issues which are dilemmas in society. In science learning, there are complex issues related to science that require solutions, often referred to as socio-scientific issues. Socioscientific issues (SSI) are a representation of issues in 4 societies related to natural

science in a social aspect (Anagün & Özden, 2010). SSI gives students a role to think like scientists in solving social problems in society. Socioscientific issues (SSI) are complex issues related to science, socially relevant, generally requiring a level of moral reasoning in the process of arriving at a decision and having many solutions (Emery et al., 2017; Garrecht et al., 2020). Socioscientific issues including climate change, food and energy scarcity (Zaikauskaite et al., 2020), as well as decreased biodiversity and sustainable development, are complex issues related to society, science, and technology (Kinslow et al., 2019; Lee, 2007; Sutter et al., 2019).

Climate change is one of the global challenges in the 21st century and will have an even worse impact in the future if efforts are not made to address it (Putri et al., 2022). Climate change is a global challenge that impacts everyone, everywhere (United Nation, 2016). Climate change is a socioscientific issue (Zaikauskaite et al., 2020) that can have an impact on health, life, food security, water availability, and economic growth (Hicks, 2019). Currently, climate change continues to occur, while human attitudes and behavior have not changed much to reduce the impact of climate change (Hicks, 2019). Because in this research a study was conducted on the level of students' decision-making abilities and how important it is to improve these skills to deal with climate change problems that require appropriate solutions and decision-making.

Decision-Making on Socioscientific Issues

To produce the best and accountable decision, there are stages in making a decision. The stages of the decision-making process consist of seven steps, as follows: defining the problem, determining available options, determining criteria, surveying information, conducting analysis, making choices, and conducting reviews (evaluations) (Ratcliffe, 1997). According to Bersch and Herstroh (2005), the stages of decision-making process consist of three stages, as follows: 1) a pre-selectional phase, where students identify problems that require decisions, generate decision-making behavior, and seek information; 2) a selectional phase, where students compare and evaluate various options and reach a decision; and 3) a post-selectional phase, where students underline and defend the chosen decision. Decision-making activities start from defining the problem, making a list of possible solutions to the problem, determining the criteria for the solution to be selected, conducting an informal survey to support available options based on predetermined criteria, analyzing the choice of solutions, making decisions, and evaluating options. taken (Zhang & Hsu, 2019).

There are several examples of socioscientific issues that have been discussed in previous studies. Research conducted by (Gresch et al., 2017) on sustainable development. The first issue discussed was the protection of coral reefs, students were asked to determine steps to protect coral reefs. Then about the coal mining area, and decided on the problem of trout farming location. These topics were chosen because they were considered to be discussed from the point of view of various aspects that met the SSI topic standards. Meanwhile, research conducted by (Lee et al., 2019), raises socio-scientific issues related to shark hunting. This topic was chosen because culturally and economically closer to Hong Kong than the UK, shark fin is a cultural Chinese food consumed at special celebrations such as weddings or birthday parties. So culturally closer to China than

England. Currently, the number of sharks has decreased, so there must be action to reduce shark poaching. This might become a problem and cause different responses between HK and UK students, where HK students have a culture close to shark hunting. In the research, preliminary research was carried out to assess the importance of improving students' decision-making skills on socioscientific issues, especially the topic of climate change which is a dilemma in today's global society.

Method

In this study, data collection was carried out through questionnaires. The questionnaire contains closed-ended questions about how students make decisions and open-ended questions related to students' knowledge of climate change. Questionnaires were given to 44 junior high school students in Bandung City, Indonesia. The data obtained were then analyzed using a descriptive method that aims to describe the extent of students' decision-making abilities so that it will be seen how important it is to improve this ability based on their level of ability when this data is collected.

Results

Students' Decision-Making Skill

Based on the results of the questionnaire data obtained, 75% of students stated that they made decisions based on personal feelings and only 47.7% of students had ever made decisions about environmental issues such as climate change in science learning. The level of student decision-making ability is assessed based on whether or not students carry out the stages of decision-making when deciding something. These stages include defining the problem, seeking information related to the problem, listing possible solutions, seeking supporting information before making a decision, analyzing the advantages and disadvantages of each alternative solution, and evaluating the decisions that have been made. The following graph presents the percentage of students who have done each of these stages.

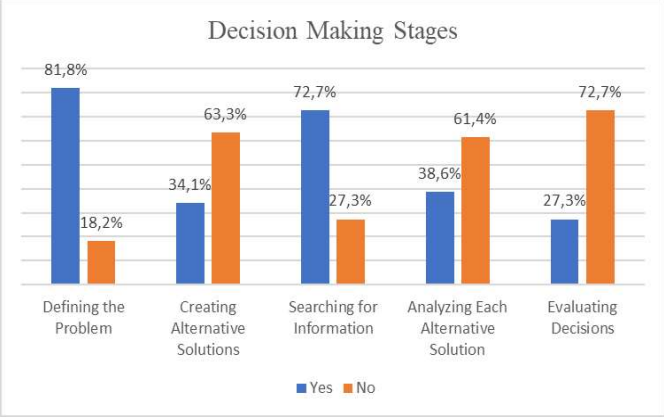

Figure 1. Stages of Student Decision Making

In the graph above, it can be seen that most of the students have done the first step in making decisions, namely as many as 81.2% of respondents, when faced with a dilemma students have already done finding out the essence of the problem and defining the problem. However, only 34.1% of the respondents carried out the second stage of making decisions, namely making alternative solutions to the problems they faced. After carrying out the first stage of making a decision, students immediately searched for information, this stage was carried out by 72.7% of respondents. Then, the stages of making decisions in the form of analyzing each alternative solution and evaluating the decisions that have been taken are also only carried out by 38.6% and 27.3% of respondents.

Student Knowledge of Climate Change

The questionnaire also presented questions to see how far students know about climate change. It was found that most of the students had heard about climate change and global warming, namely 90.9% of the respondents. They hear about climate change from the mass media and from learning at school. In the open-ended questions given to respondents about what is known about climate change, most of the students' answers focused on rising global temperatures and disasters caused by climate change. However, there are still 20.5% of respondents who think climate change is not a global problem and 32% of respondents have never decided on climate issues. In the next open-ended question, students are asked what kind of climate change issues they have ever decided, students explain the actions they are taking to help prevent climate change such as saving electricity and reducing the use of motorized vehicles.

Conclusion

Six stages need to be carried out to produce the best decision, namely defining the problem, determining alternative solutions, seeking information, evaluating each alternative solution, analyzing, making decisions, and evaluating decisions (Ratcliffe, 1997). These stages will be able to help to produce the best and most accountable decisions. Meanwhile, based on the data obtained, it was found that most students had not followed the decision-making stages properly, so the resulting decisions tended to be based solely on personal feelings without any analysis of the advantages and disadvantages of the resulting decisions. Climate change is also a topic that students are familiar with, however, their knowledge of climate change is limited to the increase in the earth's temperature and there is no awareness of the dilemma and worse impacts that can be caused by climate change. Therefore, based on the study results obtained, it appears that student's ability to make decisions has not been well trained, both in general decision-making and decision-making on environmental issues such as climate change. The results of this study indicate that further research is needed which aims to improve the decision-making skills of these students, especially for socioscientific issues regarding climate change.

It is very important to train students' decision-making skills on socioscientific issues about climate change. Climate change is a global issue that requires the best solutions and decisions in the present and the future.

Every individual must be able to work together to overcome this problem, including students. Training students to make decisions about socio-scientific issues of climate change that surround them will help students to be aware and sensitive to what disasters and impacts might have in their lives in the future. In addition, today's fast-paced global world requires individuals who can think quickly and make decisions in a solution, right, and efficiently. This research is expected to provide an overview to educators, that there are still weaknesses in student decision-making, so it is very important to train this ability in students.

Recommendations

Based on the results of this study, the researcher recommends further studies on innovations and the best learning strategies that can train students' decision-making skills, especially using the context of socioscientific issues regarding climate change. So that students can not only practice decision-making skills but at the same time can also build awareness that climate change is taking place and each individual is responsible for stopping it before it gets worse in the future.

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