

## Evaluation of Technology Literacy Capabilities Through Automotive Simulator Assisted Learning

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**Abstract.** The purpose of the study was to assess student learning outcomes on automotive technology literacy skills in aspects of automotive technology knowledge and competence. The research method used descriptive method. The time of the study was carried out from January to March 2022. The research location is in the automotive study program vocational high school in Cimahi City. The research sample used cluster random sampling, 1 (one) class of 35 students was selected. The research instrument was a multiple-choice technological literacy test. Technological literacy indicators consist of identifying scientific problems, explain scientific phenomena, and using scientific evidence. The scope of the test questions is air conditioning in the vehicle. The test questions were validated by five automotive teachers and lecturers. Automotive learning treatment virtually and face to face, using simulator media. Data analysis using percentages. The results of the study show that 46.6% of students have automotive technology literacy skills in terms of knowledge and competence, 71% of students have scientific identification skills (car air conditioning issues), 46% of students have literacy using scientific evidence and 40% have literacy in explaining scientific phenomena.

**Keywords:** Technology literacy, automotive simulator, assisted learning

### INTRODUCTION

Automotive learning innovation is interpreted as a learning process with creative ideas, for example from teachers who use lectures then teachers innovate by means of teachers doing learning using automotive simulators. The limitations of practical facilities (laboratory) make teaching teachers not based on the achievement of student competencies. Likewise, students practice just carrying out the teacher's orders through practical work sheets. Non-conventional learning resources and educational media are still not utilized by teachers, so that many school graduates do not have global character competencies (Grigorescu, et.al., 2020; Munawar, 2021).

The limitations of automotive learning facilities also result in obstacles to automotive technology literacy skills in students. The results of observations in a vocational high school in Bandung describe the condition of practice facilities with past tools, and limited learning media. The limited practice tools and learning media make the learning process not optimal for the teacher.

Automotive learning has learning characteristics that emphasize hard skills and soft skills. In automotive knowledge, students are expected to be able to apply knowledge, tools and materials for automotive work practices when doing automotive practice. In automotive practice, students are expected to have skills in work processes and produce work products that have quality and time standards.

Alternative problem solving is the innovation of automotive vocational learning using an automotive simulator to improve technological literacy skills. The question in this study is whether automotive simulators can improve automotive technology literacy in vocational high school students?

### LITERATURE REVIEW

#### Literacy of Technology

Literacy comes from the word literatus which means marked by letters, literate, or educated. According to Rose (2007) and Chandra (2014), the term technological literacy can be interpreted as the

ability to use technology, especially in learning and teaching science and the ability to inquiry, the ability to evaluate and make a decision.

Technological literacy ability can be measured by a test that refers to the 2014 NAEP framework where there are 3 competencies in technological literacy assessment, namely: (1) Understanding the basic principles of technology, focusing on students' knowledge and understanding of technology and their ability to think and reason with that knowledge; (2) Developing solutions and achieving goals, which refers to students' systematic application of knowledge, tools, and technology skills to solve problems; (3) Communicating and collaborating, centered on students' ability to use contemporary technology to communicate for various purposes and in different ways of working (Feerrar, 2019; National Assessment Governing Board, 2014).

In this study, the definition of technological literacy adopts scientific literacy according to the 2012 PISA framework. Literacy consists of the following aspects of context, knowledge, competence, and attitudes: (1) The aspect of literacy context involves important issues related to technology in everyday life. Literacy assessment items are designed for contexts that are not only limited to school conditions, but also in the context of student life in general; (2) Competency Aspect, literacy is focused on several aspects of competence, namely: identifying scientific issues, explaining scientific phenomena based on scientific knowledge, and using scientific evidence to draw conclusions; (3) Knowledge Aspect is describing the extent to which students can apply their knowledge in contexts that are relevant to their lives (Hovde, & Renguette, 2017). Fakhriyah (2019) that the teaching materials of the developed scientific literacy concepts were effective in improving the students' computational thinking skills.

Assessment of technological literacy, researchers or education practitioners usually uses guidelines from ETS (Educational Testing Service) (Stukalenko, et.al., 2016). This assessment focuses on the cognitive domain, namely problem solving and critical thinking skills associated with the use of technology to organize information (Ellis, 2013). The measurement of technological literacy assessment is through seven performance areas, namely define, access, manage, integrate, evaluate, create, and communicate (Irvin, 2007).

### **Simulator of Air Conditioning Automotive**

Simulator is a learning media that can be used to solve problems in the learning process (Blikstein, et.al, 2017; Rifdarmon, 2018). Simulators can replace expensive practice tools used in workshops. Simulators can be used in many contexts, including technology. Therefore, simulation tools continue to be developed and are now an important tool in training and learning (Bui, Cat, & Hong, 2008).

Simulator is a teaching model with the assumption that not all learning processes can be carried out directly on the actual object. Dress rehearsal is an example of a simulator, which demonstrates the process of learning a lesson. The simulator process is designed to be close to reality where movements that are considered complex are deliberately controlled (Burchert, et.al., 2014 Rahayu, 2015).

Simulator is a simulation where the objects displayed have dimensions of width, length and depth. Simulated objects can appear like the real thing, because the dimensions are not only length and width, but also depth, coupled with the right shadow fiber lighting effect, the result is more original impression of the simulated object (Smetana, & Bell, 2012). Simulator is a combination of media and tools/real objects for the delivery of subject matter so that communication becomes more memorable.

According to Helaludin (2019), the development of simulator-assisted automotive learning in the context of knowledge (cognitive domain) can be developed into four pillars of competence, namely: (1) factual knowledge; (2) conceptual knowledge; (3) procedural knowledge; and (4) metacognitive knowledge. Factual knowledge includes the basic elements used to understand the problem. Elements are usually symbols that relate to real or concrete things. Conceptual knowledge, including competencies that demonstrate an understanding of the basic relationships among eleven in a broader

structure. Procedural knowledge, including knowledge and understanding of how to do something (technical know-how), and criteria for using skills. Metacognitive knowledge, is a competency that involves knowledge of cognition in general and awareness of self-understanding.

In this study, a vehicle air conditioning simulator was developed which was made as closely as possible to the conditions in the vehicle, as shown below.



Figure 1. Car AC Simulator  
(Source: Personal Document)

An air conditioner is a device that maintains the air in a room or cabin to a pleasant temperature and humidity. In vehicles, the process of air conditioning occurs in the cabin space. Cabin space is part of the vehicle, which is a closed room and is only intended for passengers. Cabin space usually has four or two passenger doors, plus one separate luggage door from the passenger cabin. The air in the cabin space is regulated or conditioned, such as air circulation, air humidity, and air cleanliness. The air conditioner grille is usually also located in the cabin space, which functions as a guide for air from the evaporator into the cabin space. (Liu, et, al., 2015).

## METHODS

This study used a descriptive method, this research that uses the size number or frequency as its description. The research location is in a state vocational high school with an automotive study program in the city of Bandung. The research sample using cluster random sampling was selected 1 (one) class of 35 students. The research instrument is a technology literacy test in the form of multiple choice on aspects of basic automotive knowledge. Technological literacy indicators consist of: (1) Identifying scientific problems; (2) Explaining scientific phenomena; and (3) Using scientific evidence. The scope of the test questions includes air conditioning material in vehicles. The test questions have been validated by five teachers and lecturers of automotive technology experts. To determine the validity and reliability used ANATES V4. The treatment of automotive learning is virtual and face-to-face, using simulator media. Data analysis uses basic statistics by calculating the percentage of automotive technology literacy achievement in the aspects of knowledge and competence. The percentage of literacy achievement is interpreted descriptively based on the criteria for student learning outcomes (Arikunto, 2013), with the following criteria:

Table 1. Automotive Technology Literacy Ability Criteria

Score	Criteria
66 - 100	Good
40 - 55	Enough
0 - 39	Not good or bad

Research data in the form of scientific literacy test results on aspects of knowledge and competence in automotive technology literacy are interpreted based on these criteria.

**RESULTS AND DISCUSSION**

The results of data analysis of automotive technology literacy skills by calculating the average number of students who answered correctly on each item are as follows.

Table 2. The Results of The Analysis of Automotive Technology Literacy Skills

Indicator	Number of question					Mean per indicator	
	1	2	3	4	5		
Layout of air conditioning components on the car	N	27	25	18	23	21	23
	%	.77	.71	.51	.66	.60	65.7%
Functions of air conditioning components in cars	N	6	7	8	9	10	16
	%	.77	.51	.54	.46	.46	45.7%
Air conditioning cycles and processes in cars	N	11	12	13	14		10
	%	.31	.26	.34	.49		28.6%
The average of the total test items = 46.6%							46.6%
N = 35							

Note:

N : The number of students who answered the question correctly

% : Percentage of students who answered the question correctly

Based on Table 2, it can be seen that the average automotive technology literacy ability in the aspects of knowledge and competence is 46.6% with the achievement category "enough". The data also provides information that the questions that are able to be answered by students with the "good" achievement category are five questions (item no. 1, 2, 4,5, and 6), the questions answered in the "enough" category are six questions (item no. 3, 7, 8, 9, 10 and 14), and the questions that can be answered in the "less" category are three questions (item no, 11, 12, and 13).

The research data related to automotive technology literacy skills in the aspect of knowledge and technological competence shows that two aspects of knowledge are included in the good category, namely: (1) the function of the air conditioning component in the car which was answered by 45.7% of students and (2) the layout of the air conditioning component. 65.7% of students answered the air in the car, while one aspect of technology competence was included in the sufficient category, namely the air conditioning cycle in the car, which was answered by 28.6% of the students.

Table 3. Knowledge Aspects of Automotive Literacy

Indicator of automotive literacy knowledge aspect	Percentage (%)	Category
Functions of air conditioning components in cars	45.7	Enough
Layout of air conditioning components on the car	65.7	Good
Car air conditioning cycle	28.6	Not Good

Based on Table 3, information is obtained that the percentage of achievement of the air conditioning cycle in the car, which was answered by 28.6% of the students in the "less" category. The results of this study support research (Kurniawati, 2021, Rini, 2021, Muhammad Mifta Fausan, 2021, Wahyu EPH, 2020) which states that the digital or scientific literacy skills of students are still relatively low, judging from the achievement of the scientific literacy indicators on the dimensions of content, proses and context

The results of the automotive technology literacy test analyzed per indicator on the automotive technology competency aspect are presented in Table 4.

Table 4. Automotive Technology Literacy Competency Aspect

Indicators of automotive technology literacy competency aspect	Percentage (%)	Category
Identifying car air conditioning issues	71	Good
Explain the phenomenon of car air conditioning technology	46	Enough
Using scientific evidence or data on car air conditioning technology	40	Enough

Based on Table 4, information is obtained that the percentage of achievement of automotive technology literacy skills on scientific identification indicators (car air conditioning issues) is 71% with the "good" category and the percentage of achievement on indicators using scientific evidence (car air conditioning technology data) is 46% with the "enough" category. While the percentage of achievement of scientific literacy on the indicators explaining scientific phenomena (the phenomenon of car air conditioning technology) is 40% with the "enough" category. Based on students' automotive technology literacy skills in the automotive technology literacy competency aspect, it can be seen that the highest competency indicators are achieved by students on indicators of identifying scientific issues, then competence using scientific evidence and indicators explaining scientific phenomena. The results of this study support research (Wulandari, 2016, Yu, W. F., She, H. C., & Lee, Y. M., 2010 and Zoller, U., 2016), which states that the achievement of literacy skills on the indicators of the ability to use scientific evidence is indicated by identifying the assumptions, evidence, and reasons behind the conclusions drawn in solving problems around the concept of heat matter. Rofi Rofaida (2019) showed that digital literacy still needed to be improved. The indicator of the ability to use scientific evidence is illustrated by the ability of students to interpret scientific evidence and draw conclusions by interpreting the data contained in tables and pictures on the automotive technology literacy test instrument.

The ability to identify scientific issues by 40% is shown by students with the ability to recognize key issues and characteristics of the phenomena contained in the automotive technology literacy question instrument. Students' ability to identify scientific issues is closely related to the aspects of automotive technology knowledge that they understand regarding the concept of car air conditioning. The results of this study support research (Yogi B.P., 2020 and Soewarto H., 2021), which states that the digital information literacy skills affected student learning achievement.

Based on cognitive learning theory, students use their prior knowledge to process new information by relating the new information to their prior knowledge (Lyle & Robinson, 2001). The level of cognitive aspects contained in students' memory affects students' ability to identify scientific issues. Aspects of competence to explain scientific phenomena achieved by 46% with the achievement category "enough" indicated by the ability of students to apply the knowledge of car air conditioning that they have understood in solving automotive technology literacy problems on the concept of car air conditioning material. The concept of knowledge possessed by students affects their ability to describe or interpret scientific phenomena. The "enough" category obtained in the indicator of explaining this scientific phenomenon illustrates the ability of students who have not been optimal in explaining scientific phenomena triggered by several factors that will affect the achievement of automotive technology literacy skills.

## CONCLUSION

Automotive technology literacy skills of vocational high school students in the aspect of automotive technology knowledge competence are included in the good category, while in the automotive technology literacy competence aspect it is enough. The literacy ability of automotive technology in the aspects of knowledge and competence is 46.6% with the achievement category "good". The literacy skills of automotive technology in the knowledge aspect are in good categories,

namely: (1) the function of the air conditioning component in the car and (2) the layout of the air conditioning component in the car. The automotive technology competence aspect is in the “sufficient” category, that is the air conditioning cycle in the car.

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