Evaluation of shielded metal arc welding learning in vocational high school

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Abstract. This study aims to determine the level of planning, implementation, and assessment of learning outcomes in the XI class of shielded metal arc welding (SMAW) techniques at the state vocational high school 1 Sedayu, Bantul Regency. This type of research is a descriptive study with a survey method. Data collection using a questionnaire. The study population was 90 students of class XI state vocational high school 1 Sedayu. The sample was taken the same as the population. Data collection using a questionnaire. The data analysis technique used a quantitative descriptive analysis. Based on the data analysis results, the planning category is medium, with a mean of 29.48. The implementation is a very high category with a mean of 49.60, the assessment of learning outcomes categorized as high with a mean of 10.68. The results showed that the evaluation SMAW technical learning was in the high category. Results also showed that the level of evaluation of the SMAW technique learning on planning is in the medium category and the evaluation of the implementation of the SMAW technique learning was in the very high category.

1. Introduction
Learning is a teaching effort carried out to students to learn and understand through the existing environment, and the results are reflected in behavioral changes that are cognitive, affective, and psychomotor. Learning is an organizing activity to regulate the environment and connect it with students so that the teaching and learning process can be carried out [1]. Learning evaluation is related to accountability; assessing learning outcomes has become an essential, albeit frightening, responsibility for many educators [2]. The evaluation aims to determine whether implementing the learning system that has carried out is effective and efficient or not, seen from the factors directly related to the learning process. The purpose of learning evaluation is to determine the learning system's effectiveness and efficiency regarding the objectives, materials, methods, media, learning resources, environment, and the research system itself [3].

The learning success factor is very significant based on the context and strategy used [4]. Learning is essential, but this is not according to the reality in the field, so it is not applied to learning. During the School Field Practice (SFP) at Vocational High School 1 Sedayu, several things were found to be obstacles in learning electric welding practices, namely in planning, implementing, and assessing learning outcomes learning evaluation was necessary. Evaluation is the process of planning, obtaining, and providing the information needed to find new sources. Measurement is the measurement, while assessment is evaluation [5]. The word evaluation obtained that the Indonesian word evaluation means
assessing, but it is done by measuring it first. Evaluation is planned and carried out regularly [6]. Evaluation is an activity carried out at the beginning, during the program, and at the end of the program. Evaluations in practical learning usually include observation, oral and written communication, self-evaluation, and simulation techniques [7]. Shielded metal arc welding (SMAW) involves joining two or more metals that use heat energy to melt the work piece and electrodes (filler).

During the SMAW process, heat energy is generated due to a jump of electric ions (cathode and anode) at the electrode's tip and the material's surface. The liquid metal from the electrode and the objects joined then freezes, and the two or more metals are connected [8]. During the welding process, the protective type used is the flux membrane found on the electrodes. The flux on the electric arc welding electrode protects the weld metal from melting during the ongoing welding process. This flux will become a slag when it is reliable. A learning strategy can be defined as a plan that will contain a series of activities designed to achieve specific educational goals. The learning strategy is a plan of action or a series of activities, including methods and various learning resources compiled to achieve a specific goal.

There is a research on visual inspection on shielded metal arc welding products of welding contest whose participants are from vocational high school student. The results showed that the aspects that become the weakness of contestants were a lack of knowledge and a lack of understanding in determining the welding requirements. Selecting the welding current, recognizing the type of material, identifying the welding code and selecting the SMAW electrode were the difficult factors [9]. The other study also showed that students need the other media in order to improve their understanding on SMAW subject. The conventional job sheets have not been able to solve some of the problems that exist in the learning activities of SMAW subject [10].

Determine the success of the quality of student learning outcomes, it is necessary to evaluate, which aims to measure the extent to which students understand [11]. Implementation of learning is the implementation of strategies that have been designed to achieve learning objectives and are supported by the existence of facilities and infrastructure. The implementation of learning is an essential component in realizing the quality of education. Therefore, the implementation of learning must be carried out appropriately, ideally, and prospectively. Thus, teachers must be able to implement theories related to learning theory into actual learning realities.

Assessment is a systematic implementation of the collection, analysis, and interpretation of information or data to determine the extent to which learners have achieved learning objectives. Assessment is the implementation of giving or determining the value to particular objects based on specific criteria. In the implementation of learning, assessment plays an essential role in determining whether the learning implementation has been done. This study aims to determine how high the level of evaluation of the XI class of SMAW technique learning in Vocational High School 1 Sedayu, Bantul Regency.

2. Methods
This type of research is a descriptive study using a survey method. This study aims to describe the evaluation of the XI class of SMAW technical learning at the State Vocational High School 1 Sedayu. This study's subjects were all class XI students with 90 students consisting of 3 classes, namely XI TPA, XI TPB, and XI TPC.

The research procedure for the evaluation of learning techniques for SMAW begins by making a questionnaire by dividing three indicators, namely, planning, implementing, and assessing learning outcomes. The questionnaire will be distributed to all students—this research was conducted by distributing questionnaires through google form after the data was collected and analyzed. The data used in this study used a questionnaire instrument. Instrument testing used a one-shot case study research design. The score used in this study is based on a Likert scale. According to Hadi, the Likert scale has four answers [12], namely: strongly agree (4), agree (3), disagree (2), and strongly disagree (1).

The instrument's validity is the content validity estimated by testing the test content's appropriateness or relevance through expert judgment. Content validity is carried out to ensure that the
questionnaire's contents are appropriate and relevant to the objectives. The data analysis technique in this research was carried out descriptively quantitatively. In data analysis grouping, the indicator category of the factor is determined in advance based on the category classification reference. According to Azwar, the table for categorizing the results of data measurement could be categorized as shown in table 1.

| Range                  | Category       |
|------------------------|----------------|
| \( X > \mu + 1.5 \sigma \) | Very high     |
| \( \mu + 0.5 \sigma < X < \mu + 1.5 \sigma \) | High          |
| \( \mu - 0.5 \sigma < X < \mu + 0.5 \sigma \) | Moderate      |
| \( \mu - 1.5 \sigma < X < \mu - 0.5 \sigma \) | Low           |
| \( X < \mu - 1.5 \sigma \) | Very low      |

Reliability testing by comparing the reliability price with \( r \) table, if \( r \) count > \( r \) table at the significance level with a significant 5% level, then the tool is reliable. Cronbach's Alpha reliability analysis results are 0.620, which is greater than the \( r \) table, 0.2072. Based on the results of the validity test, it can be seen that there are four invalid instrument items, namely numbers 3, 13, 26, and 28.

3. Results and Discussion
Levels of learning evaluation techniques SMAW depicted in figure 1. The results showed that the evaluation of the XI class of SMAW technical learning at the State Vocational High School 1 Sedayu Bantul Regency was in the high category, the mean obtained was 89.76, which was in the high category, namely 84.25 < 89.76 < 91.75. In detail, it can be explained as follows: very high 29 students or 32.3%, high 54 students or 60%, moderate five students or 5.5%, low one person or 1.1%, and very low one person or 1.1% with high results obtained, namely 54 students or 60.0%.

![Figure 1. Levels of learning evaluation techniques SMAW](image)

The picture above shows that the level of evaluation of the SMAW technique learning has an average of 89.76, which is in the high category. This means that students following learning theory and applying it in SMAW practice are in the high category. This indicates that the learning activities are of good quality and are carried out well, starting from planning, implementing, and assessing learning outcomes. These results describe the evaluation function categorized into four functions: determining students' progress, development and success after experiencing or carrying out teaching and learning activities for a certain period.

3.1 Planning Indicators
Levels of planning indicator result is shown in figure 2. Based on the results of the analysis, it shows that the level of evaluation of the SMAW technique learning on planning is in the medium category.
The mean obtained is 29.48, which is in the medium category, namely 28.25 <29.48 <30.75. In detail, it can be explained as follows: very high category nine students or 9.5%, high 23 students or 25.7%, medium 28 students or 31.5%, low 25 students or 27.8%, and very low five students or 5.5%.

These results can be seen from planning and learning the SMAW technique in the medium category. This shows that in the teaching and learning process, the teacher designs learning activities that will be carried out systematically so that in delivering the material it can be conveyed in language that is easily understood by students and with limited infrastructure, the teacher can balance it by modifying it with other teaching materials. Teachers and students were balanced in teaching and learning process, and quality will emerge in the learning process if it is well planned and conceptualized by the teacher.

3.2 Implementation Indicators
The analysis results show that the level of implementation of the SMAW technique learning towards implementation is in the very high category, the average obtained is 49.60, including the very high category, namely 49.60> 48.9. In detail, it can be explained as follows: very high category 62 students or 68.9%, high 26 students or 28.9%, moderate one person or 1.1%, low 0 students or 0% and very low one person or 1, 1%. The results are illustrated in figure 3.

From these results, it can be seen from the evaluation of the implementation of the SMAW technique learning in the very high category. This shows that the implementation of teacher learning always prioritizes student safety by always prioritizing Occupational Safety and Health, and students always obeying the teacher's orders. Teachers also respond to students according to their characteristics to complement each other between teachers and students. Reciprocity between students and teachers is
formed and built. In implementing the SMAW technique, learning is carried out well and following the teacher's concepts following the Learning Implementation Plan.

3.3 Learning Outcomes Assessment Indicators
The analysis results show that the SMAW technique's level of learning on assessing learning outcomes is in the high category, the mean obtained is 10.68 and is included in the high category, namely 10.65 < 10.68 < 11.95. In detail, it can be explained as follows: very high category 22 students or 24.5%, high 33 students or 36.7%, medium 18 students or 20.0%, low 12 students or 13.3%, and very low four students or 5.5%. The results are illustrated in figure 4.

![Figure 4. Levels of learning outcomes assessment indicator.](image)

Indicators assessing the learning evaluation construct SMAW technique has a high category with 36.7% as 33 learners. These results can be seen from evaluating learning outcomes in learning SMAW techniques, including in the high category. This shows that the teacher prioritizes discipline so that students always work on assignments on time and do performance results well following the teacher's orders.

4. Conclusion
Based on the discussion that has been described, it can be concluded that the quality of learning in planning indicators in SMAW technique learning is included in the medium category, which indicates that it is good enough in planning to start from the program structure and needs to be improved again to make it better. The quality of learning on the implementation indicators in learning the SMAW technique is included in the very high category, which indicates that it is excellent in implementing learning starting from the methods, facilities, and infrastructure. The quality of learning on the indicators of assessment of learning outcomes in SMAW technique learning is included in the high category, which indicates that the teacher conveys to students coherently in assessing learning outcomes.

References
[1] Nasution. 2015. Manajemen Mutu Terpadu. Bogor: Ghalia Indonesia.
[2] Fenwick, T., & Parsons, J. (2008). The art of evaluation: A handbook for educators and trainers (2nd ed.). Toronto, Ontario, Canada: Thompson Educational Publishing.
[3] Arifin, Zainal. 2011. Evaluasi Pembelajaran. Bandung: PT. Remaja Rosdakarya.
[4] Al-Fraihat, D., Joy, M., Masa’ deh, R., & Sinclair, J. 2019. Evaluating E-learning Systems Success: An Empirical Study. Computers in Human Behavior. DOI:10.1016/j.chb.2019.08.004
[5] Arikunto, Suharsimi. 2009. Evaluasi Program Pendidikan. Jakarta: Bumi Aksara.
[6] Marwanto, A. & Djatmiko, Riswan, D. 2014. Evaluasi Pelaksanaan Praktik Oxy-Acetylene Welding di Jurusan Teknik Mesin FT UNY. JPTK. 22 (2), 129-134.
[7] Logue NC. Evaluating Practice-Based Learning. J Nurs Educ. 2017 Mar 1;56(3):131-138. DOI: 10.3928/01484834-20170222-03. PMID: 28263350.

[8] Suwardi & Daryanto. 2018. *Pedoman Praktis K3LH Keselamatan dan Kesehatan Kerja dan Lingkungan Hidup*. Yogyakarta: Gava Media.

[9] R D Djatmiko et al 2020 J. Phys.: Conf. Ser. *1446* 012006

[10] R D Djatmiko et al 2020 J. Phys.: Conf. Ser. *1446* 012028

[11] Khusni, S. 2012. *Pengembangan Media Pembelajaran Modul Interaktif Las Busur Manual di SMK Negeri 1 Sedayu*. Download from: https://eprints.uny.ac.id/7548/.

[12] Hadi. 1991. *Prosedur Penelitian Suatu Pendekatan Praktis Edisi Revisi VI*. Jakarta: PT Rineka Cipta.

[13] Azwar, Saifuddin. 2012. *Penyusunan skala Psikolog*. Edisi 2. Yogyakarta: Pustaka Belajar.