

Developing CTL-based Student Worksheet on Trigonometry to Increase Scientific Attitude

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Abstract. The aims of this research is to develop CTL-based student worksheet on Trigonometry to increase scientific attitude, to know the quality of the learning valid, practical, and effective. The development model used is 4-D modified to 3-D until the stage development. The type of data used is descriptive qualitative data. The instrument used were validation sheet, test and questionnaire. The result of this research indicate that CTL-based student worksheet on Trigonometry in the category of valid a value 86.25%. Students response to worksheet very positive, so students worksheets category practical with the value 84.20%. The use of worksheets has been meeting the classical learning completeness criteria that is 83.62 %, so the student worksheet in the category of effective. Based on research result of this study concluded that CTL-based student worksheet on Trigonometry is feasible because it meets the criteria valid, practical, and effective.

INTRODUCTION

Education has a very important role in this world. One of the factors of success of a country can be seen from the quality of education in that country. Indonesia is one of the developing countries in the world, education is very important for her to face the challenges of the time. According [1], that national education is meant to develop ability and form character as well as attitude of a prestigious nation to develop a smart generation. Good attitude in the learning process greatly affect a person's learning outcomes. One of attitude that needs to be developed in the study is a scientific attitude. It is in line with [2] who said that "The development of science knowledge, science process skills and scientific attitudes in individuals exposed to science courses are the major goals of Science Education, however the assessment of scientific attitude (Affective domain) is not as simple as compared to that of the scientific knowledge (cognitive domain) and science process skills (Psychomotor domain) and this scientific attitude is one of the important aspects of today's science throughout the globe".

Scientific attitude needed in a variety of science, especially mathematics. Mathematics is an important component basis for other scientific disciplines. The study of mathematics is considered to be very important in each and every country of the world. It is in line with [3] who said "The study of mathematics is considered to be very important in each and every country of the world. Students are required to learn mathematics which is considered as a basic education, since the skill of mathematics computation is essential in every walk of life". [4] argue that "Mathematics is at the heart of many successful careers and successful lives for societal development, particularly in the extraordinary and accelerating change circumstances". Next [5] said that "Learning mathematics has become a necessity for an individual's full development in today's complex society". Attitude have an important role in Mathematics. It is in line with Borasi in [6] that "The conceptions, attitudes, and expectations of students regarding mathematics and mathematics teaching have been considered to be very significant factor underlying their school experience and achievement". The scientific attitude investigates certain scientific acts or thoughts. Scientific attitude is the ability to react consistently, rationally and objectively in certain ways to a novel or problematic situation. It is the ability to do things in a way that rely on proven principles rather than unverified principles. A person with good scientific attitude is free from superstition, unverified assumptions and many times from popular opinion that has no empirical basis [7]. Then, [8] said that "An integrated approach of curriculum development should be adopted strategically so as scientific attitude may be inculcated at every stage. The findings and conclusions of this study may help a lot in the fulfilment of goals of science education in

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this direction". So that the scientific attitude in mathematics is indispensable because it can improve the success rate of students.

Another factor that can affect student learning is the teacher. In learning, the teacher's role not only as an informant, but is expected to be a motivator who can motivate student learning, is able to organize learning activities of students, is able to create a conducive learning atmosphere for students and capable to be facilitator who help students in learning, also as a student's achievement evaluator. In addition teachers are required more creatively than students because the teacher is an important factor affecting student achievement. Student success in learning depends on how the presentation of the subject matter and learning model used by teachers. But Mathematics is still centered on the teacher. It is in line with [9] The recent fact in Indonesia is that learning is still dominated by conventional system. Thus, the implementation of learning oriented to "contextualized multiple intelligences" concept is still far away from its wish. It is proved by serious problem that should be faced in which most of students cannot relate what they have learnt.

Less creative math teacher, monotonous or just the models that are presented every day, sometimes long-winded explanations and give less to the understanding concept. Teacher only text book oriented and the books that are used less attractive. As a result, students do not get to experience in the learning process and can't explored the potential maximum in on him. Another factor affecting the success of learning mathematics is the teaching materials used by teachers. Teaching materials used by teachers today less attractive and not up to date with advances in education.

Based on the above problems is necessary to change the learning of mathematics. Teaching materials used by teachers need improvement. To increase the activity of students in learning of mathematics required instructional materials interesting and understandable for students. For that we need the development of teaching materials, such as student's worksheet. Student's worksheet typically contains about material, sample questions and exercises only. Student worksheet like that make students bored and less interested to learn mathematics. [5] argue that "in order to make students active, to increase their motivation, the learning of mathematics should be associated with everyday life". Further, [10] "The chances of enabling students to transfer learning from one teaching setting to another and/or to real life situations may increase when teachers use contextual teaching and learning practices". The approach who can be used is the approach of CTL (Contextual Teaching and Learning). It is in line with [11] who said that "CTL and Constructivist Theory, incorporating the principals of contextual teaching helps to promote authentic learning and increases students' success by allowing them to make connections as they construct knowledge. So that need to the development of CTL-based student worksheets. With the development of CTL-based student worksheets, is expected to increase the scientific attitude of students so that learning of mathematics more meaningful. The aims of this research is to develop CTL-based student worksheet on Trigonometry to increase scientific attitude, to know the quality of the learning valid, practical, and effective

METHOD

This study is a research and development. Research development refers to the Four-D development model that consists of four steps: (1) define; (2) design; (3) develop; (4) disseminate [12]. The products developed in this study is a CTL-based student worksheet. The quality of products consists of three following criteria: validity, practicality, and effectiveness [13]. The study is undertaken in Department of Mathematics Education, IKIP PGRI Madiun, East Java province, in October to November 2016. The procedures of research in this study use the 4-D development model who finished at the third stage. The specification of the models are:

- Define
This stage is the definition stage and analysis of problems and also the solutions. The activity in this stage are start-final analysis, student's analysis, concept analysis, task analysis, and the purpose specification.
- Design
In this stage produce the preliminary design of the product, that are the draft of CTL-based student worksheet. This stage consists of four step, drafting instrument, media selection, format selection, and preliminary design. This study requires validation sheet, student questionnaire and sheet of test.
- Develop
This stage is the develop stage of premilinary design to the CTL-based students worksheet. The activities of this stage are:
 1. Product validation
It takes an expert to be able to validate the product. They are mathematics lecturer, who expert in learning media and mathematics learning psychology. There are three experts judgement in this study.
 2. Limited testing

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This activity is conducted before field testing. These tests using 6 students who did not come from a class field testing.

3. Field testing

This test is performed on a student of mathematics education 1C semesters totaling 31 students. The data obtained in this trial is the response of the students, and scores the results of tests of learning.

Data, Instrument, and Data Collection Technique

The type of data collection in this study is a qualitative and quantitative. The qualitative data obtained from the feedback and suggestions from validators and students. The quantitative data obtained from the scores of test of students achievement. Data collection techniques in this study consist of questionnaires, validation, and test sheet. The questionnaires techniques was applied to collect the student's responses. The validation technique was applied to collect the validation data on CTL-based student worksheet from expert validators. The sheet of test to collect the student's achievement.

Data Analysis

- CTL-based students worksheet validity Analysis

Valid means the instrument can be used to measure what is meant to measure. Evaluation technique or test can be called as having a high validity level if it is able to measure what is actually meant to measure. Every aspect of teaching equipment is validated by validator with scoring range from 1 to 4. The criteria of validity can be seen in the table 1 below:

Table. 1. Validity Criteria

Answer percentage (%)	Meaning
85,01 – 100,00	Very valid or can be used without revision
70,01 – 85,00	Quite valid or can be used with minor revision
50,01 – 70,00	Not quite valid or need major revision
01,00 – 50,00	Not valid and can't be used

Student worksheet can be called as valid after being validated by three validator. If the result of validation obtained criteria quite valid or very valid, the process of developmental research can be continued to the next stage, but the researcher has to revise the draft if the result of validation shows that it has fulfill the criteria of a valid.

- CTL-based students worksheet Practicality Analysis

The data to be analyzed in order to know the practicality of the student worksheet is the students' response questionnaire. The analysis of students' questionnaire can be called as practical if the positive response of the students reach up to $\geq 70\%$. The formula used to measure the practicality level is:

$$RS_{students} = \frac{A}{B} \times 100\%$$

Note :

$RS_{students}$ = students' response percentage/students' response mean

A = the number of students who response

B = the number of students who give their response

- CTL-based students worksheet affectivity Analysis

The data used to see the affectivity of the student worksheet are students' score obtained from the task given after the teaching process using the students' workbook. The lesson can be called as effective when the number of students who completed the subject classically fulfill the effective criteria or very effective criteria. To get a better understanding of lesson plans implementation affectivity, the researcher presents the illustration in the table below:

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Table 2. Affectivity Criteria

No	Affectivity Criteria	Affectivity Level
1.	85,01% - 100,00%	Very valid or vary effective, can be used without revision
2.	70,01% - 85,00%	Quite valid or quite effective, can be used with minor revision
3.	50,01% - 70,00%	Not quite valid or not quite effective, needs major revision
4.	01,00% - 50,00%	Not valid and not effective, can't be used

Students' worksheet can be called as effective when students' completeness is $\geq 75\%$ classically. The classical completeness percentage can be measure through this formulae.

$$\text{completeness percentage} = \frac{\text{the number students who complete}}{\text{the total number of students}} \times 100\%$$

Students worksheet can be called as acceptable if it is fulfilled the criteria of validity, affectivity and practicality.

RESULTS AND DISCUSSION

Student Worksheet development model in this research is a four-D models (4-D models), which consists of 4 stages. The fourth stage is define, design, development, and disseminate. However, in this research only covered about three stages of development of student worksheets, namely the definition, design and stage development.

- Define

The purpose of this phase is to define, analyze potential and existing problems in the area of research. At this stage, the activities that have been done are as follows:

- a. Beginning-End Analysis

Researchers conducted direct observations in the IKIP PGRI Madiun, researchers obtain some information, among others: 1) the student motivation in learning trigonometry still low, 2) lack of innovation supporting books that belong to the students.

- b. Analysis of student

In this analysis, the researchers obtained information that the average value of the test trigonometry student is still low, at the 58.

- c. Material analysis

Trigonometry material in this research is the application of trigonometry.

- d. The task analysis (LKM)

The task analysis is used to identify the steps necessary to achieve the purpose of research. The purpose of this research is to produce CTL-based student worksheet on Trigonometry. The tasks contained in the Student Worksheet is the individual tasks and task groups based on the problems of everyday life.

- Design

The purpose of this stage is to prepare a prototype learning device, namely lesson plans and worksheets. The initial step of making lesson plans that make core competencies, basic competencies, indicators and purpose of learning, then learning steps. While the making of Student Worksheet begins by collecting the material, collecting pictures, create a cover, preface, table of contents, and make the contents Student Worksheet. The activities at this stage of development are as follows:

- a. Preparation of Student Worksheet

The results of the analysis stage is used to compile Student Worksheet. The first step in preparing the Student Worksheet is to determine basic competencies. The second step to collect the pictures and make up matter. The third step is considering the structure Student Worksheet, which includes the title, hints learning, competency to be achieved, supporting information, tasks and work steps and assessment.

- b. Media Selection

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Media that are selected based on the existing facilities in the classroom (blackboard, markers and a ruler) and Student Worksheet

c. Format Selection

Student Worksheet developed in the form of print media. The format chosen for developing the student worksheet contains the following components: Title Worksheet for Students, Student Identity (name, class), the title material, foreword and table of contents, learning objectives, materials in accordance with the CTL approach, and tasks (individual tasks and group assignments)

• Development

This stage aims to determine the steps to create a CTL-based Student Worksheet on trigonometry which has undergone several revisions based on input from the validator and the data obtained from the limited testing to determine its quality. Once the design is created and then began to make of CTL-based Student Worksheet on the trigonometry. Student Worksheet developed made it interesting that the students are interested in the next lesson. The sequence of activities at this stage of development are as follows:

a. Validation Expert

The activities at this stage are to validate the developed learning device (Draft I) to the validator. To validate the device developed selected expert validator in the field of mathematics. The validator that validates learning device is Edy Suprpto, S.Si., M.Pd, Wasilatul Murtafiah, M.Pd, and Reza Kusuma S, M.Pd. They are Lecturer Mathematics Education IKIP PGRI Madiun. Learning device should have a valid status, before use. Thus, if the learning device is not yet valid it will be revised and validation back to obtain a valid learning device. Based on the results of validation by validator so Lesson Plan and Student Worksheet (LKS) is said to be valid.

b. Limited Test

Limited test was conducted to determine whether the developed learning tools can be understood by students. Based on the results of student questionnaire responses and test results on a limited test learning can be said to be practical and effective.

c. Field test

Field tests held 3 meetings. The first meeting and the second meeting, researchers presenting the trigonometry material with CTL approach and at the end of activities the students work on the problems that have been prepared by the researcher. The third meeting is an evaluation of test results Learning and fill out a response questionnaire. Based on the results of a student responses questionnaire and achievement test in field trials can be said to be practical and effective

Development Results

Based on research that has been conducted by researchers obtained the following results:

1. Validity and practicality of the learning device

a. Analysis of the validity of the Student Worksheet

Validation results of Student Worksheet by validator is as follows:

Table 3. Result Validation Student Worksheet after Revisions

Validator	V1	V2	V3
Percentage (Vp)	86,45%	86.9%	85,40%
Average Validation (V)	86,25%		

Based on the data analysis of validation Student Worksheet that has been revised obtained a percentage of final validity 86.25%, so Student Worksheet included in the very valid criteria because it has met the criteria of validity that is ≥ 85 .

b. Practicality Analysis

Practicality analysis Student Worksheet obtained by filling the response questionnaire for the students after using Student Worksheet.

1) The results of Response Questionnaire for student in Limited testing

Here are the results of responses questionnaire for the student on limited testing:

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Table 4. Results fill out a questionnaire on a limited test

Total Score obtained (A)	227
Total score criterion (B)	240
Percentage of practicality (P)	94,58%

According to the table above were obtained practicality percentage of 94.58%, it can be concluded that the use of Student Worksheet on a limited test met the criteria of practicality because of the percentage positive respondents more than 70%.

- 2) The results of Response Questionnaire for student in field testing
Here are the results of responses questionnaire for the student on field testing:

Table 5. Results fill out a questionnaire on a field test

Total Score obtained (A)	1055
Total score criterion (B)	1120
Percentage of practicality (P)	84,20%

Based on the results of questionnaires by 31 students on field trials obtained practicality percentage of 84.20%, it can be concluded that the Student Worksheet met the criteria of practicality because of the percentage positive respondents more than 70%.

2. The effectiveness of the learning device

Student Worksheet efficacy data obtained from achievement test scores in a limited test and field test. Achievement test scores of students in a limited test are as follows:

a. Results Validation and Reliability Problem on the Limited Test

Table 6. Student test scores in limited testing

Total Score obtained	470
The total value of the overall	600
Percentage of completeness Learning	87,02%

Based on student test results obtained on a limited test completeness learning percentage of 87.02 %, it can be concluded that learning using CTL-based Student Worksheet has fulfilled the classical completeness.

b. Results Validation and Reliability Problem on the Field Test

Tabel 7. Student test scores in limited testing

Total Score obtained	2320
The total value of the overall	2800
Percentage of completeness Learning	83,62%

Based on field test results, students meet in classical learning completeness is 82.86%. So that the CTL-based Student Worksheet can be declared effective because it has met the criteria of classical learning completeness in field test.

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Discussion of Final Products

Based on the results of research, Student Worksheet can be said to be feasible if it meets three criteria, namely validity, practicality, and the effectiveness.

- a. Validity of Student Worksheet learning device can be measured from the aspect of instructions, preparation of feasibility aspects, aspects of the content and language aspects. After the researchers to test the validity of the Student Worksheet obtained with a percentage of 86.25%, thus the percentage included in the criteria valid.
- b. CTL-based Student Worksheet can meet the criteria of practicality learning device if the percentage of student responses to more than 70%. The data used is the result of questionnaires by students. Filling the questionnaire on a limited test resulted in the students' response by 94.58%, while in the field test result of 84.20% student response. Based on these results, the CTL-based Student Worksheet can be expressed practically.
- c. Learning device Student Worksheet can be said to be effective if all students complete in classical learning and meet the minimum completeness criteria in the implementation of the results of tests of learning. All students must meet the minimum completeness criteria, namely the total score of $\geq 75\%$ of the maximum score of 100.
- d. Based on the analysis of research data obtained as follows:
 1. Students in the limited test class achieve an average score of 87.02% total achievement test,
 3. Students in the field test class achieve an average score of 83.62% total achievement test,
 4. Based on the data, all the students can be said to be completed by learning classical. It can be concluded that the CTL-based students worksheet on trigonometry learning developed effectively meet the criteria.

Based on the research, the student worksheet is good because have valid, practical and effective criteria. So that, need to develop the other CTL-based mathematics teaching materials. That is in line with [14]'s research that have a result CTL approach recommended to be implemented in the learning of mathematics, because theoretically believed to be able to develop AQ. Supported by [11]'s research result that "Contextual Teaching and Learning (CTL) has been defined here as a way to introduce content using a variety of active-learning techniques designed to help students connect what they already know to what they are expected to learn, and to construct new knowledge from the analysis and synthesis of this learning process". The student science attitude is increase because they can exploring their knowledge with CTL approach. That is in line with [8], "The study reveals that academic achievement is positively as well as significantly correlated with scientific attitude. It means that with increase in academic achievement, scientific attitude of female students also increases. The finding may lie in the fact that at the higher secondary level overall scientific attitude develops among the students in its optimal level".

CONCLUSIONS AND SUGGESTIONS

Based on the research development of CTL-based student worksheets can be concluded that the Student Worksheet decent used as valid criteria, practical, and effective. The science attitude is increase.

Conclusion

Based on the results of research and development has been done, can be summed up as follows:

- CTL-based student worksheets were developed as valid, as data validation results that have been made by the three validators scored 86.25%.
- CTL-based student worksheets developed meet the criteria of practicality, because the general assessment made by the three validators concluded that students' worksheets can be used without revision. As well as the response of students in the class test and a field test with a percentage of 94.58% and 84.20%.
- CTL-based student worksheets developed in effective criteria, for an average total score of student learning outcomes in the classroom testing and field testing class scored 87.02% and 83.62%.

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Suggestions

Some suggestions are given in this research, namely: (1) the data obtained in the limited test still needs to be tested in another class with a variety of different conditions in order to obtain a higher quality learning device. (2) CTL-based students worksheet on Trigonometry subject only, so it need to given on other subjects.

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