Study of Clarification Android Based Worksheet of Topic Cartesian Coordinate at Level Junior Secondary

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Abstract. This study aims to design an Android-based student worksheet on the topic of cartesian coordinate learning and obtain evidence for clarification of research on prototype design. The design research method was carried out based on stages, namely research clarification, descriptive study 1, prescriptive study, and descriptive study II. This research revealed the results of the research clarification stage by involving 35 Mathematics and Natural Sciences students of FMIPA UNM. They were asked to test the prototype and provide responses through the questionnaire provided. There are three main things to be responded by respondents, namely the suitability of the format, the material submitted, and worksheet form. The data obtained were analysed descriptively quantitatively. The results show that the prototype format meets the suitability. Likewise, the criteria for the material presented and the prototype designed. In other words, this Android-based worksheet prototype meets the stated design objectives.

Keywords: Design, Android, Worksheet, Clarification

1. Introduction

Learning equipment as required learning kit is needed to support the learning process, called discipline-based teaching materials [1]. The equipment of learning is such as a lesson plan, subject matter, assessment, students’ worksheet, learning media, etc. During the learning process, students’ worksheet plays the primary role in the main activity of teaching and supports more active to construct and create productive ideas of students. However, it becomes a problem for students if the content of students’ worksheet only provides some issues. Meanwhile, students need the worksheet to guide them to build their learning experiences and construct new ideas, or to meet needs in the learning environment [2].

Nowadays learning environment is not enough when students bounded by classroom. Learners need more situation that can trigger them to explore more about knowledge and experience. Also, this brings positive effect to change students’ activities which are not in the classroom. The advance of technology also influences learning method and strategy to address objectives of learning outcomes. The power of technology gives multi-approach to the teacher to organise classroom activities to learners such that they can learn “from” and “with” the technology [3]. Mobile learning is an example of the intervention of technology in the classroom and shares beneficial support which is diversification of learning activities, managing effective learning process, and connecting learning experience [4], [5].

The development of smartphone enables people to realise their agendas online [6]. Started by this idea, the learning environment can be extended into the online environment. This new environment creates the process of learning in the classroom more flexible than usual of a traditional class. Although
students still need to follow instructions from the teacher by face to face, this activity ensures that students are getting the core of information. However, more learning activities, more time is needed to allocate all of the learning activities. For this reason, wherever and whenever students are outside [7], they still can work and even more active than when they are inside.

Android-based devices are one of the examples in personal devices assistant (PDA) that is enriched by sophisticated features. This such determiner making android-based programming is helpful and interesting people to use as daily PDA [6]. Not only adult people have the PDA, but also children are familiar to operate it as they have been together in a long time. One beneficial thing that android based hardware is supporting interactivity to the user who can explore, communicate, search, and browse what they need to know.

Following this interactivity, users can be engaged to intertwine information they want to know [8], [9]. So, this activity trigger readers to discuss on their own. In other words, students can be employed to follow the planned activities by design of Android Based Devices (ABD). A sequence of learning activities can be organised in the package of ABD [10]. The teacher who interested to develop mobile learning can construct learning material displayed in the ABD.

Interestingly, integrating sophisticated devices like ABD in educational practices promote the potential to facilitate learning approach more innovative and creative. As kinds of ICT development that allow ABD explored by the teacher in the integration of ICT in educational practice [11], [12]. The ability to involve digital literacy and work together as a team to solve the problem and do a project considered as life long learning competencies.

Moreover, students also need to be interactive and creative to explore more ideas. At the same time, the teacher needs to fulfil this target in the creative and innovative as well [13]. Integrating technology to the students’ worksheet can be conducted by packaging into the ABD. The result of this integration is Android Based Worksheet (ABW). For the first material learning, the Cartesian coordinate is chosen to be inserted as the topic for students in the class.

ABW is provided to teacher and students in learning mathematics such that users can use the device to teach, to build knowledge, to do exercise, and to develop knowledge and mathematical ability learners in the level of junior secondary. It is on track to enhance essential competencies in learning mathematics.

2. Method
This study was conducted by design research method. In this design, there are some stages driven to reach the aim of the research. The steps are research clarification, descriptive study I, prescriptive study, and descriptive study II [14]. In the research clarification, prior research had done by designing the ABD using android studio and literature review. Android studio is the application to build an android based app which can be used free and well-developed, but it is connected to the internet to complete during the construction process. In the literature review, some references related to the content of the mathematical topic are discussed and constructed to build the learning material. This process focused on the mathematics lesson grade 8 of Junior Secondary students. In this session, the Cartesian diagram is the chosen topic to be packaged in the ABD. Following this, the research revealed the results of the research clarification stage by involving 35 Mathematics and Natural Sciences students of FMIPA UNM to share their responses. The questionnaire provided by google form is used to collect the responses. There are three main things to be responded by respondents, namely the suitability of the format, the material submitted, and worksheet form. The data obtained analysed descriptively quantitatively. To illustrate the opinion of respondents, we use responses with interval 1 to 5, which the lowest category is very inappropriate to very appropriate. With this choice, respondents are expected to provide an assessment of the ABW distributed in the form of a google form. The results are then shown with a diagram so that it looks like what is the tendency of respondents' opinions.

3. Result and Discussion
The first step in this study is to design the prototype, ABW including subject matter about Cartesian Diagram. In the design of the prototype, the android studio is a free application used to construct the program. There are five main parts developed in the device which are Coordinate System, Point Position,
Line Position, Exploration Problems, and Exercise. Also, there are three additional parts which are instruction guide, creator, and report of learning result.

As seen from the picture above, the existence of this device is to facilitate the ease of learning and obtain mathematical knowledge interactively. Besides, ABW contains teaching facilities that uphold principles wherever and whenever [15]. However, to ensure that this device meets what students need. There are several aspects that we explored from respondents that are in line with this idea.

For this reason, through a clarification study, we asked the respondents' opinions regarding the suitability of the ABW format, content ABW, and the type of technology ABW. This search serves to ensure that the basic things of a learning device are fulfilled, especially in the form of an electronic-based on Android. Concerns can occur; for example, the type of electronic packages that frame the material instead of providing convenience; on the contrary, it does not support active student learning. Also, the mathematical content provided becomes unpleasant to learn because its electronic presentation format does not support it.

By using a data collection tool in the form of a questionnaire that was constructed using Google Form, obtained the results of user responses as follows.

Based on Figure 2, three parts describe ABW. Part (a) ABW format, (b) content of ABW, and (c) type of technology of ABW. What do the respondents think about these three things is described as follows. For the first Figure 2(a), respondents were asked to respond to the format carried by ABW about its suitability, interactive support, and active learning support. The results show that, first in terms of conformity, respondents tend to judge the ABW format in accordance with mathematics learning; second, in terms of support for interactive mathematics learning, respondents tend to think that the ABW format is compatible with the objectives of interactive learning; and the last is support for active learning, respondents argue that the ABW format is suitable for active learning activities for students. This response data illustrates the respondents' opinions about the ABW format as a useful learning tool to support mathematics learning activities.

Following this is the content of ABW. In Figure 2(b), almost all opinions are placed on a score of $\geq 3$ and for a score of 3. This trend shows that ABW material is considered more than sufficient to fulfill basic competencies, support active learning, effective learning, and fun learning. That way, the content contained in ABW is suitable to be applied in mathematics learning activities.

Figure 1. Display of ABW designed by Android Studio
Figure 2. The response of user about the format, content, and type of technology of ABW
Next, we also examine the types of technology packaged in this ABW. There are six indicators that we propose to be responded by respondents in assessing ABW technology. The indicators meant are that ABW supports technology-based learning, ease of use of ABW, ABW forms support the suitability of use in learning mathematics, ABW can improve mathematical abilities, ABW supports the acquisition of students’ mathematical knowledge, and ABW can overcome the limitations of paper-based worksheets. The results for 2.c, the diagram maps respondents' opinions about the type of ABW technology based on the indicators proposed for the response. The lowest score is 3, and the distribution of responses given is at intervals of $3 \leq R \leq 5$ (R is the response). This tendency to describe the types of technology carried by ABW is more than enough to support technology-based learning, ease of use, the feasibility of use in learning mathematics, improve mathematical skills, support the acquisition of mathematical knowledge, and are willing to provide alternative non-print worksheets for mathematics learning.

Before we conclude what and how ABW is for learning mathematics, the responses given by respondents illustrate that this tool is a learning tool that is expected and easy to use. Their opinion also emphasized that the ease was demonstrated by the mobile capabilities it possessed, supporting diversification of learning activities, managing effective learning processes, and connecting learning experiences [4], [5], helpful and interesting people to use as personal daily PDAs [6], and integration of ICT doing educational practice [11], [12] fun, effective, and active.

4. Conclusion
Study of clarification aimed at ABW by reviewing the suitability of the format, the material submitted, and the worksheet form. Of the three criteria responded by respondents with a tendency that ABW meets not only in terms of a format suitable for learning mathematics, supporting active learning and fun. Also, respondents gave positive assessments for the material presented reasonably to support the fulfilment of basic competencies, active learning, effective, and fun. Interestingly, the technology carried in the ABW device meets the criteria of technology-based learning, user-friendly technology, suitable for use in mathematics learning, able to improve mathematical skills, support the acquisition of mathematical knowledge, and be a solution to the limitations of a print-out worksheet.

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