Development of ICT integrated project based learning student worksheet

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Abstract. Inadequate text books, non-communicative languages and poor student understanding of material concepts were known to be contributing factors to the level of student learning outcomes. This study aims to produce a valid and practical ICT integrated project based learning student worksheet. It used Plomp model of that were preliminary research, prototyping phase and assessment phase. The population was student of Mathematics Education Study Program STKIP PGRI Sumatera Barat. The research subjects used purposive sampling. The instruments used validity sheet, questionnaire and interview guideline. Technique of analysis used validity and practicality analysis. Validity and practicality result were analyzed descriptive quantitative and qualitative. The result of the validation sheet analysis shows that the average validity of ICT integrated project based learning student worksheet is 3.9 where it is included into a very valid category. The practicality can be seen from the average questionnaire where it results 3.8 and it is included into a very practical category. It is concluded that ICT integrated project based learning student worksheet in Geometry course is valid and practical. It is expected that this student worksheet can be one of the learning sources that is able to improve the student learning outcomes.

1. Introduction

The future of globalization era will be full of complicated problem and challenge. Education must be able to prepare a generation who is capable of responding to the challenges and problems as well as solving various problems encountered. The learning process in the educational unit should be interactive, inspirational, fun and challenging, motivating the learners to participate actively and provides adequate space for initiative, creativity and independence according to the students' physical and psychological talents, interests and development. The Directorate General of Higher Education of the Ministry of Education and Culture states that the main problems faced in our education especially in universities today are: 1) lack of understanding of the essence of the curriculum in the education system; 2) lack of preparation of lecturers in preparing learning tools before learning; 3) unclear formulation of learning achievement; 4) unclear strategies and learning methods; 5) unclear whether the choice of strategies and methods of learning is the right choice to elicit predetermined learning achievements; 6) assessment activities tend to score to students rather than provide guidance to unlock its potency; 7) instruments for assessing tend to characterize summative judgments rather than formative assessments [1].

Most of learning processes used nowadays is largely in the form of lecturing, or one-way communication. It is even that the learning materials are not organized based on the knowledge dimension taxonomy to be achieved and the cognitive process dimension correctly [1]. As a result, in
the course of the lecturing process, students are difficult to follow or capture the message of learning materials. The student’s activities are limited to take a note where it is quite doubtful. 

The result of observation shows that the learning process is still conventional, limited to the delivery of materials from the lecturers to the students, the learning activities have not been able to activate the participation and activeness of students. In addition, the source of information in the form of textbooks or teaching materials is not appropriate. Students rely solely on old textbooks whose language is poorly understood; even the materials on the textbook have not entirely provided the learned material.

The unstructured materials in textbooks cause a disrupted material sustainability. It can certainly affect a conducive and effective lecturing process. In addition, students’ understanding towards existing concepts in textbooks is still low, especially in abstract mathematical concepts. It is because the course requires relatively high student visualization ability. Therefore, it is necessary to interact the learning with ICT. ICT-integrated mathematics learning is a learning utilizing computer technology as a means to support the effectiveness of the learning process. ICT Learning is a learning using computer media as a tool to convey the lessons to users interactively [2-4].

A lecturer should innovate and make innovations by producing a learning that is able to develop the potency of student’s ability, either critical thinking skills, systematic, logics, creative, the ability to cooperate effectively and develop independence in searching and finding knowledge to the problems that occur in the learning process resolved [1]. To create such a learning process, the materials developed are student sheets based on ICT-based project based learning (project).

Project-based learning is a systematic teaching method involving students in learning knowledge and skills through a structured, real-time and meticulous process designed to produce a product [5, 6]. The point of project based learning is to connect the student's experience with life to foster critical thinking as students gaining new knowledge [7]. The use of student worksheet project-based can encourage the creation of independent, interactive, inspiring, challenging, and motivational learning of students in the learning process and it will make the learning more effective and efficient [8]. ICT Integrated project based learning student worksheet can make students to find their own concepts in accordance with their knowledge and skills [9]. Student worksheet helps the learners to add information about learned concepts through systematic learning activities and to increase creativity and critical thinking among learners [10]. Project-based learning can improve the cognitive and learner skills of the learning process [7, 11, 12]. It can increase the motivation and enthusiasm of learners to follow the learning process and develop creative ideas and skills of learners in the learning process [13]. The use of learning materials based on project based learning can make the students actively-involved and eager to follow the learning process [14]. Most of them a positive attitude with the existence of project based learning materials [15, 16]. Project-based learning makes learning meaningful [17]. In this case, the researcher tries to develop the ICT Integrated project based learning student worksheet Geometry course and produce a valid and practical student worksheet.

2. Method

It is a research and development research. A developmental research as a systematic review of the design, development, and evaluation of programs, processes, and learning products that must meet the criteria of validity, practicality, and effectiveness [18]. In order to get a qualified product, the researcher develops a development research with the Plomp model consisting of 3 phases, namely preliminary research, prototyping phase, and assessment phase [3]. The research was conducted in STKIP PGRI Sumatera Barat. The population was all students of Mathematics Education Study Program STKIP PGRI Sumatera Barat Academic Year 2016. Sampling of research used purposive sampling.

The implementation steps of Project Based Learning as the following:
Figure 1. Step implementation of project based learning.

Figure 1 shows that the steps of project based learning are: 1) Start With the Essential Question; 2) Design a Plan for the Project; 3) Create a Schedule; 4) Monitor the Students and the Progress of the Project; 5) Assess the Outcome; 6) Evaluate the Experience [1]. Data were qualitative data. The instruments used were validation sheet, self-evaluation guidelines, questionnaire, and interview guideline. Techniques of data analysis were qualitative and descriptive analysis by firstly determining the average score of developed student worksheet and practicality of the questionnaire.

3. Results and discussion

The ICT-based project based learning student worksheet is developed based on the analysis results at the preliminary research stage. The purpose of this stage is to define the requirements needed in the development of student worksheet project-based on Geometry Course in order to produce a valid and practical ICT-based project based learning student worksheet. The student workshop developed contains materials that are appropriate to the learning achievements that have been established and in accordance with the components that must exist in a student worksheet. Depdiknas mentioned that the basic components that must exist in the development of a student worksheet for example: a) title; b) study instructions; c) competence to be achieved; d) supporting information; e) tasks and work steps; and f) assessment.

Figure 2. Example ICT integrated project based learning student worksheet.

Figure 2 is ICT integrated project based worksheet sample by using wingeom software. In the initial stage, the students get a basic question contextually in relation to the daily activity. Mean while on the
project implementation, the students are required to find out the solution manually in line with the steps consisting in the worksheet using wingeom software. How to use the software is dearly written on project implementation. Through a ICT integrated project based worksheet, students will be easy to understand and learn the material.

The developed student worksheet was evaluated by two lecturers of mathematics in order to make evaluation and give suggestion about ICT-based project based learning student worksheet. The results of evaluation are as the following.

| No | Evaluation Aspects | Validator 1 | Validator 2 | Validation Mean | Category |
|----|--------------------|-------------|-------------|-----------------|---------|
| 1  | Content            | 4.29        | 4.32        | 4.31            | Very Valid |
| 2  | Language           | 4.75        | 4.25        | 4.50            | Very Valid |
| 3  | Display            | 4.00        | 4.50        | 4.25            | Very Valid |
|    | Mean               | 4.35        | 4.36        | 4.35            | Very Valid |

Table 1 shows that assessments for each aspect of ICT-based project based learning student worksheet are excellent. There are 14 indicators in the content aspect with the average assessment score i.e. 4.31 included into very valid category. The average assessment score on the language aspects is 4.50 included into very valid category and the average assessment score is 4.25 included into very valid category. Overall, the average score of student worksheet is at 4.35 included into very valid category.

To find out the practicality of ICT-based project based learning student worksheet, a try-out to a small group was conducted for 6 students. Practicality data were from questionnaire. Results of the questionnaire are as in the following.

| No | Evaluation Aspects | Mean | Category |
|----|--------------------|------|---------|
| 1. | Easiness           | 85.56| Very Practical |
| 2. | Time Efficiency    | 87.33| Very Practical |
| 3. | Interpretable      | 82.78| Very Practical |
| 4. | Equivalence        | 88.89| Very Practical |
|    | Mean               | 86.14| Very Practical |

Table 2 shows that the percentage of assessments given to the ICT-based project based learning student worksheet ranges between 82% - 89%. Overall, ICT-based project based learning student worksheet is in very practical category with an average percentage i.e. 86.14%. This means that the ICT-based project based learning student worksheet has elements that attract students' attention and can make students motivate in learning, digging and finding their own concepts [19]. It can be concluded that ICT-based project based learning student worksheet is feasible to be used for the learning process.

The ICT-based project based learning student worksheet is stated valid because it is well designed and any project activities found in it are meaningful to the students. In accordance with John Larmer's statement that the project is said to be good if the project is meaningful and fulfills an educational objective [20]. In addition, the components contained in the ICT-based project based learning student worksheet are in line with the indicators set in the validity of the instrument. So that, after the data processing, the average score of ICT-based project based learning student worksheet is very valid. The work sheet also developed in accordance with aspects of validity measurement that satisfy the content and construct validity. It fulfills the content validity that means its development has been based on the theories used as the basis for the preparation of work sheet. It meets construct validity which means that its development has taken into consideration the linkages between the components in the work sheet.
Messick explains construct validity including: 1) content; 2) substantive; 3) structural; 4) external; and 5) the consequences [21]. Language in the worksheet is also communicative. The presentation of the material has been fully-directed to the learning achievements formulated. The problems contained in the work sheet are in line with the material presented.

The ICT-based project based learning student worksheet is considered practical because it is very interesting both in terms of content and appearance, especially it is integratedly-developed by ICT in the form of software that can guide and assist students in understanding the material being studied. The problems that exist in work sheet are also easy to understand as they relate to the problems of everyday life. Problems given are also quite simple, so that it can involve students to obtain their own material learned. The work sheet is also equipped with pictures that can be encountered by students in everyday life. The display of colors, images, and writings can help to improve the curiosity of the learners and improve their understanding of the concept [22]. According to students, it is new and interesting and helpful for them to learn independently, interactively, inspired, challenging, and motivating students in the learning process [23, 24]. The entire view can make students become active and eager in the learning process [8]. Students argue that they prefer to learn to use an ICT-based Project Based Learning student worksheet because it is easier to understand the material. In general, student response is very good.

The developed ICT-based project based learning student worksheet has several advantages over other work sheet in general. It is integrated with ICT where the integration uses various software learning such as software wingeom, geoGebra, Autograph, etc that facilitate students in understanding the material and can motivate them in doing project assignment [23]. The integration of the software in the worksheet also comes with instructions to determine the solution of the given problem. Various examples of questions and exercises will also help the students to reflect on the extent to which they master the material learned in the learning process where it aims at exploring their knowledge and experience of the work done [25].

4. Conclusions
Result of analysis concludes that ICT-based project based learning student worksheet has fulfilled validity requirement that fulfills the validity of construction and validity of content with validation scores 4.35 included into very valid category. The work sheet has also qualified for practicality. It can be seen from the average score of student responses i.e. 86.14 which is categorized as very practical. So it is feasible to be used in the learning process.

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