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An Evaluation Study of the Mechanical Skills and Learning Strategies in using Lathes at State Technology Vocational School (SMK) in Kupang City

Petrus Ly[*1], Made Parsa[2]

Department of PPKn Education, Faculty of Teacher Training and Education, University of Nusa Cendana, Kupang 85001, Nusa Tenggara Timur, Indonesia

Faculty of Teacher Training and Education, University of Nusa Cendana

Email: lypetrus@yahoo.co.id

Abstract

This study was aimed at understanding the difference between the influence of VCD media and demonstration learning strategies towards the skills of using a metal-working lathe and on its use by low-mechanically talented students. A quantitative experimental design with evaluation research orientation was employed. The research samples were obtained from State Technology Vocational Schools (SMK) in Kupang City, through the use of cluster random sampling. The data were collected by observation, interviews, and tests conducted on the practical learning of using the lathe machine through VCD media and demonstration, putting students' mechanical talents into consideration. The data were analysed through the use of a two-way ANOVA. The results showed that there was a difference in the effect of learning strategies with VCD media and demonstrations of the skills of using a lathe for students majoring in Mechanical or Automotive Engineering, and a difference was also observed in the skills of using a lathe for low mechanically talented students.

Keywords*:* Learning Strategy, VCD, Demonstration, Skill, Lathe

Introduction

Vocational high schools are established for the purpose of preparing students for working life, not only in large industries but also in the informal business sector that requires work independence. The graduates of these schools are expected have good knowledge, attitudes and work skills. Their ability to work should always be dynamic by changing and developing along with changes in science, technology, and the demands of the community.

However, the evolving working life requires a highly adaptive, anticipatory, and competitive workforce that is always open to changes and possesses the ability for continuous learning throughout their lifetime. The students must also have the capacity to deal with new things and have a broad, strong and fundamental ability to develop and compete in the globalisation era.

Vocational students are required to adapt their abilities to varieties of work demands in the industry. This adaptive essence refers to their intellectual ability to analyse, predict, and anticipate the possibilities of a production process based on data and prevailing phenomena, both before and during production. The curriculum structure of vocational education has a more adaptable and flexible character making it possible to migrate from one profession to the other. These abilities in basic proficiency are founded on the substance of basic skills, standard skills, competencies, and basic competencies that are supposed to be learned in school.

According to Suparman, Alwi (2016), in the enhanced K13 curriculum, vocational school structure is divided into three components: normative, adaptive, and productive. It is, however, important to point out that productive components are subject to changes in society. However, this is observed in learning the use of lathe in the vocational school which is not in accordance with the objectives written in the K-13 curriculum. The observation of these problems has resulted in the inability of the product to meet the quality standard of competence required by

the industrial world and there is a lack of high adaptive and anticipatory abilities by the student in the industrial world.

Formulation of the Problem

According to Fred N. Kerlinger (2009), problems can be limited when some specific ones are focused. Therefore, the problems examined in this study are as follows:

1. Is there any influence of applying VCD media and demonstrations as learning strategies toward the skills of using a lathe?

2. Is there any influence of applying VCD media and demonstrations as learning strategies on the skill of using a lathe for low-mechanical talented students?

Literature Review

Skills in using a Lathe

There are three human abilities explored in Robert Wilton's Gagne theory (2012) and they include the taxonomy of learning outcomes, special learning conditions, and a further nine learning events. Furthermore, Gagne recognised five taxonomies to include (1) verbal information which is an important way for humans to pass on knowledge to future generations through facts, principles, and generalisations; (2) intellectual skills which include the ability to know by following the format of discrimination, concept, rules, and problem solving; (3) cognitive strategy which is the capabilities internally organised and used by students to regulate their ways of learning, remembering, and thinking; (4) attitude, which is internally formed with effects on personal actions towards groups of objects, people or events; and (5) motor skills as a function of learned capabilities aiding the performance of the muscles correctly, smoothly and measurably.

The theory of Kehlab (2010) with respect to special learning (*specific learning condition*) emphasises that it is very important to categorise learning objectives according to the type of learning outcomes. In this way, the teacher could design the learning process to achieve it's objectives and pay attention to the critical conditions that must be prepared to reach the goal. For example, if the learning goal to be achieved is to remember a number of vocabulary words, the teacher must prepare special conditions such as cues or certain tricks for students in order to make them remember and understand the words.

Intellectual Skills

This has to do with the combination of various concepts into one rule in order to solve a problem. The definition shows that learning materials require more intellectual skills to be effective and efficient. According to Bambang W. (2009), the number of levels in the intellectual process is adjusted to the learning objectives and arranged from the lowest to the highest, i.e. (1) discrimination, which is the ability of a person to move stimulus or object to one another, including distinguishing one symbol from the other. For example, the process can be observed in distinguishing materials such as teak, mahogany, albasih wood, and other materials often used in the work; (2) concrete concept, which is a person's ability to identify a stimulus as a member or part of a group with the same characteristics, even though in reality, they are different from one another. This concept also includes identifying the position of an object, for example, above, below, right, left, in front and so on; (3) the defined concept, which is the ability of a person to classify and explain the intent of a particular group, event or a connection, for example, explain or identify a square shape. The square shape is the concrete form, while the formulated concept is a closed field formed by long four lines with mutual and perpendicular meeting ends; (4) rules or provisions, which have to do with the performance of students in different specified

conditions; and (5) problem solving, which is the highest skill level because of its use of complex rules through the combination of simpler ones.

Learning Strategies through the use of Video Compact Disc (VCD) Media

Media are physical tools used in presenting messages to stimulate learning students. They are physically used to convey information through the use of books, tape recorders, tapes, video cameras, video recorders, films, slides, photos, images, telephones and computer graphics (Gagne Robert Wilton: 2012).

Media could also be people, material, or events with the ability to create conditions allowing students to obtain new knowledge, skills, and attitudes (Mc Kealhic W, 2017). Meanwhile, VCD media is a tool used in showing images with sound when conveying information or messages. However, learning is a process requiring communication between students, teachers, and learning materials, and this will only be effective through the application of the tool or media.

A good media enables students to provide response and feedback, and also encourages correct practice (Kehlab, 2010). The application of VCD media as a learning strategy, by building the knowledge from the environment, helps in developing skills through the step by step information on conducting various activities (Plomp and Elly, 2016).

Learning Strategies by using Demonstration

Demonstration is a learning strategy where a teacher shows a process for all students in the class to see, observe, hear, or maybe grope and feel (Carrol and Joice, 2013). Furthermore, Smaldino, Lowther, and Russell (2017) reveal it is a learning activity in which students see an example of a skill or procedure learned from an expert in order to be able to imitate or adopt it.

According to Kehleb (2010), demonstrations are used to solve problems in the class, answer questions relating to a concept, introduce a new technique or basic skill, and to bridge the gap between concepts. In support of this opinion, Smaldino and his colleagues above point out that the process helps in getting feedback through the arrangement of work-related questions and allow students to learn the right skills by following the observed steps or procedures.

The learning strategy of using demonstration, according to Mc Keachie W. (2017), is one of the one-on-one teaching techniques, where teachers and students could interact with each other directly during the learning process. This method is characterised by (1) requiring a model to show the performance of a tool; (2) having work procedures to identify the basics of a skill; (3) students completing tasks through direct experience guided by the teacher; and (4) students needing practical work or real experience with skills' performance feedback.

Student's Mechanical Talent

Talent is a special ability possessed by a person. It can also be defined as distinguished characteristics of an individual, both attitudes and intellectual abilities, used in processing and forming new information from stimulus and reality. Furthermore, it has the potential of increasing the probability of learning a process (Plomp and Elly: 2016). The general talent is also called intelligence and could be observed from the differences in the way a person learns, based on variations in personality factors, cognitive factors, and special abilities. Talent is further defined to be a person's basic or initial ability to strengthen his subsequent abilities.

In addition to the general talent, there is a prominent talent and this includes verbal, numerical, and abstract abilities. In a more concise sense, the abstract ability consists of verbal, numerical, spatial, and mechanical logical abstract abilities. The mechanical part was further divided into masinal and mechanical logical talents (Cronbach, 2014).

The talent test results could be used to find out the possibility of a person's success in certain positions or expertise. Plomp and Elly (2016) report that the division of abilities into lower and upper groups can be used to distinguish basic abilities in a class. Meanwhile, according to John Carroll in Joyce Well and Calhoun (2009), talent traditionally correlates with students' achievements. It is further associated with how long it takes people to learn something rather than the capacity or ability to become experts in it.

Research Methodology

Research Sample

According to Agung, I Gusti Ngurah, (2010), experimental research of this nature requires a sample in order to achieve the objectives. Therefore, this study made use of 30 students each from the Mechanical Engineering Department of the State Technology Vocational Schools 2 and 5 in Kupang City as a sample. Therefore, the sample selected through the cluster random sampling technique was 60 SMK students.

Research Procedure

The study was conducted in several stages including:

a. The Preparation Phase. At this stage, the field staff and students appointed as research subjects were prepared. The learning ability test instruments to operate the lathes as well as the guidelines to deliver learning through the application of VCD and demonstrations with regards to mechanical talents were also prepared.
b. The Implementation Phase. This included group arrangement for research subjects in easily observable settings, the conduct of the learning process by applying VCD and demonstrations' learning strategies, with considerations for the mechanical talents of the

students, and the collection of research data for dependent variables, the learning outcomes for both groups.

Research Instrument

For the purposes of this study, an instrument was developed with the help of a grid based on the subjects or training courses on the operation of the lathe as stated in the syllabus/curriculum and named the lathe mastery test.

The test instrument was tested for validity and reliability before application. The validity test was conducted with reference to the curriculum for operating the lathe and technically prepared with the assistance of the grid. Meanwhile, the reliability test made use of reliability analysis-scale (Alpha) as proposed by Agung (2014) and the results calculated with computer assistance to produce an alpha price of 0.8845. Therefore, the operational test instrument was declared reliable.

Research Data Analysis

After the Learning Science and Technology product was achieved in accordance with the output of the study, a descriptive analysis was conducted with taxonomy descriptive analysis technique by domain analysis, in accordance with Bloom's principle. Furthermore, an inferential statistical test data using 2-factor ANOVA was conducted on the experimentation based on the normality and homogeneity test performed by Stephen Issac and William B. Michael (2008).

The design of the 2 x 2 factorial model of ANAVA is illustrated in Table 1 below.

Table 1. *Design of 2-Factor ANOVA Analysis*

Mechanical Talent of Learning Students (B)	Learning Strategies (A)	
	A1 (VCD)	A2 (Demonstration)
B1	Y	Y
B2	Y	Y

Notes:

A_1 = VCD Learning Strategy

A_2 = Demonstration Learning Strategy

B_1 = Mechanical Talent of Upper Students

B_2 = Mechanical Talent of Lower Students

Y = Student's Learning Output in Operating Lathe Machine

Discussion

Prerequisite Test Analysis Techniques

These included data normality and homogeneity tests conducted before the inferential analysis of the research hypothesis.

Normality Test

The inferential analysis for the hypothesis was conducted by using parametric statistical techniques which require the data to be analysed to be in the form of an interval scale or a normal distribution. Sugiyono (2013) revealed that "the use of parametric statistics works with the assumption that the data of each research variable to be analysed forms a normal distribution. If the data is not normal, then the parametric statistical technique could not be used for the analysis tool". Therefore, the normality test was conducted by using the Lilliefors test technique

through Microsoft Excel 2010 program to determine if the data to be analysed were obtained from a population with a normal distribution.

The test started with the determination of the significance level, which was set at $\alpha = 0.05$. Furthermore, the statistical hypotheses tested were:

H_0: Data obtained from populations with a normal distribution

H_1: Data not from a population with a normal distribution

Test criteria: accept H_0 if $L_o < L_{table}$, and reject H_0 if $L_o > L_{table}$.

Normality Test of Each Group

Eight groups of data on learning outcomes of Turning Practice (Y) were tested for normality and they include A_1 or experimental group (given VCD learning model), A_2 or control group (given a learning model in form of demonstration), B_1 (High Interest/Talent), B_2 (Low Interest/Talent), A_1B_1 (experimental group with High Interest/Talent), A_1B_2 (experimental group with Low Interest), A_2B_1 (control group with High Interest/Talent, and A_2B_2 (control group with Low Interest/Talent). From the results of data processing with Microsoft Excel 2007 program, the results of the normality test of learning outcomes in Lathe Operation Practice are as follows.

Table 2. Summary of the Analysis of Normality Test on Learning Outcomes in Turning Practice (Y) using Lilliefors Test Techniques

Group	N	Lo	Lt	Summary of Population Origin
A1B1	15	0.098	0.220	Normal distribution
A1B2	15	0.123	0.220	Normal distribution
A2B1	15	0.094	0.220	Normal distribution

A2B2	15	0.119	0.220	Normal distribution
A1	30	0.079	0.159	Normal distribution
A2	30	0.076	0.159	Normal distribution
B1	30	0.064	0.159	Normal distribution
B2	30	0.111	0.159	Normal distribution

From Table 2 above, it could be seen that the L_o value for all groups of data on Turning Practice (Y) is below the L_{table} value. Therefore, it was concluded that all the groups were obtained from normally distributed populations.

Homogeneity Test

After the confirmation of the normality of the group, the homogeneity of the research sample was conducted using two techniques, F-test for two sample groups, and Bartlett test for more than two sample groups. The tests were conducted to find if the non-free/bound variables between each sample group had the same variant or not by testing the statistical hypothesis as follows:

H_0: $\sigma_1^2 = \sigma_2^2 = ... = \sigma_n^2$ (all groups are homogeny)

H_1: is not H_0 (there is a sample group which is not homogeny)

The test was conducted through the use of a significance level of $\alpha = 0.05$ with the testing criteria being: accept H0 if χ^2hitung < χ^2tabel and reject if χ^2hitung > χ^2tabel.

Inferential Analysis Techniques (Hypothesis Research Inferential Analysis Techniques) (Testing Hypothesis Research)

The aim of the study was to examine the mean differences between the two dependent variables together (univariate). According to Agung (2014), an inferential analysis is conducted in order to test the research hypothesis and for the purpose of this study, a 2x2 factorial variant univariate analysis (ANOVA) was employed through the use of SPSS version 17.0.

The procedure was used to examine the mean difference in learning outcomes of turning practice by using learning strategies of VCDs and demonstrations, the effect of interaction between VCD learning strategies and Students' Mechanical Talent in turning, the differences of the average practical learning outcomes in turning between students with high and those with low mechanical talents, and the mean differences of practical learning outcomes in turning between two sample groups formed by the main factors of VCDs and mechanical talents. However, the parameters tested were the differences in the mean of one dependent variable (bounded).

In summary, the hypotheses tested in this study included the univariate hypothesis in the interaction effect, and the simple effect hypothesis (the difference in the average of a bound variable between two groups of data).

The Main Hypothesis Test (Main Effect)

a. Testing the Multivariate Main Effect Hypothesis

The multivariate hypothesis test was conducted by using the most complete regression model, i.e. $Y_{ijk} = \mu + A_i + \varepsilon_{ij}$

where:

Y_{ijk} = the value of the k-multivariate observed in cells (i, j)

μ = the overall average parameter vector

A_i = the level of influence of the parameter vector or *i*-treatment from the formative assessment factor in the form of objective and essay tests (A)

ε_{ij} = a multivariate random error

The hypothesis test above was conducted by using the F-test and the Multivariate GLM analysis with "DESIGN = A." for the Test Block was conducted through the use of SPSS version 17.0. Therefore, based on the multivariate regression model above, several hypotheses were tested.

The first research hypothesis tested was "There are differences in the influence between VCD media and demonstrations learning strategies toward the skill of using a lathe". The statistical hypothesis could be written as follow:

H_0: $A_i = 0$ for all cell-*i*

H_1: is not H_0

or

H_0: $\mu_i = \mu$ for all cell -*i*

H_1: is not H_0

The test was conducted using the F-test and the results were analysed by GLM Univariate analysis with "DESIGN = A B A * B" for the Univariate Test Block. The results of the calculations using SPSS 17.0 GLM Y1 Y2 BY A / DESIGN = A. "CRITERIA = ALPHA 0.05" for Block Test of Between-Subjects Effects are as shown below.

Table 3. Testing the effect of VCD media and demonstration learning strategies on the skills of using a lathe. Multivariate Tests[b]

Effect		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	0.989	2.456E3[a]	2.000	57.000	0.001
	Wilks' Lambda	0.011	2.456E3[a]	2.000	57.000	0.001
	Hotelling's Trace	86.180	2.456E3[a]	2.000	57.000	0.001
	Roy's Largest Root	86.180	2.456E3[a]	2.000	57.000	0.001
A	**Pillai's Trace**	**0.145**	**4.838[a]**	**2.000**	**57.000**	**0.011**
	Wilks' Lambda	**0.855**	**4.838[a]**	**2.000**	**57.000**	**0.011**
	Hotelling's Trace	**0.170**	**4.838[a]**	**2.000**	**57.000**	**0.011**
	Roy's Largest Root	**0.170**	**4.838[a]**	**2.000**	**57.000**	**0.011**

Source: Primary Data processed by using SPSS version 17.0

The data in Table 3 shows that the F values of 4,838a are compatible with Pillai's Trace test, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root, but with the significance value of 0.011 <0.050. This means that the first null hypothesis proposed in this study was rejected and the alternative hypothesis accepted.

Therefore, it can be concluded that the application of the strategies gave different outcomes, thereby showing that learning strategies have different effects on acquiring the skills of operating a lathe.

This conclusion was also supported by the acquisition of descriptive statistics, which show that the average learning outcomes of turning by students using VCD media were 81.03 and higher than the demonstration which was found to be 74.13. This shows that the use of VCD has more influence on turning practice. Furthermore, students' skills, training, and development of practical tasks help in providing feedback to the teacher on the ways to improve the learning outcomes of using a lathe.

The learning outcomes were meant to provide students with information about the background knowledge about the machine and encourage the psychomotor abilities embedded in them, especially to formulate the mission, goals, and objectives of the practical skills in turning. In achieving these, there is a need for the training, development, and evaluation of each process involved.

However, the use of VCD was considered to be meaningless because it has significant effects on students that can memorise and none on those that really want to understand. Therefore, the method is most useful for memorisers. The use of VCD as a learning media, according to Carroll and Joice (2013), involves learning the whole information needed by memorising the displayed practical steps.

Meanwhile, demonstration is a form of learning media that aids understanding of a concept. Bambang W (2009) reveals they are designed to measure learning outcomes where the elements to be emphasised are sought, created and compiled by the students. The method gives room for an independent arrangement of steps and practice activities needed in formulating skills. Based on these explanations, it can be deduced that there are differences in the results of practising turning between students who are given VCD media and those given demonstrations.

Another research hypothesis tested was "There are differences in the influence of learning strategies with VCD media and demonstrations toward the skill of using a lathe" The statistical hypothesis could be written as follows:

H_0: $(AB)_{ij} = 0$ for all i & j

H_1: is not H_0

or

H_0: $\mu_{ij} = \mu$ for all cell -(i,j)

H_1: is not H_0

The test was conducted using the F-test and the results were analysed by GLM Univariate analysis with "DESIGN = A B A * B" for the Univariate Test Block. The data in Table 3 above shows that F values are good for Pillai's Trace test, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root.

It also shows that the students of Technology State Vocational Schools in Kupang City each has F value = 12,647a and significance value of 0.001 <0.050. The first null hypothesis proposed was rejected and the alternative hypothesis was accepted. Therefore, this means there are differences in the results of learning practice in turning between Vocational students who were taught using VCDs and Demonstrations.

Based on the explanation above, it could be concluded that the learning strategies produced different learning results.

Testing the Univariate Hypothesis

According to Sukardi, (2008), the univariate hypothesis test was conducted by using the results of the most complete regression analysis of ANAVA stated above, i.e. $Y_{ijk} = \mu + A_i + \varepsilon_{ij}$

The hypothesis to be tested was about the differences in the effect of VCD media and demonstrations learning strategies on the skills of using a lathe for low mechanical talented students.

The statistical hypothesis could be written as:

H_0: $A_{k}._i = 0$ for all cell -i, and k = 1,2,..

H_1: is not H_0

or

H_0: $\mu_{k}._i = \mu$ for all cell -i, and k = 1,2,..

H_1: is not H_0

The test was conducted by using the F-test and results were analysed by GLM Univariate analysis with "DESIGN = A." for Block Test of Between-Subjects Effects using SPSS version 17.0.

Testing the Univariate Main Effect Hypothesis

The multivariate hypothesis test was conducted by using the most complete regression model, namely: $Y_{ijk} = \mu + A_i + \varepsilon_{ij}$ as stated above.

The test was conducted by using the F-test and results were analysed by GLM Univariate analysis with "DESIGN = A." for the Multivariate Test Block using SPSS version 17.0.

Based on the multivariate regression model above, the hypothesis tested was "The differences in the effect of VCD media and demonstrations learning strategies on the skill of using a lathe for low mechanical talented students".

The statistical hypothesis could be written as below:

H_0: $A_i = 0$ for all cell -i

H_1: is not H_0

or

H_0: $\mu_i = \mu$ for all cell -*i*

H_1: is not H_0

The results of the calculations by SPSS 17.0 GLM Y1 Y2 BY A / DESIGN = A. "CRITERIA = ALPHA 0.05" for Block Test of Between-Subjects Effects using SPSS version 17.0 are as shown below:

Table 4. Testing the Learning Strategies on Learning Outcomes and Turning Practices on All Groups with *Multivariate Tests*[b]

Effect		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	0.989	2.456E3[a]	2.000	57.000	0.001
	Wilks' Lambda	0.011	2.456E3[a]	2.000	57.000	0.001
	Hotelling's Trace	86.180	2.456E3[a]	2.000	57.000	0.001
	Roy's Largest Root	86.180	2.456E3[a]	2.000	57.000	0.001
A	**Pillai's Trace**	**0.145**	**4.838[a]**	**2.000**	**57.000**	**0.011**
	Wilks' Lambda	**0.855**	**4.838[a]**	**2.000**	**57.000**	**0.011**
	Hotelling's Trace	**0.170**	**4.838[a]**	**2.000**	**57.000**	**0.011**
	Roy's Largest Root	**0.170**	**4.838[a]**	**2.000**	**57.000**	**0.011**

Source: Primary Data processed by SPSS version 17.0

Table 4 shows the data on the second main hypothesis which states that there are differences in the mean results of turning practice of all groups based on the learning strategy factor.

The statistical hypothesis could be written as:

H_0: $A_i = 0$

H_1: is not H_0

Or by using its contrast:

H_0: $\mu_i = \mu$ for all cell -*i*

H_1: is nor H_0

The data in Table 4 above shows F values of 4.838a to be compatible with Pillai's Trace test, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root in finding the main effects of treatment (objective versus essay) on practical ability in turning by students of State Vocational Schools in Kupang, NTT, but with the significance value of 0.011 <0.050. This means that the first null hypothesis proposed in this study was rejected and the alternative hypothesis accepted. This shows there are differences in the effect of VCD media and demonstrations' learning strategies on the skill of using a lathe for low mechanical talented students, thereby, producing varying learning outcomes.

It was discovered that for students with low talent in turning, the average learning outcomes of VCD learning media is higher than students that underwent demonstrations. This is reinforced by the acquisition of descriptive statistical scores that showed average learning outcomes of turning students using VCD media to be 82.40 and 82.47 and those under demonstration to be 66.80 and 66.93.

The learning outcomes of students with a low talent for turning are psychological needs. This is important because of their slow response and stimulus, dealing with changes

without internal motivation, and as a result of this, they usually wait to be instructed or asked by teachers, parents or friends before they do anything. Caroll and Joice Bruce (2013) explain that they tend not to practise turning if there are no external stimulating factors and lack initiative for their own encouragement and willingness to practise.

Therefore, to achieve practical learning outcomes of turning, there is a need for guidance and development through each psychomotor learning process. According to Lowter and Rossello (2013), teachers need to improve the students' understanding of psychomotor skills during turning practice. Therefore, a skill assessment must be continuously conducted in order to get the feedback needed for improvement.

Furthermore, demonstration is more suitable than VCD media for students with low talent for turning because it focuses more on making sure students understand the process intensively rather than memorise it. It has also been observed to be a method of stimulating them to learn the practices in more detail (Carroll and Joice Bruce, 2013).

Conclusion

It was discovered from the research that there was a difference in the effect applying VCD media and demonstrations of learning strategies towards the skills of using a lathe and for low talented students of Mechanical or Automotive Engineering department at State Vocational High Schools 2 and 5 in Kupang City.

Suggestion

It is recommended that turning learning practices should be prepared both in theory and practice by the teachers with the use of mature and relevant theoretical sources. It was also suggested that the practice of turning and the use of lathe machines should be arranged in a group with good working standards for all the students to practice at the same time.

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