

THE DEVELOPMENT OF ICT-BASED INTERACTIVE STUDENT WORKSHEETS (LKPD) ASSISTED BY SOFTWARE CONSTRUCT 2 FOR MTS STUDENTS

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ABSTRACT

LKPD (Student Worksheet) is a teaching material used to maximize student understanding. LKPD contains a set of basic student assignments that are equipped with materials, summaries, and implementation instructions in accordance with achievement indicators. The use of LKPD can increase effectiveness and efficiency in the learning process. This study aims to develop ICT-based interactive worksheets assisted by Construct 2 software for class VII MTs students on the subject of the relationship between angles and to determine the eligibility and student responses to ICT-based interactive worksheets assisted by Construct 2 software for class VII MTs students on the angle pair relationship. The development model used was a 4-D or 4-P model which is modified into three stages, such as the definition stage, the design stage, and the develop stage. The subjects of this study were students of MTs Amaliyah Sunggal class VII using a small scale of 10 students. The research instrument used was a questionnaire consisting of a material expert assessment questionnaire, a media expert assessment questionnaire, and a student response questionnaire. ICT-based interactive worksheets assisted by Construct 2 software on the material of the angle pair relationship that were developed met the criteria for being very eligible to use for grade VII MTs students. The eligibility could be seen from the results of the validator's assessment, where from the results of the material expert's assessment a score of 88.2% was obtained with a very decent category. From media experts, a score of 88.4% was obtained in the very eligible category, and the student response questionnaire obtained a score of 91.8% in the category of very interesting.

1. INTRODUCTION

Education is required to have 4Cs, which are creative thinking skills (creative thinking), critical thinking and problem solving, communicating (communication), and collaborating (collaboration) (Septikasari et al, 2018). The communication skill mentioned is the skill to use technology and communication media (Wijaya et al, 2016).

The rapid growing of ICT can be utilized to improve the quality of learning. This is as stated by Uno and Nina (2010: 19), the use of ICT in education involves all aspects of solving learning problems. In line with this, Alavi and Gallupe (in Rusydi, 2017) put forward several objectives of using ICT in education, including (1) improvement of competitive positioning; (2) improvement of brand image; (3) improving the quality of learning and teaching; (4) increasing student satisfaction; (5) income increasing; (6) expansion of the student base; (7) improvement of service quality; (8) reduction of operating costs; and (9) improvement of new products and services. Utilization of ICT can increase the efficiency and effectiveness of learning (Simamora et al, 2020). In addition, with the use of ICT students', motivation and interest can be raised, understanding can be improved, material or data is presented in an attractive and reliable manner, data is interpreted easily, and information is conveyed in a dense manner that can be done using ICT in learning (Hariyono and Darmoto, 2018).

On the other hand, the use of ICT in education is only limited to subjects called ICT (Information and Communication Technology). In addition, until now mathematics learning is still using conventional methods that are centered on teachers, as well as the lack of student roles in the use of learning media and teaching materials which results in a lack of focus and motivation of students in participating in mathematics learning. If this continues, it will slowly result in the weakness of students' mathematical knowledge, which of course has an impact on the low learning achievement of students.

The achievement of student learning outcomes is influenced by the availability of learning resources (Panggabean, 2015). One source of learning is teaching materials. The effective use of teaching materials greatly influences students' independence from the presence of the teacher, as well as the opportunity for students to learn independently (Saluky, 2016). As teaching materials, LKPD contains materials, summaries, and implementation instructions in the form of task sheets that must be completed by students in accordance with the achievement of basic competencies (Prastowo, 2011: 204). Effectiveness and efficiency in the learning process can be increased by using LKPD (Khairunisa, 2020). In addition, the use of LKPD can make it easier for teachers to carry out learning, and students will learn to understand and do assignments independently (Majid, 2006: 177).

The provision of hardcopy LKPD is considered less effective, because the presentation is less varied. Most students are less interested in using the LKPD. It is because according to students, mathematics is a difficult thing to learn, so the presentation of the questions should be done in an interesting form. However, until now the presentation of mathematical problems is still done conventionally, without any creativity to present them innovatively. In addition, the questions on the LKPD can only be done and assessed manually, without the help of technology. Whereas education demands an increase in knowledge that is supported by the use of technology (I. H. Batubara et al., 2019), (I. Batubara, 2020), (I. H. Batubara, 2017)

Based on the description above, innovation is needed in developing LKPD as teaching materials. One of them is by developing LKPD into interactive teaching materials. Through interactive teaching materials, several learning media, such as text, graphics, audio, and video can be combined to carry out an order (Prastowo, 2011: 330). The development of interactive LKPD is carried out with the aim of combining conventional LKPD with effective, efficient, and flexible learning media (Himmah et al, 2019). Research by Nurhairunnisah and Sujarwo (2018) shows that interactive teaching materials are very eligible to use and can increase students' knowledge. In addition, interactive worksheets can be developed with the support of the use of ICT.

This is as research by Patahuddin et al (2012) which produced ICT-based worksheets in RSBI Junior High Schools, showing that the use of ICT can help the mathematics learning process, increase student motivation, attract students' attention, and make it easier for students to understand the material. In addition to using ICT, Construct 2 software can also be used in the development of interactive worksheets. Construct 2 is advanced software specially designed with HTML5 features for 2D games (game platforms) (Sholihin and Kemal, 2016). The research of Pangestu et al. (2020) shows that the use of Construct 2 in producing Android-based m-learning is quite effective and can improve student learning achievement. Likewise, the research of Hamidah et al (2020) which shows that the development of STEM-based E-LKPD through Construct 2 software meets the valid criteria and is very suitable for use in learning. The purpose of this study was to obtain an interactive ICT-based worksheet with the help of Construct 2 software on the material of the angle pair relationship for MTs students that was valid, practical, and effective. While the benefit of this research is to become a reference and a

driving force for innovation in learning, one of which is by utilizing ICT developments in developing interactive teaching materials that can actively involve students in learning.

2. METHODOLOGY

A. Place and Time of Research

This research was conducted at MTs Amaliyah Sunggal which is located on Jalan Tani Asli Gang Origin, Kec. Sunggal Kab. Deli Serdang, North Sumatra and was held in June 2021 for the VII grade mathematics' students.

B. The Subject and Object of the Research

The subjects of this study were seventh grade students of MTsS Amaliyah Sunggal Academic Year 2020/2021, with an ICT-based interactive mathematics worksheet validator for the assistance of Construct 2 software consisting of two experts, which were three material experts and two media experts. While the object of this research was the interactive mathematics worksheet based on ICT assisted by Construct 2 software on the material of the angle pair relationship for students of MTsS Amaliyah Sunggal.

C. Research Procedures

The development of interactive ICT-based mathematical worksheets with the help of Construct 2 software used the Thiagarajan model (in Trianto, 2014: 232), which is known as the 4-D or 4-P model consisted of define (defining), design (design), develop (development), and disseminate (spread). However, in this study the development model was modified only to the 3-D or 3-P stage such as:

- 1) Defining Phase Activities. This stage focused on analyzing the conditions faced by teachers, student characteristics, concepts being taught, needs in the learning process, and the formulation of specific learning. The steps taken at this stage include: (1) preliminary and final analysis, (2) student analysis, (3) task and concept analysis, and (4) specification of learning objectives (Yosa & Halomoan, 2020).
- 2) Design Phase. This stage is carried out to produce a prototype design of an ICT-based interactive worksheet with the help of Construct 2 software in mathematics learning. The steps taken at this stage include: (1) preparation of benchmark reference tests, (2) media selection, and (3) format selection.
- 3) Development Phase (Develop). This stage is carried out to produce an interactive ICT-based LKPD draft assisted by Construct 2 software. The steps taken at this stage include: (1) initial design to produce draft I of interactive LKPD, (2) expert validation to produce draft II of interactive LKPD, and (3) limited trial to produce draft III of interactive LKPD, (4) analysis and revision of draft III of interactive LKPD so as to produce interactive LKPD which is eligible to use in learning (Lubis & Karnasih, 2020), (Harahap, 2021).

D. Data Collection Techniques

Data collection in this study was carried out using a questionnaire. The questionnaire in this study was a direct questionnaire that used a Likert scale with a rating of 1 to 5 which was given to experts and students to determine the eligibility of interactive mathematics worksheets as a reference for improvement before testing. While the questionnaires were given to students to determine students' responses to the interactive mathematics worksheets that had been developed after the trial.

E. Data Analyzing Techniques

The quantitative data analysis technique in this study was carried out using a Likert scale. Assessment of the questionnaire was done by ticking the categories that were already available. Then the results obtained were analyzed by the formula. The results contained in the expert assessment questionnaire and student responses was analyzed using the following formula:

$$P = \frac{n}{N} \times 100\%$$

Furthermore, the percentage results obtained in the expert questionnaire were grouped based on the criteria for interpretation of eligibility according to the Likert scale. While the percentage results obtained in the student response questionnaire were grouped based on the attractiveness interpretation criteria according to the Likert scale. So a conclusion about the eligibility and attractiveness of interactive mathematics worksheets could be obtained.

3. RESULT AND DISCUSSION

a) The Results of ICT-Based Interactive LKPD Development Assisted by Software Construct 2

1. The Definition Stage

a. Front-end Analysis

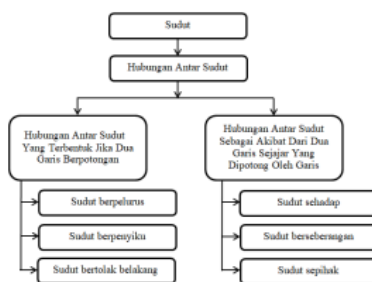
From this analysis, it was found that the use of LKPD in the form of hardcopy in learning was considered less effective because it was not suitable for the conditions of students. Most students were less interested in using the LKPD. According to students, presenting the questions in hardcopy form was not interesting. The presentation of math problems was still done conventionally, without any creativity to present them innovatively. In addition, the questions on the LKPD could only be done and assessed manually, without the help of technology. Whereas education demands an increase in knowledge which is supported by the use of technology.

b. Student Analysis

From this analysis, it was known that students often have difficulty understanding the mathematical material presented by the teacher. This resulted in the weakness of students' mathematical knowledge, which of course affected their low learning achievement. It was also found that students in schools had strong motivation and enthusiasm in using advanced technology. This was proven by the frequent use of technology advancement for students to do schoolwork and social media. It was also proven when researchers showed LKPD in the form of software that was operated using a laptop.

c. Task and Concept Analysis

Task analysis was obtained based on basic competencies and indicators of achievement on the material of the angle pair relationship. The task analysis on the material of the angle pair relationship that is formed when two lines intersect carried out by the researcher is: (1) finding the concepts of straight angles, right angles, and opposite angles, (2) determining straight angles, right angles, and opposite angles if given another angle, (3) solve problems related to the angle produced by two intersecting lines. As well as task analysis on the relationship between angles as a result of two parallel lines cut by a transverse line is: (1) finding the concepts of corresponding angles, alternative angles, and interior angles, (2) determining corresponding angles, alternative angles, and interior angles if given other angles, and (3) solve problems related to the angle produced by two parallel lines cut by a transverse line. While the analysis of the concepts formulated by the researchers could be seen in Figure 4.1 below:



Gambar 4.1 Hasil Analisis Konsep Hubungan Antar Sudut

d. Specification of Learning Objectives

This step was carried out to determine the learning objectives on the material of the angle pair relationship that students must achieve. In the angle pair relationship that is formed when two lines intersect, there are 3 learning objectives, such as (1) students can understand angles that are straightened, squared, and opposite, (2) students can determine the value of angles that are straightened, squared, and opposite, and (3) students can solve problems related to the angles produced by two intersecting lines. As well as in the angle relationship of two parallel lines cut by a transverse line, there are 3 learning objectives, such as (1) students can understand corresponding angles, alternative angles, and interior angles, (2) students can determine the value of corresponding angles, alternative angles, and interior angles, and (3) students can solve problems related to the angle produced by two parallel lines cut by a transverse line.

2. Design Stage

a. Preparation of Benchmark Reference Test

After using the developed interactive mathematics worksheet, students were expected to understand the meaning of the relationship between angles, determine the relationship between angles, and be able to determine the angle value of an image.

b. Media Selection

The relevant media based on the analysis at the defining stage was an interactive ICT-based worksheet assisted by Construct 2 software.

c. Format Selection

The appropriate format was used in product design in the form of interactive ICT-based worksheets assisted by Construct 2 software with the material of the angle pair relationship referring to the making of storyboards and flowcharts. Making storyboards and flowcharts aims to provide a clear picture of the appearance and layout of various media as well as the required navigation buttons.

3. Development Stage

a. Initial Design

The initial design of the interactive mathematics worksheets started with typing the identity of the LKPD, basic competencies and indicators, materials, questions, instructions for use, how to work, collecting the various components needed such as background, images, text, navigation, animation, and audio, then proceed with making LKPD templates. In this step, the first draft of interactive mathematics worksheets was obtained.

The basis for developing this interactive worksheet was a storyboard and flowchart. The interactive LKPD developed consisted of an introduction (intro), and 7 options on the main menu (main menu), such as (1) Instructions, (2) Identity, (3) Basic Competencies & Indicators, (4) How to Do it, (5) Material, (6) Start, (7) Developer Profile and final score display.



Gambar 4.2 Tampilan Halaman Awal



Gambar 4.3 Tampilan Menu Utama



Gambar 4.4 Tampilan Skor Akhir

This interactive LKPD was a development of the previous LKPD. The previous LKPD had several shortcomings, such as presentation techniques in terms of ease of navigation, and the menus provided were only for learning purposes, materials, problem-solving, and developer profiles. Meanwhile, in this interactive mathematics worksheet, there were various navigation buttons and an explanation of their functions, and there were several menus related to LKPD elements. In addition, in this interactive mathematics worksheet, there was also a time allocation system and the addition or subtraction of scores that run automatically, back and next navigation buttons to go to other questions, as well as a display of the final score obtained.

Based on the description of the research results, it was obtained the ICT-based interactive mathematics worksheets assisted by Construct 2 software. This interactive mathematics worksheet was developed using the Thiagajaran model known as the 4-D or 4-P model, which was define, design, development, and disseminate. However, the development model in this study was modified to the 3-D or 3-P stage, which was development. After that, the results of the development of this interactive mathematics worksheet was tested for eligibility.

The development of interactive mathematics worksheets started from the define stage. Several analyzes were carried out at the defining stage, including front-end analysis, student analysis, task and concept analysis, and specification of learning objectives on the angle pair relationship. From these various analyzes, it was found that there was a need for innovation in learning. One of these innovations was ICT-based interactive mathematics worksheets assisted by Construct 2 software. Interactive mathematics worksheets were in accordance with existing situations and conditions and could be a tool for students to achieve learning goals.

At the design stage, the benchmark reference test, media selection, and format selection were carried out. From the results of the preparation of the benchmark reference test, a test was obtained that could help students understand the material of the angle pair relationship. Furthermore, the selection of media could help students achieve learning objectives on the material of the angle pair relationship. From the selection of formats, an initial description of the design of interactive mathematics worksheets was obtained in the form of storyboards and flowcharts. At the design stage, it produced an illustration that facilitates the development process as well as the combination of various components needed in interactive mathematics worksheets.

The final stage of this research is development. In this stage, initial design, expert validation, and limited trials were carried out. The initial design was carried out by developing interactive mathematics worksheets on the angle pair relationship according to a predetermined design, in order to obtain the first draft of ICT-based interactive mathematics worksheets assisted by Construct 2 software. After that, the draft I worksheets was validated by experts using an assessment questionnaire. Then the analysis and improvement of the interactive math worksheets were carried out according to the input and suggestions from the experts.

The material expert's assessment obtained an average score of 4.41 with the criteria of "Very Good (SB)" or 88.2% which was in the "Very Eligible" interval. While the media expert's assessment obtained an average score of 4.42 with the criteria of "Very Good (SB)" or 88.4% which was in the "Very Eligible" interval. So it could be concluded that the interactive mathematics worksheets that were developed have been valid according to experts, with a very good degree of validity. After expert validation, the second draft of ICT-based interactive mathematics worksheets was obtained with the help of Construct 2 software.

After the interactive mathematics worksheets were developed and declared valid/eligible by the experts, then a small group trial was carried out. The trial was conducted to determine the student's response to the attractiveness of the interactive mathematics worksheet that was developed. In this limited trial involving 10 grade VII students of MTsS Amaliyah Sunggal. Students were given a response questionnaire after using the interactive mathematics worksheet that was developed. From the student response questionnaire, an average score of 4.59 or 91.8% was obtained which was in the "Very Interesting" interval. Very interesting criteria were also obtained based on the impressions given by students after using interactive worksheets. This proved that ICT-based interactive mathematics worksheets assisted by Construct 2 software were interesting to use in learning. After limited trials and improvements were made, the third draft of interactive mathematics worksheets was obtained.

Based on the description, it could be concluded that the interactive ICT-based worksheets assisted by the Construct 2 software developed by the researchers met the criteria of being very eligible and very interesting to use in learning. The results of this study were strengthened by research conducted by Patahuddin et al (2020) which states that the use of ICT-based worksheets can increase student learning motivation, attract students' attention, and make it easier for students to understand the material. In addition, it is also strengthened by research conducted by Hamidah et al (2020) which states that the use of E-LKPD with the Construct 2 application is very eligible to be used as a learning tool.

4. CONCLUSION

Based on the results of research and discussion, it can be concluded that:

1. Development of ICT-based interactive mathematics worksheets assisted by Construct 2 software on the subject of the relationship between angles for MTs students which was developed using the Thiagajaran model or known as the 4-D or 4-P model modified up to stage three, which was the development stage met the criteria of being very eligible and very interesting to use in learning. Eligibility can be seen from the results of assessments from material experts with an average score of 4.4 or 88% which is in the Very Eligible interval, as well as assessments from media experts with an average score of 4.42 or 88.4% which is in the Very Eligible interval.
2. ICT-based interactive mathematics worksheets assisted by Construct 2 software on the subject of the angle pair relationship received a very interesting response from students. This is obtained from obtaining an average score of 4.57 or 91.4% in the student response questionnaire.

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