

Encourage Students Creativity Through Creative Science Learning Activities on Environmental Issues

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ABSTRACT

This study provides an overview of science creativity learning activities using online learning media as a stimulus and describes creative competence, which includes the development of curiosity, creative thinking, and students' creative products on the theme of environmental sustainability. Data collection is done by observation and analyzed based on the phenomena that arise in learning, which are divided into four criteria. Based on the results of the study, it was found that creativity learning activities that were stimulated using online learning media and carried out through eight learning steps gave a positive response to student creativity. The development of students' curiosity and creative thinking is in a good category but needs improvement, especially in terms of giving critical comments on products. Assessment of students' creative products shows that the characteristics of creativity are very good. This study recommends the need to integrate a combination of various online learning media to be able to enrich the learning process of creativity in science learning with students' creative products in the form of ideas, pictures, charts, objects, and prototypes in order to motivate students to be more creative, think critically, and actively participate in protecting the earth in a sustainable way.

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Student creativity through creative science learning activities has a crucial role in dealing with environmental sustainability issues. Through creative learning activities, students can be actively involved in finding innovative and sustainable solutions to global environmental challenges (Stables K, 2009). This can provide a more meaningful learning experience. Creative science learning with online learning media is an approach that attracts attention in an effort to build students' creative skills (Abdullah, 2017). Online learning media provides flexibility for teachers and students to access a variety of information and resources that are relevant to the topic of environmental sustainability. Various applications, simulations, videos, and interactive learning resources that can be accessed from anywhere and anytime can increase student involvement in the learning process and encourage them to think critically and apply their knowledge.

Studies that have been conducted regarding student creativity through creative science learning activities on environmental sustainability issues using online learning media generally aim to explore the extent to which science-based learning can stimulate student creativity in addressing environmental issues. These studies often involve the development of creative learning methods that integrate natural science concepts with environmental sustainability issues. This method aims to encourage students to think creatively and find innovative solutions related to environmental problems, such as in research on environment-based projects (Chen, et al, 2022), problem-based learning with the topic of environmental change (Anjarwati, et al, 2018) and topics in the Environment on Watershed Conservation Materials (Rizal, S., et al, 2022) there is also an increase in creativity. Although these methods indicate an increase in creativity but cannot measure the final results of student creativity, such as the products or innovative solutions produced, it is often difficult to fully measure the creative process behind it, such as how learning activities are given during learning.

The environmental issue of preservation aims to develop knowledge, skills, values, attitudes, and behaviors in society to protect the environment (Nicolaidis, 2006). This concept does not only discuss the environment but has experienced a broader expansion that focuses on social and economic development. The link between environmental sustainability and creativity is very close and influences each other. Environmental sustainability refers to efforts to maintain a balance between the use of natural resources and environmental protection (Al-Kuwari, Al-Fagih, & Koç, 2021) so that current human needs can be met without compromising the ability of future generations. Meanwhile, creativity involves the ability to generate new ideas, innovative solutions, and unique approaches to overcoming challenges and problems (Fasco, 2001).

Teachers and students can use their own creative abilities to make ideas and content more interesting and understandable by following science learning with creative activities. For teachers, teaching by providing creative activities to students is defined as a form of teaching aimed at developing students' own creativity (Hong, et al, 2005). It involves instructional strategies designed to encourage students to think and act creatively. Teachers can encourage students to experiment, innovate, and not give answers but give them the tools they need to find solutions to explore new ways through simple tools and materials that are proud of their environment (Khikmah, 2019) like studies that have been conducted to train creativity by making wafe machines from used matchboxes.



**Figure 1. Creative products wafe machine made from match boxes
(Trnova & Trna, 2014)**

In the digital era, online learning media is an important tool. The studies conducted looked at how the use of online platforms such as learning videos (Al-Zahrani, 2015; Hendriyani, Rifqiawati & Lestari, 2022), interactive simulations (Loganathan, et al, 2019) online discussions (Barak & Ziv, 2013) and other collaborative tools can support creative science learning, but the effectiveness of creative science learning in stimulating creativity can be greatly influenced by context factors such as student background, school policies, and the learning environment. Study results may not always be easily applied in various contexts. The use of online learning media can be limited by the accessibility of technology, which is not evenly distributed in all places, as well as limitations in the ability of students or teachers to operate these tools.

The existence of studies that have been conducted indicates that there is no research that examines the relationship between creativity, technology, and environmental sustainability issues within the classroom. Much of the research on the relationship between creativity, technology, and education is conducted from an ethical perspective—beyond the classroom experience. The most urgent needs and become a novelty from this research are (a) to examine more deeply about developing students' creativity through science learning with creative activities with stimulation of online learning media using online learning media in the form of YouTube (Jones, 2011; Rahmatika, Yusuf, & Agung, 2021) and online internet searches that can be accessed easily for students in the practice of learning in class. (b) Research that comes from action based on practice and experience This study also (c) describes creative learning activities that are carried out effectively and are photographed based on observations from the class. In addition, this study can provide a comprehensive picture of students' creative abilities in providing innovative solutions to dealing with global challenges that occur in the environment for present and future generations.

METHOD

The research subjects were 15 junior high school students in class VIII. Consists of 7 women and 8 men. And 11 of them are active subjects who are present at each session of the meeting. ages between 12 and 14 years. The ability of each student varies in each group. Two IPA teachers and five students of IPA candidate teachers are part of the group of IPA teachers who work on learning design planning.

Observations are carried out during the learning process to look at the student's forms of creative activity and creative competencies, which include the development of curiosity, creative thinking, and creative products. The observation process is carried out with an adaptation of the Assessment Criteria of a Lesson for Creativity (ACLC) instrument (Tran, et al, 2017) which is evaluated on the basis of four levels of criteria. Level This criterion consists of very good (86–100), good (71–85), good enough (56–70), and bad (0–55). The provision of these criteria is based on the regularity and consistency of the many signs made by students during the learning process, such as questions answered among students, critical comments on products, selecting the best ideas, and presenting creative products.

RESULTS

The creative activity that has been carried out during the three meetings is a learning design that has been designed by the science teacher community at school. The topic of the theme Environmental Sustainability Issues is the accumulation of plastic waste in the environment. The patterns of creative learning activities carried out in the classroom are as follows.

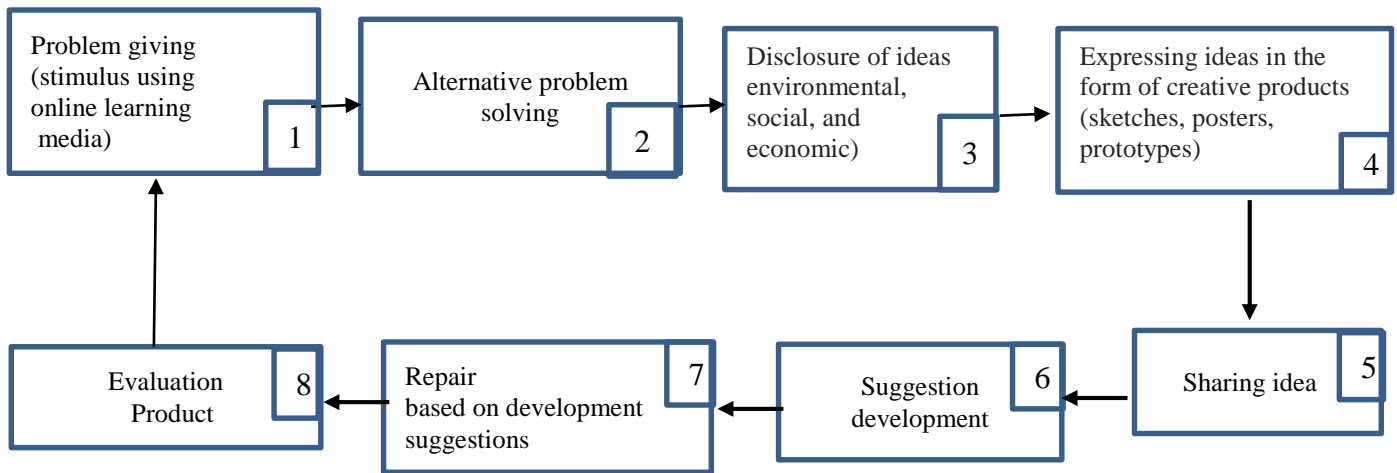
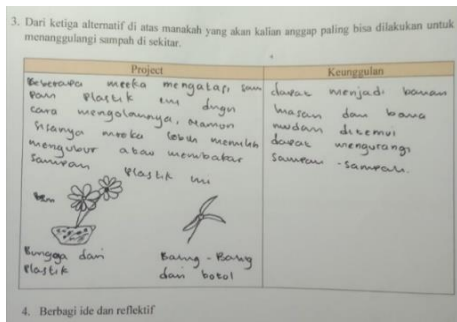


Figure. 2 The Pattern of Creative Learning Activities

Figure 2 describes the learning activities carried out in the learning process. The following is an explanation of each stage of the activity performed.

- (1) The learning activity begins with providing a learning stimulus with a YouTube display about the current environmental damage. Students were asked to give their opinions regarding what they had seen in the broadcast. Based on these opinions, the teacher makes an inventory by writing down important points related to the topic to be discussed. Furthermore, at this stage, they are given a kind of ‘jumping task’, namely, giving them concrete problems they face in everyday life. (2) The teacher presents several alternative methods of problem solving, both conventional and technology-based, that are currently developing (3) Students are asked to choose one of the methods used from the several alternatives given. (4) Students are asked to state the reasons for choosing these alternatives by considering environmental, social, and economic aspects. (5) Furthermore, students are asked to express ideas in the form of creative products through sketches, drawings, or alternative designs of their choice. At this stage, students can explore electronic learning resources and books and access information through an online search system without plagiarizing or imitating pre-existing ones. (6) The next stage is sharing ideas. Each group of students presented the results of the alternative solution they had chosen and developed in the form of a creative product, which could be in the form of a sketch, poster, or prototype, and then provided an opportunity for other groups to give their opinions. Other groups opinions or comments focused on suggestions for development. What do they like about their friends' creative products, and what needs to be improved to make the product even better. (7) Time is given for students to make improvements based on the development suggestions that have been given. (8) Product assessment can be carried out among groups of students by giving the most smiley faces to the creative products that have been developed. While the assessment carried out by

the teacher can be done using a creative product assessment sheet. An example of a creative product produced by students with creative learning activities on environmental sustainability issues that have been carried out can be seen in figure 3.



(a) Initial Idea Sketches

(b) The Resulting Product has Economic Value

Figure 3. Students' Creative Products Using Reuse to Reduce Plastic Waste

Creativity competence is carried out through an observation process during learning using an adaptation of the Assessment Criteria of a Lesson for Creativity (ACLC) instrument. This instrument is used to see creativity competence in three general aspects, namely (a) the development of student curiosity and exploration, which can be seen from the activity. Ask questions that are answered among students; (b) develop creative thinking, which can be seen through student activity when giving comments critical of the product; and (c) showcase students' creative. products. Based on the results of the analysis that has been done, they can be described as follows.

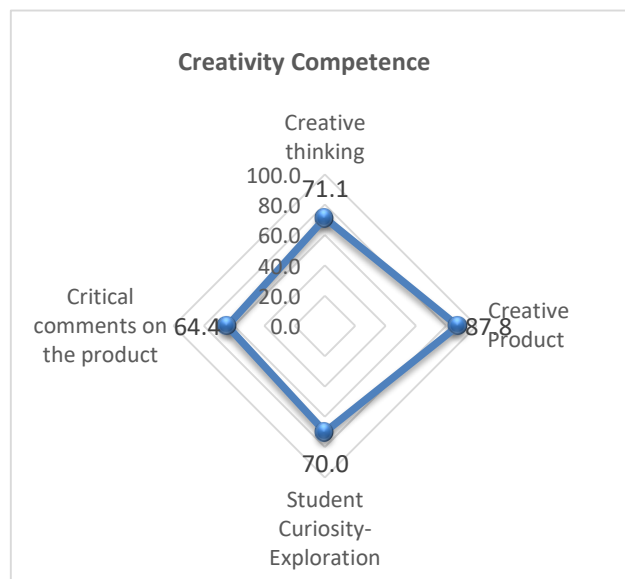


Figure 4. Creativity Competence

Figure 4 describes how the better the creativity ability, the perfect rhombus will form at the outermost point. Based on the picture above, it indicates that students' creative competence is in the very good category (87.8), especially in the aspect of producing their creative products. The ability to think creatively (71.1) and the development of students' curiosity and exploration (70.0) are in the good category, while the ability that needs to be developed is to give critical comments on creative products because they are still in the good enough category (64.4). Based on the results of observation and data analysis, it shows that students still lack these characteristics during the learning process in class. This can be caused by the fact that students' understanding of products produced by friends is still lacking. Both related to the use of the technology used and the basic working concept of the products produced by their friends. This indicates that critical thinking skills still need to be developed.

DISCUSSION

The ability to provide critical comments on creative products that receive a "Fair" rating indicates the potential for improvement in providing constructive feedback and deeper analysis of creative works. Various factors can affect the limitations of this ability. These factors can be related to the concepts of creativity and subject matter. Providing critical comments involves analytical thinking skills (Fadhullullah & Ahmad, 2017) to evaluate aspects related to creative products. If students are not yet familiar with analyzing the impact of solutions on environmental problems, they may have difficulty providing substantial feedback. The accumulation of plastic waste involves various aspects, such as environmental science, technology, design, and human behavior. Students may have difficulty integrating these elements into their critical commentary if they are not used to a multidisciplinary approach.

To improve the ability to provide critical comments related to the accumulation of plastic waste, students can be given training in environmental problem analysis, given access to various sources of information, and encouraged to participate in creative projects that require critical thinking. The use of online learning media that combines multimedia sources, articles, and videos can give students (Henriksen, et al, 2021) deeper insight into the problem of plastic waste accumulation, broaden their understanding, and ultimately help improve their ability to provide more in-depth and focused critical comments.

Student creativity competence that looks very good is in student creative products. This implies that they have impressive skills in designing, developing, and presenting new ideas in innovative ways. This can be due to the use of online learning media such as YouTube and online search sources that display visual and interactive content. This can help students understand information better and encourage creative thinking through strong visual representations (Cheng, 2011). Through online learning media, students can observe various creative approaches that have been taken by individuals or other groups to overcome the problem of plastic waste accumulation. This can open students' minds to various possible solutions that they have not considered before. In addition, it provides opportunities for students to broaden their understanding of the issue of plastic waste accumulation and seek inspiration to produce innovative solutions.

CONCLUSION

This study demonstrates that students have a high capacity for creativity in relation to environmental sustainability issues. This demonstrates their inventiveness in applying scientific concepts to environmental problems. Students have the potential for creativity in the "good" category in the ability to think creatively and curiosity through exploration. This indicates the potential for students to have flexible minds and the motivation to explore new ideas related to environmental sustainability issues. Nevertheless, there is room for further development, especially in the ability to provide critical comments. By utilizing a variety of online learning media and appropriate learning strategies, schools can help students develop their full range of creative skills, strengthen their understanding of environmental challenges, and stimulate sustainable innovative solutions.

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