Unesa Journal of Chemical Education *ISSN: 2252-9454*
Vol 9, No. 2, pp. 216-221, May 2020

IMPLEMENTATION OF GUIDED INQUIRY LEARNING MODEL TO TRAIN STUDENTS' SCIENTIFIC LITERACY SKILLS IN CHEMICAL EQUILIBRIUM

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Abstract

The research aims to describe the guided inquiry learning model implementation, students' activities, students' scientific literacy skills, and students' responses to the implementation of guided inquiry learning in chemical equilibrium matter. This research used a Pre-Experimental Design with one group pretest-posttest design. The target in this research are 33 students XI grade at MAN Surabaya. The research result after the implementation of guided inquiry learning model shows that: 1) The average percentage of the learning implementation score in the meeting 1, 2, and 3 respectively 3,50; 3,67; and 3,77 with very good category, 2)Students have been using their times of 14,98%; 30,74%; and 24,69% to train scientific literacy skills include explain scientific phenomena, evaluating and designing scientific investigations, and interpret the data and scientific evidence, 3) Students' scientific literacy skills have increased from pretest to posttest which proved by the total students who have gain score in the medium and high categories at 100%, 4) Students give positive responses to the implementation of a guided inquiry learning model to train students' scientific literacy skills which the percentage of responses is 88,38% with very good category. This research states that the duration of student activity when implementing a guided inquiry learning model does not always result in better scientific literacy skills.

Keywords: Guided Inquiry, Scientific Literacy, Chemical Equilibrium

INTRODUCTION

Natural Sciences Education is a part of education that has an important role in efforts to improve the quality of education because it a natural learning concept and has a very broad relationship related to the phenomena that exist in daily life. One of the natural science groups that related to phenomena in daily life is chemistry [1].

Chemistry is one of the groups of sciences that obtained and developed based on experiments to find answers to the questions of what, why and how about natural phenomena that related to the composition, structure, nature, transformation, dynamics, and energetics of substances [2]. Therefore, chemistry learning can't be taught only through theory but must conduct experiments to improve students' understanding and skills.

One of the chemical matters that emphasize the realm of skills is the chemical equilibrium matter because it related to phenomena in daily life. Student learning outcomes at MAN Surabaya also states that 60.53% of students on chemical equilibrium material are still incomplete.

Daily phenomena related to chemical equilibrium are expected to make students able to explain scientific phenomena and investigate these phenomena. Based on existing basic competencies, the material will easily be understood if students conduct experiments to find their concepts so that students' skills can be trained. These skills include designing and conducting experiments to solve problems and process existing data and make conclusions.

These skills are interpretations of scientific literacy competencies that explain scientific phenomena, evaluate and design experiments, and interpret the data and scientific evidence. By following the guidelines for the preparation of the 2017 revised RPP that literacy must be integrated into learning. According to PISA 2015, scientific literacy is defined as the ability to explain scientific phenomena, evaluate and design scientific investigations, and interpret data and scientific evidence [3]. Science literacy also illustrates a person's ability to understand laws, theories, scientific phenomena and many things [4].

Based on the results of the OECD report states that the ranking of Indonesian students in the ability of scientific literacy at PISA 2015 ranks 64 out of 72 countries [3]. The same result was shown in PISA 2018, Indonesia was ranked 70 out of 78 countries [5]. The results of pre-research data that have been carried out in MAN Surabaya class XI

MIPA 1 and XI MIPA 4 state that the average scientific literacy skills of students especially in the three scientific literacy competencies are explaining scientific phenomena, designing and evaluating scientific research, and interpreting data and scientific evidence obtained percentages of 15.38%, 4.31%, and 47.69%.

The low level of scientific literacy of Indonesian students is caused by the lack of learning that involves scientific processes such as identifying scientific questions, using knowledge possessed to explain natural phenomena and make a conclusion based on facts obtained through investigation [6].

One of the appropriate learning models in training students' scientific literacy is the guided inquiry learning model. The guided inquiry model can be used as a learning model to train science literacy skills because the syntax of inquiry is compatible with competencies in science literacy [7]. Besides, guided inquiry learning emphasizes active participation and the responsibility of students to find new knowledge [8].

One of the research results stated that the ability of the scientific literacy of 31 students increases between the results of the pretest and posttest. It is indicated by the percentage of pretest results of 12.9% in categories below level 1; 22.6% category level 1; 48.4% category level 2; and 16.1% category level 3. Posttest results increased with the percentage of pretest results of 22.6% category level 2; 32.3% category level 3; 35.5% category level 4; and 9.7% level 5 category. Besides, the number of students was 12.9% of people who received a high score gain score, 54.83% of students who received a moderate category gain score and 32.26% low category. This shows that guided inquiry-based learning can improve students' scientific literacy skills [9].

Based on the description above, it is necessary to conduct a research entitled "Implementation of guided inquiry learning model to train students' scientific literacy skills in chemical equilibrium matter at xi grade MAN Surabaya".

METHOD

The research design is Pre-Experimental Design which using One - Group Pretest – Posttest Design to measure students' scientific literacy skills.

$$\boxed{O_1 \; X \; O_2} \quad [10]$$

Information :

O_1 : test score before applying treatment

X : implementation of guided inquiry learning model

O_2 : test score after applying treatment

The quality of guided inquiry learning model implementation was observed through the implementation sheet of the guided inquiry learning model during the learning process with the syntaxes on the guided inquiry learning model that was by the lesson plans that had been made. Two observers will rate the teacher on a scale of 0 to 4.

The value of the implementation data can be calculated by the following formula:

$$\text{Implementation score} = \frac{\sum score\ obtain}{\sum score\ maximal} \text{ x } 4$$

The score obtained converted using the score criteria in Table 1.

Table 1. Assessment Criteria

Score	Criteria
3,1 – 4	Very Good
2,1 – 3	Good
1,1 – 2	Enough
0 – 1	Bad

[11]

Student activities were observed by student observation sheets and were observed every 3 minutes. The data obtained will be analyzed by calculating the percentage of students' activities using the following formula:

$$\% \text{ Activity} = \frac{\Sigma\ specific\ activity\ time}{\text{total time}} \text{x}100\% \quad [12]$$

Student activities are said well if the relevant activities were greater than irrelevant activities.

Scientific literacy skills are assessed using pretest and posttest question sheets which contain of multiple-choice questions. The scientific literacy score of students can be calculated using the following formula:

$$\text{Scientific literacy score} = \frac{score\ obtain}{score\ maximal} \text{ x } 100$$

Increased scientific literacy skills can be known using the gain score with the following formula:

$$\langle g \rangle = \frac{posttest\ score - pretest\ score}{score\ maximal - pretest\ score} \quad [13]$$

Gain score which obtained is converted to the gain level criteria described in Table 2.

Table 2. Gain Gain Level Criteria

Gain Score	Criteria
<g> < 0,3	Low
0,7 > <g> ≥ 0,3	Medium
<g> ≥ 0,7	High

[13]

Students' responses were obtained from the questionnaire responses that are given after the lesson ended in the form of statements with yes and no answers. Data will be analyzed using percentages based on the Guttman scale in Table 3.

Table 3. *Guttman Scale*

Response	Score	
	Yes	No
Question (+)	1	0
Question (-)	0	1

[11]

$$\text{Percentage (\%)} = \frac{\sum \text{student who answer}}{\Sigma \, respondent} \, x \, 100$$

The percentage results of students' questionnaire responses were converted to the criteria of the questionnaire responses listed in Table 4.

Table 4. Questionnaire Responses Criteria

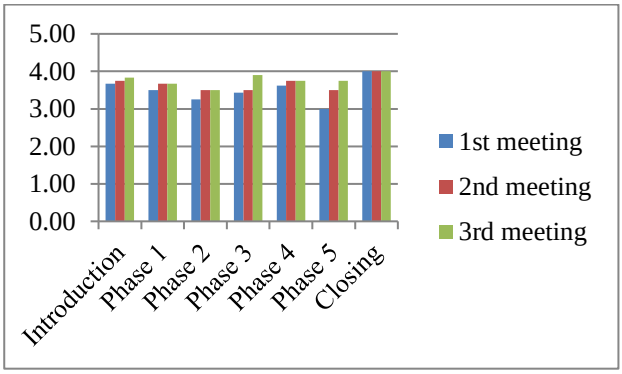
Percentage %	Criteria
0 – 20	Very Bad
21 – 40	Bad
41 – 60	Medium
61 – 80	Good
81 – 100	Very Good

[11]

RESULT AND DISCUSSION

Learning Model Implementation

The observations results of the implementation of guided inquiry learning model during 3 meetings can be seen in Picture 1.



Picture 1. Percentage of Guided Inquiry Learning Model Implementation

Based on Picture 1, it can be seen that the average score increases from the first meeting to the third meeting. The initial activity in a lesson is the introduction. Introduction activities include teachers who say greetings, pray together, the teacher checks the presence of students. Then the teacher begins to remind students about the matter that has been previously studied, provide motivation to students and convey learning objectives. The average score of implementation in first meeting until third meeting respectively 3.67; 3.75; and 3.83 with very good criteria.

The core activities of the learning are 5 phases of the syntax of guided inquiry learning models [14]. Phase 1 is presenting an inquiry problem or phenomenon with the activities of students identifying the problems that exist in the phenomenon presented. The average Phase 1 implementation score obtained at meetings 1, 2 and 3, respectively, was 3.50; 3.67; and 3.67 with very good criteria.

Phase 2 of the learning syntax is collecting data verification, in this phase, the teacher guides students to determine the problem formulation and make a hypothesis. The average score of implementation for phase 2 at meetings 1, 2 and 3, respectively 3.25; 3.50; and 3.50 with very good criteria.

Phase 3 is collecting experimental data, activities in this phase are teacher guides students to identify tools and materials, determine the experimental variables, make experimental procedures, conduct experiments and write the results of experimental observations. The average implementation score at meetings 1, 2 and 3, respectively 3.43; 3.50; and 3.90 with very good criteria.

Phase 4 is organized and formulated explanations and conclusions. Activities in this phase are teacher guides students to analyze the experimental data and make conclusions. The average score of implementation at meetings 1, 2, and 3 in a row is 3.63; 3.75; and 3.75 with very good criteria.

Phase 5 is analyzing the process of inquiry, in this phase, the teacher guides students to associate the concepts obtained with the phenomena presented at the beginning of learning. The average

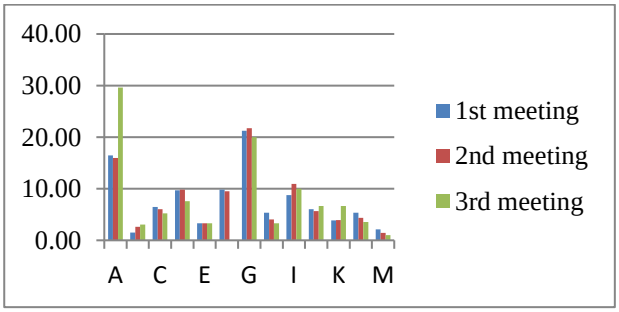
score of implementation at meetings 1, 2, and 3 in a row is 3.00; 3.50; and 3.75 with very good criteria.

The last activity in a learning process is called the closing activity. Closing activities include the teacher giving additional assignments, informing the next matter, then continuing to pray together and greet. the average score of the implementation of the syntax of guided inquiry learning models at meetings 1, 2, and 3 respectively 3.50; 3.67; and 3.77 with very good criteria.

Based on the analysis of the implementation score data that has been obtained at the three meetings, the average score of the implementation of the syntax of the guided inquiry learning model at meetings 1, 2, and 3 respectively 3.50; 3.67; and 3.77 with very good criteria. So it can be said that the teacher has carried out the learning activities following the syntax of the guided inquiry learning model.

Students Activities

Student activities are observed using research instruments that is student activity observation sheets which aim to assess the suitability of student activities with the syntax of guided inquiry learning models and to know that students have been trained in scientific literacy skills including explaining scientific phenomena, evaluating and designing scientific experiments, and interpret data and scientific evidence. Observation sheet activity of students filled with dominant activities and observed every 3 minutes during the learning process. Student activities were observed by 6 observers, with each observer observing 5-6 students who were in the same group. Student activities can be said to be good when the relevant activities are greater than irrelevant activities. Observation result data of student activity for meetings 1, 2, and 3 in detail are presented in Picture 2.



Picture 2 Students Activities Chart

Based on Picture 2 it can be seen that the percentage of relevant student activity time is greater than irrelevant students activities, meeting 1 97.88%, meeting 2 98.55% and meeting 3 98.99%. Based on these percentages it can be concluded that the activities of students in this research are included in very good criteria. Guided inquiry learning emphasizes active participation and the responsibility of students to be able to find new knowledge [8]. This supports the percentage of student activities in this learning that students have been active during the learning process.

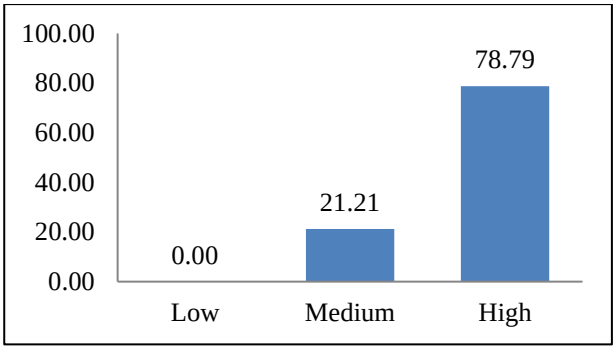
Student activities include students paying attention to teacher explanations (A), expressing their opinions (B), formulating problems (C), making hypotheses (D), identifying experimental variables (E), designing experiments (F), conducting experiments or paying attention to experimental videos (G), write down observations result (H), collect and analyze experiment data (I), conclude experimental results data (J), convey experimental and discussion results (K), associate concepts obtained with phenomena (L) and conduct other activities that are not in accordance with teaching and learning activities (M).

Based on Picture 2 it can be concluded that 14.95% of the time students are used to practice scientific literacy skills in explain scientific phenomena competencies seen through activities C and E. Students use 30.74% of their time to train scientific literacy skills in competencies evaluating and designing scientific investigations seen in the activities of E, F, and G. As much as 24.69% of the time students are used to train scientific literacy skills in the competence of interpreting data and scientific evidence seen in the activities of H, I, J, and L.

Scientific Literacy Skills

PISA 2015 said that there are four domains in scientific literacy skills which include scientific context domain, scientific knowledge domain, competence domain, and scientific attitude domain[3]. This research only trains scientific literacy skills in the competence domain which includes explaining scientific phenomena, evaluating and designing scientific investigations, and interpreting data and scientific evidence. Students' scientific literacy skills are measured

through a test method in the form of giving a pretest before learning and giving a posttest at the last meeting after the guided inquiry learning model is applied. The following graph is presented the percentage of students' gain scores on the scientific literacy skills in Figure 3.



Picture 3. Percentage of Students Gain Scores

Picture 3 shows that 0% of students get gain scores in the low category, 21.21% of students get gain scores in the medium category, and 78.79% of students get gain scores in the high category. The total percentage of students who get gain scores in the medium and high categories of 100%, so it can be said that the guided inquiry learning model can be used well to train students' scientific literacy skills, especially in chemical equilibrium matter.

Based on the explanation above, it can be seen that the duration of student activity when implementing a guided inquiry learning model does not always obtain a good scientific literacy skills as well. It is suitable for the weaknesses of the inquiry learning model that is difficult to control the activities and the success of students which in this research are students' scientific literacy skills [15].

Students' Responses

Students' responses were obtained from the questionnaire responses that were distributed when the learning process had ended. Response questionnaire aims to find out how students respond to the implementation of guided inquiry learning models to train students' scientific literacy skills. This response questionnaire contained 6 statements about the process of guided inquiry learning with a choice of answers between yes or no. Student response data are presented in Table 5.

Table 5. Data Questionnare Response Result

Question	Response		Percentage (%)	Criteria
	Yes	No		
1	31	2	93,94	Very Good
2	29	4	87,88	Very Good
3	28	5	84,85	Very Good
4	28	5	84,85	Very Good
5	30	3	90,91	Very Good
6	29	4	87,88	Very Good

Based on Table 5 it can be concluded that the implementation of the guided inquiry learning model especially in chemical equilibrium matter to train scientific literacy skills received positive responses from students. The positive response is proven by the average percentage of all statements that are equal to 88.38% with very good criteria. The positive responses of the students showed that the teacher had successfully applied the guided inquiry learning model and the students had been trained in the students' scientific literacy skills during the learning process.

It is supported by the statement that the guided inquiry learning model emphasizes the development of cognitive, affective, and psychomotor aspects in a balanced way, which makes learning more meaningful. It also provides space for students to be able to learn based on their learning styles. So students will find it easier to learn the matter [15].

CONCLUSION

Based on the explanation above the conclusion are:

1. The implementation of a guided inquiry learning model to train students' scientific literacy skills on the chemical equilibrium matter as a whole gets very good criteria. This is evidenced by the average percentage of the score of implementation at meetings 1, 2, and 3 respectively 3.50; 3.67; and 3.77 in the very good category.
2. Students use 14.95% of their time to practice scientific literacy skills competence explaining scientific phenomena with activity categories C and D, 30.74% time is used to practice competence evaluating and designing scientific investigations with activity categories E, F, and G, and 24.69% of the time is used to practice competence in interpreting data and scientific evidence in the H, I, J, and L. activity categories.

3. Students' scientific literacy skills have increased based on the results of the pretest and posttest. This is evidenced by the percentage of total students who obtain gain scores in the medium and high categories is 100%.
4. The implementation of guided inquiry learning model to train students' scientific literacy skills which the percentage of responses is 88,38% with very good category.

SUGGESTION

1. Before the implementation of guided inquiry learning models, teachers should organize learning well so there is enough time.
2. The guided inquiry learning model can be used to train scientific literacy skills in other chemical matter.

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