

Development of Learning Modules Manual Shield Metal Arc Welding (SMAW) with Service Learning Approach

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Abstract— This development research aims at this research to develop a learning module for welding shield arc welding (SMAW) techniques with a service learning approach in accordance with learning needs that are valid, practical and effective. This module is designed to assist students in carrying out interactive and effective independent learning activities so that they are expected to increase motivation and learning outcomes and can foster a sense of empathy and active participation in helping the community to overcome problems around students. The development model used in this study was adapted from the ADDIE model. The learning module of the SMAW welding technique developed has been said to be practical after testing on students. The results of student assessment of the practicality of the learning module of the SMAW welding technique state that the modules are in a very practical category. The learning module of the SMAW welding technique that was developed has gone through the stages of effectiveness testing through student learning outcomes tests, namely in the form of pretest and posttest. The results of the effectiveness test state that the learning module of the SMAW welding technique in the effective category is proven by student learning outcomes that have increased.

Keywords— Learning Module, SMAW Welding, Service Learning.

I. INTRODUCTION

The role of education is very important to create a smart, peaceful, open and democratic society. The quality of education is expected to increase human dignity. The renewal of education in Indonesia needs to be carried out continuously to create an adaptive world of education to the times. Therefore, education reform must always be done to improve the quality of education of a nation. Efforts to improve the quality of education continue to be carried out both conventionally and innovatively.

Education is a fundamental approach in the process of change, therefore education provides learning activities that can equip students with life skills (life skills or life competency) that are in accordance with the environment and needs of students. Vocational secondary education aims to prepare workers who have the knowledge, skills, and attitudes that are in accordance with the nature of vocational specialization as well as the requirements of the industrial and business world.

Vocational education must strive to improve the quality of education so that educational goals can be achieved. Efforts to improve the quality of education are carried out by improving

the quality of components that are interconnected in the education system. One form of an effort to improve the quality of education is by planning in making learning devices that are in accordance with the characteristics of students. The teaching and learning process (PBM) is well planned so that it can run smoothly, directed and in accordance with the learning objectives.

Batusangkar 2 State Vocational School is one of the Vocational Schools that always strives to implement quality learning. One of the lessons learned is the Mechanical Engineering expertise program. There are several subjects that must be learned and mastered by students in the mechanical engineering expertise package, one of which is the technique of shield metal arc welding (SMAW) manual arc welding. The technique of welding shield metal arc welding manual arc (SMAW) is a subject that provides knowledge of welding techniques that are needed as a theory and basic practice for each student so that they can carry out the manufacturing process properly and correctly.

Seeing learning about welding practices that are so complex, the implementation of learning must be carried out in accordance with the welding standards set by the teacher. Teachers are learning resources in universities that are expected to be able to plan, prepare inspirational, enjoyable learning, motivate students to actively participate in achieving successful learning. One form of readiness for learning undertaken by the teacher is preparing learning devices. Preparation of good learning tools is a strategic step in managing the learning process to achieve learning goals.

The importance of developing learning tools so that the learning process can be implemented properly and learning materials can be accepted by students. In other words, the development of learning devices is in accordance with the needs of students who are expected to realize effective teaching and learning processes. ^[1]KBBI, (2018), "a device is a tool or equipment, while learning is the processor way of making people learn. Learning tools are a guide for teachers in conducting learning both in class, laboratory or outside the classroom.

Designing and compiling learning modules is done so that the goals planned in learning can be achieved. Based on the interviews that have been carried out on the teachers of the Department of Machine Batusangkar 2 State Vocational

School, information can be obtained that the learning devices used in the teaching and learning process are still not perfect and there are no modules suitable for practical learning, especially the practice of welding. Welding practice activities are carried out with guidance from the teacher due to the lack of students' ability to use the module during practice.

Based on preliminary observations made by looking at the learning process of welding subjects of manual arc welding techniques (SMAW) at Batusangkar 2 Vocational High School, the learning process is still carried out using conventional approaches such as conducting question and answer and discussion, learning is still much theoretical but students do not respond to questions submitted by the teacher. Class conditions when the learning process takes place are not conducive, many students do activities that are not related to the material being taught by the teacher. In addition, students often ask permission when the learning process takes place.

Students' abilities are limited because they have not been able to develop knowledge independently. The learning approach applied in Batusangkar 2 Vocational School has not been able to increase students' motivation to be active in the learning process, making learning not yet relevant, fun, and not yet presenting the proper learning experience.

Learning facilities at Batusangkar 2 Vocational High School for subjects Manual arc welding techniques (SMAW) are carried out in the welding workshop of Batusangkar 2 Vocational High School. It's just that, based on observations during practical learning students still use the welding machine alternately. One welding machine is used by 3-4 students so this causes students to be ineffective in practical learning. The practice of welding, which is only carried out alternately, has not been maximized to provide skills to students so students are often absent during practical learning in the workshop.

One of the WBL models that according to researchers is appropriately applied to overcome the problems discussed in this study is Service Learning, which is a learning strategy that integrates services to the community with instruction and reflection to enrich learning experiences, teach community responsibility, and strengthen community communities. Service Learning involves students in organizing academic learning activities and designing activities to meet community needs.

II. REVIEW OF LITERATURE

A. Vocational Education

Hughes, as quoted by ^[2]Soeharto (1988:1), suggests vocational education is special education whose programs or subject matter are chosen for anyone interested in preparing to work alone or to work as part of a workgroup. In line with that opinion Evans as quoted ^[3]Muliati (2007:7) suggests vocational education is part of an education system that prepares a person to be better able to work in one workgroup or one occupational field than other occupational fields. ^[4]Hamalik (2010:24), argues that vocational education is a form of talent development, basic education skills, and habits that lead to the world of work which is seen as skill training.

^[5]Djohar (2007:128) said that vocational education is an educational program that prepares individual students to

become a professional workforce. Confirmed by ^[6]Byram dan Wenrich (1956:50) "*vocational education is teaching people how to work effectively*". Specifically, Wenrich was quoted as saying Soeharto (1988:2) arguing that vocational education is all forms of preparatory education for work done in secondary schools. *Technical education*, according to Roy W. Robert (In Soeharto, 1988:2) is a vocational education whose field of expertise covers industrial engineering issues. It was also explained that technical education carried out in various engineering faculties in the university environment was not included.

Technology education is vocational education to prepare and develop productive work. Vocational education can be classified into a type of specialized education because the study groups or programs provided are only chosen by people who have a special interest in preparing themselves for employment in the future. In order for special employment to succeed, vocational education is intended to prepare skilled workers needed in the community.

B. Vocational Education Goals

^[7] Law No.20 of 2003 explains, the purpose of vocational secondary education in particular is (a) to prepare students to become productive human beings, able to work independently, fill existing job vacancies as middle-level workforce in accordance with the competencies in the expertise program chosen, (b) preparing students to be able to choose a career, resilient and persistent incompetency, adapt to the work environment and develop professional attitudes in the field of expertise that they are interested in, (c) equip students with science, technology and art to be able to develop themselves later both independently and through higher levels of education, and (d) equipping students with competencies that are in accordance with the chosen expertise program. ^[8]Jama (2010: 1) said "*Vocational education should be responsive to the changes in society. In this era of the rapid change of technology, vocational education must play many important roles in order to grab roles in the world of work*".

Thorogood (1982) in ^[9]Giatman (2011) mentions vocational education aims to: (1) provide stock skills that sell well in society, so that it can support their economic life, (2) help students obtain and maintain the job they want, (3) encouraging regional and rational economic productivity, (4) encouraging the growth of trained personnel to support economic and industrial growth, and (5) encouraging the improvement of community quality.

C. Learning Device

Learning tools are everything that must be observed so that the implementation of learning is more directed to achieve the expected competencies ^[10](Rusman, 2012:126). There are components that are needed and must be prepared in managing and carrying out learning activities to achieve learning goals. ^[11]Zuhdan(2011:16) states that the learning device is a tool or completeness to carry out a process that allows teachers and students to carry out learning activities.

Furthermore ^[12]Suhadi (2007:121) states that learning devices are a number of materials, tools, media, instructions,

and guidelines that will be used in the learning process. Based on ^[13]Permendikbud No. 65 the year 2013 concerning the standard process of primary and secondary education stated that the preparation of learning tools is part of the preparation of learning plans. Learning planning is designed in the form of syllabus, RPP, Modules, and Jobsheet which refers to content standards. Learning planning also prepares media and learning resources, assessment tools and learning scenarios.

D. Work Based Learning (WBL) Model

Work-Based Learning (WBL) as a learning approach plays a role in enhancing professional development and learning. ^[14]Depdiknas (2003:11) revealed the work of kinetic learning that work-based learning is a learning model that provides students with the experience to learn learning materials in schools using the workplace context. Learning activities are designed according to the workplace so that students gain learning experience so that learning objectives can be achieved. Bern dan Erickson (2001:8) in ^[15]Komalasari (Komalasari, 2013) states that the implementation of work-based learning activities is integrated with the material in the school so that students understand the world of work.

E. Service Learning Approach

Service learning is the approach used by implementing the learning that combines services to the community with school-based structures by reflecting services to the community. The Canadian Alliance for Community Service defines service learning as an educational approach that integrates service in society with intentional learning activities. In an effective SL effort, educational institutions and community organizations work together towards mutually beneficial outcomes.

Learning provides opportunities for experience-based and reflective education, the integration of academic learning with community service, a reciprocal collaboration between elements, enhancing learning without sacrificing academic rigor, and finally being able to provide opportunities for students to connect student experiences with learning outcomes and the basis for discourse and critical reflection. (Apples Service Learning Program, 2009)

Community service learning (SL) or Learning-Service is a form of learning based on unique experience and pedagogy that combines academic learning through practical work experience and critical reflection. The term "service-learning" was created in 1967 by two educators, Robert Sigmon, and William Ramsey to describe the educational process applied to community-based extra-curricular activities as a way for students to improve their learning methods. (Seitsinger, 2005).

III. DEVELOPMENT METHOD

This study develops learning tools in the form of RPP and modules that are equipped with job sheets using work-based learning models equipped with service learning approaches in the technique of shielding metal arc welding (SMAW) welding, for the evaluation of products developed by validity experts by material experts and material experts practicality tests by teachers and students, while the effectiveness test was carried out on students who took part in the subject learning

process of shield metal arc welding (SMAW) manual arc welding techniques.

This research is basically a form of development research because it is based on the understanding and characteristics contained in development research and by paying attention to the peculiar nature of education especially schools, this study seeks to produce a product in the form of RPP learning modules and techniques for welding shield metal manual arcs arc welding (SMAW) at SMK Negeri 2 Batusangkar based on the actual conditions and potential of the school.

This research was carried out at Batusangkar 2 Vocational High School, located on the Bukit Gombak - Batusangkar highway, Lima Kaum Subdistrict, Tanah Datar District.

IV. DEVELOPMENT AND DISCUSSION RESULT

Development Results

The development of learning modules for Shield Metal Arc Welding (SMAW) manual welding techniques with the Service Learning approach aims to improve the competency of students' knowledge, skills, and independence in the learning process of welding engineering subjects.

The development of this learning module is carried out by using the ADDIE research and development model where the development stage of the learning module consists of 5 stages which include: a) Analysis in the form of analyzing student characteristics, analyzing curriculum, analyzing teaching materials and analyzing community needs; b) design stage in the form of formulating learning objectives, designing learning strategies, designing draft learning tools, designing modules, and compiling test instrument grids; c) the development stage (Development) in the form of making learning devices, making instruments, testing instruments and revising modules; d) the implementation stage in the form of implementing RPP and modules, validation tests, practicality tests and effectiveness on learning modules and; e) evaluation stage in the form of a module that has been validated, practical and effective for learning welding techniques

Preliminary Analysis

The subjects of this study were grade XI welding engineering subjects at Batusangkar 2 Vocational High School. At the age of 16-18 years, students are generally able to analyze and make their own hypotheses on a problem. Students at this age have the possibility and opportunity to develop their knowledge and skills independently. Therefore, the achievement at this stage of analysis is to give students the possibility to learn independently and in the use of welding equipment students will better see and experience for themselves how the tool works and are able to explore welding skills independently.

Curriculum analysis is used as the basis for compiling the main concepts that will be described systematically and can associate a concept with skills, in this case, SMAW's welding skills. Curriculum analysis refers to the syllabus of subjects of manual arc welding techniques (SMAW) that are applied to Batusangkar 2 Vocational High School so that the learning module that will be produced does not deviate from the learning objectives.

TABLE 1. Material and subject matter of the SMAW Welding Module

3.6	Applying plate welding techniques with plates at the vertical position angle connection or 3F by manual arc welding (SMAW)
4.6	Welding plates with plates on a vertical or 3F angle connection with manual arc welding (SMAW)
3.7	Applying plate welding techniques with plates on blunt vertical or 3G position with manual arc welding (SMAW).
4.7	Welding plates with plates on blunt vertical or 3G position with manual arc welding (SMAW).
3.8	Applying plate welding techniques with plates on head-to-head or 4F angle connections with manual arc welding (SMAW).
4.8	Welding plates with plates on the head top or 4F angle connection with manual arc welding (SMAW).
3.9	Applying plate welding techniques with plates on top-head or 4G blunt position with manual arc welding (SMAW).
4.9	Welding plates with plates on top-head or 4G blunt position with manual arc welding (SMAW).

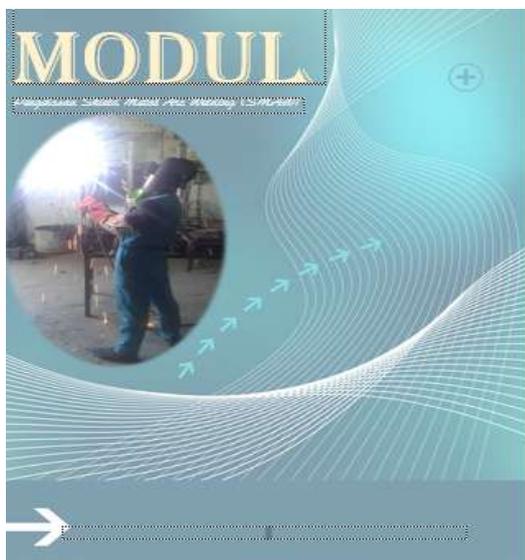
The compilation of modules for manual arc welding techniques (SMAW) uses a service-learning approach. The use of the community service approach aims to enable school learning to be applied to the community by producing products that can be used by the community and in accordance with students' abilities.

Design

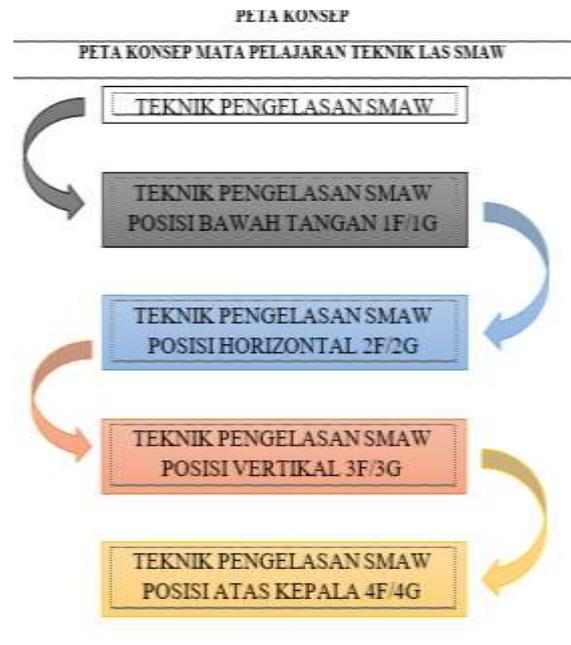
After conducting the analysis and the material then formulating learning objectives, namely: 1) Can practice the method of welding vertical position angle plates according to the module properly and systematically; 2) Can practice the blunt welding method of vertical position according to the module properly and systematically; 3) Can practice the method of welding the angle plate position over the head according to the module properly and systematically; 4) Able to practice blunt welding of positions on the head according to the module properly and systematically.

Development

The cover page of the learning module contains the name of the subject of welding and presented an image that is in accordance with the discussion of modules as can be seen in the picture:



The concept map page is presenting a learning structure for welding techniques which previously began by studying the 1F / 1G position welding technique and ending with a 4F / 4G position.



B. Discussion

The development of learning modules for SMAW welding techniques is carried out using the ADDIE model, which is a development model consisting of 5 stages including preliminary analysis, design phase, development stage, implementation stages and evaluation stages. The product developed in this research is the SMAW welding technique learning module which has been tested on class XI welding techniques of SMAW welding engineering subjects at Batusangkar 2 Vocational High School.

This research begins with conducting preliminary observations to schools to find obstacles, and what phenomena are faced in the field in connection with learning, then needs analysis, including curriculum analysis and identification of needed material. The SMAW welding technique learning module has gone through the stages of validation test, practicality test, and effectiveness. In the trial, validity is done by asking for expert opinion through a validation sheet. Validated aspects of the learning module are aspects of content feasibility, appearance feasibility aspects, language feasibility aspects, work-based learning models and service learning. Based on the validation sheet that has been obtained, the overall aspects are of a very valid value.

After the welding technique module is declared valid, it is continued by carrying out the implementation in the school for students of class XI welding techniques. After implementing the module a module practicality test was conducted based on 3 aspects, namely the aspect of the display, presentation of material and benefits. Practical results obtained for the display aspects of 89.17 with a very practical category. Practical results for material presentation aspects amounted to 90.33 in a

very practical category. Practical results for the benefit aspect amounted to 92.92 with a very practical category. After the practicality test, it is continued with the effectiveness test by using the gain score. The gain score is 0.64 which is included in the medium category.

V. CONCLUSION

Based on the research findings of the development of the learning module of the SMAW welding technique that has been carried out, the following conclusions are obtained:

1. This research has produced a learning module of SMAW welding techniques that are implemented in class XI welding techniques at Batusangkar 2 Vocational High School. The process of developing the learning module of the SMAW welding technique was developed using the ADDIE development model. The learning module of the SMAW welding technique was developed using a service learning approach.
2. The learning module of the SMAW welding technique developed has been declared valid after being validated by 3 validators. Validation assessment consists of several components, namely: feasibility of content, the feasibility of presentation, language feasibility, work-based learning model and service learning.
3. The learning module of the SMAW welding technique developed has been said to be practical after testing on students. The results of student assessment of the practicality of the learning module of the SMAW welding technique state that the modules are in a very practical category.
4. The learning module of the SMAW welding technique that has been developed has gone through the stages of effectiveness testing through student learning outcomes tests, namely in the form of pretest and posttest. The results of the effectiveness test state that the learning module of

the SMAW welding technique in the effective category is proven by student learning outcomes that have increased.

REFERENCES

- [1] Kbbi.web.id, "Arti kata," *Badan Pengembangan dan Pembinaan Bahasa, Kemdikbud (Pusat Bahasa)*, 1996. [Online]. Available: <https://kbbi.web.id/perangkat>.
- [2] Soeharto, *Desain Instruksional sebuah Pendekatan Praktis untuk Pendidikan Teknologi dan Kejuruan*. Jakarta: Departemen Pendidikan dan Kebudayaan, Direktorat Jenderal Pendidikan Tinggi, 1988.
- [3] Muliati A.M. [Online], "Evaluasi Program Pendidikan Sistem Ganda: Suatu Penelitian Evaluatif berdasarkan Stake's Countenance Model Mengenai Program Pendidikan Sistem Ganda pada sebuah SMK di Sulawesi Selatan (2005/2007).," Jakarta, 2007.
- [4] O. Hamalik, *Proses Belajar Mengajar*. Jakarta: PT. Bumi Aksara, 2010.
- [5] A. Djohar, *Pendidikan Teknologi dan Kejuruan. Dalam Ilmu dan Aplikasi Pendidikan*. Bandung: Pedagogiana Press, 2007.
- [6] R. . Byram, H.M. & Wenrich, *Vocational Education and Practical Arts in the Community School*. New York: The Macmillan Company, 1956.
- [7] Undang-Undang No 20 Tahun 2003, "Undang-Undang No 20 Tahun 2003." Jakarta, Indonesia, 2003.
- [8] J. Jama, "Transformasi Teknologi pada Pendidikan Kejuruan.," Padang, 2010.
- [9] M. Giatman, "Implementasi ISO 9001:2008 Sebagai Sarana Agar Warga Sekolah Siap Menghadapi Perubahan Paradigma Pendidikan (Educational Change) Sesuai dengan Tuntutan Kurikulum 2013 di SMK," *Prosiding*, no. Pengembangan Pembelajaran Pendidikan Vokasi dalam Perspektif Kurikulum 2013, pp. 521–539, 2013.
- [10] Rusman, *Model-Model Pembelajaran: Mengembangkan Profesionalisme Guru*. Jakarta: Rajawali Pers, 2012.
- [11] D. Prasetyo, Zuhdan Kun, "Pengembangan Perangkat Pembelajaran Sains Terpadu untuk Meningkatkan Kognitif, Keterampilan Proses, Kreativitas serta Menerapkan Konsep Ilmiah Peserta Didik SMP.," *Pascasarjana UNY*, 2011. [Online]. Available: elib.unikom.ac.id/download.php?id=139350. [Accessed: 18-Aug-2018].
- [12] Suhadi, *Petunjuk Perangkat Pembelajaran*. Surakarta: Universitas Muhammadiyah, 2007.
- [13] Permendikbud, "Permendikbud No. 65 Tahun 2013," Jakarta, 2013, p. 5.
- [14] Depdiknas, *Reposisi pendidikan vokasi menjelang 2020*. Jakarta, 2013.
- [15] K. Komalasari, *Pembelajaran Kontekstual*. Bandung: PT. Refika Aditama, 2013.