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DEVELOPMENT OF STUDENT WORKSHEET WITH GUIDED INQUIRY-BASED TO TRAIN STUDENT'S CRITICAL THINKING SKILL ON ELECTROLYTE AND NONELECTROLYTE SOLUTION MATTER GRADE X

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Abstract

This research aims to develop student worksheet with guided inquiry-based to train student critical thinking skill on electrolyte and non electrolyte solution matter based on validity, practicality and effectiveness. This type of research is research development depend on the 4D model, but only to develop stage. The instruments used is review sheets, validation sheet, pretest and posttest critical thinking skills of sheet and student questionaire responses. The data sources from two chemistry lectures and chemistry teacher. The limited trial was conducted on 20 students of X grade XI MIPA 6 SMAN 1 Manyar then the data can be analyzed using descriptive and quantitative. The results of this reasearch indicate the content validity of 83.80% in the category is very feasible and the construct validity of the percentage of 76.6% in the feasible category. The result of questionnaire from students shows that 87,5% of students give positive response to student worksheetthat developed with very feasible criteria. The result of the students' thinking skill test has a range of 73.3% -86.7%, so that the developed student worksheet is categorized as feasible.

Keywords: student worksheet, guided inquiry, critical thinking skills, electrolyte and nonelectrolyte solution.

INTRODUCTION

Education is a planned conscious effort to bring about an atmosfer of learning and the learning processso that learners are actively developing their potency to have a religious, spiritual power, self-control, personality, intelligence, good attitude, and skills that needed, community, nation, and state [1]. National education serves to build and build the character and civilization of a dignified nation within the framework of the nation's intellectual life, the means to develop the potency of learners to be a human being who believes and cautious to God Almighty, noble, healthy, knowledgeable, capable, creative, independent , and become a democratic and responsible citizen [1].

Indonesia curriculum K13 needs to balance the spiritual and attitude, knowledge, skill, and apply it in a variety of situations in schools and the critical community [2]. Skill acquire through activities: observe, ask, present, and created. Therefore critical thinking skill needed to be developed because it is very essential ability to make all aspects of live effectively. Student cannot develop his thinking skills properly without practice it in the various field of study.

In scientific learning, especially chemistry, teacher is expected to be able to give critical learning so students are able to acquire a good concept and are not passive. Teacher is given free chance to implement suitable learning model and method in learning activity. Besides, students also needs relevant learning source so they are able to acquire accurate information [3].

Critical thinking is reflective way of thinking that makes sense or reason that is focused to determine what should be believed and practiced [4]. The critical thinking skills based on Ennis were develop into five indicators: providing basic explanation, establishing basic skills, summarizing, giving further explanation, and strategies and tactics [4]. Learners who think critically can improve their understanding when they are learning a material [5].

One of the attempts to train the critical thinking kills by choosing the learning model involve students actively, and demand the students to think critically. An alternative that can be used to train critical thinking skills is a guided inquiry learning model.

Inquiry learning model is learning process approaches that involve students to find and use a variety of source to get a grasp of the matter [6]. Students are directed to find the answer by themselves from questionable something use different source to explain the phenomena.

The appropriate learning model also needs to be supported with appropriate learning media,

so that needed a media that can support the learning. One of the learning media is student worksheet. Student worksheet is sheets containing the tasks that must be carried out by students [7].

Based on the preresearch result conducted in SMA Negeri 1 Manyar that in the learning process of students still using student worksheet that contain about matter and question. It resulted the students felt less interested in studying chemistry. In addition, critical thinking skills which belonged to students were very low so that the using of student worksheet in the learning process hasn't train students yet to find their own concepts.

From the description of the background, so the researchers are motivated to do research on "Development of Student Worksheet With Guided Inquiry-Based to Train Student's Critical Thinking Skill on Electrolyte and Nonelectrolyte Solution Matter Grade X".

METHOD

This research is a type of development research using 4D model those are define, design, develop, and disseminate. But it is limited to the develop stage [9]. The designs in this research conducted by the trials which is limited to students who were heterogeneously selected based on their academic ability level of 20 students.

This research uses several research instruments, there are: review and validation. The review on student worksheet was developed by 2 chemistry lecturers at Universitas Negeri Surabaya and 1 chemistry teacher at SMAN 1 Manyar Gresik using a sheet of study. It aims to provide suggestions towards the worksheet that is still developed.

Data validation results are analyzed by quantitative descriptive method through percentage. This data is used for determine the validity of content and constructs. The assessment of each criterion uses a validation sheet using the Likert scale in Table 1.

Table 1 Likert Scale

Scale	Categry
1	Not appropriate
2	Less Appropriate
3	Enough appropriate
4	Appropriate
5	Very appropriate

[8]

The resulting data was calculated its percentage by using the following formula:

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

Obtained percentage then convertedinto category on Table 2.

Table 2 Score Interpretation

Pecentage	Category
0% – 20%	Very bad
21% – 40%	Bad
41% – 60%	Feasible enough
61% – 80%	Feasible
81% - 100%	Very feasible

[8]

Validity of worksheet is feasible when the results of the validation from the validator get ≥ 61% for each criterion [8].

Student questionnaire responses assessed on a Guttman scale in Table 3.

Table 3 Guttman Scale

Response	Score
Yes	1
No	0

[8]

The obtained data is calculated to get the percentage of student response result by using formula:

$$percent\ (\%) = \frac{scores\ obtained}{maximum\ score}$$

The obtained percentage results are interpreted according to Table 3. Based on Table 2, the practicality of the student worksheet was developed based on the student response questionnaire said to be feasible when obtaining ≥ 61% [8].

The test data of students' critical thinking skills are analyzed descriptively. Assessment on each item of test is adapted to the critical thinking skills taught and then converted into categories such as in Table 4.

Table 4 Conversion Score and Predicate Learning Outcomes Skills

Knowledge	
Average Score	Predicion
3,85 – 4,00	A
3,51 – 3,84	A^-
3,18 – 3,50	B^+
2,85 – 3,17	B
2,51 – 2,84	B^-
2,18 – 2,50	C^+
1,85 – 2,17	C
1,51 – 1,84	C^-
1,18 – 1,50	D^+
1,00 – 1,17	D

[10]

Critical thinking skills of students said to be complete if the test scores achieved by students ≥ 2.67 or get the predicate B-. Then the value of pretest and posttest used to know the category of student gain with the calculation below:

$$<g> \equiv \frac{\%<G>}{\%<G>max} = \frac{(\%<S_f>-\%<Si>)}{(100-\%<Si>)}$$

Furthermore, the number obtained will be converted to the range of category scores as in Table 5.

Table **5** Categories of Gain

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

[11]

Based on the gain category, student worksheet based on inquiry is guided to train students' critical thinking skill to be feasible if there is an increase of gain score with medium or high category.

RESULTS AND DISCUSSIONS

Validity

The result of the review test is used to know the weakness of student worksheet were developed then get improvement of student worksheet based on the suggestion from the reviewers.

Based on the review result that conducted towards the developed student worksheets obtained some suggestions, there are: fix the cover of student worksheet, change the sentence in the learning objectives correctly, change the student worksheet's guides by adding features to become more interesting, change the phrase phenomenon correctly, change the problem formula by relating the respond variable and manipulation, change the sentence by writing the result of observation in table form in order to facilitate the student on grouping, and adding a question that could bring the concept to the student worksheet.

The developed student worksheet then validated by two chemistry lecturers and one chemistry teacher. The data processing results of validation results are presented in the following Table 6.

Table 6. The Results Of Validation

Feasibility Criteria	Percentage	Category
Content validity	83,6%	Very appropriate
Construct validity	73,3%	Appropriate

Based on the data of validation result contents in Table 6, it can be seen that the developed student worksheet has fulfilled the content and consruct validity. Content validity itself gets 83.6% and constructs validity get 73.3%. Components of content validity include conformity of student worksheet with material, conformity of student worksheet with criteria related to presentation, conformity of student worksheet with student worksheet grading, conformity of student worksheet with guided inquiry learning model, and conformity of student worksheet with critical thinking skill component, and conformity of student worksheet with linguistic criteria. While the validity of the construct includes the conformity of the material with guided inquiry component and the conformity of guided inquiry component with critical thinking skill component.

The conformity of student worksheet with the material is said to be feasible because every component that includes: the material in the student worksheet in accordance with the Curriculum 2013 gets 86.7%; the material in the student worksheet contains important concepts obtaining 86.7%; experimental activities in student worksheet are also in accordance with the basic competencies developed obtaining 86.7%; the questions in the student worksheet in accordance with learning outcome indicators earn 86.7%; develop students' critical thinking skills earn 80.0%.

Based on the data of validation result, the conformity of student worksheet with criteria relating with graphics to be feasible because each component includes: the image illustration in accordance with the content gets 80.0%; conformity size and font type get 86.7%; attractive cover design gets 80.0%; conformity of illustrations or drawings with subject matter; earn 80.0%; use of color according to background 86.7%. This is in accordance with the feasibility of graphics is part of the preparation of teaching materials where there are several ways that can be used to attract attention to text-based media is the color, letters, social tools and appearance that is not boring [12].

Based on the data of validation result, conformity of student worksheet with criteria relating to the presentation including: worksheet cover gets 80%, presentation of logical and systematic student worksheet gets 80%, write the answer as needed gets 86.7%, completeness of the components presented in the student worksheet gets interval 80-100%, and the presentation of

student worksheet generate student motivation gets 80% percentage. These results indicate that the guided inquiry-based student worksheet developed are said to be feasible according to the Likert scale.

The conformity of the student worksheet with the guided inquiry learning model is considered feasible because complete the criteria on the aspect which contains: the guided inquiry phase of the model gets 80.0% and the guided inquiry phase is presented sequentially get 86.7%.

The conformity of the student worksheet with the critical thinking skill component is said to be feasible because the result of critical skill test, pre-test of students' critical thinking skill, the value of 2 students has not fulfilled minimum mastery criteri with value ≥ 2,67. The range of values they get between 1.00 - 2.60. Based on the range of values can be said that 20 students are not complete. In contrast to the post-test results after using the developed student worksheet, the students were given the same problem as the pre-test, and the post-test result showed an increase of 18 students is complete and 2 students were not complete. Students who have completed the posstest get grades ranging from 3.00 to 3.80.

The conformity of student worksheet with the criteria of language is said to be feasible by obtaining the percentage of 81.7% because the student worksheet is developed using good and correct language, the language used is clear and concise, the writing of student worksheet uses the exact term and easy to understand, and the sentence does not contain ambiguous sentence so not give different interpretations or understandings.

The conformity of the material with guided inquiry component is considered feasible by obtaining the 80.0% because it contains guided inquiry phase which includes: confrontation with the problem, data gathering-verification, data gathering-experimentation, organizing, an formulating explanation, and analysis of the inquiry process [13]. The conformity of the material with guided inquiry component is evident from the conformity of the material to the experiment that will be done by testing the electrolyte and nonelectrolyte solutions as well as the strong and weak electrolyte solution.

The conformity of the guided inquiry component with the critical thinking skill component contained in the guided inquiry phase complete the criteria by obtaining a 72.3% of the critical thinking component which includes: providing basic explanations, developing basic skills, summarizing, and preparing further explanations [4]. Based on the data above validation results, it can be said that the student worksheet developed feasible use of content and construct validity as a percentage of ≥61%.

Practicality

The practicality of student worksheet developed can be seen from the student's questionnaire data. The result of the student's response was obtained from the students' opinion on the guided inquiry-based student worksheet obtained through the questionnaire of the student's response indicated that all aspects got a percentage of ≥ 61% with very feasible category. The student's response from the developed student worksheet earned an average percentage of 87.5% with a very feasible category according to the Likert scale [8].

Effectiveness

The effectiveness of the developed student worksheet can be known from the data of critical thinking skills on the material of electrolyte and nonelectrolyte solution. The results of critical thinking skills tests obtained from the results of student work on the test sheet in the form of essay to know students' critical thinking skills after using the developed student worksheet. Based on the results of critical thinking skills tests of students who were given before and after lesson using student worksheet based inquiry guided relatively increased. Students who have completed the test get scored with a range of 2.80-3.40 with the value obtained n-gain score in the range of 0.3-0.8 in the medium to high category.

The test results of each component of students' critical thinking skills are presented in Table 7.

Table 7 Results of Critical Thinking Skills Tests for Each Component

No.	Component	Pretest	Postest
1	Providing simple explanation	37.5%	72.5%
2	Building basic skills	32.5%	73.75%
3	Summarizing	40%	76.25%
4	Giving further expanation	60%	82.5%

Based on these results can be seen that the percentage of critical thinking skills of each component was increased which is providing simple explanation of 37.5% to 72.5%; building basic skills 32.5% to 73.75%; summarizing 40% to 76.25%; and giving further explanation 60% to 82.5%. Along with the increase of posttest result

proves that student of class XI MIPA 6 SMA Negeri 1 Manyar have good critical thinking skill.

CLOSURE

Conclusion

Based on the results of data analysis and discussion that has been done, it can be concluded as follows:

1. Based on the validity, student worksheet with guided inquiry-based to train student's critical thinking skill on electrolyte and nonelectrolyte solution matter grade X is feasible for use according to content validity of 83.80% and 76.6% construct.
2. Based on practicality, student worksheet with guided inquiry-based to train student's critical thinking skill on electrolyte and nonelectrolyte solution matter grade X for according to student response get 87.5%.
3. Based on effectiveness, student worksheet with guided inquiry-based to train student's critical thinking skill on electrolyte and nonelectrolyte solution matter grade X is feasible for use according to critical thinking skills students get interval 73.3%-86.7%.

Recommendation

Based on the research and the results obtained, it can be given some suggestions, there are:

1. Development of student worksheet with guided inquiry-based to train student's critical thinking skill on electrolyte and non electrolyte solution matter grade X in this research is only done through the develop stage, so that the next research is expected to be carried until the disseminate stage.
2. When applying the developed student worksheets to note an allocation of time, because in the student worksheet a lot of activities are ranging from create a research until analyze data so that needed estimated time efficiency.

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