'Direct Training' Practical Learning Model on the Teaching Material Diesel Fuel Injection System

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Article Info	Abstract
	This research and development study developed a direct training of practical learning model on the teaching material diesel fuel injection system. It aims to determine the validity, practicity and effectiveness of the practical learning model on the teaching material diesel fuel injection system. The study employed research and development (R & D) method with before after without pretest and posttest control design. This study adopted three stages: planning, implementation, and evaluation. The results showed that the direct training of practical learning model was valid. The validity was shown by the average score of the 1st expert on the second cycle of 3.77 and the 2nd expert on the second cycle of 3.46 with a highly valid category and highly feasible to use. The results of the practicity questionnaire given to 20 students and 2 teachers shown as very practice with the final score 86.60. In addition, the assessment of learning effectiveness was performed using T- Test with a significance level of 95%. The result of paired samples T – Test showed the probability value = 0,000 < 0,05 and the average value of gain test = 0, 67 indicating an increase in the medium category. It can be concluded that the direct training of practical learning model was proven able to improve the students skills on diesel fuel injection system.

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INTRODUCTION

Education and technology are demands that must be fulfilled to improve the quality of human resources (HR). Improving the quality of human resources can be done through the education in Vocational High School (SMK), because vocational school is school-based skill which graduated has aplicative skills to be able to directly dive into the workplace. Students practical skills can be measured by considering: 1) Quality of work (accuracy, speed, and results); 2) Operational skills, 3) Ability to read pictures, diagrams, and jobsheets; 4) Traffic analysis (Leighbody in the Ministry of National Education, 2008: 4-5). The student skills must be supported by facilities and infrastructure compatible with the competencies taught (Sudiyono, 2016: 91). It appropriate with research of Muchlisin and Sudiyanto's (2017: 1) says the result of student skills can be improve by facilities and infrastructure.

Gamble (2013: 224) explains that the learning model in vocational education consisted of three fundamental dimensions: 1) Formal subject or technical, 2) Practical workplace experience, 3) Pedagogic expertise. The government began seriously with Vocational Schools because that slogan of 70th, 71st, 72nd, and 73rd of Indonesian independence adopted the occupation from Germany. Based on the percentage, vocational school ratio are 80% more than public school ratio at 20% (Atika,2017:10).

In 2005, a policy issued by the Minister of National Education, Bambang Sudibyo encouraged an increase in the ratio of vocational high school : high school at 70:30. It has increasing number of Vocational Schools in Semarang City. Majoring in automotive currently ranges from thirty-two (32) schools consisting of seven (7) Public Vocational Schools and twenty-five (25) Private Vocational Schools. Based on the last 10 years, vocational schools in Semarang with automotive majors showed that five private vocational schools which were still relatively new. The result of a survey on the five (5) Vocational Schools. The Askhabul Kahfi Vocational School more complete than other Vocational Schools. Though the completeness of facilities and infrastructure is very important to use as a learning media and learning innovation that aims to improve student knowledge.

The direct training of practical learning model is new innovation in the learning process. This practical learning model using learning aids in subjects of diesel fuel injection systems to overcome the lack of learning facilities and infrastructure. In one conditions, the used of In one conditions, the used of learning model was considered to be able to improve students' abilities because students can practice directly using actual objects. Relevance to research (Royani, Mirawati, & Jannah, 2018: 1) the direct learning model based on practicum is able to improve students' critical thinking skills and abilities. Related with direct training of practical learning model, many learning model have been carried out with teaching aids, such as research by Derlina & Afriyanti, (2016: 1) saying the use of media assisted by learning models has been shown to improve students' skills and creativity. In addition, Seto, & Wijaya's (2017: 1) say that used media assisted on learning proved effective to understanding by student learning in the otomotif educations.

Research of Mursid (2013: 32-33) and Prayogi, S., & Muhali, M. (2015:1) both proved effective in improving students thingking skills, Kelly et al. (2016) showed that it has advantages in reflecting on students' practical work skills. Fakhri, Hadromi, & Widjanarko (2018: 106) has advantages in the validity of the model, practicity of the model and effectiveness of the model. Ismail, Samsudi, and Widjanarko (2017: 5) showing effectiveness of learning and improving student attitudes.

In addition, the other research studies that use learning aids such as Pratiwi, & Linuwih (2017: 48) and Putra, Dantes, & Nugraha (2017) both proved to be improving to understanding concepts in practicum and students learning outcomes. While the research Dariyati, Marhaeni & Widiartini (2015) and Kurniawan (2013:95) are proven to improve students psikomotor skill. Based on the results of previous studies above, it's inline with the purpose of the research to be carried out to knowing that the direct training of practical learning model are able to improve the abilty of students with testing the validity of model, practicity of model, and effectiveness of model. The implementation of this model consisted of three stages: planning, process practical learning, and evaluation

METHOD

The study employed research and development with 4D design consisting of define, design, develop, and disseminate stage. Based on figure 1, this study was conducted on the development stage, the dissemination stage was performed by testing on a limited scale in students due to funding constraints and the research and development coverage (R & D) is very wide.

This study resulted in the product of direct training on practical learning model to improve students' practical skills. The evaluation analysis of learning outcomes was carried out experimentally by comparing with the situation before and after the study with technical assistance without pretest-posttest control group design.
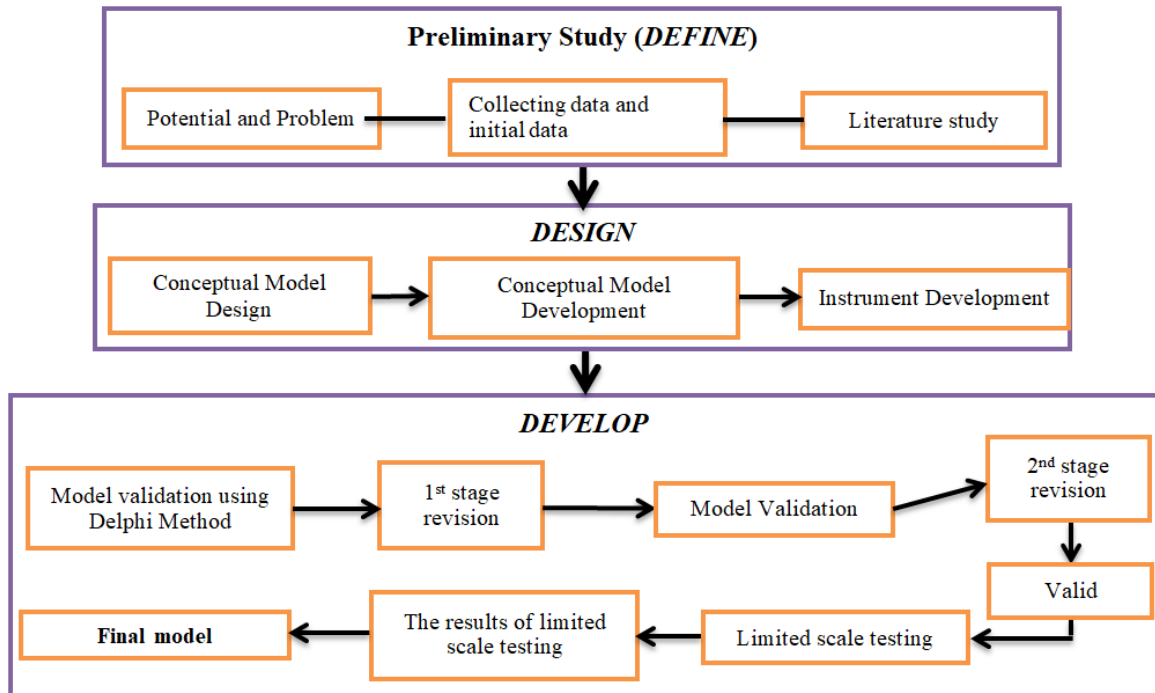
Figure 1. R & D Design Direct Training of Practical Learning Model

The techniques and instruments for collecting the data in this study consisted of quantitative and qualitative collection techniques. Quantitative data collection employed model assessment questionnaire, learning administrations questionnaire (syllabus, lesson plan, teaching materials and job sheet), cognitive skill test (multiple choice question), and students' practical skills assessment instrument. In addition, the observation was performed for qualitative data collection. A summary of techniques and instruments for data collection can be seen in table 1.

Table 1. Techniques and Data Collection Instruments

Research Steps	Data collection technique	Instrument
Model Validation	Questionnaire by expert judgement	Validation Sheet
Model effectiveness	*pretest and posttest*	Questionnaire, Problem
Practicality of the Model	Questionnaire	Questionnaire

RESULTS AND DISCUSSION

Testing practical learning model with trainer – assisted diesel fuel injection system consists of validity, practicality, and effectiveness. Testing the validity of the learning model was performed by using Delphi exercise technique which resulted in the average final score shown in table 2.

Table 2. Results of Expert Validation on the Model

Category	The Evaluation of Model Validity	
	Drs.Supraptono M.Pd	Dr. M. Burhan Rubai Wijaya M.Pd.
Average score	3. 77	3. 46
Criteria	Very Valid	Very Valid
Information	Very valid for implementation	Very valid of implementation

Based on the results of the table above. the average score of the 1st expert validation score on the cycle II was 3.77 and the expert score on the cycles II was 3.46. The results were categorized as very valid and feasible category. Therefore. it can be concluded that the practical learning model uses a fuel injection system diesel trainer is suitable / valid and can be implemented in the field. The final model can be seen in Figure 2 about the direct training of practical learning model

Practicality testing was performed by distributing a practicality test questionnaire to 20 students and 2 teachers. The results of the practicality score are shown in table 3.

Table 3. Practical Test Results

Category	Model Practical Assessment	
	Students	Teacher
Average score (%)	85.70	87.50
Criteria	Very Valid	Very Valid
Information	Very valid for implementation	Very valid for implementation

Based on the calculation results. the mean score of the students was 85.70% and the mean score of the teacher was 87.50%. Those values were above 80%. It can be concluded that the direct training of practical learning model is very practical to use.

The direct training of practical learning model is effective if there is difference in pretest and posttest after the implementation of direct training on practical learning model based on the results of T test. Before T test. normality and homogeneity tests were conducted. The results of the normality test can be seen from the results of the sig calculation. The normality test was performed using Shapiro Wilk. The probability value was 0.064 for the pre – test and the post – test is 0.179 where the value is> 0.05. Therefore. it can be concluded that the data were normally distributed. In addition. the results of homogeneity test obtained probability value = 0.061 > 0.05. Therefore. the data are homogeneous.

T-test was performed to find out the significant results of t_{stats} and t_{table}. The results of the T-test on the pre – test and post – test showed that the mean score of pre – test was 58.30 and the that of the post – test was 84.10. The probability value of the paired samples t-test showed a value of 0.000 <0.05 (95% confidence level). Therefore. it can be concluded that there was a difference between before and after learning. The average graph of the pretest and posttest can be seen in Figure 3.
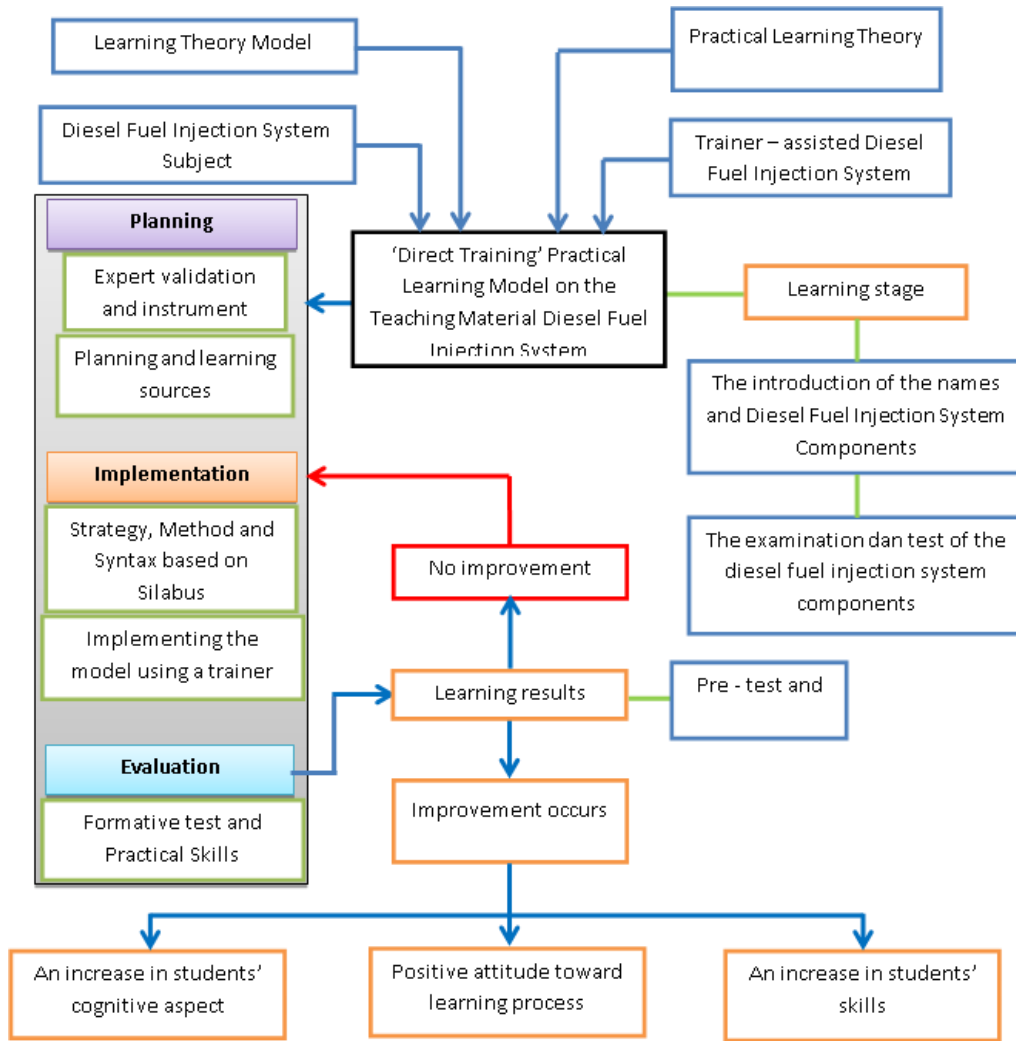
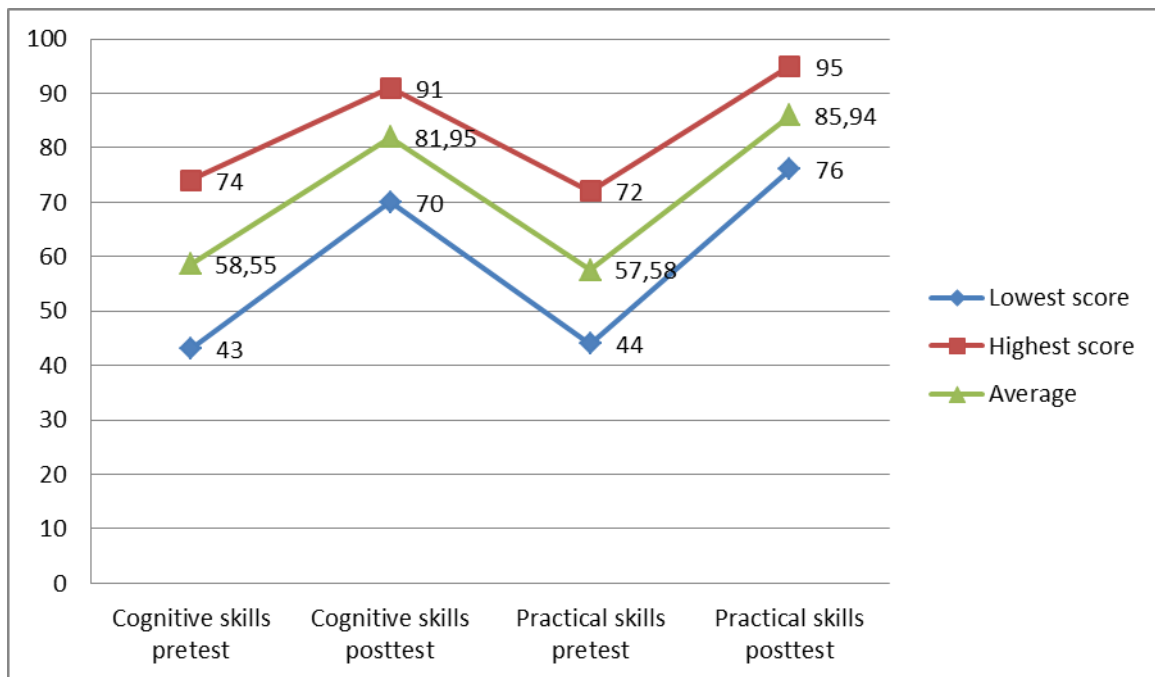**Figure 2.** Direct Training of Practical Learning Model

Figure 3. The Average graph of Pretest and Posttest Results

N-gain test was carried out to determine the improvement in the direct training of practical learning model. The results of n–gain test showed that there is an increase which can be categorized in the medium category. The results can be seen in table 4.

Table 4. Gain Test Results

Results	Score			Category
	Pretest	*Posttest*	Gain Test	
Skill Test	58.55	81.95	0.56	medium
Practical skills	57.58	85.94	0.67	medium
Total Mean Score	58.06	83.59	0.62	medium

Student competency assessment is the final result of research that aims to find out whether students are competent or not. Of the 20 students. 3 students were categorized as excellent and 7 students were in the good category. The highest score of practical skills was 93 and the lowest score was 74. The results can be seen in table 5.

Table 5. Results of Practice Skills

Score	Exact Score	Total students	Category
Highest	93	3	Excellent
Lowest	74	1	Good
Value 81-92	81-92	10	Very good
Value 75-80	75-80	6	Good

The direct training of practical learning model is a model created with the aim of increasing the ability of vocational school students on aspects of cognitive. affective. and practical skills. Therefore. it is necessary to develop a model that is valid. practical and effective to achieve the objectives of the model. In the development of direct training on practical learning model consisted of several stages including the define. design. and develop stages .

The define stage contained initial steps to find information and data which were used as the first step in the research. This information revealed the development of private vocational school majoring the automotive engineering in Semarang in the last 10 years. and there were five (5) private vocational high schools.The data from five private vocational high school showed that the schools lacked of facilities which affected their practical learning activities. The many students obtained scores under the learning mastery score. especially during the practicum of diesel fuel injection systems. Based on these findings. it is necessary to develop an appropriate learning model to overcome the problem of the low scores and lack of practical media facilities by developing a practical - based learning model as a variation in learning process. The direct learning of practical learning model aiming to help students improve their practical skills. Therefore. the practical skills can be used as after their graduation. This is in line with Hanrahan. et al..(2018 : 78) and Chavan. SK. Chavan. KD. Giri. PA. Jogdand. S. S (2014) stating that learning with the help of simulations can improve students' skills and motivation .

The design phase in this study resulted in the design of conceptual models and empirical models of the development of practical learning model using the trainer – assisted diesel fuel injection system. This model was developed in accordance with existing learning in vocational schools such as adjusting core competence and basic competence of Automotive Engineering Program. injection system syllabus. lesson plans. and practical teaching materials. In addition. the research instrument was developed to assist in collecting useful data or information to answer research problems. The research instrument used in this study was used to determine the validity. practicity and effectiveness of the learning model.

The development stage was the next step after the planning stage. This stage included: 1) validation and revision of the learning model and its lesson administrations. 2) validation of assessment instruments of cognitive and skills aspect. and. 3) validation of the practicality of the learning model. 4) Limited scale testing. 5) the Final model. The validator assessed those aspects and provided feedback regarding learning models based on the learning objectives. The validated model was tested in the field to adjust the model to the condition in the field. The results of the testing are then evaluated to obtain the final model on direct training of practical learning model.

Based on the results of the evaluation. the model was then analyzed for its validity. reliability and effectiveness. The results of the evaluation showed that the direct training of practical learning model was valid. practice . and effective to improve the practical skills of vocational school students. The new findings in this study explaining that the use direct training of practical learning model in automotive learning is proven to improve students skill in teaching materials on diesel fuel injection systems.

The advantages of using direct training of practical learning models are: 1) provide new innovations in automotive learning. especially in teaching material diesel fuel injection system. 2) making it easier for students to understand the teaching materials of diesel fuel injection systems because students can observe directly on the actual objects. 3) improve student skills in practical learning because the fuel injection system diesel trainer can be used repeated. 4) make it easier for students to prove concepts that are already understood by the actual state of things in a diesel fuel injection system.

The results of this study are inline with earlier research such as research Ferris. & Aziz (2005) the use of learning models to improve cognitive aspects. affective and psychomotor. especially in the professional skills of work. Mursyid's research. (2013) shows that practical learning model is proven to improve the effectiveness of learning. motivation. creativity and skills of students in engineering technology courses.

Research by Djatmiko. Sunyoto. & Hertanto. D. B. (2016) where the results state that effective learning models in improving students' abilities in the learning of Electric Motors Direct Current. In addition. research by Rahdiyanta. D.. Hargiyarto. P.. & Asnawi. A. (2016) proves that the practical learning model can improve the quality of learning outcomes and student learning activities in engineering courses.

CONCLUSION

The results of the study showed that the final score of the model validity in cycle II with a mean score of 3. 615 with a very valid category and very applicable for use. Therefore. the practical learning model using the trainer – assisted diesel fuel injection system is very valid and very applicable in learning process.

Practicity test conducted on teachers and students showed a percentage of 87.50% and 85.70%. Therefore. it can be categorized as "very practical". The mean score of the practicality test given by students regarding practical learning model using trainer – assisted diesel fuel injection system in automotive engineering program was 86.60%. The trainer – assisted diesel fuel injection system was categorized as very practical to be used in learning.

The effectiveness test results based on T- test showed 0.000 <0.05. which means there is a difference between before and after the implementation of the model with a confidence level of 95% . This result was corroborated by the results of gain tests. The score total n-gain was 0.62. Four students had increasing test scores in high category. and 16 students increased their scores in the medium category. It can be concluded that there was a significant increase in the students' practical skills after the implementation of trainer – assisted diesel fuel injection system.

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