Implementation of Guided Inquiry Learning Model to Train Students' Science Literacy Skill in Electrolyte and Non-Electrolyte Solutions Topic for X Grade Senior High School

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Abstract
This research aimed to describe the implementations of guided inquiry learning model in electrolyte and non-electrolyte solutions topic, students' activities, students' learning outcomes, and students' responses. This research used One Group Pretest-Posttest Design research design. The objects of this research are 24 students of X Grade Senior High School. Methods that used for collecting data are observation, test, and questionnaire. The results of this research were as follows: (1) Guided inquirylearning model were 86%; 89%; and 86.75% implemented and categorized as very good. (2) Percentages of relevant students' activities with guided inquiry learning model is higher than the irrelevant activities. (3) Students' learning outcomes from pretest to posttest was increased; from 8.33% students who passed minimum criteria at pretest to 80.00% students who passed minimum criteria at posttest. The achievement of students' science literacy was increased; proved by 50% of students achieved gained score in high category and 50% of students gained score medium category (4) Students gave positives responds for implementation of guided inquiry learning model to practice science literacy skill.

Keywords: Guided Inquiry, Science Literacy Skill, Electrolyte and non-electrolyte Solution.

1. INTRODUCTION

Education is a conscious and planned effort to create an atmosphere of learning and learning process so the learners actively develop their potential to have spiritual strength, self-control, personality of intelligence, noble character and skills for him, society, nation and state [1]. The curriculum that used in Indonesia at this time is 2013 curriculum. The curriculum of 2013 was developed to improve the mindset of the students [2].

Revision of the 2013 curriculum in 2017 according to the guidance of learning activity plan making 2017 are: (1) integrating the strengthening of character education in learning; (2) Integrating literacy (3) Integrating 21st century skills or 4C (Creative, Critical thinking, Communicative and Collaborative); (4) Integrating HOTS (High Order Thinking Skills) [3].

Chemistry is a science; therefore chemistry has the same characteristics as science. Science is a systematic study of nature and how nature affects human life and environment. Science also includes certain methods for discovering and applying scientific knowledge involving three main elements, namely science as attitude, science as a process and science as a product [4]. Characteristics of chemistry are same as the characteristics of science, the objects in chemistry, how to obtain, and its usefulness [5].

The result of study on one of senior high school in Surabaya stated that 62.5% students said that chemistry is difficult to be studied and understood and 37.5% of students didn't understand the usefulness of chemistry that have been studied in daily life and 62,5% students didn't think that chemistry are related to daily life.

Science literacy is a person's ability to understanding science, communicating science (oral and written) and applying science knowledge to solve problems and have high attitudes and

sensitivity to themselves and their environment in making decisions based on scientific considerations [6].

Literacy of science in Indonesia, based on data from *Organisation for Economic Co-operation and Development* (OECD) 2017, revealed that science literacy score of 15 year olds in Indonesia is 403 points. This is much lower than the average science literacy of other OECD member countries of 493 points [7].

The results of students' science literacy test revealed that 75% of students couldn't explain scientific phenomenon, 79.7% of students couldn't evaluate and design investigations, and 54% of students couldn't interpret data and scientific evidence.

In order to strengthen scientific aprroachs, subjects integrated thematics, thematic in a subject and discovery learning process/inquiry learning needs to be applied [8]. The guided inquiry learning model is one type of inquiry where the students will be assisted by the teacher regarding the investigation or discovery process. Teacher in guided inquiry help students develop research competencies and subject knowledge as well as motivation, reading comprehension, language development, writing skills, cooperative learning and social skills [9]. Guided inquiry syntax is compatible with competencies in science literacy [10].

Based on the description, the formulation problems for this issue are: (1) how implementations of guided inquiry learning model are, how students' activities are, how students' science literacy are and how students' responses are.

The research aims are to know: the implementation of guided inquiry learning model, students' activities, students' science literacy and students' responses.

2. METHODS

This research used One Group Pretest Posttest Design; the experiment is conducted on one group only without any comparison group. The design is as follows:

O_1 X O_2

O1: Pretest before learning using guided inquiry learning model.
X: Treatment, which is learning by using guided inquiry learning model.
O2: Posttest after learning using guided inquiry learning model

[11].

The objects of this research are 24 senior high school students. Data obtained from the observations, tests and questionnaire. Instruments that used in this research are observation sheets of learning model implementation, students' activities observation sheets, learning outcomes tests and students' responses questionnaires.

The data obtained from observation sheet of learning model implementation described by average score from two observers for each aspect and analyzed according to criteria as in table 1.

Table 1 Score Criteria

Category	Value Scale
Bad	0-1,0
Enough	1,1-2,0
Good	2,1-3,0
Very good	3,0-4,0

[12]

The data obtained then calculated by using the formula:

$$p = \frac{total\ score\ of\ collecting\ data}{scoring\ criteria}\ x\ 100\%$$

[12]

The scores were interpreted in Table 2.

Tabel 2 Interpreting Score Criteria

Value Scale	Category
0%-20%	Very Bad

21%-40%	Bad
41%-60%	Enough
61%-80%	Good
81%-100%	Very good

[12]

Students' activities during the learning process were observed based on the amount of students' activities during implementation of guided inquiry learning model. The percentage of student activity can be calculated using the following formula:

$$\% = \frac{\Sigma frequency\ of\ students'activity}{\Sigma frequency\ of\ all\ activities} x100\%$$

[12]

Students' activities described as good if the percentages of relevant students' activities are greater than the unrelevant activities.

Students' learning outcomes were analyzed to know students' conceptual understanding and students' science literacy. Students' conceptual understandings were analyzed by calculating test score with the following formula:

$$Score = \frac{Student's\ score}{\max score} x100$$

[12]

Student passed the minimum criteria score if the student's score ≥ 75.

Classical completeness were analyzed by calculating test score with the following formula:

$$p = \frac{\text{total } student\ passed\ minimum\ score}{\text{total students}} x100$$

[12]

Class stated passes the minimum criteria if percentage classical score is above 61%.

Students' science literacy was analyzed by calculating n-gain score:

$$g = \frac{posttest\ score - pretest\ score}{\max score - pretest\ score}$$

[13]

The result categorized as table 3.

Table 3. n-gain Score Category

Score	Category
0.7< g <1	High
0.3 < g < 0.7	Average
0 < g < 0.3	Low

[13]

Student's science literacy stated as advance if the students categorized if categorized as high and average learner.

Questionnaire responses given after the learning process and analyzed descriptively. The percentage of student questionnaire data was obtained based on calculation of Guttman score scale in the following Table 4.

Table 4. Guttman Scale

Answer	Score
Yes	1
No	0

[12]

Students' responses were calculated by using this following formula:

$$\text{Percentage (\%)} = \frac{total\ score}{criteria\ score} \text{ X } 100 \quad [12]$$

Students' responses stated as positive if the percentage of student response are > 61%

3. RESULTS AND DISCUSSIONS

Implemetations of Guided Inquiry learning Model

Learning activites were held for three times, with 90 minutes allocated for each time. This learning was based on 2013 curriculum with Basic Competence 3.7: Analyzing the properties of electrolyte solutions and non-electrolyte solutions based on their electrical conductivity.

Assessment of guided inquiry learning model implementation was done by 2 observers during the learning processes. There are 3 stages in the learning that includes the introduction, main activities and the closing. There are 5 phases of guided inquiry learning model. Phase 1: confronting of the problem and explaining the inquiry process (investigation), phase 2: collecting data–verification of the problem situation; phase 3: collecting data–conducting experiments; phase 4: organizing and formulating explanations; phase 5: analyzing inquiry strategies and developing more effective inquiry.

Percentages of guided inquiry learning model implelemtations are presented in the form of a histogram as in Figure 1.

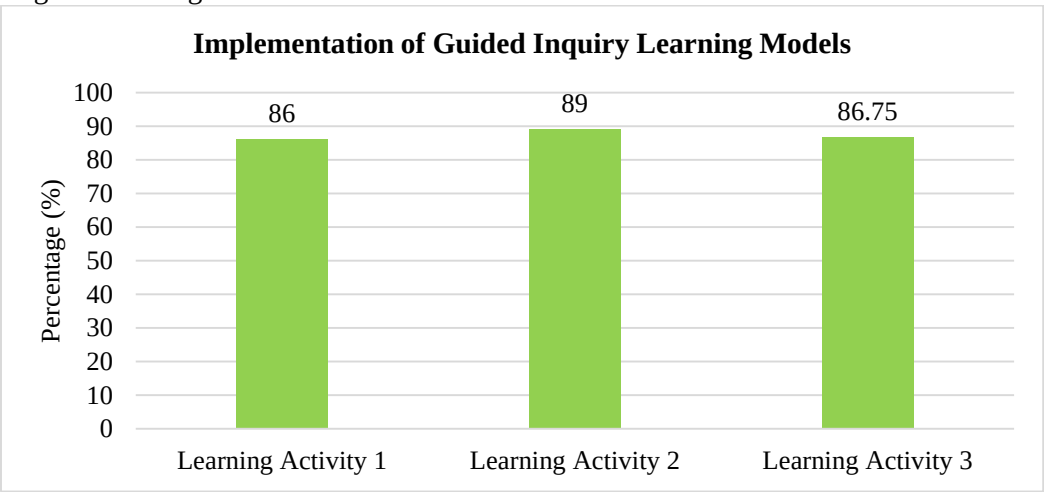

Figure 1 Histogram of Percentages of Guided Inquiry Learning Model Implelemtation

The scores for the implementation of the guided inquiry learning model from first, second and third learning activity were 86%; 89%; and 86.75%. All of three scores were categorized as very good.

Second learning activity score increased from the first learning activity because students more active in learning. However, the scores third learning activity decreased from the second learning activity score. This was due to the students had been able to perform activities without teacher guidance so that there was less interaction between teacher and students which caused less interactive learning.

All of three learning activities categorized as very good. This indicated that teacher understood, mastered and implemented the learning in accordance with the guided inquiry learning model syntax. From the description above, it can be concluded that the guided inquiry learning model has been implemented very well.

Students' Activities

Students' activities are students' behaviors during learning process. Three observers observed the most dominant student activity in every 2 minutes. Students' activities reflect the activities that related to the guided inquiry learning model presented in Table 5.

Table 5 Students' Activities

Activities	Learning Activity 1 (%)	Learning Activity 2 (%)	Learning Activity 3 (%)
Paying attention	13,33	13,33	13,33
Asking question(s)	2,22	2,96	2,96
Giving opinion(s)	11,11	8,89	8,89
Making group	2,22	4,44	4,44
Experimenting	21,48	28,89	26,67
Doing irrelevant activities	3,70	1,48	2,96
Discussing	3,70	5,93	4,44
Making problem formulation	6,67	2,22	2,22
Making hypothesis	4,44	4,44	4,44
Planing experiment	6,67	5,19	5,93
Identifiying variables	4,44	4,44	4,44
Compiling data	7,41	4,44	5,19
Analyzing data	8,89	6,67	8,15
Making conclusion	4,44	4,44	4,44

The percentage of relevant activities of students' activities during implementation inquiry model of guided inquiry is higher than the unrelevant activity, so it can be concluded that the instructional model of inquiry is effective to train science literacy skill and mastery of student concepts.

Learning Outcomes

This research obtained two learning outcomes which are conceptual understandings and science literacy. Pretest and posttest has been done in order to know conceptual understanding and science literacy of students before and after implementation of guided inquiry learning model.

Based on the students' pretest score, 22 students had not passed minimum score criteria because their obtained score is less than 75. Two students passed minimum score criteria because the score obtained is more than minimum score criteria. Based on posttest score of students, as many as 4 students had not passed minimum score criteria. While as many as 20 students passed minimum score criteria because their obtained score is more than 75. The average students' pretest score is 42.33, while the average students' posttest score has increased to 82,50. The average students' score is presented in the form of a histogram as in figure 2.

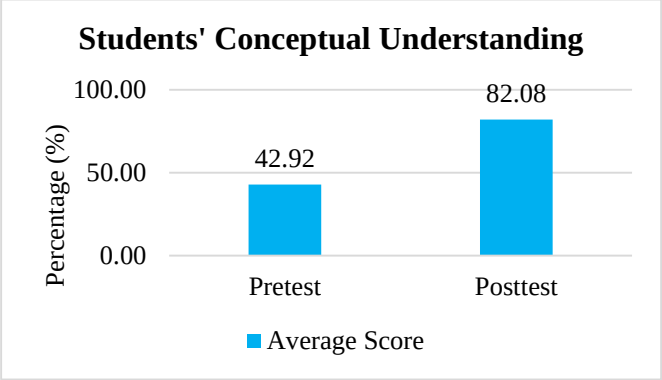

Figure 2. Students' conceptual understanding.

Classical completeness before the implementation of guided inquiry learning model is 8.33%. This shows that class X MIA 1 has been not passed minimum score criteria classically because the percentage is below 61%. However, after the implementation of guided inquiry learning model on the material of electrolyte solution, classical score of class X MIA 1 increased to 87.5%. This indicates that class X MIA 1 is 1 has been passed minimum score criteria classically because the percentage is above 61%. The classical score is presented in the form of a histogram as in figure 3.

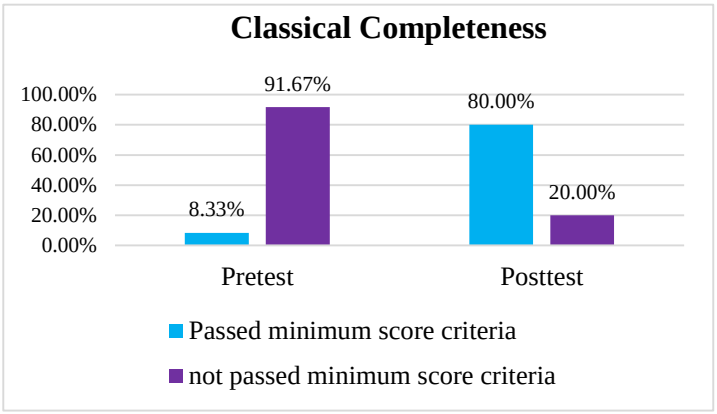

Figure 3. Classical Completeness

This suggests that the application of the guided inquiry learning model of electrolyte and non-electrolyte solvents to the skills of the science process can make students better understand the concepts of electrolyte and non-electrolyte materials.

Science literacy

The posttest and pretest items contain three competencies of science literacy: (1) competence explain phenomena scientifically, (2) evaluate and design scientific enquiry, and (3) interpret data and evidence scientifically. Two items contains competence to explain scientific phenomena, 7 items contains competence of interpreting data and scientific evidence, and 1 item contain the competence of evaluating and designing scientific inquiry. Competence of explains the scientific phenomenon contained in item number 1 and 6, the competence of interpreting data and scientific evidence contained in item number 2, 3, 4, 5, 7, 8, and 9. The competence of evaluate and design scientific inquiry contained in item number 10. Based on pretest and posttest results, the percentage of students who answered correctly on each item can be shown in figure 4.

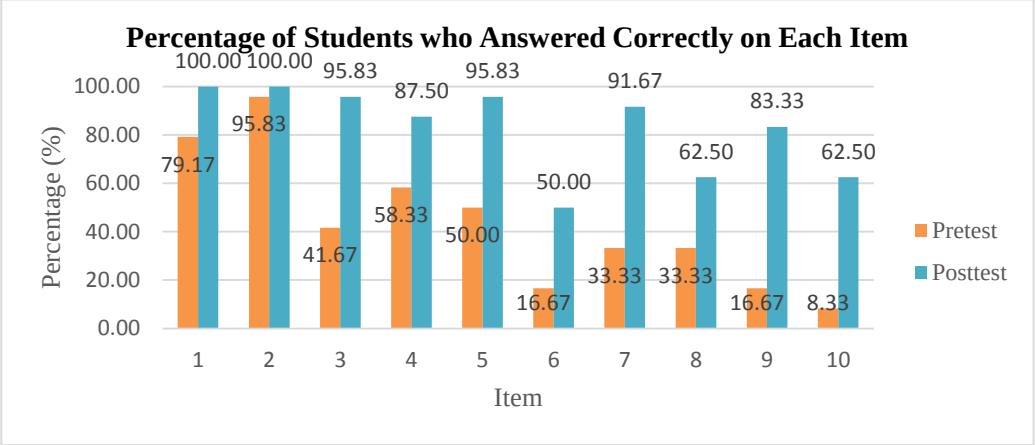

Figure 4. Percentage of Students who Answered Correctly on Each Item.

The percentage of explains scientific phenomenon competence, the competence of interpreting data and scientific evidence as well as evaluating and designing scientific inquiry can were increase after the application of guided inquiry learning model. This can be seen from the average percentage of students who are able to answer the question for every third competence of science literacy. Based on the average data percentage can then be presented graph percentage increase in the number of students who answered correctly for each competence of science literacy in figure 5.

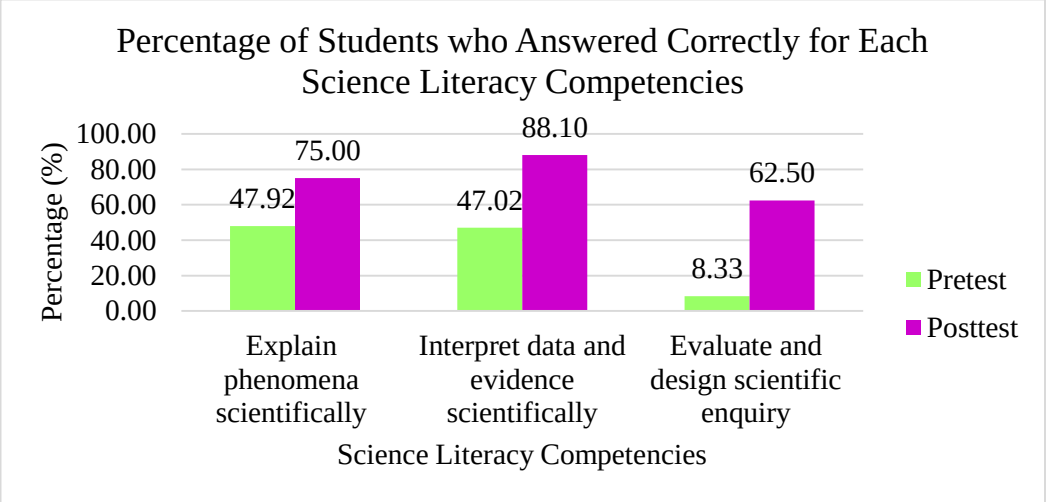

Figure 5. Percentage of Students who Answered Correctly for Each Science Literacy Competencies

After the implementation of guided inquiry learning model, there is an increasing percentage of students who correctly answer for each component of science literacy, competence to explain scientific phenomena from 47.92% to 75.00%, the competence of interpreting data and scientific evidence from 47.02% to 88.10% and competence to evaluate and design scientific investigation from 8.33% to 62.50%.

Twelve students achieved gain score between 0.7 and 0.3 and categorized as average and 12 students achieved gain score above 0.7 and categorized as high. Gain score is used to determine the improvement of student learning outcomes. The result of the gain score shows that half of the total students increased in the average category, this is due to students who rarely do experiments,

so students can not to design the experiment well and when doing experiment the students still need a lot of guidance from the teacher.

From the description of students' science literacy above, it can be concluded that the students' science literacy skills increased after learning with guided inquiry learning model and learning by using guided inquiry learning model can train students' science literacy.

Students' Responses

Overall, the percentage of student responses obtained was 81.94% students' gave positive response and categorized as excellent. It can be concluded that the students respond positively to the learning by using guided inquiry model on the material of electrolyte and non-electrolyte solution.

4. CONCLUSIONS

Conclusions

Based on the correspondence between the results and the aims, it can be concluded that:

1. The quality of implementation of guided inquiry learning model during the three learning activity obtained the average scores from 1st, 2nd and 3rd learning activity by 86%; 89%, and 86.75% and categorized as very good. This indicates that the teacher has conducted teaching and learning activities in accordance with the syntax of guided inquiry learning model and has trained the ability of science literacy to students well.
2. Percentage of students' relevant activities during leraning process is higher than the irrelevant activities, so it can be concluded that the guided inquiry learning model is effective to train science literacy.
3. Students' learning outcomes in pretest there are 8.33% of students passed the minimum score criteria and 91.67% of students didn't pass the minimum score criteria. However, the result of posttest is 80,00% students passed the minimum score criteria and 20,00% % of students didn't pass the minimum score criteria. It can be concluded that guided inquiry learning model is effective increasing conceptual understanding of students.
4. The achievement of students' science literacy skill from 24 students increased from pretest to posttest result. This is indicated by the result of students' gain score. Twelve students achieved gain score above 0.7 and categorized as high. The other twelve students achieved gain score between 0.3 and 0.7 and categorized as average. It can be concluded that guided inquiry learning model is effective to train students'science literacy skill.
5. Students gave a positive response to the guided inquiry learning model with the percentage of students' responses obtained is 81,94% and categorized as very good.

Suggestion

For further research, the other aspects of science literacy may be trained to students' as well as science literacy competencies.

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