Training of Scientific Literation and Self Efficacy Students Using Scientific Critical Thinking (SCT) Models

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Abstract. The ability of scientific literacy and self-efficacy becomes an essential part of learning chemistry in the framework of preparing students to enter the industrial era 4.0 and the era of society 5.0. The Scientific Critical Thinking (SCT) model is one of the models to practice student's scientific literacy skills and self-efficacy in learning the buffer solution concept. The research conducted during COVID 19, so learning carried out online using the Google Classroom and Zoom Meeting applications. The research design uses the type of pre-experiment with one group pretest-posttest design. The sample of this study were students of class XI MIPA 3 of SMAN 6 Banjarmasin in 2019/2020. The independent variable is the SCT, and the dependent variable is the ability of scientific literacy and self-efficacy. Data collection uses test and non-test techniques. Data analysis techniques used descriptive and inferential analysis techniques. The results of this study indicate (1) there is a significant difference in scientific literacy ability between the results of the pretest and posttest with tcount > ttable ie 13.2 > 2.00, (2) there is a significant difference in students' self efficacy with tcount < ttable ie 8.53 > 2.00, (3) students respond with criteria both for learning with the SCT model. Thus, the Scientific Critical Thinking model can train the scientific literacy ability and self-efficacy of students of XI MIPA 3 students at SMAN 6 Banjarmasin.

1. Introduction

Human resources (HR) is one of the essential factors in advancing a nation. One way to create quality human resources for the nation is through education. Education will produce human resources that can solve a problem using scientific knowledge to obtain conclusions from these problems. Education is a process of student input to produce a desired outcome following the objectives applied (Purwanto, 2011).

Significance in scientific learning for students can be obtained if students have excellent scientific literacy skills (Wulandari & Sholihin, 2015). Scientific literacy defined as an understanding of science and its application to people's lives (Adisendjaja, 2010). Scientific content refers to the key scientific concepts needed to understand natural phenomena and the changes that occur due to human activities (Nofiana & Julianto, 2018).

According to Rahayu (2017), chemical literacy is one of the concepts of scientific literacy that is very necessary to be taught to students to interpret chemistry easily. Internalizing the concept of scientific literacy in students will make it easier for students to understand chemical material (Kask, Ploomipuu, & Rannikmäe, 2015; Zoller & Pushkin, 2007).
Difficulties in learning chemistry also impact unsatisfactory learning outcomes (Majidah, Hairida, & Erlina, 2013). Therefore, we need a concept of self (self-efficacy) about how students have confidence and confidence in studying chemistry to obtain satisfying learning outcomes (Ulva, Sunyono, & Tania, 2016). Self-efficacy is a belief held by an individual to do something in a specific situation successfully (Bandura, 1986). This relates to the process of constructing mental models so that they are slowly able to interpret a problem in-depth and habituate the concept of self-efficacy understood (Darmiyanti, Rahmawati, Kurniawati, & Ridwan, 2017; Instefjord & Munthe, 2017; Löfström, Poom-Valickis, Hannula, & Mathews, 2010).

PISA 2018 revealed that scientific literacy and self-efficacy of students in Indonesia had decreased, ranking 71st out of 79 participating countries. The average value in the scientific field from various countries in PISA is 489, while Indonesia only receives an average score in the scientific field that is 396 (OECD, 2019). This shows that the ability of scientific literacy and self-efficacy of Indonesian students is still below average. This has become a public spotlight, especially students’ low ability in Indonesia to solve problems in the scientific field (OECD, 2019).

Choerunnisa, Wardani, & Sri (2017) explain that the lack of scientific literacy and self-efficacy is because most students only listen to explanations or lectures from teachers, so they lack knowledge of the material. Most students can still not associate the scientific knowledge they learn with natural phenomena in their daily lives.

The results of observations and interviews with chemistry teachers at SMAN 6 Banjarmasin found that students' scientific literacy was still low (23%). This is due to the lack of chemistry assignments that require students to get used to digging up challenging information in solving the given assignments. Students' self-confidence in the correctness of the answers given is still low because they are in doubt whether the answers that have been given really answer the problems given by the teacher.

Therefore there is a need for renewal in learning chemistry so that scientific literacy and self-efficacy can be optimally achieved following the expected indicators. The Scientific Critical Thinking (SCT) Model is a constructivist learning model that can be applied to train students' scientific literacy skills and self-efficacy. This SCT model involves many students in understanding concepts and applying them in experimental activities as a form of proof of the truth of the concepts being studied.

The SCT model has five syntaxes:
1. Student orientation
2. Scientific Activities
3. Presentation of Results of Scientific Activities
4. Completion of Critical Thinking Tasks
5. Evaluation (Rusmansyah, Yuania, Ibrahim, Isnawati, & Prahani, 2019)

The results of the SCT research model in learning to train critical thinking skills and self-efficacy show that an increase in critical thinking average N-gain is 0.87 in the high category and an increase in self-efficacy in the average N-gain is 0.78 in the high category in prospective chemistry teachers Mangkurat Banjarmasin (Rusmansyah, Ibrahim, Yuania, Muna, & Isnawati, 2018).

In this study, the learning process was carried out online, bearing in mind that since March 2020, Indonesia experienced a health crisis caused by the COVID 19 virus to follow the health protocol in learning activities. Therefore researchers in the learning process use the google classroom application and zoom meeting as a medium in the learning process. In such a situation, online learning via the google classroom application and zoom meeting much helps students improve their abilities and knowledge (Sukamto, 2012).

Appropriate learning media is beneficial for training students' scientific literacy skills and self-efficacy. The concept of chemistry used in practicing scientific literacy skills and students' self-efficacy is a buffer solution material, because, in this material, students also find it challenging to understand it well (Alivia & Dwiningsih, 2018).
2. Research Methods
This type of research is a pre-experimental design with a one-group pretest-posttest design (Sugiyono, 2015). Retrieval of research data starts from April s.d. May 2020. The object of research is students of class XI MIPA 3. The independent variable is the SCT model, while the dependent variable is scientific literacy skills and self-efficacy.

The research instruments were test and non-test instruments. This study's test instrument was the description questions given at the beginning and the end of the lesson (pre-test and post-test). The objective was to determine the increase in students' scientific literacy skills to determine how students could answer the questions given scientific literacy skills. The test used to measure students' scientific literacy skills is in a description test consisting of 7 questions. The measured scientific literacy competencies explain scientific phenomena, design and evaluate scientific investigations, and interpret scientific data and facts. The non-test instruments used in this study were a self-efficacy questionnaire and a student response questionnaire.

Self-efficacy questionnaire sheets and student responses were made using a Likert scale. The self-efficacy questionnaire contains 15 statements, and the response questionnaire contains ten statements. The self-efficacy questionnaire consists of 4 measured aspects. These aspects are: (1) aspects of belief in the ability to deal with uncertain situations that contain elements of obscurity, unpredictability, and stress, (2) aspects of belief in the ability to drive motivation, cognitive abilities and take actions needed to achieve a result, (3) aspects of belief in achieving targets that have been determined, and (4) aspects of confidence in the ability to solve problems that arise. Student response questionnaires to find out students' responses to the SCT model used.

Descriptive data analysis to analyze scientific literacy skills, self-efficacy questionnaires, and student questionnaire responses while inferential analysis for scientific literacy skills and self-efficacy aims to test the hypotheses proposed, there are differences or no differences. This analysis uses a different test to find out whether H0 was accepted or rejected. Before conducting a different test, first test the normality and homogeneity tests of the initial test (pre-test) and the final test (post-test) (Sudjana, 2005).

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3. Results and Discussion
Data on the results of scientific literacy skills and students' self-efficacy questionnaires obtained through pre-test and post-test were analyzed descriptively and inferentially, while the questionnaire responses to the SCT model were analyzed descriptively using percentage techniques.

3.1 The ability of scientific literacy
Indicators of scientific literacy ability that used refer to the PISA problem. The selection of indicators based on the stages in the SCT model. Overall, the average percentage increase in the level of achievement of students' scientific literacy skills presented in Figure 1.
Figure 1 Average pre-test and post-test scores of scientific literacy

Figure 1 shows that the average score of students' scientific literacy post-test is higher than the pre-test. The mean percentage of the post-test was 88.89% (very high category), while for the pre-test was 37.18% (low category). Aspects explaining scientific phenomena increased by 20%. Aspects of designing and evaluating scientific research increased by 47.80%. Aspects interpreted scientific data and facts by 67.39%.

This happens because the treatment applied to the learning process uses the Scientific Critical Thinking model, where students get the learning process with the SCT model syntax. Learning activities with the application of the SCT model have a positive impact in increasing students' scientific literacy. Students' scientific literacy has been well trained, especially in the syntax of student orientation, scientific activities, presentation of the results of scientific activities, completion of critical thinking tasks, and evaluation. Each STC model syntax can improve students' scientific literacy.

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| Class | Result | dB | SD² | t hitung | t tabel (α = 0.05) | Result  |
|-------|--------|----|-----|----------|-------------------|-------|
| XI MIA 3 | Post-test & Pre-test | 88.89 & 37.18 | 42.64 & 274.28 | 13.2 & 2.00 | Significantly different |

Based on table 1 above, the t count price is higher than t table where tcount> t table (13.2> 2.00), so Ho is rejected, and H1 is accepted. Thus, there is a significant difference between the average value of scientific literacy pre-test and post-test of students after learning with the SCT model, where there is an increase in students' scientific literacy.

One factor that influences scientific literacy is the ability to think critically (Gherardini, 2016). Through critical thinking, students will soon realize that answers cannot be obtained only through books, but they must think deeply to eliminate possibilities, compare and oppose ideas until finally getting a solution so that students' literacy abilities will also be trained.

The SCT model can improve students' critical thinking skills. This is in line with the research result Rusmansyah, Yuanita, Ibrahim, Isnawati & Prahani (2019), who revealed that learning using SCT is more effective in increasing students' critical thinking skills compared to learning using conventional models. Other results from Rusmansyah, Ibrahim, Yuanita, Muna & Isnawati (2018) also showed that by using the SCT learning model there was an increase in student CBC (mean N-gain 0.86 (high)) on all indicators, where N-gain for analysis indicators = 0.84 (high criteria), evaluation indicators = 0.84
(high criteria), interpretation indicators = 0.80 (high criteria) and inference indicators = 0.84 (high criteria).

3.2 Self-efficacy

The self-efficacy of students was measured before and after learning using the SCT model. The results of students’ self-efficacy before and after learning with the SCT model can be seen in Figure 2.

Based on Figure 2, it was known that the average post-test has an average value of self-efficacy that is higher that is 72.00 with a high category. The average value of self-efficacy of the pre-test experimental class is 57.29, with the moderate category indicating differences in the post-test and pre-test scores of the experimental class. Inferential analysis test results using the t-test showed that there were differences in students’ self-efficacy between the experimental classes before being given treatment and after being given treatment.

Aspects of belief in the ability to face uncertain situations that contain elements of obscurity, unpredictability, and stress increased by 7%, aspects of belief in the ability to drive motivation, cognitive abilities, and take the necessary actions to achieve an outcome increased by 14%, confidence in achieving predetermined targets increased by 15%, and aspects of confidence in the ability to solve problems that arose increased by 19%.

This increase was caused by the application of the SCT model because in the syntax of the SCT model in the first stage of student orientation where the teacher provided directions and goals about the learning process to be achieved so that students could increase their sense of self-confidence, it was related to the self-efficacy aspect, namely the aspect of belief inability. In the face of uncertain situations that contain elements of obscurity, unpredictability, and stress.

The second stage is a scientific activity where the teacher gives a practicum video that will be analyzed by students in groups in which there are identifying problems, formulating hypotheses, collecting data, and analyzing data. Scientific activities should be carried out by practicum directly, but because the situation does not support the teacher to work around this by providing practicum videos for students’ analysis. Scientific activities can give students confidence in the aspects of self-efficacy, namely confidence in the ability to move motivation, cognitive abilities, and take actions needed to achieve an outcome and aspects of confidence to reach the targets that have been determined.

In the third stage, after conducting scientific activities, the students present the results of scientific activities that made to make students collaborate and communicate their use to deepen the results of the activities of scientific activities that have been carried out. Students are welcome to present the results of scientific activities in groups using the zoom applications’ help so that this syntax can be fulfilled. When students present the results of their scientific activities students can learn to collaborate and communicate. It can train students' confidence contained in the aspects of self-efficacy, namely confidence in the ability to move motivation, cognitive abilities, and take action needed to achieve an outcome.
The fourth stage of solving critical thinking questions is that individual students work on critical thinking questions to practice scientific literacy skills. Individual problems made with the aim that students can understand the material buffer solution. After grouping, it is time for students to work on the questions given by the teacher individually. This can increase students' confidence in self-efficacy, namely the aspect of confidence in the ability to overcome problems that arise and the aspect of confidence in achieving the specified targets.

In the fifth stage of the evaluation, the teacher guides the students to evaluate completing the task. In completing the task, students are also allowed to conclude the learning obtained at each meeting in self-efficacy, namely the aspect of confidence in the ability to overcome problems that arise.

Nuyami, Suastra & Sadia (2014) states that students who have confidence in learning are very influential on their learning outcomes. Self-efficacy is very important for students to have because this underlies the emergence of curiosity in learning. This is because students who have functional self-efficacy have high self-confidence to learn and think to find a learning concept.

3.3 Students' responses
The students' responses to the use of the SCT model carried out at the end of the lesson in the form of a questionnaire with seven positive statements and three negative statements. The results of assessing students' responses to learning on the buffer solution material briefly presented in Figure 3.

![Figure 3 Results of students' responses](image)

Figure 3 shows that students' responses to the SCT learning model on the buffer solution material very well. The percentage of students' responses with very much agree was 30.7%, agreed 61.1%, and doubts - 8.2%. This shows that students respond positively to using the Scientific Critical Thinking model aided by the google classroom application and zoom meeting on the buffer solution material.

4. Conclusions And Suggestions
Based on the description above, it can be concluded that the learning of buffer solution material using SCT models aided by the google classroom application and zoom meeting can improve scientific literacy skills and students' self-efficacy. Students' responses to the SCT model aided by the google classroom application and zoom meeting are very positive, where the SCT model helps students practice their literacy abilities and self-efficacy. It is suggested that research related to the SCT model be conducted for other chemical materials to improve students' literacy abilities.

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