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The Effectiveness of Integrated Socio-Scientific Issues Jigsaw Model to Improve Students' Chemistry Literacy and Communication Skills

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Abstract

This quasi-experimental study was designed to determine the effectiveness of the integrated socio-scientific issues (SSI) Jigsaw learning model to improve students' chemical literacy and communication skills on acid-base solution topic. A number of 31 and 36 of 11th grade students were randomly selected for the experimental and the control classes, respectively. The integrated SSI Jigsaw learning model was applied for the experimental class, while the Direct Instruction (DI) model was used for the control class. The literacy test, and the Likert scale instrument were used for collecting the data; while the t-test, and the n-gain test technique were used for analysing the data. The results indicated that there were significant mean increasing in the chemistry literacy and communication skills of students after learning with the SSI Jigsaw integrated model. The n-gain value for chemistry literacy skills and for student communication skills were 64.26% and 56.19%, respectively. This mean that the integrated socio-scientific issues (SSI) Jigsaw learning model is promising improve students' chemistry literacy and communication skills on acid-base solution topic.

Keywords: *Chemical Literacy, Communication Skills, Jigsaw Learning, Socio-Scientific Issues*

INTRODUCTION

The learning activities in 21st-century emphasize that every student must have multiple skills, including critical thinking skills, digital literacy, information literacy, and media literacy, and be able to master science and technology. One of the sixteen skills identified by the World Economic Forum as necessary in the 21st century is science, one of which is chemistry, literacy (WEF, 2015). The learning process of chemistry does not only involve students' cognitive knowledge, but also scientific ideas, attitudes, interests, and rational thinking of students. Students' ability in making a connection between chemistry and everyday life are exercised in the chemistry literacy learning process.

Referring to OECD report (2018) about PISA test results, Indonesia is ranked in the bottom of 6, which is ranked 74 out of 79 countries. The average scores of the three basic competencies in reading, mathematics, and science literacy are 371, 379 and 396, respectively. These scores are far below the average of OECD countries (OECD Teams, 2019). In general, the report also represents the low chemistry literacy of Indonesia students.

Based on the observation on 11th-grade students in Yogyakarta, the students were unable to use the higher-order learning skills (HOLS) to solve the chemistry problems. The students failed to explain the chemistry phenomena and to identify scientific issues related to chemistry. The chemistry learning did not develop the students' ability to analyse a reading. About 80% of students are lacking in representing good chemical literacy skills, and the chemistry learning objectives are not achieved optimally.

Furthermore, Schwartz et al. (2006) propose four aspects of chemical literacy: chemical content knowledge, chemistry in context, higher-order learning skills, and affective aspects. Chemistry content knowledge describes how chemically literate students should understand general chemical ideas through scientific investigation, generalization of findings, and utilization of knowledge to explain a phenomenon—the key ideas or characteristics of chemistry, including how students can explain the macroscopic level of chemistry. Chemistry in context describes real-life situations involving chemistry and technology, and the students should be able to

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use chemistry knowledge to explain everyday situations from any points of view (e.g., health, environment), describe chemistry in everyday life, and participate in social arguments about chemistry-related issues. Students' high-level learning skills involving decision-making and reasoning abilities. The affective aspect describes students' interest in learning chemistry. Students provide responses to scientific issues that represent their interest in the issues, support the scientific approach, and have a sense of responsibility for the situation. These skills are essential in interacting science and technology with society, ecology, economics, and students' desires, needs, and interests (Fensham, 2002; Marks & Eilks, 2009).

Besides chemical literacy skill, learning chemistry in the 21st century requires students to master communication skill. Communication skill is one of four learning competencies: high comprehension skill, critical thinking skill, collaboration and communication skill, and critical thinking skill. Thus, students' communication skill is essential to learning (Rizki et al., 2019).

Communication is a process of individual in relationships, groups, organizations, and society, by creating and using information to communicate with others and their surrounding (Ruben & Stewart, 2013). Communication skill in the learning context is interpreted as the abilities that students must possess and master because they aim to explore knowledge as much as possible and convey information to the public both orally and in writing. (Marfuah, 2017). According to Latifah and Mujianto (2020), communication skill is the ability to argue and respond to information.

The ability to argue is the ability to convey ideas to others. Exchange of ideas activities are carried out during discussing learning material. The ability to respond to information can be seen in students' ability to listen to other people's opinions, appreciate differences of opinion during discussions, and be able to respond by responding. The importance of communication skills provides an active learning atmosphere which students have confidence in conveying arguments and becomes a means of developing empathy in respecting differences of opinion (Marfuah, 2017).

Referring to the Ministry of Education and Culture's Policy Research Center Number 3 of 2021 concerning improving the basic literacy abilities of Indonesian students based on PISA 2018 data analysis, it was found that teachers still have not accustomed students to using various metacognition strategies which can be formed from nine indicators, of which the percentage has not been implemented by teachers to students occurred in the indicator of answering questions related to reading at 90.4%; expressed opinions related to reading texts by 74.2%; and discussing reading texts with other students was 87.6%. From the data, the three indicators that have yet to be achieved can represent students' low communication skills in argumentation ability and ability to respond to information.

Other data were also obtained based on the initial observations of students at one of the senior high schools in Sleman, Indonesia. Around 70% of grade 11 students who filled out the observation questionnaire stated that they had difficulty explaining their understanding or argumentation and responding in their own words during a discussion. One of the reasons is that the chemistry learning that is carried out only facilitates a few scientific discussions or presentations in front of the class. Therefore, it is necessary to develop chemistry learning that facilitates students' communication skills and chemical literacy.

On the other hand, the current development of the chemistry learning paradigm has changed towards the student center. Student-centered learning requires students to build their knowledge without relying on teachers (Khusniati & Pamelasari, 2014). However, several schools have yet to use chemistry learning with a student-centered approach widely. Many schools carry out teacher-centered learning that does not involve students in learning (Pada et al., 2019), such as the Direct Instruction model which the teacher explains the concept of material to students using the lecture method without any other variations. The teacher structures all learning objectives so students' activeness, communication, and critical thinking processes are not adequately emphasized because communication is only one way from teacher to student.

Chemistry learning enables students to form their chemical knowledge through complex and critical thinking in line with aspects of chemical literacy in the form of high-level learning skills. Even though some schools have used a student-centered approach, so far, the implementation of learning still needs to improve. Only a few chemistry teachers use a student-centered approach to facilitate scientific discussion and communication activities. It includes content, knowledge, context, and real-life applications (Cigdemoglu, 2020). Student-centered chemistry learning facilitates students in the discussion and communication process, enabling them to achieve higher levels of learning and critical thinking.

Learning that involves student activity, communication, and discussion processes uses a cooperative learning model. One type of cooperative learning model is Jigsaw. The learning process with Jigsaw uses home groups and expert groups. Jigsaw learning consists of heterogeneous teams of 4-5 students, teaches students to be responsible for mastering parts of the learning material, and can teach parts to team members (Slavin, 2015). This cooperative learning has been considered a best practice for teaching students and has been proven to be an effective strategy for improving literacy (Baye et al., 2019).

The chemistry learning process in increasing literacy must also be related to chemical applications so that chemistry learning has a dimension between science and society. Chemistry applications in everyday life can take the form of socio-scientific issues (SSI). Socio-scientific issues can be adopted as a relevant topic to be applied in chemistry learning because it can help students connect their chemical concepts with everyday social problems. One of the chemistry topics that is integrated with SSI is acids and bases. The concept of acids and bases is often found in everyday life, especially household chemicals, acid rain news, and industry, all familiar to students (Cigdemoglu et al., 2017). The integration of SSI in learning acid-base chemistry encourages students' curiosity so that it can overcome the lack of achievement of student learning outcomes in acid-base material.

SSI can be integrated with Jigsaw learning. Learning chemistry using Jigsaw, which is integrated with SSI, can make students think more critically, work together, and actively communicate and solve social problems related to chemistry, which are currently widespread in society. The integration of SSI in Jigsaw learning can be one of the teacher's efforts to improve the chemistry learning process to make it more meaningful so that it can improve students' chemistry literacy and communication skills.

This research expanded the use of the Jigsaw model integrated with SSI acid-base material to improve students' chemical literacy and communication skills. The following research questions are in this study. First, is there a significant increase in students' chemical literacy skills before and after implementing the SSI-integrated Jigsaw learning model on acid-base material? Is there a significant increase in students' communication skills before and after implementing the SSI-integrated Jigsaw learning model on acid-base material? How effective is the SSI-integrated Jigsaw learning model for increasing students' chemical literacy in acid-base material? How effective is the SSI-integrated Jigsaw learning model for improving students' communication skills in acid-base material?

METHOD

Research Design

This research used a quasi-experimental method with a pre-posttest design. As an experimental class, one group applied the SSI-integrated Jigsaw learning model. Meanwhile, the other group, as the control class, used the DI learning model. The experimental class measured chemical literacy and communication skills before and after treatment. Meanwhile, only chemical literacy abilities were measured before and after treatment in the control class.

Research Sample

There were 31 grade 11 students in the experimental and 36 in the control classes. A total of 67 students were taken using a cluster random sampling technique from one of the senior high schools in Sleman, Indonesia. The same teacher taught both classes with students with the similar social and economic background and prior knowledge of chemistry.

Teaching Intervention

The teaching intervention was carried out over six meetings of 80 minutes each. This activity covers four topics: acid-base theory, acid-base indicators, and acid and base pH calculations. The experimental class worked in home groups (4 students) and followed learning with the SSI-integrated Jigsaw model. The integrated SSI includes problems with Coca-Cola, smart labels, carbonated drinks, and problems with Kangen Water drinks. SSI was used in the discussion phase in expert groups and home groups. The control class applies the DI model. The DI model has an orientation phase, presentations, structured practice, practice under teacher guidance, and independent practice.

The learning topic was calculating acid-base pH. The first learning phase was conveying objectives, providing student motivation, and classroom learning orientation. The treatment provided apperception about the differences in taste when eating lemon, vinegar, ulcer medicine, and soap. The second phase was related to the presentation of initial information from the teacher regarding examples of acid-base substances and the theories of Arrhenius, Bronsted-Lowry, and Lewis. Differences in learning conditions can be seen in the third phase, which the experimental class organizes students into groups. The aim was to analyse and provide student assignments through student worksheets.

Meanwhile, structured training was given in the control class in the third phase. One of the students was asked to explain the material given again, and a guide was provided for working on sample questions. In the experimental class, the home group students and the expert group discuss the same problem. The existence of home groups and expert groups is a characteristic of the Jigsaw-type cooperative learning model. SSI integration in this phase was divided into SSI Coca-Cola (acid compounds contained in Coca-Cola and the strong and weak properties of these compounds); Arrhenius theory (understanding of phosphoric acid according to Arrhenius, examples of basic compounds and their ionization reactions, categories of phosphoric acid in the types of monoprotic, diprotic or tricrotic acids); Bronsted-Lowry theory (conjugate acid-base pairs and phosphoric acid belong to the type of acid or base); and Lewis theory (definition of Lewis acids and bases and determining the acid-base reactions of the formation of H2CO3 from H2O and CO2).

Unlike the experimental class, the fourth phase in the control class consisted of exercises under the teacher's guidance. Students worked on practice questions, and the teacher guided the process of working on the questions. Student representatives explained their answers. In the final phase, the control class was given independent training where the teacher provided feedback. In the fifth phase of the experimental class, the expert group returned to the original group. Expert students returned to their previous groups and presented the results of their respective discussions and presentations. Quizzes in the form of multiple-choice practice questions were given to all students during the evaluation phase. At the end of the experimental class learning, the teacher gave awards to groups who successfully made presentations, answered questions, and asked questions in the question-and-answer session.

Data Collection Tools

The acid-base chemistry literacy test consisted of 8 questions. These questions included acid-base theory, its applications, and acid-base degrees. Four problems were raised in four contexts to develop pretest and posttest acid-base chemistry literacy questions. The problems in the pretest questions found in particular themes namely *celery in the personal-environmental context* (items 1.1–1.3), *bee stings in the personal-health context* (items 2.1–2.3), and *industrial waste in the national-environmental context* (items 3.1–3.2). Meanwhile, the problems in posttest questions were in themes: *stomach ulcers in the personal-environmental context* (items 1.1–1.3), *shampoo and conditioner in the personal-health context* (items 2.1–2.3), and *acid rain in the global, danger and environmental context* (items 3.1–3.2). The poin of the pretest and posttest questions was the same.

Another instrument was Likert scale. This scale was aimed to measure students' communication abilities. The scale consisted of 30 items in 2 aspects of communication (the ability to argue and respond to information). The indicators of students' communication skills developed were brave and confident in expressing opinions during group discussions (4 items), being brave in expressing opinions during class discussions (2 items), and being brave in conveying opinions according to the material correctly and clearly in forums (4 items), listening to other people's opinions (6 items), respecting other people's opinions (12 items), and asking about material that is not clear or understood (2 items). To ensure content validity, a group of experts from chemistry lecturers and teachers examined the chemical literacy test questions and the Likert scale of students' communication skills. Based on their suggestions, both instruments have been revised and declared valid for research.

Data Analysis Technique

The data analysis technique used two different tests: the difference test and the n-gain effectiveness test. The paired sample t-test was used to analyse the significant increase in students' chemical literacy and communication skills before and after learning with the Jigsaw model integrated with SSI. The prerequisites for the paired sample t-test were calculated. The data were normally distributed based on the Shapiro-Wilk test with a Sig value. > 0.05 (experimental class chemical literacy 0.083 and 0.275; experimental class communication skills questionnaire 0.808 and 0.559).

The n-gain effectiveness test was used to determine the effectiveness of the Jigsaw learning model integrated with SSI to improve students' chemical literacy and communication skills in acid-base material. The n-gain test formula is described as follows (Hake, 1999):

$$\text{NGain} = \frac{\text{posttest score} - \text{pretest score}}{(\text{maximum score} - \text{pretest score})}$$

Meanwhile, to determine the hypothesis, the n-gain criteria (Hake, 1999) were used in Table 1, and the n-gain effectiveness interpretation categories in Table 2.

Table 1: N-gain Criteria

N-Gain Score	Criteria
n-gain ≥ 0.7	High
0.3 ≤ n-gain < 0.7	Medium
n-gain < 0.3	Low

Table 2: N-gain effectiveness interpretation categories

Percentage (%) N-Gain	Criteria
< 40	Not Effective
40 – 55	Less Effective
56 – 75	Quite Effective
> 76	Effective

The criteria or indicators for the effectiveness of the model used are a significant increase in the pretest to posttest scores on chemical literacy and scores from the initial questionnaire to the final questionnaire on students' communication skills from the paired sample t-test, analysis of the results of the n-gain value criteria, and interpretation categories. N-gain effectiveness percent value.

RESULTS

Descriptive Statistical Analysis of Students' Chemical Literacy and Communication Skills

Based on Table 3 and 4, the average value of chemistry literacy and communication skills in the experimental and control classes has increased. Students studying in Jigsaw learning using SSI have better chemical literacy and communication skills than previous learning.

Table 3: Descriptive statistics of students' chemical literacy

Parameter	Students' chemical literacy			
	Experimental class		Control class	
	Pretest	Posttest	Pretest	Posttest
Number of students	31	31	36	36
Mean score	23.92	72.92	18.58	58.51
St. Dev.	9.741	11.154	10.627	9.148

Table 4: Descriptive statistics of students' communication abilities

Parameter	Students' communication skills			
	Experimental Class		Control Class	
	Initial	Final	Initial	Final
Number of students	31	31	36	36
Mean score	70.23	98.52	66.06	89.19
St. Dev.	4.971	5.421	4.056	5.098

Students' Chemical Literacy Ability Before and after Implementing the SSI Integrated Jigsaw Model Learning

This analysis focuses on data for the experimental class to see a significant increase in students' chemical literacy abilities before and after learning with the SSI-integrated Jigsaw model. Sig value. (2-tailed) from the paired sample, t-test results obtained $0.000 \leq 0.05$, meaning a significant average increase in students' chemical literacy abilities before and after implementing the SSI-integrated Jigsaw learning model.

Student Communication Skills before and after Implementing SSI Integrated Jigsaw Model Learning

This analysis focused on experimental class data to find out the differences in students' communication skills before and after learning with the SSI-integrated Jigsaw model. Sig value. (2-tailed) paired sample t-test results were $0.000 \leq 0.05$, which means there was a significant average increase in students' communication skills before and after implementing the Jigsaw-integrated SSI learning model.

The effectiveness of SSI Integrated Jigsaw Learning Model to Improve Students' Chemical Literacy Abilities

Test effectiveness used the n-gain value calculation. The results of the n-gain test calculation for students' chemical literacy abilities in the experimental class obtained an average n-gain value of 0.64, which meets the medium criteria. The average n-gain result in percent is 64.26%, included in the quite effective category. From these results, the SSI-integrated Jigsaw model effectively increases students' chemical literacy in acid-base material in the medium category.

The effectiveness of SSI Integrated Jigsaw Learning Model to Improve Student Communication Skills

Test effectiveness used the n-gain value calculation. The results of the n-gain test calculation for students' communication skills obtained an average of 0.56, which meets the medium criteria. The average n-gain result in percent is 56.19%, included in the quite effective category. From these results, the SSI-integrated Jigsaw model effectively improves students' communication skills in acid-base material in the medium category.

DISCUSSION

The improvement of Students' Chemical Literacy before and after Applying the SSI Integrated Jigsaw Learning Model on Acid-Base Material

Implementing Jigsaw learning integrated with SSI in the experimental class increased students' chemical literacy skills significantly. It can be seen from the results of the paired sample t-test, which shows an increase in the average pretest score of 23.92 and an increase in the posttest score of 72.92. All students (100%) from the experimental class increased their scores from the pretest to the posttest.

The use of the SSI-integrated Jigsaw learning model can improve chemical literacy skills in this research in line with the theory of Baye et al. (2019), who revealed that cooperative learning has been considered a best practice in teaching students and has been proven to be an effective strategy for improving literacy. This research also aligns with Cigdemoglu et al. (2017), who revealed that the argumentation practice results improved chemical literacy skills. The argumentation practicum referred to in this research is oral argumentation practicum in student discussion activities in expert groups, home groups, question and answer presentations, and written practicum when students and their groups try to explain the answers to the students' worksheet. This contribution can improve students' chemical literacy skills in the experimental class.

The integration of SSI presented in Students' worksheet in the Jigsaw learning model in this research also plays a positive role in increasing chemical literacy, which the role of SSI can provide opportunities for students to be involved in argumentative activities, think logically, and make decisions related to social issues. Related to science (Presley et al., 2013). Other research conducted by Rahayu (2019) also stated that using SSI contexts in chemistry learning can increase students' chemical literacy, critical thinking skills, and collaboration abilities. Integrating the SSI context and the Jigsaw learning model provides directly proportional results for improving students' chemical literacy skills.

Increasing chemical literacy skills with Jigsaw learning integrated with SSI can occur because students are more responsible for studying material. Students feel needed in their group, so they try to understand the material and convey it to friends in the same group. Thus, students' willingness to study the problems given is outstanding, especially in the context of SSI in students' worksheet. The Jigsaw learning model integrated with SSI provides a more effective classroom atmosphere. A conducive learning atmosphere makes students understand the material better to understand and do well when carrying out the chemical literacy posttest. Apart from that, because of the advantages of the Jigsaw model (Astuti, 2013), namely that it prioritizes teamwork so that students learn to socialize with relatively little time, students can master the material in depth because it is supported by a team, student learning motivation increases, and student knowledge results increase.

Improving Students' Communication Skills Before and After Applying the SSI Integrated Jigsaw Learning Model on Acid-Base Material

Implementing Jigsaw learning integrated with SSI in the experimental class improved students' communication skills significantly. It can be seen from the results of the paired sample t-test that there was an increase in the average value of the initial questionnaire from 70.23 to 98.52 in the final questionnaire. The average communication ability of students before being treated with the SSI-integrated Jigsaw model was 58.52%, which increased to 82.1% after being given the treatment.

The increase in experimental class students' communication skills occurred in all indicators. In the first indicator, namely being brave and confident in expressing opinions during group discussions, there was an increase of 24.8%. In the second indicator, namely being brave in expressing opinions during class discussions, there was an increase of 20.56%. In the third indicator, expressing opinions according to the material correctly, it is clear that when in a forum (class or group), there is an increase of 21.78%. In the fourth indicator, listening to other people's opinions has increased by 25.81%. In the fifth indicator, respecting other people's opinions increased by 24.13%, and in the sixth indicator, asking about material that was not clear or understood increased by 17.74%.

The highest increase in students' communication skills is in listening to other people's opinions. Students can respond to what their friends say during a discussion by listening carefully when their friends give arguments. Meanwhile, the lowest increase in students' communication skills was found in the indicator of asking about material that was not clear or understood. It happens because students are still afraid to ask the teacher. Apart from that, the average increase is also low because the number of statements on the indicators developed is less than the others.

Increasing students' communication skills with the SSI-integrated Jigsaw learning model aligns with Cigdemoglu's (2020) theory that chemistry learning with a student-centered approach is better when it can facilitate scientific discussion and communication activities that include content knowledge context and provide real-life applications. The jigsaw learning model applied is one of the models included in the student-centered approach to facilitate scientific discussion and communication activities, ultimately improving students' communication skills.

This research is in line with research conducted by Halimah and Sukmayadi (2019), who conducted research using the Jigsaw method to improve pedagogical knowledge and communication skills. The results obtained succeeded in improving pedagogical content knowledge and verbal communication skills. Using the same Jigsaw model as Halimah and Sukmayadi's (2019) research, favourable results were obtained in improving the communication skills of experimental class students in this research.

The increase in communication skills in this research can occur because students who take part in learning with Jigsaw integrated SSI are more responsible for the material being studied and are responsible for conveying it to friends in their group so that when discussing in expert groups, students can provide arguments to try to solve problems that arise. When expert students return to their groups to present the results of expert discussions, all group members pay close attention and ask questions if something needs to be clarified. Students compete to become an active group during the discussion and class presentation stages so that students' communication skills improve.

SSI Integrated Jigsaw Learning Model is Effective for Increasing Students' Chemical Literacy in Acid-Base Material

The effectiveness of the SSI-integrated Jigsaw learning model in improving students' chemical literacy skills can be seen from several indicators. The first effectiveness indicator is seen as a significant increase from pretest to posttest. The average pretest to posttest score, which increased significantly, was obtained from the results of the paired sample t-test for chemical literacy skills. Referring to this study's first research objective, the results show that the Sig. (2-tailed) of $0.000 \leq 0.05$, which means a significant increase in students' chemical literacy abilities before and after implementing the SSI-integrated Jigsaw learning model.

The second effectiveness indicator is based on the calculated n-gain value of 0.64, which is in the medium criteria. This result means moderate increases in students' chemical literacy skills before and after learning acids and bases with SSI-integrated Jigsaw learning. Apart from that, based on the third indicator, the n-gain percent value was also 64.26%, which shows that the interpretation category is quite effective. So overall, applying the SSI-integrated Jigsaw learning model improves students' chemical literacy skills in acid-base material with a moderate increase.

In general, the Jigsaw learning model integrated with SSI effectively improves students' chemical literacy skills. However, from several effectiveness indicators, maximum results have not been obtained. It is influenced by the fact that students need to get used to working on chemical literacy reading analysis questions and high-level learning skills (HOLS) so that they cannot optimally explain the meaning of scientific phenomena or issues in the questions. Another factor is that the test question instrument needs to construct empirical validity for students, so the test questions have too high standard.

SSI Integrated Jigsaw Learning Model is Effective for Improving Students' Communication Skills on Acid-Base Material

The effectiveness of the Jigsaw learning model integrated with SSI to improve students' communication skills can be seen from several indicators. The first effectiveness indicator is seen from a significant increase in the initial questionnaire to the final questionnaire. Scores from the initial questionnaire to the final questionnaire, which increased significantly, were obtained from the results of the paired sample t-test of students' communication skills. Referring to the second research objective of this study, the Sig value was obtained. (2-tailed) of $0.000 \leq 0.05$, which means a significant increase in students' communication skills before and after implementing the SSI-integrated Jigsaw learning model.

The second effectiveness indicator is based on the calculation results of the n-gain value 0.56, which meets the medium criteria. This result means that the increase in students' communication skills before and after learning acid base with SSI-integrated Jigsaw learning is classified as moderate. Apart from that, based on the third indicator, the n-gain percent value was 56.19%, which shows that the interpretation category is quite effective. Applying the SSI-integrated Jigsaw learning model effectively improves students' communication skills in acid-base material with moderate categories.

The Jigsaw learning model integrated with SSI effectively improves students' communication skills. However, from several effectiveness indicators, maximum results have yet to be obtained. The weakness of the Jigsaw learning model influences this. According to Asmadi Alsa (2010), learning with the Jigsaw model can make students feel bored so that towards the end of the fourth meeting, the implementation of discussions and the activeness of expressing students' opinions decreases, which causes the score for filling out the questionnaire at the last meeting to be left unfilled. as much as possible. Also, selecting questionnaire instruments to collect data on communication skills could have worked better.

CONCLUSION

Using SSI as a context in the Jigsaw learning model facilitates students in scientific discussions to identify, relate, and analyse scientific information about social issues with scientific concepts (chemistry). SSI's integrated Jigsaw learning has successfully improved students' chemical literacy and communication skills significantly. An important implication that can be taken is that the teachers should raise SSI problems in chemistry learning so that they become more innovative. It is an alternative in improving students' chemical literacy, communication skills and involvement in scientific discussions in class.

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