



Effectiveness of Learning using Web-Based Inquiry Based on Socioscientific Issues to improve students' understanding of Socioscientific Issues

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Abstract: The era of 21st-century learning requires students to have various abilities to overcome the complexities of society modern. This creates a breakthrough in learning by implementing an inquiry approach using a web-based socio scientific issue. Learning supported by the use of web-based inquiry can be accessed and implemented online and offline so that learning can become blended learning. The socio scientific issue raised in this study because to determine the level of students' knowledge of the problems in their environment. Samples that were used in this study were 32 junior high school students who were selected by random sampling technique in class. The research method used is a time series design where the pretest and posttest are carried out twice on different materials, namely water pollution and air pollution. Data analysis using normalized gain to determine the effectiveness of the use of web-based inquiry based on socio scientific issues. Based on this research, the average value of the first pretest is 17.53 and the posttest has increased to 26.78 so that the normalized gain value is 0.41 with the following criteria: currently. In the second pretest, the average score of students is 19 with the post-test average being 39.94 so the normalized gain obtained is 0.57 with moderate value criteria. The aspect of the value of socio scientific ability is also an issue measured by the results. In the first pretest and posttest with the topic of water pollution, aspects of evaluating information experienced an increase with a normalized gain value of 0.44 with moderate criteria, and the pretest and posttest values of the aspects of making decisions also increased with a normalized gain value of 0.39 with moderate criteria. On the pretest and the second post-test with the topic of air pollution aspects of evaluating issues have increased with a gain value Normalized value is 0.54 with moderate criteria, and for the aspect of making decisions to increase the normalized gain is 0.59 with moderate criteria.

Keywords: Web-based; Inquiry; Socio scientific issue; Environmental pollution

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Introduction

The 21st-century era makes developments in the world of education occur quickly and complexly, to prepare students to face the complex demands of modern society (Pratiwi et al., 2019; Haug et al., 2021). The challenge was responded to by presenting a new

paradigm in the world of education in Indonesia, namely by providing a set of 21st-century skills consisting of critical thinking skills, collaboration skills, creativity, innovation, metacognition, information literacy, ICT, and problem-solving (Haug et al., 2021; Lee et al., 2017; Sumardi, 2020; Chan et al., 2020). In the 21st century, students are increasingly relying on the internet

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as a source of information, but this does not guarantee that students have the skills to conduct research or obtain strategic, structured, and complete information according to their needs. This happens because in the internet world there is so much information available, making it difficult for students to get the right information. Therefore, students must be trained to select relevant information so as not to spend hours navigating between websites (Downes, 2007; Maveidis et al, 2017).

One of the goals of learning science is that students can build a perspective on nature and solve all problems in the surrounding environment scientifically, so it is very important to show students' closeness to the environment in which they live (Yuzuak & Zahni, 2022). One of the topics that are being intensively integrated into science learning is the socio-scientific issue (SSI). Socio science is a complex, contemporary science issue, usually ill-structured, related to social aspects that are often debated, and has no absolute solution (Christenson & Gericke, 2016). This is due to the complex nature of socio scientific issues and involves multiple perspectives and values (H. Lee & Zeidler, 2014). socio-scientific contexts can be adopted for science learning because they are effective for learning science knowledge, and skills and train students to find scientific evidence so that the learning carried out is more meaningful because the context discussed is associated with students' lives (Gulacar et al., 2020; Anagün & Özden, 2010). This socioscientific issue can facilitate students to actively find alternative solutions to a problem circulating in the community (Herawati et al., 2019).

One of the recommended learning approaches in this decade is inquiry because it is an efficient approach to foster student curiosity and motivation by connecting science learning in the school environment and its relation to life phenomena that students encounter every day (Suarez et al., 2018). Inquiry is also able to help students to master a certain skill in the cognitive process. This happens because in inquiry learning students gain knowledge personally and it settles in their minds and thoughts (Farida, 2019). However, science learning using inquiry can only be successful if the context discussed in the learning is following the student's capacity (Erman & Sari, 2019). Based on research conducted by (Rahmawati et al, 2022) revealed that inquiry learning without socioscientific discussion of issues makes it difficult for students to maintain their interest in learning, it is difficult for students to move forward to do deep thinking, and makes learning not run optimally.

Inquiry learning can be integrated with technology because in online learning students can maximize independently to conduct experiments, control variables, and make plans to find scientific concepts (Hong et al., 2019). Many studies have shown that

learning in an online environment assisted by technology can increase activity, interest, and motivation in students (Moreno & Bartolomo, 2021). Inquiry learning often requires searching for information through the internet such as collecting background information, and further understanding a topic, so that research via the internet can also be understood as a practice using the world wide web, as a way of collecting information (Muralidharan et al., 2018).

The web has a function to minimize authentic direct inquiry activities because not all students can carry out relevant activities according to the instructions in inquiry (Wolf et al., 2002). Learning using web-based inquiry can be used as collaborative and effective learning. This web-based also provides an advantage in terms of implementation time which can provide space for students to develop confidence and skills to learn science (Raes et al., 2014). Based on research conducted by Ulus & Oner (2020), shows that learning using a collaborative web-based inquiry science environment (CWISE) can effectively increase student inquiry activities, as well as research conducted by Chen, and Wang, (2020) shows that learning using a web-based inquiry science environment (WISE) can increase students' knowledge in inquiry.

To support learning to run well it needs to be facilitated by instructional design, material content, practical media based on socio scientific issues, and good mastery of the material by the teacher. Developing web-based content with a socio-scientific context of issues will give a new color to learning using the web because the prepared material has been adapted to contextual problems. The current web has also been easily designed and equipped with various additional features such as the addition of e-books or virtual laboratories to support learning. Based on this, the purpose of this study was to determine the effectiveness of using web-based inquiry based on socio scientific issues to increase students' understanding of students' socio scientific.

Method

This research uses time series design research using one experimental class group without using a comparison group. The design of this study is divided into time segmentation to know the progress of student learning in the hope that there will be major changes every time (Zhang et al., 2022). This was done to see an increase in understanding related to socio scientific issues with a focus on only one class. This research was conducted in one of the junior high schools in Purwodadi District, Pasuruan Regency, East Java Province. The sample used was selected by the random sampling method in the class, where in this technique all

members of the population have the same opportunity and are free to be selected as samples (Sukmadinata, 2013). This technique is done by choosing one class from several 7th grades in the school without having to choose students from each class as a sample because each class has the same or homogeneous abilities. The sample used was class 7C even semester with a total of 32 students.

In this study, students measure students' understanding of socio scientific issues by using pretest and posttest questions for two tests, on different topics. The first pretest and posttest are related to the issue of water pollution, while the second pretest and posttest are related to the issue of air pollution. The instruments used in this study had already gone through the content and empirical validation stages as well as through reliability testing. The purpose of the validity test is to measure the accuracy of the instrument to be able to measure what it should measure (Frankel & Wallen, 2012). Meanwhile, reliability aims to measure the consistency or consistency of the instrument.

In the first research stage, the first step was to measure the students' initial abilities by using the pretest questions about water pollution. After that, students carry out learning activities using an inquiry approach. In inquiry learning students are given stimulus information in the form of reading on a web-based inquiry on eutrophication events due to agricultural waste, then students are invited to formulate hypotheses, design experiments, and analyze data to make conclusions according to the stages of inquiry learning. However, in the section making conclusions, students need to examine more deeply the causes, and effects and provide solutions to a socioscientific event on the issue. After the learning phase is complete, students are given a posttest according to the material discussed. This applies to the next meeting on air pollution material with the context of motor vehicle pollution in the surrounding environment.

Based on this method, the data will be analyzed using normalized gain to determine the effectiveness of the learning that has been carried out on students' understanding of socioscientific issues.

Result and Discussion

Socio scientific issues are issues raised by inquiry learning using web-based this time. The web-based inquiry used in this study had previously gone through the validation stage and a limited-scale trial with very feasible results. The use of web-based inquiry is an effort to create learning using interactive media that can facilitate structured learning steps so that the objectives of learning can be achieved and students can actively interact with their friends and interact with digital content independently (Mah et al, 2021).

In this research, the web-based inquiry used is one of the learning facilities that can be integrated with various types of contexts or materials, one example is the socio-scientific issue of environmental pollution.

Learning steps on socio scientific issues according to (Yuliastini et al., 2016) include (1) scientific background (presenting issues related to scientific knowledge); (2) evaluation of information (evaluating the socio-science issues being studied); (3) local, national, and global dimensions (assessing local, national, and global impacts); and (4) decision making (making decisions related to socio-science issues). Based on these steps, the researcher took several learning steps as an aspect of inquiry assessment, namely the aspect of evaluating the issue being studied in this case students were asked to find out the causes and impacts on the occurrence of socio scientific issues. The second aspect is making decisions related to socio scientific issues.

Socio scientific issues are problems that develop in society and can be reviewed scientifically. In this study, the socio-scientific issue raised was environmental pollution because the problem of pollution is very close to students' lives (Gulacar et al., 2020). In this activity, there are two issues raised, namely about the eutrophication event due to agricultural waste and the second is air pollution due to motor vehicle pollution. This study used a pretest and posttest with a total of three essay questions that were valid and reliable before being used as a research instrument.

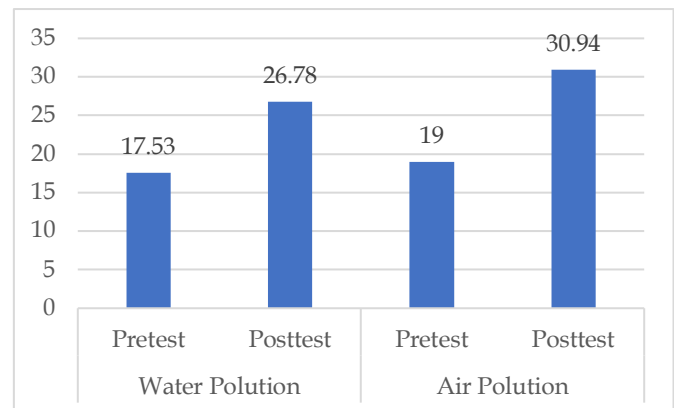


Figure 1. Increase in the average value of socioscientific issues

On the data above the average score of students during learning using SSI-based web-based inquiry increased in each segmentation of the test time on different materials. The average value of the first pretest was 17.53 and the posttest increased to 26.78 so the normalized gain value was 0.41 with moderate criteria. In the second pretest, the average value of the students is 19 with the post-test average of 30.94 so the normalized gain value obtained is 0.57 with a moderate value criterion.

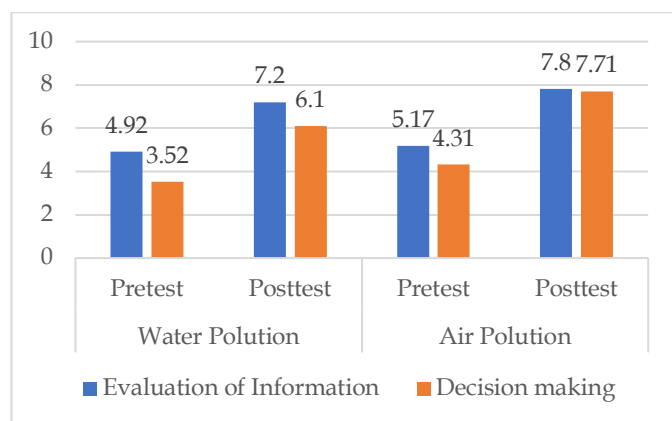


Figure 2. Increasing the value of socioscientific aspects of issues

Based on the above values, there is an average increase in value. Each aspect is divided into two aspects. In the first pretest and post-test with the topic of water pollution, the aspect of evaluating information has increased with a normalized gain value of 0.44 with moderate criteria, and the pretest and post-test values for the aspect of making decisions also increased with a normalized gain value of 0.39 with moderate criteria. In the second pretest and posttest with the topic of air pollution, the aspect of evaluating issues has increased with the normalized gain value being 0.54 with moderate criteria, and for the aspect of making decisions, the normalized gain increase is 0.59 with moderate criteria.

In the graph, it can also be seen that the pretest and posttest scores on air pollution for both aspects are higher than the first pretest and posttest on water pollution. This happens because students are getting used to learning using web-based inquiry based on socio-scientific issues so it makes student learning outcomes increase. The habit of using web-based inquiry is an effect or result of a treatment action that results in the achievement of goals following the planned instructional objectives (Lumban & Sitepu, 2020).

Learning using SSI-based web-based inquiry is also one of the new media-assisted approaches that have never been used by students so during learning students become enthusiastic and actively participate in learning because this learning involves group and independent activities both in online and offline environments. This kind of learning tends to be more attractive to students because it makes students challenged to try new things and discuss topics that are close to students' lives (Bulkani et al., 2022).

The difference in the material raised in the study by taking data twice aims to see the consistency of student learning outcomes because a concept can be learned by students if the student can maintain his learning outcomes. These different topics are given with the aim that students get used to constructing knowledge and can see the effectiveness of web-based inquiry used

during learning on different topics (Elwijaya et al., 2022; Lubiano & Magapenty, 2021).

Conclusion

This study concludes that learning using web-based inquiry can improve student learning outcomes, and increase student activity during learning. The context of the socioscientific issue raised is environmental pollution because of the degree to students' problems in everyday life, this makes students enthusiastic during learning and feels new things during learning.

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