Development of Performance Assessment of Car Air Conditioning Skills in Learning of Automotive Vocational

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ABSTRACT
The purpose of this research is to develop performance assessment in automotive engineering learning. This research is development research. The development model used by the ADDIE model consists of five stages, namely analysis, design, development, implementation, and evaluation. Performance assessment validation was carried out by 10 experts including: automotive materials experts and automotive learning experts. The test instrument used is a performance test. Data analysis used descriptive analysis. The results of the study are: (1) the quality of performance assessment according to expert judgment, has a validation of 0.90; This means that the performance test items in the vacuum work process in vehicle air conditioning meet the content validity requirements.

Keywords: *Performance Assessment, Car Air Conditioning, Automotive Vocation.*

1. INTRODUCTION

Ideally, the performance assessment aims to assess the process and learning outcomes of students on job-related abilities. This is in accordance with the purpose of the assessment, namely assessing the process and learning outcomes. Process assessment aims to improve the learning process, while the assessment of learning outcomes to assess the achievement of learning outcomes (learning outcomes).

The current real condition, assessment has received less attention from teachers in learning processes and products. The teacher places more emphasis on aspects of the content (material) of learning, while assessment becomes an aspect that gets less attention in the learning cycle. The teacher's ignorance of the importance of assessment tends to produce a learning process that has "dry" meaning for students. The teacher only conveys learning material, while students learn the subject matter from the teacher but do not know what the subject matter is for. This indicates that teachers lack professional competence.

In automotive engineering vocational learning in Vocational High Schools a performance assessment is required that refers to the competencies tested. The goal is that the performance assessment instrument can accurately measure/validate the competencies possessed by students.

Some teachers in automotive engineering vocational schools still carry out conventional assessments, for example measuring students' skill competencies using written tests without performance tests. In fact, to measure automotive vocational competence, proper competency test tools are needed, such as performance tests.

The case that occurred in automotive vocational schools, in learning about car air conditioning, the teacher conducted a written assessment in the form of descriptions and cognitive assignments to obtain information on learning outcomes in car air conditioning subjects, even though the car air conditioning subject emphasized more on the skill (psychomotor) aspect.

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Therefore, it is very important to develop performance assessments for automotive vocational skills in the automotive expertise sector at vocational schools, so that graduates who have skills in the field of car air conditioning are produced using the right measuring tools.

The formulation of the problem is: "How is the Development of Performance Assessment on Car AC Skills in Automotive Vocational Learning?"

2. THEORETICAL REVIEW

2.1 Performance Assessment in Automotive Vocational Learning

Assessment is an important component in the administration of education. The quality of education can be seen from the quality of learning and the quality of the assessment/assessment system [1]. Assessment of learning has a role in determining student learning outcomes [2]. Learning outcomes are abilities that can be produced by students which involve measurements in the cognitive, affective and psychomotor domains [3].

Assessment is a collection of information about student performance, to be used as a basis for making decisions, all assessments must refer to predetermined learning objectives [4]. The purpose of the assessment (assessment) is to determine the level of achievement of learning objectives and improve the teaching and learning process [5].

Assessment of learning outcomes in automotive vocational learning is carried out through observing changes in behaviour to assess students' psychomotor development. Assessment of mastery of competency aspects of skills or psychomotor competence in automotive vocational competence students is carried out by means of a performance assessment [6].

Automotive subjects at Vocational High Schools are subjects that equip students with automotive expertise that can be used as life skills for students after graduating from Vocational High Schools. Automotive learning in SMK is taught with a variety of automotive skills in accordance with the interests and talents of students.

2.2 Car Air Conditioning (AC)

Automotive air conditioning is a cooling system that is widely used in modern cars today. The cooling system is not intended for the engine but to impart cooling effect to the occupants inside the vehicle in hot weather. The air conditioning is a mechanical process for simultaneous control of temperature, humidity, and air motion [7]. Automotive air conditioning system is a looping process of heat transfer which is composed of the process of evaporation and condensation. During the evaporation the refrigerant absorbs heat and changes from liquid to vapor henceforth for the condensation the process is vice versa [8]. There are many ways to do the study on the automotive refrigeration system which is through the experimental and the computer simulation software [9]. For the experimental, the performance test can be done through the real car experiment and through the test rig experiment. The test rig is a rig which the automotive air conditioning system is installed outside of the vehicle itself. This method was developed due to the small space from the real car air conditioning system so it helps and is easy to do the experiment. The automotive refrigeration test rig usually consists of basic air conditioning from vehicles such as a compressor, condenser, evaporator, and a motor that drives the compressor belt. Since most of the automotive refrigeration test rigs use motors, therefore the electrical energy consumption is used instead of the fuel [10].

In general, the performance of the refrigeration system is greatly influenced by several factors. The influencing factors include refrigerant type, cooling load, refrigerant recharging period filled in the system, compressor type, compressor rotation, system working pressure etc. One of the refrigeration system applications is used in air conditioning systems that are used to cool room air. The use of Air Conditioning, especially in car air conditioners, is increasing, and system performance is influenced by the above factors [11]. The current problem in general is that the air conditioning system is a heavy burden on the vehicle engine so that fuel consumption will increase during its use [12].

The development of performance assessment on air conditioning in cars is limited to the process of emptying air in air conditioning in cars (vacuum) (Figure 1).

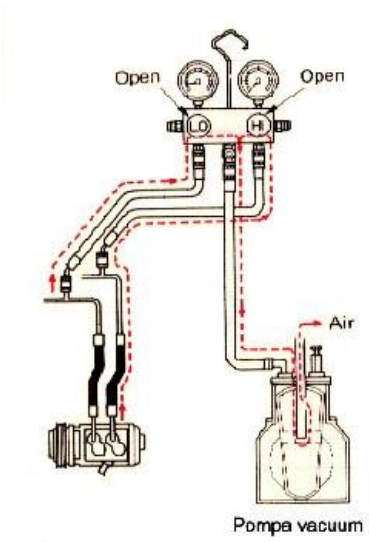

Figure 1. development of performance assessment on air conditioning in cars [13].

The picture above is the working steps of the air conditioning vacuum in the car. The following are the

working steps of the air conditioning vacuum in the car, namely:

1. Open one of the manifolds and start the vacuum pump
2. Look at the size on the vacuum gauge, until it shows +/- 600 mmHg (23.62 inHg; 80 kPa)
3. Open the other valve so that the vacuum works from both sides to make the vacuum pump work more efficient
4. Look again at the size on the vacuum gauge and make sure the system is clean from air and moisture with the pointer number at 750 mmHg (29.53 in Hg; 99.98 kPa)
5. Close both manifolds before turning off the vacuum pump

Wait about 15 minutes, look at the manometer if there is a decrease it means there is a leak

3. METHOD

The performance assessment development model uses the ADDIE model [14] Considerations for selecting the ADDIE development model because the learning design model is through an effective and efficient system approach and the process is interactive. This model consists of 5 phases, namely: Analyze (Analysis); Design (Design); Development (Development); Implementation (Implementation) and Evaluation (Evaluation) [15].

In the analysis stage, it consists of five types of activities carried out, namely the initial-end analysis, namely the analysis carried out to elicit and determine the basic problems faced by teachers in learning automotive material for car air conditioning. Student analysis, namely the analysis carried out to see and examine the characteristics of students based on their needs and development as a reference point for designing the development of performance assessments in automotive learning.

The purpose of the design stage is to prepare a performance assessment instrument design in automotive learning. This stage consists of four steps, namely: preparing the instrument grid, determining the instrument scale; making assessment criteria or rubrics, and designing performance assessments. this stage is to produce a performance assessment instrument that has been revised based on input from experts and field tests. This stage consists of several stages, namely: expert validation and teacher validation.

The steps for implementing performance assessment in automotive learning are designed and implemented according to their roles and functions in schools. In implementing the product, the following things must be done: prepare the tools needed during the learning process such as learning materials, assignments to be given and assessment instruments to be used, namely performance assessment and coordinating with the teaching teacher so that there is good collaboration between the developer and Teacher. Program implementation is going according to plan, and more specifically described in product trials.

The evaluation phase is carried out to evaluate the product development process from analysis to product implementation. The steps carried out are as follows: Contacting experts including learning content experts, learning design experts, and learning assessment experts; Providing assessment instruments to learning content experts, learning design experts, and learning assessment experts; Analysis of the results of the assessment of experts and the implementation of field trials.

Product trials in this development research consist of: trial design through two stages, namely validity level trials and effectiveness level trials. The test subjects in this study were conducted by 10 (ten) subject matter experts, instructional design experts and learning assessment experts. Subject matter content experts are teachers in automotive vocational high schools. The learning design and assessment expert for reviewing the performance assessment design is an automotive lecturer at the Indonesian Education University.

Data analysis used descriptive qualitative and quantitative (percentage) analysis. This qualitative descriptive analysis technique is used to process data from the review of subject content experts, learning design experts, learning assessment experts and student trials. This data analysis technique was carried out by grouping information from qualitative data in the form of input, responses, criticisms and suggestions for improvement contained in the questionnaire. The results of this analysis are then used to revise the product. developed.

Quantitative descriptive analysis is a way of processing data that is carried out by systematically compiling in the form of numbers or percentages, regarding an object studied, so that general conclusions are obtained [16]. The instrument test carried out is the instrument validation test from the results of the performance test. Analysis of the results of the research instrument validation test was carried out using the Content Validity Ratio (CVR). The stages of processing instrument validation are carried out by: (1) criteria for expert/validator responses. The expert response data obtained is in the form of a checklist, namely: a score of 1 for suitable criteria and 0 for inappropriate criteria; (2) scoring the item answers using the CVR [17]. The CVR formula is:

$$CVR = \frac{n_e - N/2}{N/2} \quad (1)$$

where: ne = the number of validators who agree
N = total number of validators

The CVR calculation results are in the form of numbers 0 – 1. The value categories are as follows.

Table 1. CVR Value Categories.

Criteria	Information
0 – 0.33	Invalid
0.34 – 0.67	Valid
0.68 – 1	Very valid

4. CONCLUSION

The product produced in this study is a performance assessment instrument. Product development begins with the analysis and planning stages. The analysis phase aims to determine the appropriate competencies for performance appraisal, develop competency-based process indicators and learning outcomes and design tasks to be used in performance appraisal. Furthermore, at the planning stage, the following steps were carried out: compiling the instrument grid; develop instrument scales and create scoring criteria or rubrics.

The quality of product development results, explained three main points, namely the results of the subject content expert test, the learning design expert test and the learning assessment expert test. Project product development is carried out through the stages of content testing, learning design and learning assessment [19].

Subject content expert test, this product was assessed by automotive subject teachers at Bandung Vocational Schools. The instrument used for the subject matter expert trial was a performance test of the air conditioning vacuum process in a car. Test the learning design expert, the performance assessment product is assessed by the learning design expert. Test learning assessment experts, value assessment products by learning assessment experts.

The development of this performance assessment went through three stages, namely the subject content expert test, the learning design expert test, and the learning assessment expert test. Based on the expert test, the work process instrument was revised to the sequence of work steps for the vacuum process in air conditioning in cars.

Based on the content validity test, data was obtained that: (1) two performance test items number 1 and 2 were declared invalid; and (2) five performance test items were declared valid, namely number 3, 4, 5, 6 and number 7.

From the results of the focused discussion, information was obtained that the performance test items number 1 and 2 did not include vacuum performance in the air conditioning system in cars, but included performance in the manifold gauge installation process for car air conditioning work. The following is a draft of a car air conditioning vacuum process performance test (Figure 2).

Figure 2. Draft of a Car Air Conditioning Vacuum

Table 2 The results of the content validity test of the car air conditioning vacuum process performance test.

Work Process Assessment	Performance Test Items	Validator Score		CVR	Resume
		Ne	N		
Vacuum (empty air) on the car air conditioner	Attach the manifold to the compressor with the yellow hose to discharge (high pressure)	4	10	0.2	Invalid
	Attach the manifold to the compressor with the blue hose to the subcooling (low pressure)	4	10	0.2	Invalid
	Look at the size on the vacuum gauge, until it shows +/- 600 mmHg (23.62 inHg; 80 kPa	8	10	0.6	valid
	Open one of the manifolds and start the vacuum pump	9	10	0.8	valid
	Look again at the size on the vacuum gauge and make sure the system is clean from air and moisture with the pointer number at 750 mmHg (29.53 in Hg; 99.98 kPa)	10	10	1.0	valid
	Close both manifolds before turning off the vacuum pump	10	10	1,0	valid
	Wait about 15 minutes, look at the manometer if there is a decrease it means there is a leak	9	10	0,8	valid

The process of vacuum work (empty air) in car air conditioners is as follows; (1) Open one of the manifolds and start the vacuum pump; (2) Look at the size on the vacuum gauge, until it shows +/- 600 mmHg (23.62 inHg; 80 kPa); (3) Open the other valve so that the vacuum works from both sides to make the vacuum pump work more efficient; (4) Look again at the size on the vacuum gauge and make sure the system is clean from air and

water vapor with the pointer at 750 mmHg (29.53 in Hg; 99.98 kPa); (5) Close both manifolds before turning off the vacuum pump; (6) Wait about 15 minutes, look at the manometer if there is a decrease it means there is a leak.

5. CONCLUSION

The results of the study were in the form of a calibration assessment of the performance of air conditioning on vehicles with test material for the vacuum process on car air conditioners. Based on content validity, it was concluded that the performance test items met the validity requirements.

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