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Development of the Teaching Material at Sheet Metal Course in Program Vocational Mechanical Engineering

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***Abstract*—Based on the observations, the problem to: limited availability of the books and yet Machining and Fabrication Techniques module that may cause the learning process is not maximized. The purpose of this study is to produce the learning module fabrication technique theory which is valid, practical and effective in order to fit for use in the field and understanding the form of learning module. The research model was the IDI (Instruksional Development Institute) model of development. The method was the research method and the development (Research and Development / R & D). The subjects of this research were students of Mechanical Engineering FT-UNP who take course in Mechanical Machining and Fabrication. The type of data is primary data where the data given by expert lecturers and students. The instrument data collectors in the form of a questionnaire. The descriptive data analysis techniques to describe the validity, practicality and effectiveness of the module fabrication technique theory. Based on the findings of this study concluded that the module of fabrication technique theory type was valid, practical and effective to be used as learning module on subject Mechanical Machining and Fabrication.**

Keywords—teaching material; learning outcomes; validity; practicalities; effectiveness

I. INTRODUCTION

The mandate of law number 20 of 2003 states that education is a conscious and planned effort to realize a learning atmosphere and learning process so that students actively develop their potential to have religious spiritual strength, self-control, personality, intelligence, noble character and necessary skills. for himself, society, nation and country. Thus education is expected to be able to develop the potential of students, so that students can solve various problems faced. The higher the quality of education, the higher the quality of human resources. With good education is one way to improve the welfare of the nation.

Observation results with the chairman of the Department of Mechanical Engineering on September 28, 2015, then obtained information that for the Fabrication course that the lecturer in teaching uses learning media in the form of PowerPoint, Handout and Jobsheet. Some of the learning processes of the Machining and Fabrication Engineering courses are still simple, for example the lecture method by relying on explanations from the lecturers so that they do not actively involve students in the learning process. The learning process is certainly influenced by several factors that support among others students, lecturers, facilities, environment and teaching media. The factors of education that are not appropriate in the delivery of material and the selection of learning media cause learning objectives to be poorly received by students. It is important to choose material learning media needed by the lecturer in interaction with students.

Lack of teaching materials or learning resources is one of the causes of not maximizing the understanding of students in the learning of Mechanical and Fabrication Engineering courses especially in Fabrication Techniques. For this reason, it is necessary to add references and increase the material for Fabrication Techniques to support students' ability in understanding the lesson.

The results of the Semester of July-December 2014 which contained two sections of courses namely section 104676 and section 104677, the competence of students achieved was still not optimal. Based on data obtained from 59 students, only 43 students (72.88%) were rated 65 and above or B- and above. While from students whose grades are under 65 there are 16 students (27.12%), meaning that almost one third of the number one semester 2014 students who are under 65 and there are grades below 40 or get an E score of 8.47%.

Learning media can enhance the quality of student learning processes, among others, teaching materials will attract students' attention so as to foster student learning motivation. This is very important for lecturers to choose the learning media used. Selection of inappropriate learning media causes students to get bored quickly, not listen to the lecturer so that students do not like the subject. This affects student learning outcomes and student learning motivation.

Learning tools for Machining and Fabrication Techniques have advantages including the presence of syllabus, lecture event units (SAP), task design, teaching materials. But having weaknesses in student learning, namely: Learning tools for Machining and Fabrication Techniques are only held by lecturers of Machining and Fabrication Engineering courses

and students are only given some topics of discussion that will be studied in the classroom, can not be used as a guide for students in learning. So that this does not maximize in students' understanding of the learning of Machining and Fabrication Engineering courses.

Various kinds of books on Machining and Fabrication Techniques in the library have the advantage of discussing in a broad, detailed, structured and directed scope. But in the book the unavailability of guidelines, the absence of student activity sheets, the absence of work sheets, the absence of key work sheets, the absence of test sheets, the absence of key learning test sheets. This cannot be seen from the level of students' understanding in the subject matter of the Machining and Fabrication Engineering course.

Jobsheet as a learning media in the available Engineering and Fabrication Engineering courses is not sufficient in mastering and understanding student theory. Because in Jobsheet has weaknesses such as only consisting of work drawings and followed by operational work steps and completed evaluation sheet of student practice results. In Jobsheet there is no supporting material to help students in learning. This results in imperfect students in understanding the material.

Overcoming the problems mentioned above, the need to add references in student learning such as modules as learning media. The module has advantages for learning because in the module consists of: 1). Guidance, contains instructions to teach efficiently and provide an explanation of the types of activities that must be carried out by students, time to complete modules, learning tools that must be used. 2) Student activity sheet, discussion of material in accordance with instructional objectives to be achieved such as student work safety in practicum, material for each lecture so as to help students in the machining and fabrication techniques. 3). Worksheet, accompanying student activity sheets used to answer or work on task questions or problems that must be solved. 4). Key to work sheets. 5). Test sheet. 6). Lock test sheets. So that with structured learning both material and student work steps in the module, it is expected that it will have an impact on students' understanding of learning. Then the module is very important in learning Machining and Fabrication Techniques.

The learning process that will be carried out in the local before using the lecture method which results in a lack of student activity. Strategies in teaching determine a student's success in learning at a local level. To overcome these symptoms and problems the researchers tried to use learning methods that make students more active. To support student activity, the Jigsaw Cooperative learning method is used. Researchers chose the Jigsaw Cooperative learning method because in the learning process students can develop themselves in groups, expressing their opinions, not only fixated in one group as in other methods and in this Jigsaw model all students in the group are demanded to be active so that they are not dominated by one or two students only. Another factor that makes researchers choose the Jigsaw learning model are:

- This learning model can encourage students to express their ideas verbally and compare with their friends' ideas. This is especially meaningful when in the problem solving process
- This learning model can train students to express opinions, improve communication skills.
- This learning model can help motivate students and improve the ability to think creatively in interacting during group learning.

Jigsaw is a type or flexible cooperative learning model [1]. Much research has been done with regard to Cooperative learning models on the basis of Jigsaw. The research consistently shows that students involved in the Jigsaw Cooperative learning model get better performance, have a better and more positive attitude towards learning, in addition to respecting the differences and opinions of others.

II. Literature Review

A. *Fabrication Techniques*

Fabrication is a series of work from several material components in the form of plates, pipes or profile steel strung together and formed step by step based on certain items to become a form that can be installed into a series of production and construction tools.

B. *Instructional Media*

The media comes from Latin Medius, which literally means middle, intermediary [2]. Media as intermediaries that deliver information between source and recipient. If the communication media carries messages or information that aims instructional or contains teaching purposes, then the media is called learning media [3]. Media is any tool that can be used as a channel for messages to achieve teaching objectives [4]. Learning media is as the carriers of messages from several channel sources to the recipient of the message (the receiver of messages) [5].

C. *Functions and Benefits of Learning Media*

The function of media is as a tool in the teaching and learning process used by teachers to teach students to achieve the teaching objectives [5].

The media can be associated as a student puller, have motivational aspects, increase interest, more interactive learning, the length of time learning can be shortened, the quality of learning outcomes can be improved, learning can be done when and where desired, students' positive attitudes toward what they learn can be improved and the burden the teacher for repeated explanations can be reduced [6].

D. *Learning Module*

The module is a learning tool or means in the form of material, methods and evaluations that are made systematically and structured as an effort to achieve the competency objectives that are expected to be designed specifically and clearly based on the speed of understanding of each student, thus encouraging students to study accordingly with his ability. Modules can be formulated as: a complete unit that stands

alone and consists of a series of learning activities arranged to help students achieve a number of goals that are formulated specifically and clearly [7].

Module is a book written with the aim that students can learn independently without teacher guidance, so that the module contains at least the basic components of the teaching material mentioned earlier. This makes students required to learn independently so as to increase learning motivation and learning outcomes [8].

E. Cooperative Learning Model

Cooperative Learning comes from cooperative words which means forms of learning by the way students learn and work in small groups collaboratively whose members consist of four to six people with heterogeneous group structures.

Cooperative learning is a learning model with a number of students as members of small groups with different levels of ability. In completing group assignments, each group member must work together and help each other to understand the subject matter. In cooperative learning, learning is said to be unfinished if one of the friends in the group has not mastered the lesson material.

Is a learning model that has long been known for a long time, at which time the teacher encourages students to collaborate in certain activities such as discussion or teaching by peers [9].

F. Jigsaw Model Learning

Jigsaw cooperative learning is one of the cooperative learning models that encourage active students and help each other in mastering the subject matter to achieve maximum performance. The Jigsaw cooperative learning model is a cooperative learning model by means of students learning in small groups consisting of four to six people heterogeneously and students working together on positive interdependence and independently responsible [1].

A group of four people proved very effective [10]. Some students collected in one group can consist of 4-6 students [11]. The most appropriate number according to Slavin's research results is that because the group of 4-6 people is more agreeable in solving a problem compared to a group of 2-4 people.

The relationship between the origin group and the expert group is described as follows [12].

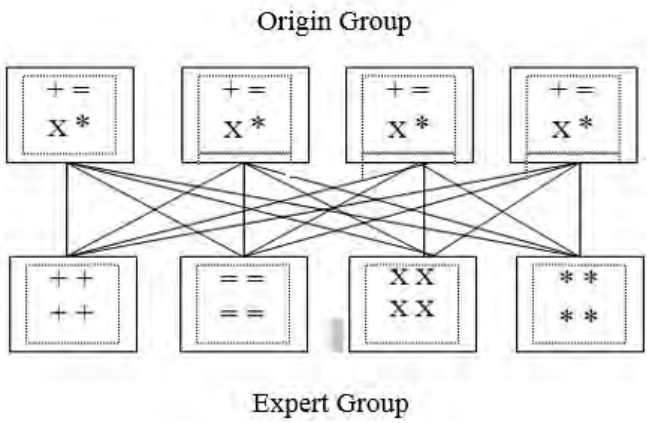

Fig. 1. Jigsaw group illustration.

III. Research Method

This research uses research and development (Research and Development) methods. Development research is a research method used to produce a particular product and test the effectiveness of the product [13]. This learning module development model uses the IDI (Instructional Development Institute) model. The IDI model establishes the principles of a system approach which includes three stages, namely define, develop, and evaluate [14].

Data collection techniques are questionnaires. Validity analysis is the result of validation through a questionnaire on the fabrication technique theory module from the validator on all aspects, namely aspects of material, format and presentation that are assessed. Practicality analysis is obtained from the results of an assessment through a questionnaire on the fabrication engineering theory module from lecturers and students. Analysis of the effectiveness of the fabrication technique theory module is determined by looking at the achievement of the completeness of student learning outcomes by using the fabrication technique theory module obtained during the research and compared with before using the fabrication engineering theory module.

IV. Research Findings

The stages that are carried out to produce the product fabrication engineering theory learning module are as follows:

A. Define Stage (Defining/Analyzing Needs)

1) Class observation: Observations made in the Mechanical Engineering Study Program of the Mechanical Engineering Department of FT-UNP in the course of Machining and Fabrication Engineering were found to have problems, namely that during the learning process of the Machining and Fabrication Engineering courses did not use modules, causing the ongoing learning process to be centered on the lecturer, this can be seen because students are passive, relying solely on lecturers to get learning material, so that learning takes place in a monotonous manner and ultimately makes students easily bored and bored. When the lecturers'

learning process explained the lesson more without involving many students, the way the presentation of material that was less interesting by the lecturers made students less motivated to attend lectures. So the need to develop the Fabrication Engineering theory learning module in the Engineering and Fabrication Engineering courses. This research was carried out in the Department of Mechanical Engineering, Faculty of Engineering, Padang State University, in the Section of Diploma Program 201510720066 Section, totaling 36 students.

2) Interview: The interview found that the delivery of the Fabrication Engineering theory material needed a module that was able to:

- Explain the basic understanding of Fabrication Engineering and work safety in the Fabrication Technique workshop and Image Expanse.
- Explain the use of hand work tools, cutting tools and assistive devices and various tool functions and marking on Fabrication Techniques.
- Explain the meaning, type and shape and material properties in the Fabrication Technique.
- Explain the formation of plates in cold, hot and spring back work.
- Describe manual plate formation and plate formation using a variety of machines.
- Describe connection construction, folding connections, keeling connections, firing nails, solder / solder and resistance welding Fabrication techniques.
- Explain welding with oxyacetylene welding in fabrication techniques.
- Explain welding with electricity and work for fabrication techniques.

3) Literature study:

a) Assessing the curriculum: Reviewing this curriculum refers to the synopsis and SAP Fabrication Engineering courses. The material / subject matter developed in the Fabrication Engineering theory learning module is the topic that is in the synopsis of the Fabrication Engineering course.

b) Identifying material required by module: Identifying the material needed by the module is useful to determine the achievement of student learning outcomes. The identification of learning formulated in the module material are: (1) Basic Fabrication and work safety techniques in fabrication and drawing techniques workshops stretches, (2) the use of hand tools, cutting tools and assistive devices and various functions tools and markings in Fabrication Techniques, (3) Understanding, types and shapes and material properties in Fabrication Techniques, (4) Formation of plates on cold work, heat and sping back, (5) Formation of plates manually and plate formation using various kinds engine, (6) connection construction, folding connection, keeling connection, firing nail, soldering / solder, resistance welding Fabrication technique, (7) Welding with oxyacelin welding in Fabrication Technique, (8) Welding with welding power and work on Fabrication Techniques.

B. Phase Develop

At this stage, researchers develop the theoretical module of Fabrication Technique through several stages, including:

1) Fabrication engineering theory design module: This stage is the development of modules in accordance with the designs that have been made. The results of the module design consist of:

- Design of Module Fabrication Module Cover Page
- Design of Module Title Pages Fabrication Engineering Theory
- Design of the Foreword Fabrication Engineering Module Page
- Design Position Map Fabrication Learning Module Modules.
- Design of Glossary of the Fabrication Module Theory of Engineering Glossary.
- Draft Page Chapter 1 Introduction Fabrication Engineering Theory Learning Module.
- Page Design Chapter 2 Discussion of Fabrication Engineering Theory Learning Module.
- Module Design.
- Draft page of chapter 3 discussion of the fabrication technique theory learning module.
- Design of a Bibliography Study Module Fabrication Engineering Theory.
- Design of Biography Page Author Module Learning Theory of Fabrication Technique.
- Design of the Cover Page of the Fabrication Engineering Theory Learning Module.

2) Module validation phase fabrication technique: The overall validation values given by each validator in the value of the content / material validation were 0.94 with the "valid" category, the module format validation value was 0.93 with the "valid" category, the module presentation validation value was 0.89 with the "valid" category. The average validation of the Mechanical Engineering Theory module can be taken as 0.92 so that it can be concluded that the module is in the "Valid" category.

C. Phase Evaluation

1) Practical data:

a) The response of the lecturer to the practicality of the theoretical learning module of the farication technique: Practicality is related to the ease in using the Fabrication Technique Theory module developed. Practicality data is obtained through questionnaires filled by lecturers which is 97.50%, so that it can be concluded that the module is in the "Very Practical" category.

b) Student response to the module practices of fabrication engineering theory: Practicality of the Fabrication Engineering Theory module also requires a response from students. This data was obtained through a questionnaire given to students after learning, the average result of the module practicality test according to students was 83.59%, so that it could be concluded that the module was in the "Very Practical" category.

2) Effectiveness test data: The learning outcome data was taken aiming to see student learning outcomes after using the learning module in the Fabrication Engineering course. Learning outcomes are obtained after pretest and posttest tests using multiple choice questions as many as 15 questions every 3 times the research test. The average learning outcomes or pretest on the first treatment did not use a module of 46.67 and the average student learning outcomes after using conventional lecture learning methods were 67.07.

The average learning outcomes or pretest on the treatment of the two students before using the fabrication technique theory learning module is 51.52 and the average student learning outcomes after using the Fabrication Engineering theory learning module is 85.05. The average learning outcomes or pretest on the treatment of the three students before using the Fabrication Engineering theory learning module is 51.31 and the average student learning outcomes after using the Fabrication Engineering theory learning module is 91.52.

TABLE I. AVERAGE STUDENT LEARNING OUTCOMES USING CONVENTIONAL METHODS LECTURE WITHOUT USING MODULE FABRICATION TECHNIQUES THEORY OF JIGSAW COOPERATIVE MODEL

Average Overall Learning Outcomes				***Average Improvement***
Number of Students	***Meeting 1***	***Meeting 2***	***Meeting 3***	
	With Lecture Learning Methods	With the Jigsaw Cooperative Model Learning Module	With the Jigsaw Cooperative Model Learning Module	
33	67,07	85,05	91,52	12,22

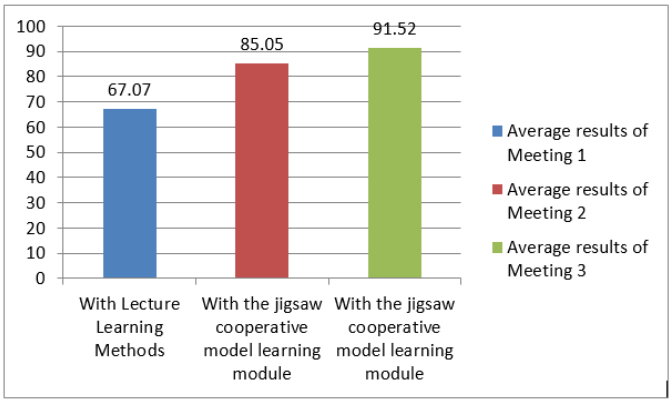

Fig. 2. Histogram of increasing student learning outcomes.

Seeing the increase in the average student learning outcomes after using the fabrication technique theory learning module, it can be concluded that the use of the fabrication technique theory learning module is effective to improve learning outcomes, as evidenced by the increasing average learning outcomes of Mechanical Engineering D3 Study Program students who take courses Fabrication Technique.

V. CONCLUSION

The research on the development of the Fabrication Engineering theory module of the jigsaw cooperative model was developed using the IDI model, which consisted of define, develop and evaluate. The Fabrication Engineering theory learning module of the jigsaw cooperative model consists of 8 lecture activities adapted to the synopsis and SAP Fabrication engineering theory. Each lecture activity consists of indicators for the purpose of lectures, material descriptions, summaries, formative tests, practice questions, student worksheets and formative test answers. The exercises in each lecture activity consist of formative test exercises with a total of 5 items for objective questions and 5 essay questions.

The validity of the theory module of Fabrication Technique of the jigsaw cooperative model on the material aspect in the module can average the validation result is 0.94 with the category "valid", in the aspect of the format in the module, the average validation result is 0.93 with the category "Valid", in the aspect of presentation in the module, the average validation result is 0.89 with the "valid" category. On average the validation results of the Fabrication Theory module are jigsaw cooperative model which is 0.92 so it can be concluded that the module entered "Valid" category. The practicality of the module in learning can be seen from the use of the well-made Fabrication Technique Theory module as a whole. This can be seen from the results of the lecturers' responses that obtained an average percentage of 97.50% and the results of student responses that obtained an average percentage of 83.59%. This shows that the jigsaw cooperative model of the Fabrication Technique Theory module developed is included in the "very practical" category. The effectiveness of modules developed on students is seen from the improvement of student learning outcomes in meeting 1 using conventional lecture method without using Fabrication Theory Theory model of jigsaw cooperative model 67.07, the average learning outcomes of meeting 2 using the Fabrication Theory Technique module of the jigsaw type cooperative model which is 85 , 05 and the average learning outcomes of meeting 3 using the Fabrication Theory Theory model of the jigsaw cooperative model is 91.52, it was seen that there was an increase in student learning outcomes after using the Fabrication Technique Theory module of the jigsaw cooperative model of 12.22%. Seeing the increase

in average student learning outcomes after using the Fabrication Technique Theory module of the jigsaw cooperative model in three meetings and the average student learning outcomes as a whole, it can be concluded that the use of the Fabrication Technique Theory module is effective to improve learning outcomes, evidenced by the increasing average learning outcomes of Mechanical Engineering D3 Study Program students who take Fabrication Engineering courses.

REFERENCES

[1] L. Anita, Kooperatif: Mempraktikkan Kooperatif Diruang-Ruang Kelas, Jakarta: Grasindo, 2002.

[2] A. Arsyad, Media Pembelajaran. Jakarta: PT. Raja Grafindo Pustaka, 2011.

[3] A. Azhar, Media Pembelajaran. Jakarta: Raja Grafindo Persada, 2010.

[4] D.B. Syaiful and Z. Aswan, Strategi Belajar Mengajar. Jakarta: Rineka Cipta, 2010.

[5] Trianto, Mendesain Model Pembelajaran Inovatif-Progresif. Jakarta: Kencana Predana Media Group, 2012.

[6] S. Yuyus, Pengembangan Media Pembelajaran. Bandung: Alfabeta, 2009.

[7] S. Nasution, Bebagai Pendekatan dalam Proses Belajar dan Mengajar. Jakarta: PT. BumiAksara, 2005.

[8] A. Majid, Perencanaan Pembelajaran Mengembangkan Standar Kompetensi Guru. Bandung: PT. Remaja Rosdakarya, 2006.

[9] R. Slavin, Cooperative Learning Theory, Second Edition. Massachusetts: Allyn and Bacon Publisher, 1995.

[10] Y. Edward, Modern Structured Analysis International Edition, U.S.A: Pretince-Hall, New Jersey, 1989.

[11] N. Sudjana and A. Rivai, Teknologi Pengajaran. Bandung: Sinar Baru Algensindo, 2007.

[12] Rends, Model-Model Pembelajaran Inovatif berorientasi Konstuktivitis. Jakarta: Prestasi Pustaka Publisher, 1997.

[13] Sugiyono, Metode Penelitian Kuantitatif, Kualitatif dan R&D. Bandung: Alfabeta, 2011.

[14] G. Sarah, Teaching and Media: A Systematic Approach. The Gerlach and Ely Model, 2003.