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Relationship between knowledge and students' welding practical skills

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Abstract

This research aims to produce an understanding that explains the correlation between Theoretical Skills in Welding and the Results of SMAW Welding Practicum. The research method used is a quantitative method with a descriptive correlational approach, aimed at measuring the relationship between theoretical skills and practical skills. The research instruments used in this study include questionnaires, the results of practical exams, and documentation. The research was conducted at SMK Negeri 2 Payakumbuh, with a research population of 50 students in the eleventh grade of Welding Technology. The data analysis results show a significant and positive relationship between theoretical skills and practical results, with a correlation coefficient of 0.701 and a significance value (2-tailed) of 0.000. This indicates a significant and mutually influential relationship between theoretical skills and practical results. Based on the research findings, it can be concluded that the improvement of students' theoretical and practical skills can be utilized and implemented in SMAW welding education, leading to improved student learning outcomes and time efficiency in school. For the future, it is recommended that teachers pay more attention to the students' learning process, which is expected to have a positive impact on the enhancement of both theoretical and practical learning outcomes for students in the field of SMAW welding.

Keywords: *Theoretical Ability, Practical Skills, SMAW Welding, Students*

Introduction

Education is a universal aspect that must be present in human life (Abass et al., 2020). In the absence of education, humans will never experience development and have a culture. In addition, life will also turn into static, there is no progress, and there may be failure and destruction. Therefore, through education, quality human resources will emerge. According to (Al-Barakat et al., 2023), education is all knowledge acquired throughout life, in every place and every situation, which has a positive influence on the development of each individual organism. Education is one of the main needs of humans, has a very large role in supporting and providing results, namely human resources that have quality (Adnani et al., 2022; Okolie et al., 2020; Putra et al., 2021).

Vocational High Schools (SMK) were established to train creative, accomplished, and qualified human resources (HR) to fulfil industry's need for highly skilled human resources in certain fields of work (Antonietti et al., 2022; Furtasan Ali Yusuf & Basrowi, 2023). Human resources can be improved by improving the quality of education. Some factors that influence the quality of education include teachers, learning process, students, environment, factory infrastructure and learning time (Fortuna et al., 2023; Xu et al., 2021). The vocational school that the researcher is interested in studying is SMKN 2 Payakumbuh, which offers eight expertise programmes namely Civil Engineering, Mechanical Engineering, Electrical Engineering, Automotive Engineering, Electronics Engineering, Surveying and

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Mapping Engineering, Plumbing and Sanitation Engineering. Each department has skills and 16 skills in total. An example of learning at SMKN 2 Payakumbuh is the SMAW (Shield Metal Arc Welding) welding technique. Welding is the process of joining two metals through the use of heat energy (Prasetya et al., 2023). Steel surrounding the weld or joint will occur a rapid thermal cycle which results in complex metallurgical changes, freezing and thermal stress (Eliaz, 2019). The technique for welding is generally used, namely the SMAW (Shielded Metal Arc Welding) welding technique, which is used with electrons (electric arcs) as a source of melting heat. The arc temperature can be 3300^0C, much higher than the melting temperature of steel, so it can melt steel instantly (Lai et al., 2020).

Theoretical learning is a learning activity that includes teaching activities, student activities, models and interactive processes between teaching staff and students, as well as teaching resources in the classroom. learning environment in efforts to implement educational programmes (Mustabsyiroh et al., 2021). The theoretical learning process is a psychological or mental activity that takes place in active interaction with the environment, resulting in shifts in knowledge, understanding, skills, and attitude values (Mustabsyiroh et al., 2021). Learning theory is basically about how the teaching process can be carried out in children (Miller & Krajcik, 2019). This means that understanding teaching theory will help teachers learn well and effectively, which in turn can also help children / students learn optimally and help children change their behaviour. Not only in the field of theory, students also need to increase their practical capacity.

Practice is a component of the learning programme that all students must undertake, and is a true manifestation of the education system in vocational schools. So, through practice, we can develop our skills continuously and apply them to real life situations, we can become proficient and achieve better learning outcomes. The practice of welding techniques in vocational high schools (SMK) is an activity carried out by students in learning and mastering metal welding skills (Miller & Krajcik, 2019). Welding is the stage of joining two or more metal objects through the use of heat and pressure to unite them into one part (Mueller et al., 2019). When practising welding techniques in vocational schools, students will learn various aspects related to welding, including understanding metal types, welding forces, material preparation, tools and equipment use and safe welding procedures that must be applied during the welding process. The results of student practice become a measure of students' ability to apply knowledge and skills in a real-life environment (Olaniyi, 2020). Practice grades are often used in education, especially in school programmes that emphasise the development of practical skills. These practical grades reflect the extent to which students can apply their theoretical knowledge to practical situations, including in the context of welding, not just in the field of practice but also in the field of theory (Levrini & Dos Santos, 2021).

Based on the results of observations, researchers found that students' capacity to understand welding learning theory was less than optimal, this was due to a very monotonous theory learning system that made students less enthusiastic. The teaching and learning process only focuses on reading books. However, the use of technology-based learning materials such as Microsoft Power Point, Canva, Powtoon, Google Classroom and Quipper that have not been applied by teachers will slow down students' understanding of the learning process, causing their learning to be more difficult. Practical learning motivation is higher than theoretical learning. This greatly influences students' learning outcomes when practising, causing their scores not to be optimal. Based on the general description above, researchers are interested in conducting research concerning the achievement of student knowledge. This research focuses on learning outcomes, knowledge, and understanding between theoretical abilities and SMAW welding skills.

Methods

Type of Research

The method of research used in this study is a quantitative research method through the use of descriptive correlation methods (Bloomfield & Fisher, 2019), including the search for information about existing symptoms, clearly defining the objectives to be achieved, and formulating a plan of approach, the process of collecting data for report writing.

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Population and Sample

In the study, the subjects to be surveyed were Welding Engineering students in class XI of SMK Negeri 2 Payakumbuh. The sample for this study was determined as many as 50 students who were grouped into 2 classes, namely Class XI Welding Engineering 1 which numbered 26 students and Class XI Welding Engineering 2 which numbered 24 students, the sample was taken from the entire existing population, this is called demographic study research. Based on the above statement, so the sample of this study was taken referring to the entire Welding Engineering Class XI 1 and Welding Engineering Class XI 2 at SMK N Payakumbuh as shown in table 1.

Table 1: Sample size

No	Class	Number of Students
1	XI Welding Engineering 1	26
2	XI Welding Engineering 2	24
	Total	50

In research, there must be a process for reaching data to get data that is as clear as possible. The main way of collecting data is to collect good data. Data was collected based on the class theory ability test. Techniques for analysing data used are normality testing, uniformity, and T test.

Research Procedure

In this study the author wants to know, measure or describe the relationship between theoretical ability (X) and the results of practical skills (Y). This research was conducted at SMK Negeri 2 Payakumbuh, the object of research was Class XI Welding Engineering which was divided into two groups and in general the research process can be divided into three stages, including: preparation, implementation and completion, 1) The observation preparation stage is carried out at SMK Negeri 2 Payakumbuh, 2) Make a research schedule to collect needs analysis data on aspects of theoretical ability.

Research Instruments

The instrument used in this research is a questionnaire. According to (Vodă et al., 2022) Questionnaires are tools for obtaining data in the form of a list of questions distributed to respondents in order to obtain answers in writing. In this study, the authors used a closed questionnaire. Regarding closed questionnaires. According to (Sishchuk et al., 2020), questions that require short answers or answers are given by rounding off certain notes. The list of things asked is designed through answer options, respondents are directed to select one or more answers through the options created. According to (Sinclair et al., 2023), research instruments are equipment for making observations of natural and social phenomena. Research instruments are measuring equipment used to obtain data. The questionnaire used in this study is through the use of a Likert scale which measures the attitudes, opinions, and perceptions of individuals or groups about social phenomena. 'On this Likert scale, five options are offered as questions ranging from strongly disagree to strongly agree.
This questionnaire is structured based on a network of instrumental variables. The variables used in this study include: Theoretical capacity (X), practical outcome (Y). The following is the instrument grids of motivation and learning-based variables:

Table 2: Kisi-kisi Instrumen

No	Variables	Indicators	Question Number	Number of Questions	Scale
1	Theoretical Ability	a. Rapid and Regular	1, 2, 3	3	Likert

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		b. Teacher's ability to teach	4, 5, 6	3
		c. Student condition	7, 8, 9	3
		d. Students' environmental conditions	10, 11, 12	3
		e. Remember what is seen rather than what is heard	13, 14,15	3
		f. Teachers' efforts to teach students	16, 17	2
2	Practicum Score Results	a. Shaping Attitudes		
		b. Increase knowledge		
		c. Experience when doing the practical		
		d. The role of the teacher during the practicum		

The final stages of this research instrument are: Collecting data on learning outcomes in measuring students' theoretical abilities and SMAW welding practical skills test results. Processing value data from two object classes. And Drawing conclusions from the results obtained according to the techniques for analysing the data used.

Data Collection Technique

In a study, there is always a data collection process to obtain the clearest data possible. The data collection method is to obtain good data. The data collected is based on looking at the theoretical ability of class XI welding engineering students before the students carry out work practices compared to the results of student work practices after carrying out work practices.

Data Analysis Technique

Prerequisite test (normality and homogeneity test) and T test.

Results and discussion

Data Description

The description of this research data has the aim of providing a description of the relationship between theoretical competence in the field of welding and the actual SMAW welding results of class XI students of SMK Negeri 2 Payakumbuh. This research was conducted at SMK N 2 Payakumbuh from September to August, where researchers wanted to see the relationship between theoretical ability and student academic achievement. The relationship between theoretical capacity in the field of welding is shown through questions in the form of a theoretical capacity questionnaire totalling 17 questions with 5 options including Strongly Agree (SS), Agree (S), Disagree (KS), Disagree (TS). Strongly Disagree (STS) which was given face-to-face and distributed to respondents. The statements in the questionnaire include statements that are in accordance with the response evaluation criteria. While the data on the results of SMAW welding training is based on the points obtained by students during the training process. Data were taken from 50 respondents including 26 students of class XI TPL 1 and 24 students of class XI TPL 1. Data analysis was conducted in this study to describe the relationship between theoretical competence in welding and the results of SMAW welding practice. Based on the responses of respondents from a total of 50 students of SMK N 2 Payakumbuh, it can be described as follows:

Test

To confirm theoretical ability Validity is a measure of the effectiveness or correctness of an instrument. How to calculate the value through the use of the Product Moment correlation formula through the use of SPSS version 25. The rxy value achieved will be used as a reference for the

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current product price at a significant level of 0.05, if Rxy> rtable then the item is achieved valid results. Summary of validity checks where r is calculated to match the r product moment table with a significance level of 0.05 df = (N-2). If r count is higher than r table then the question is said to be valid. Based on the results of the validity check carried out by the researcher, all data are valid and need to be further tested for reliability.

Check Reliability

The theoretical ability to check the reliability of an instrument is that it is reliable enough to be used as a tool in obtaining data because the instrument is good. Item reliability analysis is carried out only on items reported as valid and not on all untested items.

Table 3: Reliability of Theoretical Ability

Reliability Statistics	
Cronbach's Alpha	N of Items
0,783	17

Validation Test of Practicum Values

Validity is a measure that shows the levels of validity or validity of an instrument '. how to calculate the validity process through the use of the Product Moment correlation formula using SPSS version 25. The rxy value achieved will be discussed through the product moment price at a significant level of 0.05, if Rxy> rtable then the item is said to be valid.
Summary of the validity test where r count is matched through the r product moment table at the 0.05 singnificant rate df = (N-2). If r counts above r table then the item is said to be valid. Based on the results of the validity test carried out by researchers, each valild data is followed by a reliability test.

Reliability Test of Practicum Score

Reliability test of an instrument is reliable enough to be used as a tool in obtaining data because the instrument is good Analysis of item reliability is only carried out on items that are said to be valid only and not every item that has been tested.

Table 4: Reliability of Practicum Results

Reliability Statistics	
Cronbach's Alpha	N of Items
0,792	20

Judging from the reliability test table with a reliability coefficient of 0.792 with a very reliable interpretation. After the validity and reliability tests are carried out, the researcher proceeds to the next stage, namely the requirement test in the form of Normality, Homogeneity and T-Test tests.

Normality Test

The results of testing the normality requirements of the research data, carried out through the use of the Kolmogrov Smirnov test technique (K-S Test), are a reference for rejecting and accepting the decision whether the data distribution is normal or not from the research sample, a good regression model that has a residual number that has a normal distribution. Normality test data is set at alpha significance ($\alpha = 0.05$).

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Table 6: Homogeneity Test

ANOVA					
	Sum of Squares	Df	Mean Squares	F	.Sig
Between Groups	3492.810	1	3492.810	91.550	.000
Within Groups	3738.900	98	38.152		
Total	7231.710	99			

Based on the results of the homogeneity test process above, it can be seen from the anova table that the significance value is 0.000 <0.005, so a conclusion can be reached that the variants of the two data or data population groups are not the same. then it will continue to the Independent sample T-Test test.

T-Test

T-Test is one of the types of parametric statistical tests used to test the significance and relevance of one or two groups. Independent Sample T-Test is used to test two groups of samples that have no relationship. This T-Test was carried out through the use of the SPSS 25 application, through a significance level at the 0.05 level (α = 5%).

Table 7: T-Test

Group Statistics					
		N	Mean	Std. Deviation	Std. Error Mean
Teknik Pengelasan	Teorikal	50	68.32	5.971	0.844
	Hasil Belajar	50	80.14	6.376	0.902

Table 8. Independent Sample Test

Independent Samples Test								
Levene's Test for Equality		t-test for Equality of Means						
F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
.148	.701	-9.568	98	.000	-11.820	1.235	-14.272	-9.368
		-9.568	97.581	.000	-11.820	1.235	-14.272	-9.368

Based on the results of the data above, it can be seen from the significance value that there is 0.000, which is smaller than 0.05, so a conclusion can be reached where the data achieved means that the research data between theoretical abilities and student welding practical skills have a real interrelated relationship.

Discussion

This study found a relationship between the ability of welding theory through the results of SMAW welding practice of students from class XI SMK Negeri 2 Payakumbuh. Theory is an abstraction of reality, theory includes a group of principles and definitions that conceptually organize aspects of the world, experiments, systems, theory includes hypotheses, basic propositions and axioms that are interdependent on capacity, especially capacity, capacity, power. do something learned during the study of theory During the teaching and learning process, educators convey the theory to be discussed. After providing the theory of professional education, educators provide practical exercises to acquire skills that students can accept. Understanding is a person's skill to understand or comprehend something after it is known and remembered. In other words, understanding is knowing a thing and being able to review it through different

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perspectives. According to (Jabarullah & Iqbal Hussain, 2019), direct learning is a method of delivering teaching materials through the use of tools or objects, as demonstrated, through the hope that students become clear, easy to understand, and accompanied by being able to understand. convey. the intended material. and a day in society. This method allows students to apply, test and adapt the theory to real life conditions through practice or work. This is where students practice, practice and will receive excellent teaching in carrying out the development and refinement of the skills needed. Research data on theoretical ability variables obtained a mean value of 4.016, standard deviation of 0.782. While the Actual Result variable obtained a mean value of 4.007 and a standard deviation of 0.822. Before distributing data to test hypotheses, normality and homogeneity tests were previously carried out. After it was known that the data had a normal distribution and the two research variables, namely theoretical possibility (X) and actual results (Y) had a linear relationship, hypothesis testing was carried out. The results of the data analysis showed that there is a significant and positive relationship between theoretical ability and internship results, where the correlation coefficient is 0.701 and the significance figure (two-sided) is 0.000, meaning that theoretical ability means that there is a significant difference between theoretical ability and internship results.

Based on the direct research experience during this study, there are a number of things that have been learned and may be a number of factors that can be noted for future researchers to further add to the perfection of this study. because this researcher himself certainly has shortcomings that should continue to be improved in the future study. The limitations of this study include the above: The results of the study are based on the honesty of the respondents to answer the research questionnaire. This research is cross-sectional, meaning that it is only examined in a limited period of time and only to show that the conditions that occur take place when research and changes that may have occurred or will occur, cannot be observed.

Conclusion

Based on the results of the research and discussion described in the chapter above, conclusions can be reached where the results of this study are in line and provide mutual support through theoretical studies which generally show a positive relationship between the ability of Welding Engineering Students with SMAW Welding. Internship results at SMK Negeri 2 Payakumbuh. This means that the higher the student's theoretical ability, the higher the results of the practice of SMAW welding techniques and vice versa. Based on the research, discussion and conclusions described above, recommendations can be given including the following:
During the learning process, students should follow good teaching, try to develop good learning methods, so that the ability to understand the theory well increases so as to improve the results of SMAW welding practice; Teachers pay more attention to students during the learning process to improve their theoretical abilities later, which will also have an impact on improving student practice results in the field of SMAW welding; In schools, it is hoped that schools will encourage more efforts to improve students' reasoning abilities, such as considering what efforts can be made to create good learning methods and activities for students to increase the effectiveness and efficiency of learning in schools.

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Conflict interest

The author states that there was no conflict when conducting the research.

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