ISSN 2964-4291
https://proceeding.unnes.ac.id/index.php/iset

Integrated System of Science Learning Based on Social Scientific Issue

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Abstrak. Learning based on social issues can certainly answer scientific issues that arise in society. Science learning based on social science issues (SSI) can support learning in implementing theories with conditions or problems that exist in the environment. However, there is no SSI-based science learning system starting from the complete input, process, and output. This literature study aims to provide an overview of an integrated system of SSI-based science learning. The analysis of the articles carried out was taken from electronic databases, namely ERIC, Scopus, and Google Scholar, then directed to national and international journals from 2013-2020. The results of the analysis that the SSI-based integrated system of science learning includes input, process, and output that must be properly integrated for learning purposes.

Key words: social science issues, thinking skills, input, output

How to Cite: Winarni, D.S., Indriyanti, D.R., Saptono, S., Widiyatmoko, A. (2022). Integrated System of Science Learning Based on Social Scientific Issue. *ISET: International Conference on Science, Education and Technology* (2022), 1129-1134.

INTRODUCTION

Meaningful learning is learning that can connect concepts, theories, and their implementation in life. Problems that arise in the environment in the form of scientific issues or problems are certainly interesting things to study more deeply. The results of a study from PISA in 2012 stated that students in Indonesia were at a level below proficient in science (Ismail et al., 2016) and in 2015 there was no improvement. The results of further research in PISA 2018 on science learning in Indonesia stated that there was an average increase of 7% in student performance in science learning as well as in independent learning and applying science in various situations (OECD, 2019). Therefore, there is a need for continuity between the curriculum used and the learning context by considering norms, values, and the potential to encourage active students so that learning is more meaningful.

Learning by describing a clear context in making learning more meaningful in science began to be cultivated by teachers and researchers. One approach that is currently in demand is a socio-scientific issue (SSI) based learning. SSI as an approach to support science learning is designed by combining learning design, learning experiences, and teacher competencies based on the environment as the most relevant examples in its implementation (Presley et al., 2013). Several studies that have tried to use SSI in learning activities by linking learning concepts with implementation in the surrounding environment have an impact on thinking skills (Gutierez, 2015; Hancock et al., 2019; Siska et al., 2020), especially in making decisions (Genisa et al., 2020; Khishfe et al., 2017) based on the concept of science.

The use of SSI in several learning topics makes it easier to contextualize so that critical thinking patterns and problem-solving are formed in analyzing problems in depth. In problem-based learning activities developed by each student, of course, increasing analytical skills (Hancock et al., 2019; Mats G. Lindahl et al., 2019) by analyzing based on aspects that are around students starting from science, morals, economics, and much more.

SSI-based learning actively increases knowledge in various aspects of students' lives with issues that develop either support (pro) or objection (con) in the social environment. This learning increases the curiosity of students so that they develop more critical thinking skills according to the problems they face (Paristri & Suyanto, 2018; Rostikawati & Permanasari, 2016). The purpose of the literature review discussion is how an integrated system in science learning based on socio-scientific issues (SSI) is.

METHODS

This research is a research study of literature from journals published in electronic journals in databases of national and international journals, including Google Scholar, ERIC, Scopus, and

Elsevier. By using the keyword socio-scientific issue (SSI) or the keyword science learning with article qualifications in the range of 2013 to 2020. The articles obtained from the two specific keywords were 289 articles, then analyzed for suitability by combining the two keywords obtained there are 133 articles. Further steps in determining the right articles to analyze are as follows:

Step 1: Formulate questions to classify articles. To answer the questions in the literature review by reviewing articles consisting of input, process, and output in science learning based on socio-scientific issues (SSI).

Step 2: formulate the parts of the data. To determine the right data by analyzing articles that have data completeness sections from input, process, and output. The results of data collection in the first step were obtained from as many as 133 articles. Furthermore, the articles obtained were analyzed with the criteria for completeness of the data which contained input, process, and output. The desired data analysis results are focused on leaving 40 articles grouped according to the desired data indicators with 70% indicator achievement in each article. Articles that do not reach 70% of the indicators will be excluded.

RESULTS AND DISCUSSION

SSI learning outcomes are specified in a learning model consisting of input, process, and output. For more details on input, process and output include:

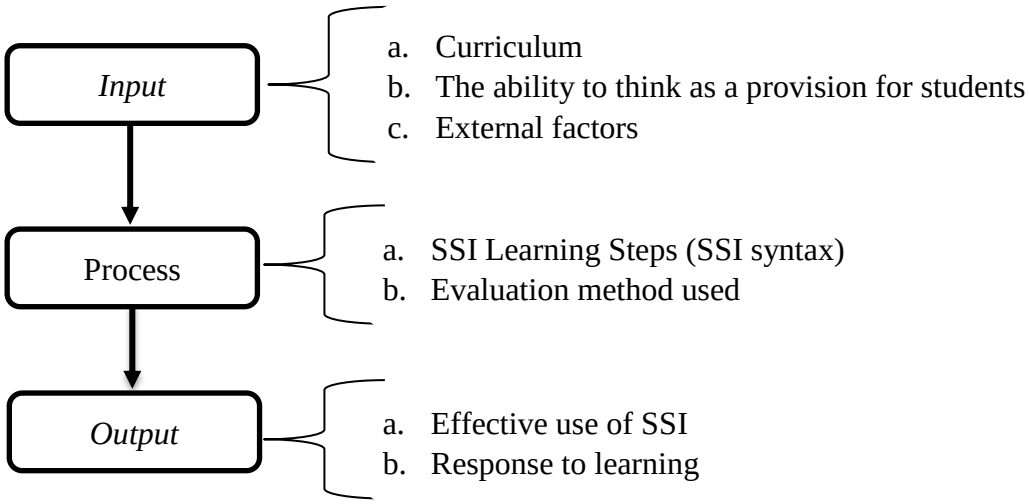

Figure 1. The flow of the SSI Model.

The development of science learning patterns in the world is growing rapidly as a form of strategy for instilling the right concepts in students. One of the learning strategies and approaches that became a trend starting in the 2000s was learning based on social science problems or better known as the socio-scientific issue (SSI) (Karışan et al., 2017). Socio-scientific issue (SSI)-based learning has become a new trend in science learning in the last few decades (Genisa et al., 2020) as an effort to prepare students to cultivate thinking skills to deal with social problems related to the implementation of scientific concepts. With a focus on developing thinking skills and making decisions in students, it is certainly by the learning objectives (Seo & Kim, 2019) that PISA wants to achieve that learning must cover all aspects of abilities in students (Dmitrenko et al., 2020; OECD, 2019). The trend of research on SSI is growing in various countries with topics that lead to social and environmental problems based on science such as environmental management and pollution problems in Taiwan, Indonesia, and Germany, while more deeply about biological studies such as genetics, biotechnology, energy, and health. in European and Australian countries (Genisa et al., 2020; Khishfe et al., 2017; Peel et al., 2019).

SSI-based science learning makes a positive contribution to processing learning to be more varied and more meaningful. SSI's involvement in exploring the potential of students as a form of contribution to thinking is complex. Based on the analysis of the article, there are similarities between the use of SSI in learning, especially in the context of branches of biological sciences such as ecology, genetics, biotechnology, and other branches of science. In implementing SSI, several education practitioners try to explore

aspects that are the benchmark for the success of a learning approach or strategy (Gámez & Erduran, 2018; Genisa et al., 2020; Paristri & Suyanto, 2018). Teachers can design SSI learning patterns and reflect on how to maximize SSI in learning. Therefore, to maximize SSI in teaching science, attention should be paid to *input*, process, and *output*.

SSI-based learning from article analysis obtained an integrated system of SSI-based science learning which includes *input*, process, and *output*. Each component of the *input*, process and *output* in learning science is described as follows.

SSI-Based Learning Input

Meaningful learning in science needs to pay attention to the input aspect first to find out whether the initial concepts as the main basis for the cognitive aspects of students are equivalent. In terms of the experience and insight of students in processing information, it will be able to run synergistically. To see the *input* of learning components, it is necessary to know the learning background which includes aspects of resources such as curriculum (Friedrichsen et al., 2016), thinking or cognitive abilities, and other external factors such as facilities, and teacher competence (Cayci et al., 2020).

The input that becomes the initial basis for determining the learning strategy is the curriculum that is being used. The curriculum in learning has not fully supported SSI so the learning patterns carried out by teachers tend to lead to curriculum achievement (Akbulut & Olgun, 2020; El Arbid & Tairab, 2020; Friedrichsen et al., 2016) not yet at the level of implementation of existing problems or phenomena. in the environment. The curriculum used mainly in Indonesia is still focused on the cognitive aspects of learning and has not yet been linked from one case to another (Anisa et al., 2020; Subiantoro et al., 2013) so there is no level of development and analysis to make decisions in learning to understand. (Solbes et al., 2018; Talens, 2016; Wang et al., 2018) .

Curriculum programs based on SSI will certainly have an impact on learning patterns in the classroom. Teachers can develop learning activities to optimize children's thinking skills (Zeidler et al., 2019). To find out the level of ability of each child, an initial study is needed to homogenize the initial knowledge or insight before teaching science concepts to students. (Solbes et al., 2018) . Research conducted by Romine (Romine et al., 2017) that understanding concepts in scientific literacy requires more applicable learning. The results of the test by providing videos of real phenomena, children can develop their mindset and language development in giving arguments or opinions (Romine et al., 2017; Sadler et al., 2016).

SSI-based learning is not only based on the curriculum and basic knowledge of students but also aspects of other internal factors such as infrastructure and competencies possessed by teachers in developing learning. A study conducted by Gámez & Erduran, (2018) that in providing learning teachers should develop argumentation skills, especially in improving students' thinking skills. Learning carried out by teachers can be a benchmark for achievement in cognitive aspects of learning resources and learning facilities can facilitate textual conflicts in finding information (Stang Lund et al., 2019) in learning for students.

SSI-Based Learning Process

The educational process is an effort to achieve educational goals for the inputs obtained in producing outputs by the goals that have been set. The process that takes place in learning will certainly be of quality if there is the right mix of inputs (curriculum, infrastructure, and teacher competence) in creating fun and meaningful learning (Saad, Sadiah, et al., 2017; Sadler et al., 2016). In SSI-based learning, of course, it is necessary to take the right steps and methods so that the learning process can be measured according to the needs and objectives of the selection of evaluation methods.

There are still many researchers who try to implement the SSI-based learning process in the learning process. This is because SSI-based learning requires more time duration (Genisa et al., 2020; ztürk & Erabdan, 2019; Vasconcelos et al., 2018) than using other learning approaches. In teaching SSI there are steps in the learning including orientation of the issues studied, personal reflection, related science concepts, group discussions, construction of group statements on related issues, making decisions based on ethics and justification, and thorough reflection (Saunders & Rennie, 2013). The steps in SSI demand the ability of students arguments in deciding between issues, scientific concepts, and ethics as integration in scientific evidence (Sadler et al., 2016).

The appropriate SSI-based learning process needs to be measured for achievement in

implementing learning using SSI. Based on the literature analysis, the method of taking student learning outcomes uses qualitative, quantitative, mixed, and development methods. Research conducted by Yapıcıoğlu & Atabey (2020) on trends in the use of SSI in Education in Turkey showed that the sample in taking data was obtained that SSI was more directed to the argumentation or decision-making abilities of students on the problems faced.

SSI -Based Learning Output

SSI-based learning uses science topics that are used to involve students in processing information based on scientific evidence and provide insight into understanding scientific information. SSI-based learning is stated as the right strategy for developing scientific literacy (Presley et al., 2013; Rahayu, 2019) and improving higher-order thinking skills (Khishfe et al., 2017; Saad, Baharom, et al., 2017). Increasing learning outcomes in students, some concepts are still not appropriate even though their learning outcomes increase or are called misconceptions (Widiyatmoko & Shimizu, 2019; Winarni, 2020). With SSI-based learning, students' misconceptions can be resolved properly. In developing the problem-based learning module, SSI can optimize argumentative abilities between students in the low group and the upper group (Purwati et al., 2019).

Learning activities with SSI as an effort to develop thinking skills have a social impact on student behavior. The results of research using SSI in learning provide behavioral changes and overall moral development (Gutierez, 2015; Rohmawati et al., 2018). Responses from students by developing learning using SSI as a strategy provide a positive correlation (Cayci et al., 2020; Mats G. Lindahl et al., 2019; Talens, 2016) on attitudes and language skills (Mats Gunnar Lindahl & Folkesson, 2016) as a result of the ability to solve problems in the environment.

CONCLUSION

Integrated science learning system based on socio-scientific issue (SSI) includes input, process and output. Input starts from the basic knowledge of students to determine the learning strategy and curriculum that is being used. The process includes steps in building students' argument skills in deciding between issues, scientific concepts, and ethics scientifically. The output of learning is produced in the form of changes in behavior and increased ability to think scientifically.

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