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ANALYSIS OF LEARNING READINESS IN IMPLEMENTATION OF SOCIO-SCIENTIFIC ISSUES BASED LEARNING

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Abstract

The research objective is to obtain a picture of the readiness of learners in the implementation of learning based on socio-scientific issues (SSI). This student readiness description is reviewed from the variable of thinking skills, especially science process skills (KPS). If the student KPS is low, then the learner is actually not ready to be involved or participate in SSI-based learning. The research targets were junior high school students, high school students, and students of one of the PGSD study programs in FKIP of a PTS (Private Higher Education). KPS data for these three groups of learners was obtained using documentation and post facto methods. KPS data for junior high school students is taken from the results of Astuti's research (2018) and Jannah (2016). KPS data for high school students is taken from the results of the National Examination (UN). This data group collector uses the documentation method and data was analyzed descriptively. The KPS PGIP FKIP student data in a PTS is the result of an assessment using KPS questions that Monica has developed (2005). Student KPS data were analyzed descriptively. The results of KPS data analysis for junior high school students concluded that KPS for students from two state junior high schools in Surabaya was still relatively low. Nationally, KPS of SMA / MA students tends to be low. The national average percentage of students answering correctly the UN questions containing the KPS component in the last three years (2016-2018) is 46.97; 39.09; and 51.08% respectively for experimental design, data interpretation, and identification and control of variables. These percentages have not yet reached the classical completeness rate of 80%, so it is concluded that the KPS of high school students is relatively low. The same trend occurs at the level of the city of Surabaya as well as the province of East Java. The target KPS of PGSD students was also low. Mean KPS score of students on indicators identifying and controlling variables, stating hypotheses, making operational definitions of variables, interpreting data, and designing experiments in succession 73,14; 47.33; 43.33; 64; and 62. The average KPS score is still low, not yet achieving the lowest good score (70). The results of the study: (1) students' science process skills (KPS) in junior high, high school, and a PTS PGSD study program are classified as low and (2) not all learners are ready to be involved in the implementation of socio-scientific issues (SSI) based learning in terms of aspects of learner experiences specifically the ownership of science process skills.

Keywords: *Social-Scientific Issues (SSI), Science Process Skills*

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INTRODUCTION

Socio-Scientific Issues (SSI) is a connection between social science and social problems that occur in society (eg climate change, nuclear power, etc.), which can represent various situations in which many individuals are challenged to practice social literacy (Presley et al., 2013). SSI-based learning is a movement that has emerged in the field of science education with the aim of increasing student involvement with matters relating to science outside the classroom walls (Sadler & Murakami, 2014). Sadler (2009), has also stated that SSI-based learning is designed to condition students who come to the learning class to identify themselves as individuals who are willing and able to engage in social-science discourse. Thus, students come to class by positioning themselves as active contributors in solving problems that occur in society armed with competence and the willingness to use scientific ideas and processes, using understanding of science and social knowledge. The long-term goal of this learning is that participants in education or learning can develop a sense of belonging in order to say about these issues and to see as legitimate participants in social dialogue, especially in relation to science.

By implementing SSI-based science learning students are expected to gain awareness of the reciprocal relationship between social, political, and scientific perspectives because students are important contenders and practice thinking skills such as argumentation, reasoning, and decision making (Hodson, 2003). To create effective SSI-based teaching, all students (learners) must have the opportunity to engage in activities designed to enhance one or more high-level thinking skills such as reasoning skills, argumentation skills, decision making, and position taking (first essential student experience) (Walker & Ziidler, 2007). Roberto & Bernando (2012: 17) revealed that the application of SSI in science education can help students to develop critical thinking skills through discussions on controversial and social-science topics. Core creative thinking skills namely analysis, inference, explanation, evaluation, interpretation, and self-regulation (Facione, 2007) will all be driven by SSI units (SSI-based learning) as well as dispositions associated with them. Therefore, combining SSI can help produce students who seek truth, are open-minded, analytical, systematic, wise, and increasingly confident in their reasoning. Both in the article Presley et al. (2013) and in the article Sadler & Murakami (2014) found a frame work for learning based on social-scientific issues (SSI) as presented in Figure 1.

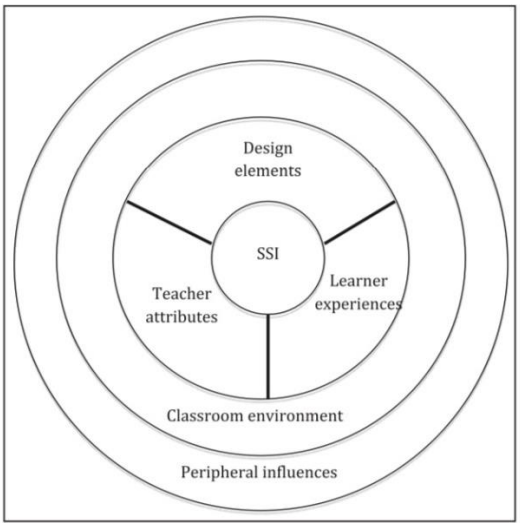

Figure 1. Framework for SSI Based Teaching and Learning

In Figure 1, it can be seen that there are three aspects in SSI-based teaching and learning, namely (1) design elements, (2) learner experiences, and (3) teacher attributes. One of the learners' experiences is collecting and/or analyzing scientific data related to the issue (Presley et al., 2013; 28; Sadler & Murakami, 2014; 337). Collecting and/or analyzing data is one of the science process skills (KPS) (Monica, 2005; Kheng, 2008). Science process skills will be the basis for the successful implementation of SSI-based learning, especially if the mosque is the second aspect of the core, which is learning experiences. This statement stays with Sadler & Murakami's (2014: 338) revelation that SSI is closely connected with ideas about how science is carried out and the nature of scientific knowledge. Implications in learning are students (students) who have sufficient scientific process skills that are ready to be involved in SSI-based learning.

According to Subiantoro (2017: 7) in SSI-based biology learning such as understanding the nature of science or understanding science concepts, thinking skills also become an orientation of abilities or important skills to be achieved. Learners involved in SSI-based learning must be able to make ideas that are then conveyed argumentatively in order to form decisions on the issues at hand. It appears that in the implementation of SSI-based learning, students must have the skills to argue.

Regarding the interrelationship between SSI-based argumentation and learning skills, note the statement of Sadler & Zeidler (2005) as well as Erduran et al. (2004). Sadler & Zeidler (2005) state that there are several ways to develop science education, one of which is SSI-based learning where learners are confronted with sociological

issues including public controversies. For this study, students must have argumentation skills. Erduranet. al. (2004) states that the argumentation skills are one of the determinants of student success in playing their role in society because it is related to one's ability to make the best decision in dealing with problem solving. This Electronic Statement gives entrepreneurship in the implementation of SSI-based learning, because in this study, learning is asked to play a role as a solution program as it is stated explicitly by Sadler and Zeidler.

Once again, it is reviewed from student sciences, SSI-based learning is colored with the involvement of students in the problem solving process. The problem being solved is more specifically the problem inspection of problems in science education and in environmental education as indicated in Figure 2.

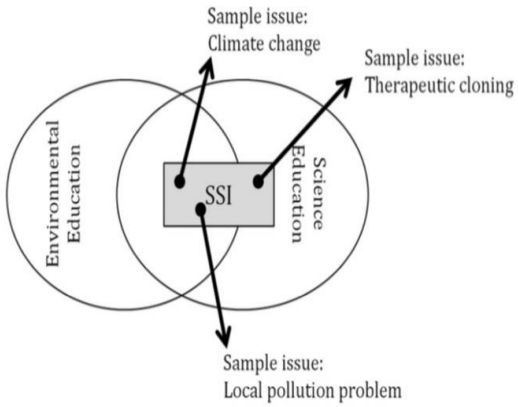

Figure 2. The Relationship between Science Education and Environmental Education

This means that the thinking skills needed by learners remain the same, at least three thinking skills, which are moderated problem-solving skills (KPM) which are moderated by argumentation skills (KA) and science process skills (KPS). KPM is very connected with KPS. This statement is based on the opinion of Jack (2018) which states that PPP has a great influence on education because it helps students to develop education to develop mental processes that are higher in solving problems, thinking critically and making decisions.

In SSI-based learning, learners (learners) are confronted with socio-social issues including controversies that occur in the public (Sadler & Zeidler, 2005). SSI-based learning is colored by involving students in the problem solving process. To go through the process of solving the problem, students must have good science process skills. KPS has a large influence on the ability of problem solving (Jack, 2018). To undergo an SSI-based learning process whose core is problem solving, students must have a good KPS. The question that will be answered through this study is how is the readiness of the learner (learner) in implementing SSI-based learning reviewed from the ability of the science process? The answer to the question in this study is the data analysis of the process of learning science skills from junior, high school, and tertiary levels. If this KPS analysis result concludes that the high KPS study, then the learners are said to be ready to be involved in learning based on SSI. Instead, the result of the KPS analysis of the higher education concludes that the KPS students are low, so the learners are not stated in the SSI-based learning.

When the latter conclusions are found, it is not recommended to reject SSI-based learning but it is recommended that students be prepared with KPS exercises prior to learning implementation. According toener & Bags (2017) KPS is a prerequisite for phasing-based learning in problem solving. While problem solving is the core of SSI-based learning.

METHOD

The research targets were junior high school students, high school students, and students of one of the PGSD study programs in FKIP of a PTS (Private Higher Education). KPS data on three learning groups was obtained using documentation and expo facto methods. KPS data for junior high school students was drawn from the results of the Auti study (2018). KPS data for high school students is drawn from the National Examination Results (UN). This data collection guide uses documented methods and analyzed analytical data. If the number of National Examination participants in Indonesia is considered to be in a class, the participants' resolution is clearly classed as at least 80% of the National Examination participants answer correctly on UN items that contain PPP components. The data taken is the percentage of UN participant mapping on issues that contain PPP components, such as design experiments, data interpretation, and identification and control of variables. The KPS PGIP FKIP student data in a PTS is the result of using KPS questions developed by Monica (2005). Monica (2005: 68) limits KPS to 4 (four) KPS components, namely identifying and controlling variables, stating hypotheses, operational definitions, graphing and interpreting data, and experimental design. the number of KPS items developed by Monica is presented in Table 1.

Table 1. KPS Specifications, Indicators and Number of KPS Items

Number	Integrated KPS	Indicator	Item Question	Amount
1.	Identify and control variables	Able to identify independent variables, dependent variables, and control variables if given a description of a research activity.	2, 6, 19, 25, 28, 29, 30	7
2.	States the hypothesis	Able to identify hypotheses to be tested to solve problems that contain dependent variables and independent variables.	8, 12, 16, 20, 23, 26	6
3.	Operational definition	Being able to put forward an operational definition of research variables that are stated verbally.	1, 7, 10, 18, 21, 22	6
4.	Designing research	Able to choose the right design to test a hypothesis.	3, 13, 15	8
5.	Draw graphs and interpret data	Being able to identify the relationships between variables from the graphs and data tables of a research result.	4, 5, 9, 11, 14, 17, 24, 27	3

The characteristics of the KPS assessment sheet developed by Monica are reported as follows. The average difference in power of items (overall discrimination index) is 0.40 (Monica, 2005: 68) which is classified as good. The mean of the index (level) of the difficulty of grain problems for KPS components is identifying and controlling variables, stating hypotheses, operational definitions, graphing & interpreting data, and experimental design is successively 0.43; 0.42; 0.35; 0.42 and 0.36 (Monica, 2005: 72). Grains are reported to have difficulty levels while the index is 0.40-0.70; index below 0.40 points is said to be difficult; and an index above 0.7 points is easy. The reliability of the KPS assessment sheet 0.81 is included in the range of good reliability from 0.70 to 1.0 (Monica, 2005: 73). The KPS assessment sheet developed by Monica has good differences, the index of difficulty is difficult and difficult, and has good scenes.

RESULTS AND DISCUSSION

1. KPS Data for Junior High School Students

KPS data for students of one of the state junior high schools in Surabaya before and after KPS is trained. The results show the completeness of KPS understanding indicators in class A and class B which was initially incomplete. After learning that includes KPS training, the chassis achieves completeness in each KPS indicator. This fact shows that in the target school, KPS students were still low (not completed) at first and then showed improvement in KPS after being trained in KPS. KPS students in other state junior high schools in Surabaya (Jannah research, 2016) also experienced improvement after KPS training. The KPS scores before learning were very low in the 2-12 range with score mode 3, the full score should be 25. Of the 25 students, 23 students were found to have increased KPS scores with a high N-gain between 0.65 to 0.93. The two students experienced an increase in PPP scores with an N-gain of 0.5. The number of students who completed the 12 KPS indicators tested also experienced an increase with a high N-gain of 0.60 to 0.93, only when the experimental design of the experiment was an average of 0.25. That is, without KPS training integrated into KPS learning the students were very low.

2. KPS Data for High School Student

The mean number of high school students answered correctly to the UN questions that included the KPS component for the last three years presented in Table 2. The data in Table 2 was sourced from UN (National Examination) data issued by the Education and Culture Ministry of Education and Culture for high school biology studies. The KPS components listed in Table 2 are identified from the formulation of capabilities tested through the UN.

Table 2. Average Absorption of Students with UN-KPS Problem Indicators in Percent

UN year	Tested Ability	KPS	Absorption (%)		
			City of Surabaya	East Java Province	National
2015/ 2016	Presented cases related to biological problems, students can explain how to overcome these problems.	*Experiment desigr*	54,15	65,01	46,97
2016/ 2017	Presented descriptions and results of experiments related to isotonic, hypotonic, and hypertonic, students can identify the events that occur in the experiment.	*Inter-preting data*	46,16	42,41	39,09
2017/ 2018	Determine research variables (indepen-dent variables, dependent variables, and control variables) in the experiment	*Identi-fying and controlling variables*	58,67	54,36	51,08

Source: National Examination data released by Puspendik Kemdikbud.

The mean number of high school students answered correctly to the UN question that involved the Surabaya City KPS component is that the high school / MA students responded correctly to all students and the UN from both public and private schools in the city of Surabaya. The mean number of high school students answered correctly to the UN question which included the KPS component at the provincial level was 38 of the districts / cities in East Java. The numbers in Table 3 show the low student enrollment on UN questions that represent KPS. The tendency is at least (not yet reaching 80%) the number of high school students who understand KPS occurs both in the city of Surabaya, East Java, and National. This data indicates that KPS has not been mastered nationally by a large number of high school students

3. KPS Data for PGSD Students in FKIP

KPS assessment has also been carried out on 25 PGSD students from a PTS. As it has been mentioned, the value of the KPS capability used is the outcome of the value assessment developed by Monica (2005). Based on the data, analysis results can be given as follows:

1) If the lowest rate for criterion is well established with 70, then 25 students who tested were 4 students (16%) whose KPS scores were good. The percentage of PGSD students in FKIP is one of the PTS in Probolinggo district who understands KPS very well.
2) The ability of KPS between individuals varies greatly. Students numbered by number 01 and numbered 06, had a total KPS ratio of almost 77.33 and 76.67, but their achievements were different if they were seen from the various KPS components. Student number 1 received score 100 on the 4th KPS component (graphing and interpreting data), while student number 06 received a score of 100 on the component 1 KPS (identifying and controlling variables). The same thing happened to students number 10 and students numbered 16.
3) The average score per KPS component that fulfills criteria is only a matter of identification and control of variables. The other four components of the scientific process have not yet been assessed as good students

In SSI-based learning, learners are confronted with socio-social issues including controversies that occur in the public (Sadler & Zeidler, 2005). SSI-based learning is colored by involving students in the problem-solving process. To undergo a problem-solving process, students must have good science process skills. To undergo an SSI-based learning process whose core is problem solving, students must have good KPS.

Through this presentation it can be concluded that the KPS of students at all three levels (SMP, SMA and Higher Education) is classified as low. Meetings about KPS high school students in the Biology course have presented national imagery, while findings about KPS junior high school students and students are still on small targets.

Basically, it can be understood that women find that furniture has good or high KPS. Though it has been known that KPS is correlated with problem solving skills (Jack, 2017). Problem solving activities are the core of SSI-based learning. KPS is a success in implementing SSI-based learning if the second core aspect of the mosque is a learning experience. This statement stays with Sadler & Murakami's (2014: 338) statement that SSI is closely connected with ideas about how science is carried out. The perpetrators of science are individuals who have the skills of the science process. The implication is that learning with high KPS has had the highest level of involvement in SSI-based learning.

Questions about how the readiness of learners in implementing SSI-based learning are reviewed from the ability of the scientific process that has been answered. The results of the KPS analysis have concluded that the KPS study yields are based on a low average. Such students are not yet readily involved in SSI-based learning. A recommended recommendation is the need for participatory learning with PPP exercises before implementing SSI-based learning.

Participants with low KPS education, in addition to being worried about experiencing difficulties in implementing SSI-based learning will also be weak in the closure of literature and scientific based information (Dogan & Kunt, 2016). If the KPS in learners at all levels is not prepared for training and is improved through learning, the efforts to improve the problem-solving ability through SSI-based learning. According toener & Bags (2017) KPS is a prerequisite for the staging of learning based on problem solving that becomes learning from SSI based learning.

Student preparation for having high KPS can be done. Low KPS learners have been shown to experience a significant increase after learning has been implicated in learning in which KPS is trained (Jannah, 2016); Astuti, 2018).

CONCLUSION

1. Through this research, it can be concluded that the learning process skills of students in junior high, high school, and education are relatively low. This conclusion is still limited to the targets of a number of junior high school students and to the target of a student in a study program, while high school students have been based on national data.
2. None of your learning tools are prepared to be involved in SSI-based learning. It is examined from expert learning experiences specifically, ownership of science process skills.

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