



## Improving Indonesian Senior High School Students' Critical Thinking Skill through Science Integrated Learning (SIL) Model

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**Abstract:** The objectives of this research was to examine the implementation of Science Integrated Learning Model in improving critical thinking skills of 11 Indonesian high school student in the excretion system and immune system. This research is a Class Action Research (CAR). Subjects were eleventh-grade students in the academic year of 2017/2018 consisted of 31 students, specifically 18 male students and 13 female students. The data was collected from students and teachers. Data collection techniques were conducted by observation, interview, and documentation study. The triangulation technique was used to verify the validity of the data. The data analysis technique employed was a qualitative descriptive analysis. The research procedure used an interrelated spiral CAR model. The experiment was conducted in two cycles, each cycle consisted of planning, action implementation, observation, and reflection. The result shows that students' critical thinking skills increased from 42.78% before research, become 54.92% in the first cycle, then 78.73% in the second cycle. It can be concluded that the implementation of the Science Integrated Learning Model can improve the critical thinking skills of 11 Indonesian high school students in the excretion system and immune system.

## INTRODUCTION

21<sup>st</sup>-century skill is very important to be developed because it helps us to adapt to the changing of time. One of the 21<sup>st</sup>-century skills is critical thinking skills. Critical thinking skills are included high order thinking skills needed to deal with the ever-increasing pace of change, complexity, and interdependence in the 21<sup>st</sup> century (Ben-chaim, Ron, & Zoller, 2000; Dwyer, Hogan, & Stewart, 2014).

To deal with this situation, the Indonesian government takes action to develop the curriculum. 2013 curriculum is made to be the following criteria; learning should be student-centered,

learning independently and by group, and strengthening critical thinking skills (Miraningsih, Winda dan Azizah, 2015). Furthermore, based on the regulation of national education ministry no. 23 the year of 2013, the student should have a logic mind, critical thinking skill, and creative to think about the environment (Permendikbud, 2016).

Based on the 2013 curriculum, critical thinking skills can be improved through education (Angeli & Valanides, 2009; Ben-chaim et al., 2000; Zenker, 2016). The development of critical thinking skills has been recognized as the main goal in science education

(Alexander, 2014; Ben-chaim et al., 2000; Mapeala & Siew, 2015; Tiruneh & Cock, 2016). 21<sup>st</sup> Century assessment must teach students to apply critical thinking skills (Binkley et al., 2012).

The core of critical thinking is cognitive skills. The result of cognitive processes is decision making and problem-solving (Facione, 2015). According to Facione, indicators of critical thinking skills are divided into six, namely: interpretation, analysis, evaluation, inference, explanation, and self-regulation.

Interpretation is the ability to understand all forms of data and information. The analysis is the ability to analyze events or information obtained. Evaluation is the ability to evaluate an opinion or information obtained. The inference is the ability to infer data or information obtained. The explanation is the ability to explain a data, opinion, or event based on relevant evidence. Self-regulation is the ability to regulate oneself in the face of certain conditions (Facione, 2015; ŽivkoviĀ, 2016).

The quality of the critical thinking skills of Indonesian students is still very concerning. According to the 2015 Program for International Student Assessment (PISA), Indonesia was ranked 62<sup>nd</sup> out of 70 countries in the aspect of scientific literacy (OECD, 2015). Also, based on the 2015 Trends in International Mathematics and Science Study (TIMSS) and Progress in International Reading Literacy (PIRLS), Indonesia ranked 50<sup>th</sup> of 53 countries on scientific literacy (National Center for Education Statistics, 2017).

The low level of critical thinking skills is also found in one senior high school in Surakarta in one of the grade XI of the 2017/2018 school year. The teacher's problem has not stimulated students' critical thinking skills. The test results show that students' critical thinking skills are still in the less critical

category, so they need to be developed (Purwanto, Nugroho, & Wijayanto, 2012).

Based on the result in students' critical thinking skills, the main problem is the implementation of a teacher's learning model is not optimal. The implementation in the learning process is not appropriate to the development of students' higher-order thinking skills, whereas the teaching strategy is significant to transfer the knowledge. To solve the problem in improving critical thinking skills, the teacher can use Science Integrated Learning (SIL) Model.

Science Integrated Learning is an independent learning model that demands the mental activity of students in understanding a concept of learning through exploration activities that are proven by experiments (Parmin, Sajidan, Ashadi, Sutikno, & Fibriana, 2017). This model is based on the integration of concepts in which scientific concepts are integrated to be understood and applied as a whole, so learning is more meaningful. The right integration learning model is used to improve students' critical thinking skills (Gretter & Yadav, 2016).

The results of research conducted by Parmin et al. in 2017 state that the SIL Model can improve students' critical thinking skills. Integrated learning can improve critical thinking skills, curiosity, a sense of responsibility for science learning. In line with Parmin et al., Barak Miri, Ben-Chaim David, and Zoller Uri in 2007 stated that critical thinking skills can increase if classroom learning displays real-world problems, directs class discussions related to concepts, and guides to conducting inquiry experiments in Group. The result of Barak Miri et al.'s research is in line with the SIL Model concept which has been structured in displaying real-world problems, discussions, and experiments. This article aims to prove the implementation of the Science Integrated Learning Model in improving critical thinking skills of 11<sup>st</sup>

high school students in the excretion and immune systems topics.

## METHOD

The study was conducted in March 2018 until May 2018 at the State High School in Surakarta. The subject of this study was in one of the grades XI Science in the even semester of the 2017/2018 school year with the biological material of the Excretion System and Immune System. The number of students is 31 consisting of 18 males and 13 females.

The type of research used is Classroom Action Research (CAR). CAR was carried out in two cycles with interrelated CAR spiral models. CAR was used in this research because it was related to the real problem found in the class, so problem-solving will appropriate to the problem. Furthermore, there will be coordination between the researcher, the teacher, and also the students that will make this research more deeply.

To valid the data, the researchers used the triangulation technique. Triangulation technique is a validity test technique using similar data but carried out by different methods (Johnson et al., 2017).

The type of data used in this study was qualitative descriptive data. Qualitative data was obtained through information on observations, interviews, and documentation studies. Data analysis techniques used in this study were qualitative descriptive.

Data quantitative was obtained from cognitive tests which refer to six aspects of critical thinking according to Facione (2015), namely interpretation, analysis, evaluation, conclusion, explanation, and self-regulation in the form of description and multiple-choice tests with a maximum score of 7 each indicator (an adaptation of Facione).

The research achievement indicator in this study is that if the critical thinking skills in the initial conditions amount to

42.78 %, which indicates less critical, then at the end of the cycle can reach > 62.51% which indicates critical (Purwanto et al., 2012).

Assessment with a range of 0 -100 % for each indicator used the following formula:

$$\text{Percentage (\%)} = \frac{\sum \text{score result}}{\sum \text{maximum score}} \times 100\%$$

The categories of critical thinking skills are used are as follows.

**Table 1.** Categories of Critical Thinking

Percentage	Category
25.00 % - 43.75 %	Less Critical
43.76 % - 62.50 %	Medium Critical
62.51 % - 81.25 %	Critical
81.26 % - 100.00 %	Very Critical

(Setyowati, Subali, & Mosik, 2011)

## RESULT AND DISCUSSION

In the pre-cycle, the results of the analysis of the teacher's questions on animal tissue material showed that critical thinking skills on the interpretation indicator are 48.39 % which is classified as less critical, the inference indicator is 45.16 % which is classified as critical, and the explanation indicator is 36.77 % which is classified as less critical. While the other three indicators, namely analysis, evaluation, and self-regulation, do not exist because the teacher does not include those indicators to the assessment.

The data is strengthened by the results of tests of critical thinking skills in the pre-cycle in plant tissue material. The results showed that students' critical thinking skills ranged from 35.02 % to 49.77 % with less to enough categories. The interpretation indicator is 43.78 %, analysis is 32.05 %, evaluation is 42.86 %, inference is 49.77 %, explanation is 42.86 %, and self-regulation is 48.39 %. Overall, the average students' critical thinking skills were 42.78 % with less critical categories, so it needed to be optimized with the SIL Model.

The results of interviews with teachers and students showed that students' critical thinking skills were still low. This is because students lack active participation in the learning process. The learning process that took place previously lacked the implementation of discussions, practicums, and presentations, so the learning process was less meaningful. The impact obtained is the ability to interpret, analyze, explain, conclude, evaluate, and self-regulation that is not optimal in students.

The results were supported by students' psychomotor and affective assessment during the learning process. The psychomotor assessment is consisted of demonstration skills and communication skills, while the affective assessment consists of curiosity, cooperation, and thoroughness.

The first cycle applied the SIL Model with excretion system material. Cycle I learning activities were carried out in four meetings in 8 days. Three meetings took place during 2 lesson hours (2 x 45 minutes), and one meeting lasted for 30 minutes. The total time spent in the cycle I was 300 minutes.

The result of students' critical thinking skills in cycle I can be seen in Table 1. Each indicator has a different percentage.

**Table 2.** Skills Test Results Critical Thinking Cycle I

No	Indicator	Percentage (%)	Category
1	Interpretation	64.52	Critical
2	Analysis	47	Medium Critical
3	Evaluation	48.39	Medium Critical
4	Inference	48.85	Medium Critical
5	Explanation	60.83	Critical
6	Self Regulation	59.91	Medium Critical
<b>Average</b>		54.92	Medium Critical

Based on Table 2, obtained the percentage of critical thinking skills of eleventh-grade students in cycle I ranged from 47 % to 64.52 %, with the category of medium to critical. The lowest percentage is in the analysis indicator. The highest percentage is on the interpretation indicator. Overall, the average percentage of class achievement in the first cycle was 54.92 % with a fairly critical category. Critical thinking skills test data showed that the cycle I action provided students with critical thinking skills improvement from pre-cycle.

The second cycle applied SIL Model with the immune system subject matter. Cycle II consisted of 5 meetings in 15 days. Each meeting lasted for 2 hours (2 x 45 minutes) with a total cycle time of 450 minutes.

The result of students' critical thinking skills in cycle II can be seen in Table 2. Each indicator has a different percentage.

**Table 3.** Skills Test Results Critical Thinking Cycle II

No	Indicator	Percentage (%)	Category
1.	Interpretation	83.41	Critical
2.	Analysis	77.42	Critical
3.	Evaluation	75.58	Critical
4.	Inference	73.27	Critical
5.	Explanation	80.65	Critical
6.	Self Regulation	82.03	Critical
<b>Average</b>		78.73	Critical

Based on Table 3, obtained the percentage of critical thinking skills in grade XI students in cycle II ranged from 73.27% to 83.41% with the critical category. The lowest percentage is on the indicator evaluation, while the highest percentage is on the indicator of self-regulation. Overall, the average percentage of class achievement in the first cycle was 78.73% with the critical category. Critical thinking skills test data showed that cycle II actions provided

students with critical thinking skills improvement from cycle I.

SIL Model has the following advantages; students know exactly the concepts they learn because they get direct experience with experiments. Besides that, the application of the SIL Model can improve students' critical thinking skills, creativity, and problem-solving skills. In this globalization era, it is necessary to think quickly in deciding something, so that these skills are very important for students. Besides the advantages, the SIL model also has one drawback, namely; this model can only be used in material that has experimented.

The challenge of using the SIL Model is; there must be an effort to encourage students to have the willingness to experiment in laboratories that use urine. Some students were disgusted with the material so that during the practicum some did not want to hold the bottle, but in the end, they wanted to. Also, the teacher must have the motivation to not only give but also to give experience to students to conduct their experiments on the material.

So far, many teachers assess without thinking about the process. So, the important thing is to finish the material. In addition to teacher activation, students must also have the motivation to learn, especially during the last hour. Sometimes some students don't want to clean the tools they use in the laboratory.

Students give a positive impression of learning that had taken place. They claimed to be more aware of the excretion material using the SIL Model. This was because, before learning, they were asked to formulate their problems even though they were still guided by the teacher so that students knew what sub-material they learned.

One of the students said, "The teacher taught us very clearly in the material of excretion. She gave us a couple of bottles of water and urine in the

beginning. She asked us to identify the differences between them. Of course, that is easy for me to answer. Then, she tried to link between that water, urine, and a material that we are gonna learn today. We can infer that we gonna learn the excretion system. Then, we can choose what the sub material we gonna learn. I think it is a good way to get students' attention from the beginning of the class. We can know what we wanna learn."

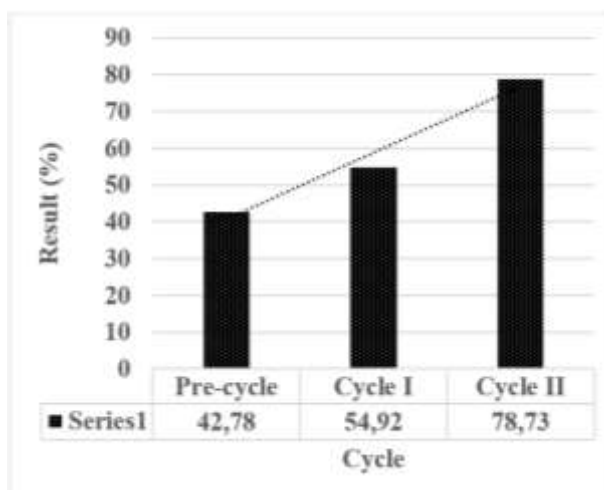
Also, students' understanding was supported by practical work. They can do the practicum by themselves guided by the teacher. They claimed to be happy if there was a practicum because they could prove and increase their understanding of the material being studied.

One of the students said, "It might be difficult to forget about what I have learned today in the future, it simply because I know what I did with my friends and my teacher. We did a lot of fun things today, and we could practice excretion, which used urine as our main material. We can link the result of the practicum with our daily activity. For example; if someone finds glucose in his urine, then he probably has diabetes mellitus disease, etc."

Students were more active and responsive to the questions given by the teacher. They were more enthusiastic to learn. The discussion runs more exciting than the previous meeting before using the SIL Model.

The teacher said, "My students were more active than before in excretion and immune system using SIL Model. They often to ask and answer questions. Furthermore, they seem to be more enthusiastic."

The comparison of students' critical thinking skills in all the cycles can be seen in figure 1. In general, there is an increase in critical thinking skills in each cycle. Critical thinking skill in pre-cycle is 42.78 %, cycle I is 54.92 %, and cycle II is 78.73 %.



**Figure 1.** The Comparison of Critical Thinking Skill

**Table 4.** The Achievement of Each Percentage of Indicators in Critical Thinking Skills Tests from Pre-Cycle to Cycle I

No	Indicator	Pre-cycle (%)	Cycle (%)	Target (%)	Information
1	Interpretation	43.78	64.52	>62.51	Achieved
2	Analysis	35.02	47.00	>62.51	Not yet
3	Evaluation	42.86	48.39	>62.51	Not yet
4	Inference	49.77	48.85	>62.51	Not yet
5	Explanation	42.86	60.83	>62.51	Not yet
6	Self Regulation	48.39	59.91	>62.51	Not yet

Based on Table 4, there is one indicator of critical thinking skills that have met the research target, namely the interpretation indicator. Meanwhile, the other five indicators have not met the research target, namely indicators of

analysis, explanation, evaluation, inference, and self-regulation. These results indicate that cycle II needed to be done to strengthen the results of the study.

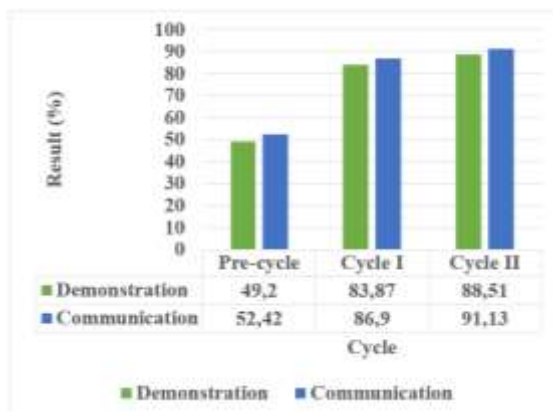
**Table 5.** The Percentage of Indicators in Critical Thinking Skills from Cycle I to Cycle II

No	Indicator	Cycle I (%)	Cycle II (%)	Target (%)	Information
1	Interpretation	64.52	83.41	>62.51	Achieved
2	Analysis	47	77.42	>62.51	Achieved
3	Evaluation	48.39	75.58	>62.51	Achieved
4	Inference	48.85	73.27	>62.51	Achieved
5	Explanation	60.83	80.65	>62.51	Achieved
6	Self Regulation	59.91	82.03	>62.51	Achieved

Based on Table 5, all indicators of critical thinking skills have met the research target of equal to > 62.51 %. The highest percentage indicator achievement is the self-regulation indicator, while the lowest percentage indicator achievement is the inference indicator.

The results obtained are supported by psychomotor and affective scores. Based on Figure 2, the comparison of students 'psychomotor' assessment shows that students' psychomotor increased in each cycle. The indicator assessed is presenting the results of the

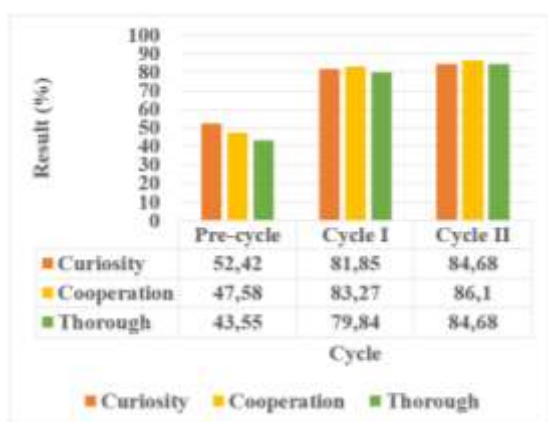
demonstration and communicating the results in the presentation.



**Figure 2.** The Comparison of Student Psychomotor Assessment

The result of demonstration skill in pre-cycle is 49.2 %, in the first cycle is 83.87 %, and in the second cycle is 88.51 %. While the result in communication skills in pre-cycle is 52.42 %, in the first cycle is 86.9 %, and in the second cycle is 91.13 %.

Based on Figure 3, the comparison of students' affective assessment shows that the student's effective increases in each cycle. The indicator that is assessed is curiosity, collaboration in the discussion, and thoroughness.



**Figure 3.** The Comparison of Students Affective Assessment

The result of curiosity skill in pre-cycle is 52.42 %, in the first cycle is 81.85 %, and in the second cycle is 84.68 %.

Then, the result in cooperation skill in pre-cycle is 47.58 %, in the first cycle is 83.27 %, and in the second cycle is 86.1 %. Furthermore, the result in thoroughness skill in pre-cycle is 43.55 %, in the first cycle is 79.84 %, and in the second cycle is 84.68 %.

According to the Association of American Colleges and Universities (2005) and the Australian Council for Education Research (2002) (Dwyer et al., 2014), teaching critical thinking skills is one of the things that need to be improved in education. Science is one subject that requires critical thinking skills. The application of the SIL Model to the Excretory System and Immune System in this study can improve students' critical thinking skills from 42.78 % in pre-cycle with less critical categories to 78.73 % in cycle II with critical categories.

Critical thinking skills are one of the higher-order thinking skills where students are required to be able to conceptualize, apply, analyze, synthesize, and evaluate information obtained from active and skilled observation, experience, reflection, reasoning, or communication (Mapeala & Siew, 2015; Nuraida, 2016). Critical thinking skills are also a process of metacognition and include high-level cognitive skills (Abrami et al., 2008; Ben-chaim et al., 2000; Dwyer, Hogan, Harney, & Kavanagh, 2017; Noone & Hogan, 2017).

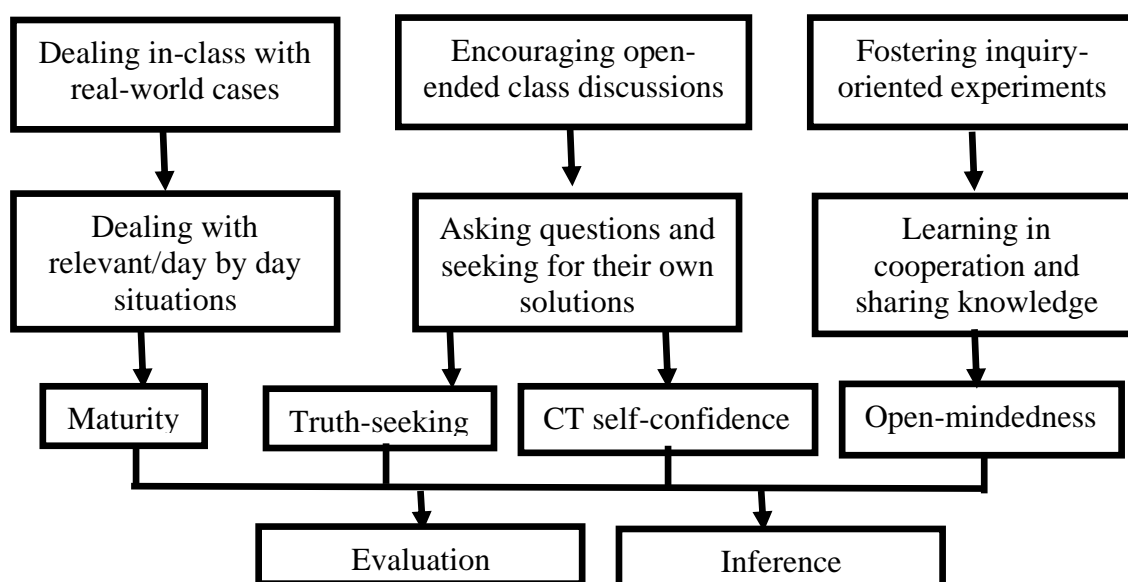
Critical thinking skills are a purposeful thinking process. The process involves cognitive skills, namely interpretation, analysis, explanation, evaluation, inference, and self-regulation (Binkley et al., 2012; Stanton & Stanton, 2017). The result of this process is the determination of decisions about trust or not regarding the information obtained and the determination of actions (Angeli & Valanides, 2009).

One of the main goals of science is the development of critical thinking skills. The development of critical thinking

skills strongly supports the integration of aspects of science (Malamitsa, Kasoutas, & Kokkotas, 2009). These skills are important when learning science (Miri, David, & Uri, 2007).

Science learning requires students to actively learn in constructing science to improve critical thinking skills (Huang & Asghar, 2016; Sjöström, 2017). Furthermore, Barak Miri, Ben-Chaim David, Zoller Uri (2007) revealed that to

improve critical thinking skills, teachers need to link learning with problems in the real world, conduct experiments to find and prove a theory, and conduct discussions. This is consistent with the SIL Model which requires students to actively learn (Parmin et al., 2017). Based on these reasons, the application of the SIL Model can improve students' critical thinking skills (Gretter & Yadav, 2016).



**Figure 4.** Teaching strategies that are targeted in increasing critical thinking skill (Miri et al., 2007)

Based on figure 4, dealing in-class with real-world activity refresh students' knowledge about the new condition of their environment, it enhances their maturity in facing their problem. In line with encouraging open-ended class discussions, it leads students to ask a question and search their solutions. Students will have self-confidence and truth-seeking. Furthermore, fostering inquiry-oriented experiments lead the student to cooperate and share knowledge. It implies their open-mindedness. These aspects improve critical thinking skills through an indicator of evaluation and inference.

The SIL Model has six learning syntaxes, namely exploration, concept integration, experimentation, analysis, taking action, and reflection. Every syntax

stimulates students' critical thinking skills.

Exploration syntax stimulates students to be able to formulate learning goals. In accordance with the research that has been carried out by Robert Duron, Barbara Limbach, and Wendy Waugh (2006) that to improve critical thinking skills is by doing 5 steps, one of which is to formulate the goals of learning together at the beginning of the learning process. Students are stimulated to formulate learning goals in the form of questions. Questions asked are in accordance with the topic to be studied at that time.

Teachers can see the quality of student questions based on taxonomy (Duron, Limbach, & Waugh, 2006). The higher the level of the question, the better



the quality. Also, questions asked by students can indicate their initial knowledge and student's level of thinking. Also, good questioning skills are needed by the teacher to increase student participation. Student active participation is needed in this SIL Model. Success or failure of the SIL Model depends on student participation.

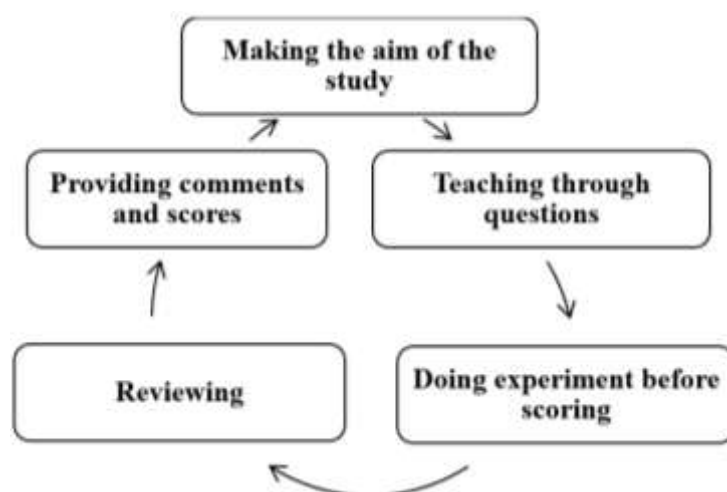
Concept integration syntax stimulates students to be able to integrate science in society into science through a scientific approach. The scientific approach can be made through experiments. Multidisciplinary knowledge needs to be taught through a learning model (Forawi, 2016).

Experimental syntax stimulates students to be able to improve critical thinking skills. According to Duron et al. (2006), another step to improve critical thinking skills is to do experiments. Experiments can be in the form of practice, observation, and simulation. In line with Duron, Sufian (2016) revealed that experimental activities can improve students' critical thinking skills because there are activities of cooperation,

communication, data analysis, evidence seeking, and knowledge integration.

All syntax of the SIL Model can be done in the discussion, analyzing, and action-taking. Discussion can be done in groups. Working in groups can improve students' critical thinking skills (Binkley et al., 2012). Students can learn something from the opinions of other students and can explore more in the understanding of other students, which can further enhance students' scientific insight (Angeli & Valanides, 2009). The process requires students to analyze information that has been obtained which can then make a decision to believe or not and can determine the action.

Reflection syntax is also important in improving students' critical thinking skills. Students can express the meaning of the learning process they have gone through. They can express what they have learned, what values can be taken, what learning process takes place, and what else to learn. The learning process that Duron has revealed is available in Figure 5.



**Figure 5.** Learning Process for Improving Critical Thinking Skills (Duron et al., 2006)

Interpretation is the ability to understand all forms of data and information (Facione, 2015; ŽivkoviĀ, 2016). In general, in the first cycle about

the excretion system material, the achievement of the interpretation indicator is 64.52 %, which belongs to the critical category. This result has met the

research target. Students are skilled at reading pictures or tables into good data. In the second cycle, there was an increase in the achievement of the interpretation indicator to 83.41 % with the critical category. Students are increasingly skilled in reading and understanding pictures or tables.

SIL Model can improve students' critical thinking skills on interpretation indicators. Students can group information received so that it becomes a coherent and clear meaning. According to Jacobsen (2009), the active discussion can improve critical thinking skills that can be stimulated when students can identify problems, categorize, classify, and interpret the information.

The analysis is the ability to analyze events or information obtained (Facione, 2015; ŽivkoviĀ, 2016). In general, in the first cycle about the excretion system material, the achievement of the analysis indicator of 47 % included in the category is quite critical. This result has not met the research target. Students have not been able to analyze information or data obtained properly. In the second cycle, there was an increase in the achievement of the analysis indicator to 77.42 % with the critical category. The increase occurs because students have been able to analyze information or data obtained properly.

According to Facione (2013), identifying problems and developing a concept and submitting opinions can improve critical thinking skills. In line with Facione, Sufian (2016) said that data collection activities, making tables or diagrams, identifying images, understanding information obtained from the internet relevantly can improve critical thinking skills. Critical thinking skills are indicators of analysis aroused when students analyze problems or practicum results by looking for references that support their ideas and link them to the initial knowledge they have so

that learning will be more meaningful in accordance with Ausubel's theory.

The explanation is the ability to explain data, opinion, or event-based on relevant evidence (Facione, 2015; ŽivkoviĀ, 2016). In general, in cycle I about the excretory system material, the achievement of explanation indicators is 60.83 % which is categorized as quite critical. This result has not met the research target. Students have not been able to explain information or data obtained properly. In the second cycle, there was an increase in the achievement of explanation indicators to 80.65% with the critical category. Improvements occur because students can explain information or data that is obtained properly.

Explanation indicators can be seen when students explain their ideas confidently. Explaining skills can be trained when students make presentations in front of the class. Students serve as presenters who explain the results of the discussion to other students. Then other students can respond to ideas from students who are presenting, add answers if it's not complete, or refute. On this occasion, students can share their opinions.

Evaluation is the ability to evaluate an opinion or information obtained (Facione, 2015; ŽivkoviĀ, 2016). The information obtained needs to be evaluated as part of critical thinking skills (Angeli & Valanides, 2009). In general, in cycle I about the excretion system material, the achievement of evaluation indicators is 48.39 %, which is categorized as quite critical. This result has not met the research target. Students have not been able to assess information or data obtained correctly. In the second cycle there was an increase in the achievement of the evaluation indicator to 75.58 % with the critical category. The increase occurs because students have been able to assess information or data obtained correctly.

Evaluation indicators can be aroused during discussions and through test questions. During the discussion, students can evaluate each other's answers and assess the credibility of the source. This stage can provide opportunities for students to express opinions, ask for opinions, and evaluate opinions that have been submitted. Suggestions submitted allow students to improve critical thinking evaluation indicator skills.

The inference is the ability to conclude data or information obtained (Facione, 2015; ŽivkoviĀ, 2016). In general, in cycle I about the material of the excretion system, the achievement of the inference indicator was 48.85 %, which was categorized as quite critical. This result has not met the research target. Students have not been able to assess information or data obtained correctly. In the second cycle there was an increase in the achievement of the inference indicator to 73.27 % with the critical category. The increase occurs because students have been able to assess information or data obtained correctly.

Students are skilled in processing information obtained and then conclude. Students' critical thinking skills can increase when students are able to prove a statement, solve a problem, and conclude something.

Self-regulation is the ability to regulate oneself in facing certain conditions (Facione, 2015; ŽivkoviĀ, 2016). In general, in cycle I about the material of the excretion system, the achievement of the self-regulation indicator was 59.91 %, which was categorized as quite critical. This result has not met the research target. Students have been able to determine an action in receiving information or solving problems appropriately. In the second cycle there was an increase in the achievement of the self-regulation indicator to 82.03 % with the critical category. The increase occurs because students have been able to

determine an action in receiving information or solving problems appropriately.

Based on the results of tests of critical thinking skills, each indicator of critical thinking skills experienced a different increase from cycle I to cycle II. Four indicators are not in accordance with the research target in the first cycle, namely analysis, evaluation, inference, and self-regulation. But in cycle II, all indicators have met the research target.

Based on the results of the interview, the teacher felt interested in using the SIL Model for the next learning. Before using the SIL Model, student test scores are low, but when using the SIL Model students' grades increased. By using this model, students can experience the learning experience directly so that learning is more meaningful. Practicum activities and simulations during learning can help students to better understand the material being studied. The use of the SIL Model is accompanied by the integration of concepts so that students truly understand the material being studied.

The science learning model requires students to actively learn in constructing science to improve critical thinking, analysis, and problem-solving skills (Huang & Asghar, 2016; Parmin et al., 2017).

The success of the SIL Model can be determined by collaboration, information exchange, and learning experiences between students (Parmin et al., 2017). Students get many learning experiences that involve collaboration and information exchange. They conduct practicums and discussions in which there are cooperation and information exchange. Based on the analysis of the results of this classroom action research, it can be concluded that the application of the SIL Model in the material of the Excretion System and the Immune System can improve critical thinking

skills grade XI of high school students in 2017/2018 Academic Year.

## CONCLUSION

Based on the results of classroom action research that has been carried out in two cycles with the application of the SIL Model on the Material of the Excretion System and the Immune System can improve the critical thinking skills of the eleventh-grade students of the 2017/2018 Academic Year in Indonesia. All indicators of critical thinking skills have increased to reach the research target.

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