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The Influence of Inquiry Learning Based on Socio-Scientific Issues (SSI) on High School Students' Inquiry Skills and Chemical Literacy

Rika Masrina Dewi[1*], AK. Prodjosantoso[1]

[1] Master's Program in Chemistry Education, Faculty of Mathematics and Natural Sciences, Universitas Negeri Yogyakarta, Yogyakarta, Indonesia.

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Corresponding Author:
Rika Masrina Dewi
rikamasrina.2021@student.uny.ac.id

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Abstract: This research examines the effect of SSI-based inquiry learning compared to discovery learning on students' chemical literacy abilities and inquiry skills. It also explores the percentage contribution of SSI-based inquiry learning to these abilities, along with the percentage of students achieving good levels in both areas. The study follows a quasi-experimental design with pretest, treatment, and posttest stages. The population includes all XI-grade students in MAN South Aceh Regency, with a sample drawn from two classes at MAN 4 South Aceh (XI IPA1 and XI IPA2). Data was collected using questions, observation sheets, and questionnaires, and analyzed through MANOVA and N-gain tests. The results indicate a significant difference in chemical literacy and inquiry skills between students using SSI-based inquiry learning and those applying discovery learning. Students engaged in SSI-based inquiry learning performed better in both areas. The study found that SSI-based inquiry learning contributes 92.80% to the improvement of students' chemical literacy and inquiry skills, with 80.90% contributing to chemical literacy and 83.20% to inquiry skills. Additionally, 82% of students in SSI-based inquiry learning show good chemical literacy, while 50% demonstrate good inquiry skills.

Keywords: Chemical Literacy**;** Inquiry learning; Inquiry skills; Socio-Scientific Issues (SSI)

Introduction

Education is a form of conscious effort to realize an active teaching and learning process to develop student potential. Education in the 21st century requires all educators to be able to describe models in learning activities. Education in the 21st century also requires teachers to be able to integrate science and technology to the maximum, so that it develops quickly and becomes increasingly sophisticated. Implementing a learning model is a form of 21st century educational integration. Khawani et al. (2023) said that the learning model is something that must be mastered by teachers in developing their experience to create an empowered and proficient learning climate.

The learning model is able to help teachers integrate the concepts studied effectively, so that students are interested in participating in learning activities. The skills that students must have in 21st century education are literacy skills. The term literacy skills is one of the main focuses in the development of the 2013 curriculum and the independent curriculum. Sutrisna (2021) says that chemical literacy is the ability to understand ideas and logical cycles using science to deal with problems in everyday life.

Chemical literacy includes an understanding of the nature of material particles, chemical reactions, chemical

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laws and theories, as well as general chemical applications in everyday life (Imansari & Sumarni, 2018). The application of chemical literacy improves the ability to understand reading content related to chemical theories, because students are motivated to be able to improve their skills and thinking abilities to solve a main problem. Anggraeni et al. (2022) said that literacy is very necessary to support the successful understanding of scientific content. Countries whose populations have low literacy will be weak in problem-solving skills and lack knowledge. Implementing literacy in chemistry lessons is very important, chemical theories are abstract. The low level of student literacy in Indonesia can be proven by the 2018 PISA results.

PISA complements various existing broad and universal evaluation frameworks and instruments, by assessing the educational abilities of Indonesian children aged 15 years at school in reading, mathematics and science. PISA characterizes reading education as the ability to perceive, use, evaluate, think about and be interested in texts to achieve goals, to create information and potential, and to take part fully in the public arena (OECD, 2019). The various literacies developed in PISA are reading, mathematics and science literacy. The results of the 2018 PISA data collection show that Indonesian students' reading ability achieved an average score of 371, while the average OECD score was 487. Then for mathematics the average score reached 379 and the OECD average score was 487. Furthermore, for science, the score average Indonesian student score is 389 and the OECD average score is 489. Indonesia's 2018 PISA data has low category data, because its position is the third lowest compared to ASEAN countries and Brazil (Kemendikbud, 2019). This shows that the literacy and science abilities of Indonesian students are still low.

The low reading and science literacy skills of students are due to the lack of implementing learning that is able to encourage students to be directly involved in the process of improving their skills. The results of observations at Madrasah Aliyah Negeri (MAN) 4 South Aceh show that some students are still less enthusiastic about participating in learning activities, because learning activities so far are still conventional, meaning that carrying out the learning process through lectures and discussions generally does not form experimental and discussion activities in general group. In fact, the curriculum accommodates every school to be able to develop literacy skills, one of which is scientific literacy. The results of observations in the field so far show that teachers do not involve students enough to be able to solve problems, improve their skills and support their literacy. The chemical literacy demonstrated in schools has not yet been realized according to expectations, so students' abilities in chemistry lessons are still low. According to Muntholib et al. (2020) Chemical literacy includes knowledge of science and chemical content, the application of chemistry in real-world contexts, high-level learning skills, and attitudes toward chemistry. These elements help students understand and apply chemical concepts, solve problems, and think critically about scientific ideas in both academic and everyday situations.

The results of observations at Madrasah Aliyah Negeri (MAN) 4 South Aceh increased the level of students' skills in the low category. Of the 24 students, only 9 or 37.5% were able to master study skills, and there were 15 or 62.5% of students who had a low level of study skills. This proves that students' skills in carrying out learning activities in chemistry subjects have decreased by <50%. Thus, students' low skills are caused by their lack of chemical literacy skills. In applying chemical literacy, students are still less able to find an idea or main problem as a solution in solving a particular problem.

The results of interviews with three Chemistry teachers at Madrasah Aliyah Negeri (MAN) 4 South Aceh stated that the implementation of learning so far still uses the lecture method and discussions of the material explained on the blackboard. Apart from that, the teacher also only uses demonstration methods through pictures and power points. Teachers have never implemented a discovery or problem-based learning model, so it is difficult for students to dig up information related to the problems being studied. In fact, through discovery-based learning, students are able to explore information related to issues or phenomena in everyday life as examples of the material they are studying. In fact, students are still unable to think critically to find new ideas, because learning activities are centered on teachers, not students. Teacher-centered learning activities can hinder students' skills.

The novelty of this research lies in the combination of inquiry-based learning models with Socio-Scientific Issues (SSI), which have not been widely applied in Indonesia. This approach not only encourages students' inquiry skills and chemical literacy, but also integrates scientific contexts with social issues that are relevant to everyday life. This is important because SSI allows students to think critically, develop problem-solving skills, and see the relationship between science and social reality. This broadens the scope of chemistry learning, which previously tended to be theoretical, to be more applicable and relevant for students. SSI is a complicated problem without a clear scientific s olution that incorporates a number of social factors and can only be resolved by integrating different viewpoint s and facets of the problem (Rahayu, 2019; Genisa et al., 2020; Husniyyah et al., 2023; Dusturi et al., 2024 & Falah et al., 2024).

This research is also important because it provides a solution to the low chemical literacy of students in Indonesia, as seen from the PISA results. By linking learning to real issues involving science and society, the SSI model helps students understand chemical concepts more deeply, increases learning motivation, and improves critical thinking skills. This innovation is expected to overcome the weaknesses of conventional learning methods that are still widely applied, such as at MAN 4 South Aceh, where students' skills in learning chemistry are still relatively low. Due to its extensive application across various fields, chemistry is often referred to as a fundamental science (Satriya & Atun, 2024).

Inquiry learning is a learning activity that can activate students. In line with research conducted by Setiasih et al. (2016) the inquiry learning model emphasizes the process of thinking critically and analytically to seek and find answers to a problem in question. The results of previous research also show that inquiry-based learning is guided effectively to improve students' scientific literacy skills because the stages of student learning according to Piaget's cognitive development include the formal operational stage, namely the stage where students can think abstractly or symbolically and solve problems through experimentation (Aulia et al., 2018). Inquiry learning or guided inquiry is one of the most popular learning models in chemistry learningbecause it can be applied in understanding concepts and carrying out experiments (Akmar et al., 2024; Agustina et al., 2024; Meisaroh & Suparno, 2024). So, inquiry learning is a learning model to improve students' abilities in solving problems.

Increasing chemical literacy can occur due to the use of the guided inquiry learning model which can train students to construct answers and think intelligently, develop understanding skills, build a sense of responsibility (individual responsibility), and train the process of conveying the concepts discovered (Imansari & Sumarni, 2018). Chemical literacy is a benchmark for the implementation of science education taught to all students from elementary to higher education (Ifdaniyah & Sukmawati, 2024; Iswanti et al., 2024; Aris et al., 2024). This shows that one solution that is considered capable of overcoming the problems being experienced by students is to improve inquiry skills and chemical literacy by using inquiry learning. However, to explore scientific issues globally, teachers need to link inquiry learning with socio-scientific issues, because they are considered capable of linking it to phenomena in everyday life, as well as issues in social life conceptually related to science.

Method

This research uses a quantitative approach with an experimental research method in the form of a quasi experiment. This method contains steps consisting of pretest, treatment and posttest. The population in this study were all class XI students in all MAN South Aceh Regency. The sampling technique used in this research was simple random sampling. The reason for determining the sample using simple random sampling was because the population was less than 100 students, so the sample in this study was randomized according to the equality of each class. Thus, the level of equality in terms of the average value is 70-80. Therefore, the sample in this study consisted of class XI IPA1 as the experimental class and class XI IPA2 as the control class. Data collection techniques in this research are test techniques, observation and filling out questionnaires. The instruments used in this research were questions, observation sheets and questionnaires. Data analysis techniques were carried out through MANOVA and N-gain tests.

Result and Discussion

Hypothesis testing in this research was carried out through prerequisite tests and MANOVA tests with the help of the SPSS version 22 application program, and was supported by tests of between subject effects, achievement of chemical literacy abilities and student inquiry skills in each experimental class and control class which were explained as follows:

Prerequisite Test Results

Data analysis in this research was conducted using the MANOVA technique with the help of SPSS version 22. Several prerequisite tests were carried out, consisting of nine assumptions before testing the hypothesis. First, the dependent variables, chemical literacy ability and inquiry skills, are continuous data types obtained from tests with a specific range of values. Second, the independent variable consists of two or more independent group categories, which in this study are SSI-based inquiry learning and discovery learning. Third, there is independence of observations, meaning there is no relationship between observations within or between groups; the sample included two groups, with the experimental group using SSI-based inquiry learning and the control group using discovery learning. Fourth, the sample size must be adequate, with 43 students serving as the sample in this research. Fifth, the research sample data must not contain univariate or multivariate outliers, which was verified through boxplot analysis as shown in Figures 1 and 2.

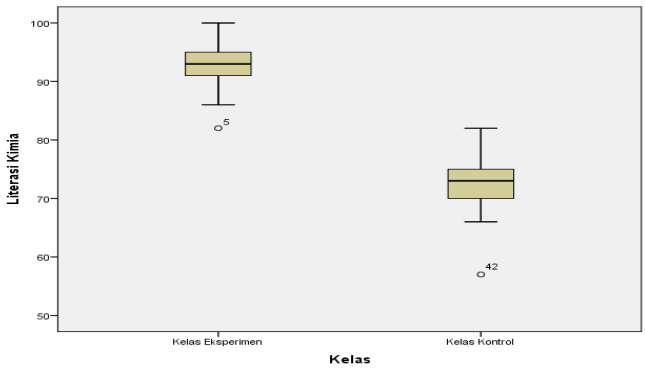

Figure 1. Univariate boxplot of chemical literacy ability

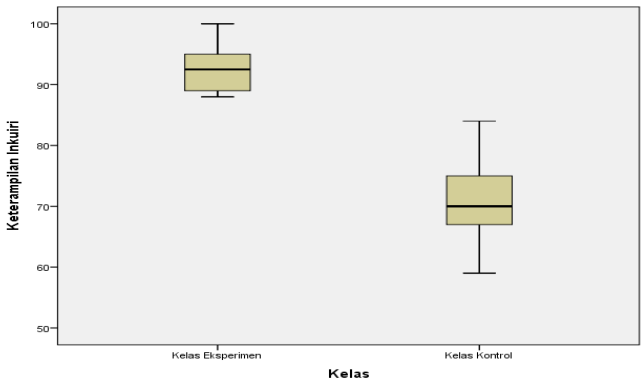

Figure 2. Univariate boxplot of inquiry skills

From Figures 1 and 2, the results of the univariate outlier analysis show that in the boxplots of chemical literacy abilities and inquiry skills in each experimental class and control class there are no points outside the box which can be concluded that there are no univariate outliers.

Based on the results of multivariate outlier analysis using scatter plots shown in Figures 3 and 4, comparing the mahalanobis distance with chi square shows that there are no multivariate outliers. The results obtained from the scatter plot tend to form a straight line with each linear squared R value for the experimental class of 0.951 and the control class of 0.954. The linear R squared value is close to one so it does not indicate the presence of a multivariate outlier.

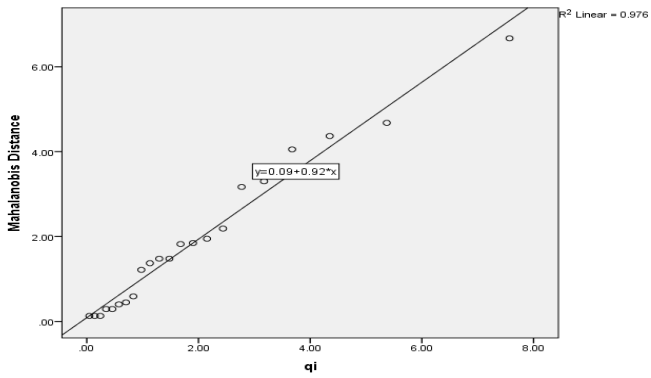

Figure 3. Experimental class scatter plot

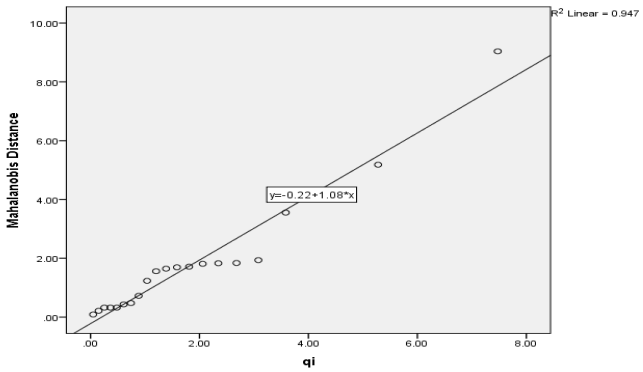

Figure 4. Control class scatter plot

The sixth assumption, the multivariate normality test of each variable measured, namely chemical literacy and inquiry skills. Normality test results use the Kolmogorov Smirnov or Shapiro-Wilk normality test.

Table 1. Multivariate Normality Test Results

Variable	Class	Shapiro-Wilk		Conclusion
		df	Sig.	
Chemical Literacy Ability	Experiment	22	0.100	Normally Distributed Data
	Control	21	0.201	
Inquiry Skills	Experiment	22	0.080	
	Control	21	0.424	

Table 1 shows the results of the normality test for chemical literacy abilities and inquiry skills in the experimental class and control class. Based on the results of the normality test analysis on experimental class and control class data carried out using the Shapiro Wilk test which has a significance value greater than 0.05, H0 is accepted, so it can be concluded that at a significance level of 5% the data on chemical literacy abilities and inquiry skills come from a population that normally distributed in multivariate analysis.

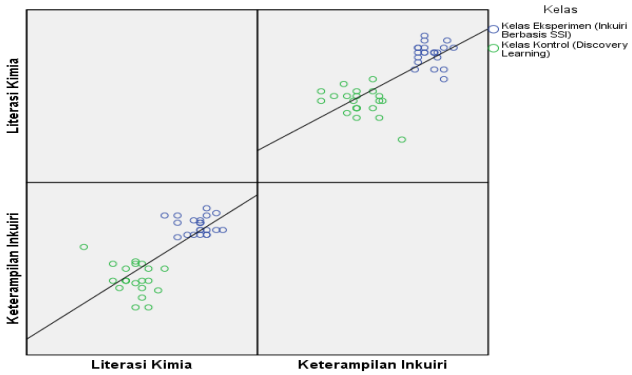

Figure 5. Scatter plot of linear relationship matrix

The seventh assumption is to have a linear relationship between each pair of dependent variables for each independent group. This prerequisite is carried out using a matrix scatter plot for the dependent variable

pair, namely chemical literacy skills and collaboration skills. The results of the linear relationship test are presented in Figure 5.

Based on Figure 5, it shows that the scatter plot tends to form a straight line, which means there is a linear relationship between pairs of dependent variables (Hair et al., 2014).

The eighth assumption is that there is homogeneity of the variance-covariance matrix using data from the experimental class and control class. Testing is carried out using the Box's M test (Hair et al., 2014).

Table 2. Results of the Variance-Covariance Matrix Homogeneity Test

Box's M	F	Sig	Conclusion
7.693	2.429	0.063	Homogeneous

Based on Table 2, the results of the homogeneity test show a significance value of 0.063 which is greater than 0.05, so H0 is accepted, so it can be concluded that the data comes from a population that has a homogeneous variance-covariance matrix.

The ninth assumption, there is no multicollinearity. The multicollinearity test can be carried out by knowing the correlation coefficient between the dependent variables using the product moment correlation test. This aims to determine the correlation between the dependent variables in this research. The results of the correlation test for chemical literacy skills with inquiry skills obtained a correlation coefficient of 0.768, including the strong correlation category.

Hypothesis Test Results

Hypothesis testing using the MANOVA test in this study used pretest and posttest score data on chemical literacy skills and the average score of the inquiry skills observation sheet. Data analysis in hypothesis testing uses the help of the SPSS program with a significance level of 5%. The hypothesis test used is the results of Hottelling's Trace because it involves two dependent variables and meets the requirements for normally distributed and homogeneous data. The decision made in testing this hypothesis is that if the significance value is smaller than 0.05 then H0 is rejected.

First and Fourth Hypothesis Test Results

The following are the results of testing the first and fourth hypotheses.

Table 3. MANOVA Test Results

Test Analysis	F	Sig.	Partial Eta Square	Decision
Hotelling's Trace	259.101	0.001	0.928	H_0 rejected

From the results of data analysis, it was found that the Hottelling's Trace significance value was 0.001, which was smaller than 0.05, so H0 was rejected. Thus it can be concluded that at a significance level of 5% there is a difference in chemical literacy abilities and inquiry skills between students who apply SSI-based inquiry learning and students who apply discovery learning. This result is supported by the results of partial eta square analysis which shows the contribution value of the dependent variable in this study, namely chemical literacy ability and inquiry skills, of 92.8%.

Second, Third, Fifth and Sixth Hypothesis Test Results

The aim of testing this hypothesis is to determine whether or not there are differences in each dependent variable. In this case the dependent variable is chemical literacy ability and inquiry skills between the experimental class using SSI-based inquiry learning and the control class using discovery learning as viewed from the results test of between subject effect. As for the results of test of between subject effect can be seen in Table 4.

Table 4. Results of Test of Between Subject Effect

Variable	Df	*Mean Square*	F	Sig.	*Eta Square*	Decision
Chemical Literacy Ability	1	4268,886	173,884	0.000	0.809	H_0 rejected
Inquiry Skills	1	5203,256	202,950	0.000	0.832	H_0 rejected

Table 4 shows that the significance value for chemical literacy ability is 0.000, which is smaller than 0.05, so H0 is rejected. Thus it can be concluded that at a significance level of 5% there is a difference in chemical literacy abilities between students who apply SSI-based inquiry learning and students who use discovery learning. This is supported by the results of the eta square analysis which shows that the contribution value of the chemical literacy ability variable is 80.9%.

Furthermore, the results of the analysis of chemical literacy abilities and inquiry skills obtained a significance value of 0.000, which is smaller than 0.05, so H0 was rejected. Thus it can be concluded that at a significance level of 5% there is a difference in inquiry skills between students who apply SSI-based inquiry learning and students who apply discovery learning. This is supported by the results of the eta square analysis which shows that the contribution value of the inquiry skills variable is 83.2%. In line with research put forward by Pedaste et al. (2015) that inquiry-based learning is able to involve students in the process of authentic scientific discovery. From a pedagogical perspective,

complex scientific processes are divided into smaller, logically connected units that guide students and draw attention to important features of scientific thinking. Even as stated by Mahanani et al. (2019) that in connection with the development of scientific or chemical literacy, Socio scientific Issues (SSI) is the right context for developing students' scientific or chemical literacy abilities.

Students' Chemical Literacy Ability in Experiment Class and Control Class

The results of the analysis of students' chemical literacy abilities in the experimental class in this study used SSI-based inquiry learning and in the control class through the use of discovery learning on reaction rate material. According to Viendrieana et al. (2021) that chemical literacy skills are needed by students to understand chemical science and technology which is experiencing continuous development. The results of data analysis prove that there is an increase in chemical literacy through the implementation of SSI-based inquiry learning. More complete results can be seen in Figure 6.

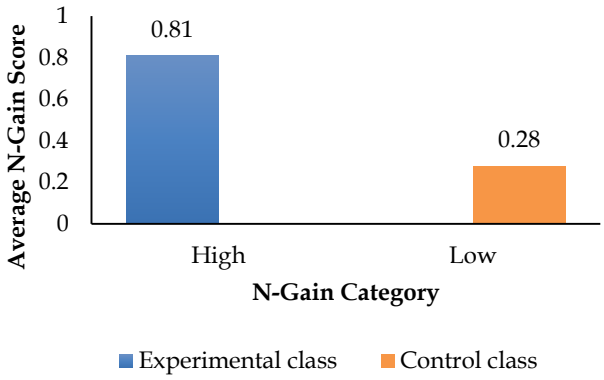

Figure 6. Results of n-gain analysis of chemical literacy

Figure 6 shows the results of the N-gain analysis of students' chemical literacy in the experimental class and control class. Based on the results of data analysis, it shows that after implementing SSI-based inquiry learning, students' chemical literacy increased higher than discovery learning in the control class. This proves that SSI-based inquiry learning is able to improve students' chemical literacy skills in reaction rate material because this learning encourages students to link learning activities with social-based phenomena found in everyday life. In line with the results of research conducted by Jerrim et al. (2020) that one of the prominent schools of thought is that science should be taught using inquiry methods. At a high level, inquiry is a form of active learning. In line with research conducted by Qamariyah et al. (2021) The inquiry-based learning process allows students to find, decide, and use various sources of information and ideas to increase understanding of problems or phenomena. Besides that, Sari et al. (2021) said that SSI's locally based investigations present problems that are relevant to students' everyday lives and provide meaningful learning opportunities.

The results of data analysis show that the application of SSI-based inquiry is a learning model that is able to support the implementation of chemical literacy, because the concepts discussed in chemistry learning are related to social concepts. This is in line with research put forward by Onwu et al. (2017) students consider socio-scientific issues in science lessons, use in developing reasoning, communication and analysis skills and appreciate the strengths and limitations of scientific processes and content in addressing specific problems. In this way the demands on science teachers and the science curriculum become integrated and all-encompassing.

Apart from that, chemical literacy abilities can also be seen from the results of the categorization percentage. The results of the analysis can be seen in Figure 7.

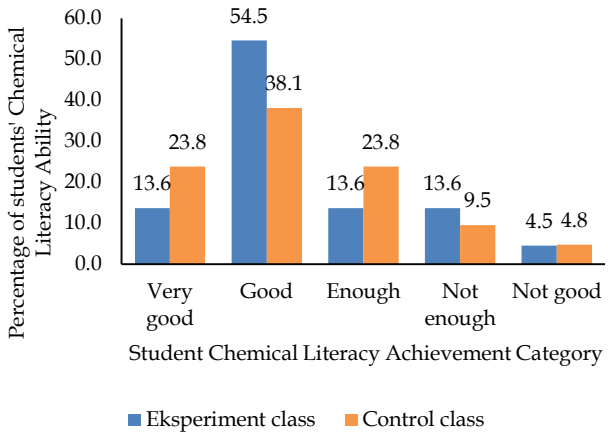

Figure 7. Achievement of chemical literacy capabilities by category

The results of data analysis in table 7 prove that after implementing SSI-based inquiry learning, the percentage of students' chemical literacy ability level in the experimental class was 54.5% in the good category and 23.8% in the very good category. Meanwhile, in the control class, 38.1% were in the good category and 13.6% were in the very good category. The results obtained prove that the experimental class improved much more than the control class. This proves that chemical literacy is very important to improve in students. This is in line with research conducted by Yustin et al. (2019) Chemical literacy explains that chemical content knowledge explains how a chemically literate student must understand general chemical ideas and use knowledge

to explain a phenomenon and understand the characteristics (key ideas) of chemistry in explaining processes and reactions in chemistry. Besides that, Thummathong et al. (2018) said that chemical literacy refers to a person's ability to understand and apply chemistry in everyday life in terms of understanding three major aspects, namely knowledge, awareness, and the appropriate and effective application of chemistry in everyday life.

Other research results also suggest that chemistry tends to focus on scientific science, thus preventing students from seeing science as something integrated with the environment, technology and society (Lukman et al., 2022).

Student Inquiry Skills in the Experimental and Control Classes

Students' inquiry skills in this research study were assessed in the experimental class and control class. The experimental class uses SSI-based inquiry learning, while the control class uses discovery learning. The achievement of improving students' inquiry skills can be reviewed through the results of the average percentage per category and the achievement of the average percentage per indicator. The complete analysis results can be seen in Figure 10.

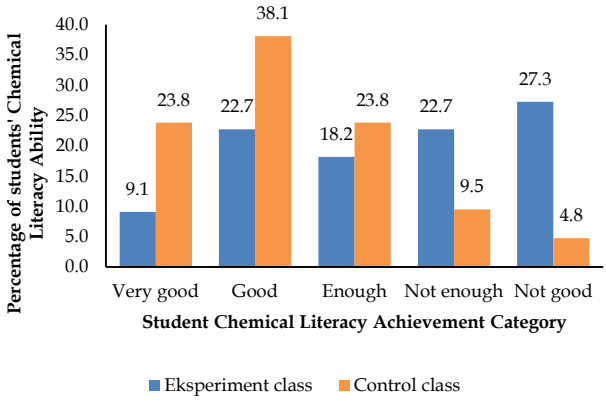

Figure 8. Achievement of inquiry skills by category

Based on the results of data analysis, it proves that the application of SSI-based inquiry learning is able to improve students' inquiry skills in 38.1% of students in the good category and 23.8% in the very good category, whereas in the control class through discovery learning there are only 22.7% in the good category and 9.1% very good category. The results of data analysis prove that students' inquiry skills are higher after implementing SSI-based inquiry learning. This is because if students can improve inquiry skills, it means students are able to improve basic skills such as selecting and controlling variables, planning operations and interpreting evidence (Ekici & Erdem, 2020).

Student perceptions show that through the implementation of SSI-based learning, it is able to encourage students to improve their skills in discussing concepts in depth and finding new ideas in solving them. Thus, SSI-based inquiry learning is very synonymous with students' skills in relating material globally that discusses scientific issues. In line with what was stated by Dobber et al. (2017) that inquiry-based learning with adequate scaffolding has a positive impact on student learning, more specifically on the development of knowledge, reasoning skills, motivation and self-regulation of learning.

Apart from that, improvements in students' inquiry skills can also be measured through indicator analysis. The results of the analysis can be seen in Figure 9.

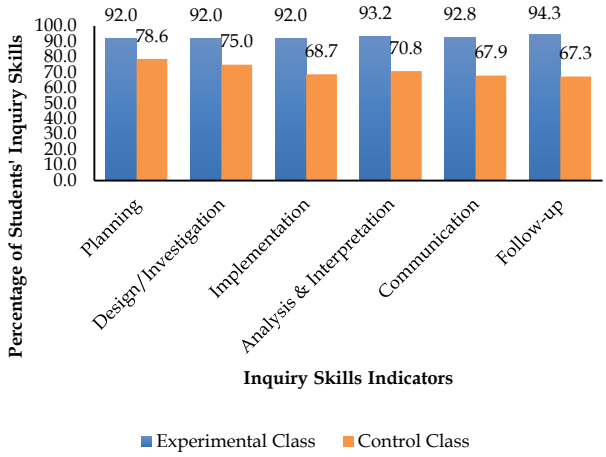

Figure 9. Improvement of indicator inquiry skills

Based on the results of data analysis in table 9, it shows that the average indicator of student inquiry skills in the experimental class has a percentage range from 92.0-94.3, then the analysis results in the control class have a percentage range between 67.3-78.6. From the results of data analysis, it shows that the highest most dominant indicator in the experimental class was obtained from the follow-up indicator, while in the control class it was obtained from the planning indicator. This proves that the application of SSI-based inquiry learning can improve students' inquiry skills better than discovery learning. This is in line with research conducted by Sergis et al. (2017) that inquiry-based approaches have received great attention globally, based on reported benefits on student achievement of educational goals related to the subject domain.

Students' inquiry skills improved better in the experimental class compared to the control class. This is because, more specifically, in the context of inquiry learning, students are expected to have different skills in drawing accurate conclusions from experiments and integrating this knowledge into existing knowledge

schemes (Dijk et al., 2016). Apart from that, increasing students' inquiry skills can be demonstrated by increasing science learning in the analysis process as well as adequate inquiry involvement (Wen et al., 2020). In this case, interest in science learning is an important factor for effective inquiry teaching because this practice often requires a lot of effort and commitment from students to actively build their own knowledge (Teig et al., 2018). This is also because inquiry learning is able to instruct an active learning process that reflects a scientific approach in investigating and investigating science learning (Sari et al., 2023). Thus, it can be concluded that students' achievement of inquiry skills has increased significantly, where students have skills in solving problems in the material they study.

Seventh Hypothesis Test Results

Testing the seventh hypothesis is to determine the achievement of students' chemical literacy skills by implementing SSI-based inquiry learning on reaction rate material. The results of hypothesis testing were analyzed descriptively using chemical literacy posttest data and in terms of test scores and interest/interest questionnaire scores in chemistry. The results of the analysis of the level of achievement of chemical literacy skills can be seen in Figure 10.

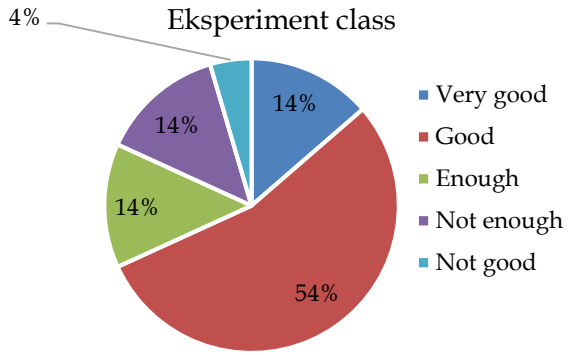

Figure 10. Achievement of chemical literacy skills

From the results of data analysis, it shows that on average the most dominant chemical literacy skills of students were obtained in the good category, namely 14% in the sufficient category, 54% in the good category, and 14% in the very good category. The results obtained prove that 82% of students have increased chemical literacy skills. This is because students' chemical literacy skills in chemistry lessons in the category increase through SSI-based inquiry learning. The following is the average chemical literacy test score in terms of question indicators from the Higher-Order Learning Skills (HOLS) aspect and the attitude aspect which can be seen in Figure 11.

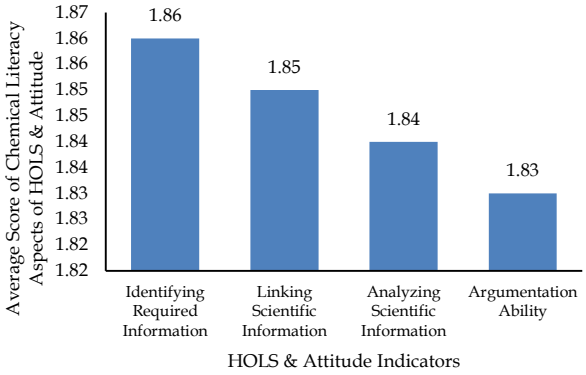

Figure 11. Average chemical literacy ability test score for HOLS & attitude aspects

Based on Figure 11, the results of the analysis of the average achievement of chemical literacy skills in terms of HOLS and attitude aspects. The results of the analysis prove that on average students are able to improve their chemical literacy skills in the high category. The results of the analysis prove that the most dominant achievement is in the indicator of identifying the information needed and the lowest is in the indicator of argumentative ability. The following are the results of a questionnaire analysis of students' interest in chemistry lessons in more detail, which can be seen in Figure 12.

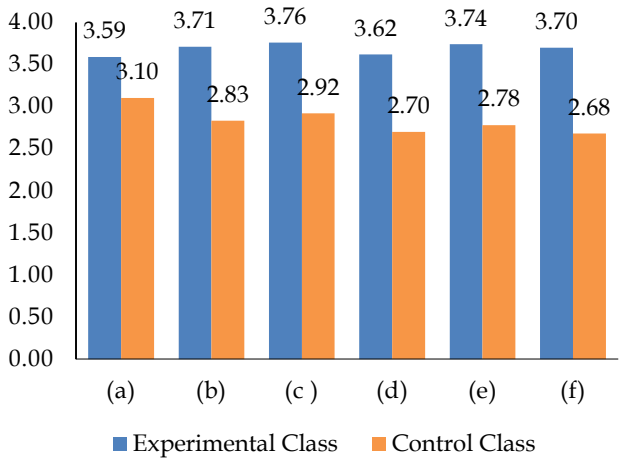

Figure 12. Average interest questionnaire score/interest in chemistry

Information:
(a) Show interest in studying chemistry
(b) Show interest in learning chemistry because it is related to everyday life
(c) Realize the usefulness of chemistry
(d) Show interest in studying chemistry because the material studied is able to explain various related examples

(e) Has an interest in studying chemistry because he is able to discuss related issues
(f) Has an interest in studying chemistry because he is able to argue in his answers.

Figure 12 shows the results of the questionnaire analysis of students' interest in chemistry lessons. Based on the results of data analysis, it shows that after implementing SSI-based inquiry learning, students have an interest in learning chemistry. This can be seen from the average student answers stating agree and strongly agree. With students' interest in chemistry lessons, SSI-based inquiry learning can be used as a learning model that supports teachers' implementation in the teaching and learning process.

Eighth Hypothesis Test Results

The results of testing the eighth hypothesis are to determine students' achievement of inquiry skills by implementing SSI-based inquiry learning on reaction rate material. The results of hypothesis testing are analyzed descriptively using the results of observations during the learning process. The observation results are reviewed from the average score and indicator values. The results of the analysis of the level of achievement of inquiry skills can be seen in Figure 13.

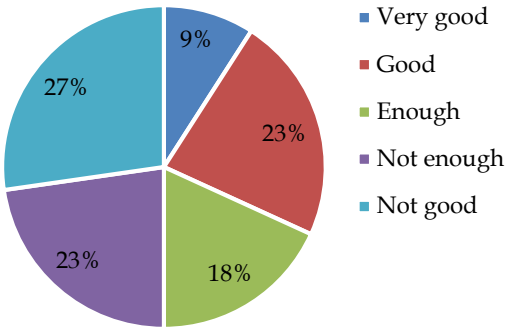

Figure 13. Achievement of inquiry skills

Figure 13 shows the results of the analysis of students' achievement of inquiry skills through the application of SSI-based inquiry learning on reaction rate material. From the results of data analysis, it proves that only 23% are in the good category and 9% of students are in the very good category. Thus, it can be concluded that students' achievement of inquiry skills is still in the low category, because there are still <50% of students who are able to improve their inquiry skills in the good and very good categories. Apart from that, the level of students' inquiry skills can also be seen from the increase in indicators. The results of the analysis can be seen in Figure 14.

Figure 14 shows the results of the analysis of students' achievement of inquiry skills while implementing SSI-based inquiry learning on reaction rate material. From the results of data analysis, it is proven that the level of achievement of indicator students' inquiry skills on average increased higher from several stages, namely planning, design/investigation, implementation, analysis and interpretation, communication, and follow-up. This is because the guided inquiry learning model is able to improve students' inquiry skills. In line with research conducted by Meisaroh & Suparno, (2024) the guided inquiry learning model is a teaching approach where the teacher presents certain material topics and guides students in understanding and finding solutions.

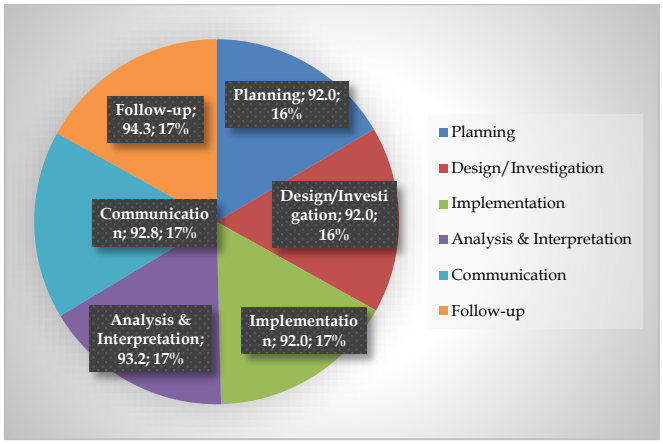

Figure 14. Achievement of inquiry skills

Conclusion

Based on the results of the research, several conclusions can be drawn. First, there are significant differences in chemical literacy and inquiry skills between students who participate in SSI-based inquiry learning and those who use discovery learning. The findings reveal that chemical literacy and inquiry skills in SSI-based inquiry learning are significantly better than those in discovery learning. Second, there is a clear distinction in chemical literacy abilities between students applying SSI-based inquiry learning and those using discovery learning, with the former showing superior literacy skills. Third, differences in inquiry skills are also evident, with students who engage in SSI-based inquiry learning outperforming those in discovery learning. Fourth, the results indicate that SSI-based inquiry learning contributes 92.80% to the improvement of students' chemical literacy and inquiry skills. Fifth, SSI-based inquiry learning specifically contributes 80.9% to students' chemical literacy skills. Sixth, this learning model contributes 83.20% to the development of students' inquiry skills. Finally, 82% of students who participated in SSI-based inquiry learning demonstrated

good chemical literacy, while 50% showed strong inquiry skills in chemistry lessons.

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Conceptualization: Rika Masrina Dewi & AK. Prodjosantoso, Data Curation and data acquisition: Rika Masrina Dewi, methodology Rika Masrina Dewi & AK. Prodjosantoso, Visualization: Rika Masrina Dewi, original draft writing: Rika Masrina Dewi.

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No conflicts of interest.

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