Inquiry-Based Worksheet Design to Improve Critical Thinking of Students in Indonesia

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Abstract: One of the skills needed in the 21st century is critical thinking. Students' critical thinking skills in Indonesia are still low. To improve students' critical thinking skills, appropriate learning resources are needed. One learning resource that can be used as an alternative solution is the student's worksheet. Guided inquiry approach inquiry method has the opportunity to improve academic achievement, sensitivity to science, critical thinking, and other scientific skills. This research is an effort to develop a student's worksheet based on an inquiry approach to improve student's critical thinking skills. The research was developed with the research and development model of Borg & Gall. The subject of this study was the seventh-grade students of Al Azhar Islamic Junior School 26 Yogyakarta. The instruments of this study were student's worksheet, validation questionnaires, observation sheets, response questionnaires, critical thinking skills sheets. The results of the study show the design of student's worksheet can be used to improve student's critical thinking skills. Thus, further research on implementation and dissemination can continue.

Index Terms: critical thinking, inquiry, student's worksheet

1. INTRODUCTION

The life of the 21st century has arrived at a new era that is usually called the industrial revolution. 4.0. This era was marked by an increase in the digitalization of manufacturing.[1] The basic principle of industry 4.0 is to combine several devices and work systems using an intelligent network during the production process, where the devices control each other independently.[2] These devices and systems can operate independently or under human coordination. This kind of automation system will replace the role of humans in work, resulting in the loss of many jobs.[3] In general, the world has accepted this change, including in Indonesia. By the Indonesian government, it is necessary to prepare employment contracts with qualifications that are in line with the demands of the times, including being able to control, operate, and maintain the technology that is in place. The world of education also needs to be organized so as to produce qualified workforce candidates.[4] Education desired by the business world and society, in general, is one that can produce prospective workers with mastery of relevant skills to meet the needs of their company.[5] The lack of supply of competent labor can be a serious threat to the life of the industrial revolution 4.0.[6] Therefore every future graduate candidate must be educated according to the concept of 4.0 industrial revolution.[7] 21st-century skills will certainly be influential and become the main reference for the development of school curricula around the world.[8] The current curriculum design must contain learning content that supports the achievement of educational objectives according to the demands of the times. The framework of the skills needs to deal with 21st-century life has been generated through research.[9]-[10] One of the skills needed is critical thinking.[8],[11],[12] Thinking skills critical is part of higher-order thinking or Higher Order Thinking Skills (HOTS).[13] High-level thinking skills have a significant role in one's moral, mental, social, cognitive, and scientific abilities.[14] The ability to think critically is a part of HOTS's ability whose influence is very important for the future of children who will face many challenges, both of which arise in the scope of their personal or career lives.[15] Through the ability to think critically they can empower themselves to contribute creatively to their professional choices. Because the ability to think critically is very important, the curriculums applied by countries in the world have a lot to promote thinking skills in a structured manner with a variety of acts or labels.[16] Included in Indonesia has also made critical thinking skills the focus of learning and student graduation standards. Mathematics is one of the subjects that must be achieved by students in Indonesia, where the purpose of learning is to train the ability to think logically, analysis, systematically, critically, innovatively, and creatively, and have the ability to work together. Special critical thinking skills can be achieved through mathematics learning given by the teacher consistently through the application of several learning methods, for example, the application of real-life problems and learning methods of investigation.[16] Another method which can train students to think critically is the guided discovery method. Teachers and prospective teachers need to think about the inquiry method because it has the opportunity to improve academic achievement, sensitivity to science, critical thinking, and other scientific skills.[17],[18],[19],[20] The significant impact of inquiry-based learning in terms of critical thinking in science education has also long been recognized. Educational standards in America also emphasize inquiry-based student understanding for learning purposes that focus on critical thinking skills.[21] Inquiry-based learning is student-centered active learning which can make students more independent and have a sense of responsibility for the learning activities that they are doing.[22] In addition, inquiry-based learning has also been proven to be able to rebuild students’ desires to learn more challenging mathematics.[23],[24],[25] Thus the teacher needs to encourage the development of critical thinking through the inquiry approach.[21] The researcher believes that inquiry-based mathematics learning needs to be developed in Indonesia. Moreover, Indonesian mathematical achievements at the international level are still unsatisfactory. We can know this from the results of the 2015 Program for International Student Assessment (PISA) that we are still below the average of other countries’ participants.[26] The results of the mathematics Olympiad in 2017 also declined compared to...
Indonesian students generally have difficulty solving problems that require higher order thinking skills. The results of the Trends International Mathematics and Science Study (TIMSS) survey for the eighth grade also show evidence that mathematical questions that require higher-order thinking skills have generally not been answered successfully. Included are critical thinking questions. So if the teacher wants to implement inquiry learning it is necessary to develop norms or rules in the classroom. Teacher limitations in learning such as limitations in the material, equipment, and learning technology need also need to be considered. Besides, that mathematics learning must also be designed to be fun and students learn without and students learn without coercion. This can be supported by the presence of learning media in the form of student worksheets. Student worksheets with an inquiry approach can also be able to improve one of the 21st-century skills of students. Based on the description above, this study aims to develop student worksheets with a guided inquiry approach to improve students' critical thinking skills, specifically in the subject matter of comparison. Comparative material was chosen because the results of observations of researchers showed students still often repeated mistakes in understanding the material. Even though mastery of comparison material is very important as the basis for mastering the next mathematical material such as arithmetic.

2 METHOD
This study uses the procedure of research and development of Borg & Gall which consists of ten steps, namely (1) research and information gathering, (2) planning, (3) developing initial products, (4) initial product trials, (5) initial product revisions, (6) limited field trials, (7) operational product revisions, (8) operational field test (9) revision of the final product (10) product dissemination and implementation. In general, the product development procedures are presented in the following figure 1: From the usual ten steps developed using the procedure on this occasion, the researchers only used five steps, starting with the steps of data collection to product revisions. The purpose of this study is to develop a product in the form of student worksheets based on the guided inquiry on comparative material to improve the critical thinking skills of seventh-grade student students. The research subjects were the seventh-grade students of Al Azhar Islamic Junior School 26 Yogyakarta. This study uses several instruments namely student worksheets, validation questionnaire, observation sheet, response questionnaire, critical thinking ability sheet.

3 RESULT AND DISCUSSION
Analysis
development of student worksheets begins with analyzing the problems carried out with field studies and then continues with product design or product development. Product design that is to be developed is validated by competitors who are competent in their fields, namely material experts and media or design experts. After graduating, the student’s worksheet design validation will be tested in teaching and learning activities at Al Azhar Islamic Junior School 26 Yogyakarta. This study aims to produce or develop student’s worksheet products that are in accordance with the guided inquiry approach to improve students’ critical thinking skills.

Design
Preparation of student’s worksheet with Guided Inquiry Approach to Improve Critical Thinking Ability Class VII students begin by arranging the stages of a guided inquiry to be applied to the comparison material. Product design planning is the design of student worksheets components consisting of: (a) cover, (b) introduction, (c) table of contents, (d) pages of Core Competencies & Basic Competencies, (e) material and training (f) information other supporters. The design of these components is presented in the following pictures starting from the cover design in figure 2:
The after page cover sheet is an introductory word that contains the author's thanks, a brief description of the material presented and ends with a request for criticism and suggestions. The preface design is presented in figure 3 below. The next sheet is a table of contents that contains the page number of the material presented. The design of the table of contents to be developed is presented in figure 4 in this chapter.

The next sheet contains core competencies, basic competencies, and learning objectives. The design of the sheet is presented in figure 5 below;

The next sheet contains material and questions that must be done by students. The design of the researcher is presented in figure 6 below;
The design of the student's worksheet components as above is then submitted to the validator for validation. The results include suggestions for making improvements. The suggestions presented by the researcher in table 1 below:

![Worksheet Image]

**Fig.6. Materials Sheets and Exercise**

The results of expert evaluations of student's worksheet product design stated that the design was categorized as good but still needed further development. The results of the full assessment are presented in table 2 below.

**TABLE 1**

<table>
<thead>
<tr>
<th>No</th>
<th>Feedback and Suggestions</th>
<th>Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Instructions for using the worksheet student should be included</td>
<td>already equipped with instructions for use</td>
</tr>
<tr>
<td>2</td>
<td>Basic competencies are written with a more attractive appearance and equipped with indicators</td>
<td>Already equipped with indicators of achievement of competence</td>
</tr>
<tr>
<td>3</td>
<td>Enriched with sample questions</td>
<td>Sample questions have been added</td>
</tr>
<tr>
<td>4</td>
<td>It will be more interesting if it is equipped with pictures</td>
<td>Already equipped with pictures</td>
</tr>
<tr>
<td>5</td>
<td>No column/material yet to communicate the results of student work and also no conclusion column</td>
<td>already equipped according to the validator's suggestion</td>
</tr>
</tbody>
</table>

Based on table II, it can be concluded that the design of the student's worksheet is declared valid and can be used in learning activities.

**4 CONCLUSION**

This study resulted in a guided inquiry approached student's worksheet that was expected to improve students' critical thinking skills. The components contained in this student's worksheet have been validated by experts and declared feasible to be used in learning with revisions according to suggestions. This research is only limited to design and will be further developed to test its effectiveness in improving students' critical thinking skills.

**5 SUGGESTION**

This design is designed to improve students' critical thinking skills, and then the results of this study can be used as a reference for further product development in the next study. We would like to thank the head of the Al Azhar 26 Islamic Middle School in Yogyakarta who has given permission from the start of the study to complete this research.

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We would like to thank the head of the Al Azhar 26 Islamic Junior School in Yogyakarta who has given permission from the start of the study to complete this research.

**REFERENCES**


