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The Analysis of Technological Literacy Capabilities in Automotive Learning Using a Minicar Vechicle Simulator at a Vocational School

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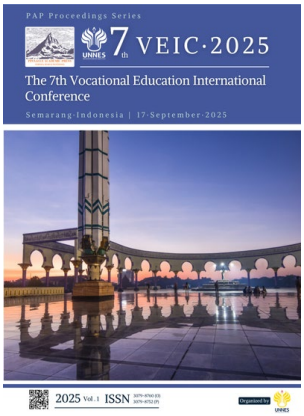

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Abstract: This research wants to explain the technological literacy abilities of vocational school students in automotive learning using a minicar vehicle simulator. Descriptive method was used in this research. The research period is January-June 2025. The research was conducted at a state vocational high school in Bandung and Cimahi of the city. The samples came from nine groups (schools) of students as a population, then group was taken as a sample with a total sample of 360 students. Data collection techniques use tests. The test is a technological literacy test on basic vehicle knowledge aspects. Technological literacy has indicators of the ability to: identify problems, explain phenomena and utilize scientific evidence. The technological literacy test refers to material about vehicles in general. The research instrument was validated by seven teachers as experts. Data analysis using percentages was carried out by calculating students' correct answers on test. The results of the study show that: (1) Students' technological literacy skills in the aspect of identifying problems achieved 25%, which is classified as "poor"; (2) In the aspect of explaining scientific phenomena, 43% achieved, which is included in the "fairly good" category; (3) In the aspect of using scientific evidence, 32% achieved, which is included in the “not good”.

Keywords: technological literacy; minicar vehicle simulator; automotive learning

1. Introduction

The application of automatic control systems in the automotive sector makes a shift from mechanical (conventional) control to electronic control. Schools cannot anticipate system changes in automotive work in the industrial world. Schools are unable to provide the latest automotive technology learning media. This makes the backwardness of the world of education even more real and ironic.

Limited practical facilities (laboratories) make teachers teach instead of referring to students' achievement of competency. Likewise, students learn only to carry out teacher orders through student worksheets. The latest technological educational media have not been utilized by teachers, as a result many graduates do not have the competencies appropriate to the world of work and have a global character. (Wahid, 2021). [1] Therefore

innovation in automotive technology learning is needed in vocational high schools. Learning innovation is interpreted as teachers having creative innovation ideas, for example teachers who usually use the lecture method carry out teaching innovations by using learning media such as simulator media. When the facilities and prices are too expensive for automotive tools such as cruise control systems, learning media can be replaced with models, simulations or prototypes. Simulation is an experiment in a computer in which the actual system is replaced by program execution, or a program that imitates the behavior of the actual system.

Based on observations during learning at a vocational high school in Bandung, worrying data was obtained that students had never carried out practical work on basic cruise control system competencies. Autotronics learning has never used a simulator to be able to understand the cruise control system. Teachers only use the lecture method in delivering learning material. Based on interviews with teachers, the cause is the unavailability of practical tools or simulation tools for learning the cruise control system.

Learning about automotive is learning that emphasizes abilities in the form of knowledge, processes and work attitudes. Students learn about automotive knowledge and continue to learn automotive practices to gain skills. Knowledge and skills constitute automotive technology literacy. This research question is how automotive technology literacy is among vocational school students ?.

Technological literacy is defined as the ability to utilize technology when learning technology, inquiry, evaluation and the ability to make decisions [2].

According to Embung (2021), technological literacy encompasses all knowledge and skills in utilizing technology, from recognizing the device, operating it, processing and communicating information. Technological literacy plays a role in the interaction process during the learning process (Rini, 2022) [3]. Literacy is the basis of the abilities that students possess when participating in learning at school (Riries, 2023) [4]. In this research, technological literacy is defined in accordance with scientific literacy based on PISA 2012. Literacy consists of aspects of context, knowledge and competence, namely: (1) Aspects of the context of literacy related to technological issues in real life; (2) Competency aspects, such as: identifying issues, explaining phenomena, and using scientific evidence to draw conclusions; (3) The knowledge aspect is literacy which describes students being able to apply their knowledge in contexts [5].

Riawan (2022), literacy represents the ability to use information and communication technology to find, evaluate, create, and communicate information, which requires cognitive and technical skills. Technological skills have a positive impact on improving a person's performance, reinforced by research from (Öncül, 2020) [6]; (Li et al., 2021) with the technological skills a person has, their performance will be better. However, in contrast to research from (Okeji et.al., 2020), which found that technological literacy does not have a significant impact on individual performance [7].

Learning media is one factor that influences student learning outcomes [8]. The learning media used at SMKN, particularly for the Light Vehicle Engineering major, still uses outdated methods, making it difficult for students to understand the lessons and tending to get bored quickly due to their complexity and frequent loss or damage of components used in the teaching materials. Kresna and Ari (2020) [9].

According to Fauziyah (2020), miniature media is a learning medium that can be used in the learning process for subject matter. This media can facilitate students' memory and understanding of the material because its 3-dimensional form eliminates the need to imagine the shape.

Ahmad's (2024) research revealed that miniature conveyor machine learning media was created with the ability to count and sort items according to the working principles transferred by the PLC, so that students can better understand the PLC's working principles [10].

The minicar simulator is a medium that can be used to overcome problems in automotive learning. Simulators can be used as a replacement for expensive practical

equipment used in laboratories. Simulators are used in a technological context. Therefore, simulation devices are an important tool in learning.

In this research, a minicar simulator was developed with the help of a cruise control system which was made as similar as possible to the conditions in the vehicle, as shown in the figure 1.

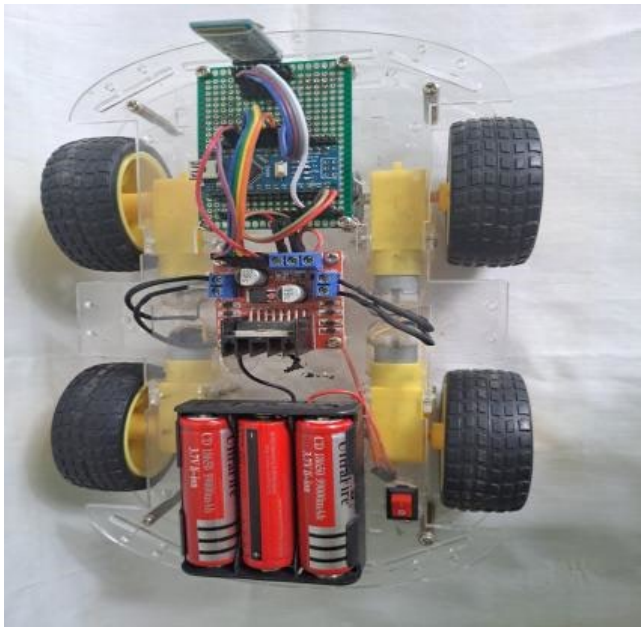

Figure 1. Minicar simulator assisted (Source: Private Document).

2. Materials and Methods

The purpose of this study is to describe the technological literacy skills of automotive study program students at vocational high schools. The research treatment is through automotive learning using miniature cars. The research variable is automotive technological literacy in the aspect of automotive knowledge. This study uses a quantitative descriptive method. The research population is all grade X students of the automotive study program enrolled in the even semester at one of the public vocational high schools in Bandung in the 2024/2025 academic year. The research sample is 360 grade X students with a cluster random sampling technique, namely by randomly selecting three classes in three vocational high schools in Bandung as research samples.

The research instrument is a multiple-choice automotive technology literacy test on basic automotive knowledge aspects. The technology literacy indicators consist of: (1) Identifying scientific problems; (2) Explaining scientific phenomena; and (3) Using scientific evidence. The test questions cover basic automotive material.

The problem identification indicators consist of: (1) the definition of automotive (vehicles) and (2) the benefits of vehicles. The indicators explain scientific phenomena consisting of: (1) the causes of vehicles moving forward; (2) the causes of vehicles stopping. The indicators use scientific evidence consisting of: (1) the starter system; and (2) the braking system.

The test questions were validated by experts consisting of five automotive teachers. Out of the initial 24 test items, 18 were declared valid by the experts. Subsequently, construct validity testing reduced this to 15 valid items. The reliability was calculated, yielding a coefficient of r = 0.74. Data analysis was carried out by calculating the percentage of technological literacy abilities. The percentage of literacy achievement was interpreted descriptively based on the criteria for student learning outcomes proposed by Suharsimi (2013), as shown in Table 1 [11].

Table 1. Criteria of Technology Literacy Capability.

Score	Criteria
66.0 – 100.0	Good
40.0 – 55.0	Enough
0.0– 39.0	Not enough

3. Results

This study describes the technological literacy skills of automotive engineering students at a vocational high school. Technological literacy focuses on contextual aspects, specifically topics that discuss basic automotive problem-solving knowledge relevant to students' lives. Based on the results of tests conducted on three basic automotive topics, the following technological literacy skills were obtained as shown in Table 2.

Table 2. The Results of Literacy Technology of three Indicators.

Indicator	Number of Question					Average
	1	2	3	4	5	
Identifying scientific problems: What is the tool or object that makes the vehicle move?						
N	100	100	80	80	90	90
%	0.28	0.28	0.22	0.22	0.25	0.25
Explaining scientific phenomena: Why can vehicles move?						
N	160	150	150	160	150	154
%	0.44	0.42	0.42	0.44	0.42	0.43
Using scientific evidence: How the vehicle starts and stops						
N	110	120	110	110	120	114
%	0.31	0.33	0.31	0.31	0.33	0.32

Note: N: The number of respondents who answered the question correctly. %: Percentage of respondents who answered correctly. Number of respondents = 360, Number of item test = 5.

Figure 2. Shows that the average number of students who answered correctly on three question topics related to the technological literacy context aspect is: (1) 25% of students have the literacy ability to identify problems; (2) 43% of students have the technological literacy ability in the aspect of explaining scientific phenomena; and (3) 32% of students have the technological literacy ability in the aspect of using scientific evidence.

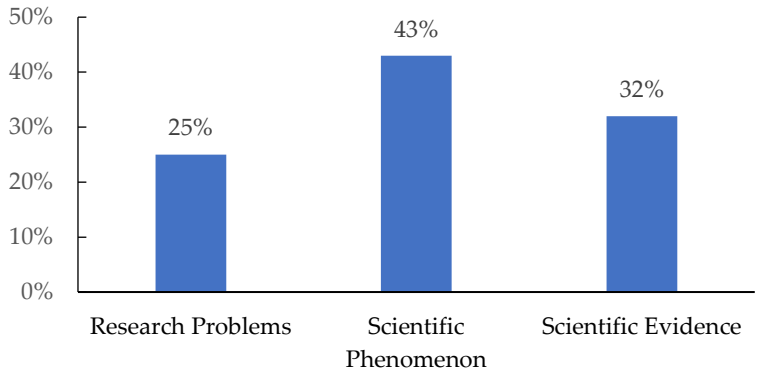

Figure 2. Results of research: automotive technology literacy.

4. Discussion

Based on the research findings, it was found that the average automotive technology literacy ability in the aspect of identifying scientific problems was 25% with an achievement category of "less good". The data also indicates that the 90 students with a "low" achievement level were able to answer five questions. This finding differs from Nisa's study, which found that scientific literacy skills in the scientific knowledge aspect were classified as "moderate." This difference is likely related to the differences in the literacy materials tested by the researchers. In Nisa's study, the literacy material related to "heat," while this study focused on "basic automotive science [12].

The research findings on explaining scientific phenomena showed that 43% achieved a "fair" achievement. The data also revealed that 150 students were able to answer five questions with a "fair" achievement. This finding aligns with Okeji's research, which found that students' ability to explain scientific phenomena was considered quite good.

The next finding was that the average automotive technology literacy skill in the aspect of using scientific evidence was 32%, with a "low" achievement category. This research data supports the findings of Nisa and Okeji's study, which stated low ability in the aspect of using scientific evidence. Vocational high school students' low literacy skills are suspected to be due to the lack of emphasis on critical and creative thinking skills in vocational high school instruction.

5. Conclusions

The results of the study show that: (1) Students' technological literacy skills in the aspect of identifying problems are classified as "fairly good"; (2) In the aspect of explaining scientific phenomena, they are included in the "not good" category; (3) In the aspect of using scientific evidence, they are included in the "not good" category.

References

1. Wahid Munawar, Application of Problem-Based Learning to Enhance Student Learning Outcomes in Basic Competencies of Maintaining Brake Systems, JOVES (Journal of Vocational Education Studies). Vol 4. No. 1. 2021. p. 89.
2. Embung Megasari Zam. Peran literasi teknologi informasi dan komunikasi pada pembelajaran jarak jauh di masa pandemi Covid-19. EDUTECH: Jurnal Inovasi Pendidikan Berbantuan Teknologi, 2021. 1(1). https://doi.org/10.51878/edutech.v1i1.176
3. Rini Nuraini, Pattiasina, P. J., & Ulfah, A. (2022). Peran literasi teknologi dalam dunia pendidikan al-Madrasah. Jurnal Ilmiah Pendidikan Madrasah Ibtidaiyah, 6(3). https://doi.org/10.35931/am.v6i3.1045
4. Riries, E. C., & Sihotang, H. Melangkah bersama di era digital: Pentingnya literasi digital untuk meningkatkan kemampuan berpikir kritis dan kemampuan pemecahan masalah peserta didik. Jurnal Pendidikan Tambusai, 2023. 7(3), 31712–31723
5. Riawan, W. W., & Kurniasi, R. Literasi teknologi dalam membentuk kualitas individu dimoderasi oleh transfer pengetahuan untuk peningkatan kinerja individu (guru). Jurnal Teknologi Pendidikan, 2022. 15(2), 95–104. https://doi.org/10.24114/jtp.v15i2.2374
6. Öncül, G. Defining the need: Digital literacy skills for first-year university students. Journal of Applied Research in Higher Education. 2020. https://doi.org/10.1108/JARHE-06-2020-0179
7. Li, Y., Zhou, C., Wu, D., & Chen, M. Evaluation of teachers' information literacy based on information of behavioral data in online learning and teaching platforms: An empirical study of China. Library Hi Tech. 2021. https://doi.org/10.1108/LHT-01-2021-0034
8. Okeji, C. C., Tralagba, E. C., & Obi, I. C. An investigation of the digital literacy skills and knowledge-based competencies among librarians working in university libraries in Nigeria. Global Knowledge, Memory and Communication, 2020. 69(4–5), 311–330. https://doi.org/10.1108/GKMC-05-2019-0
9. Kresna Warta Anugrah, & Ari Nurul Alfian. Augmented reality sebagai media pembelajaran komponen utama mesin mobil berbasis Android. Jurnal Mahasiswa Bina Insani, 2020. 5(1). https://ejournal-binainsani.ac.id/index.php/JMBI/issue/view/103
10. Fauziyah Nur, & Suparji. Penggunaan media miniatur dalam model pembelajaran berdasarkan masalah pada materi gaya dan momen di kelas X TGB 3 SMK Negeri 3 Surabaya. Jurnal Mahasiswa Universitas Negeri Surabaya, 2020. 1–10
11. Ahmad Yani. Pengembangan media pembelajaran berbasis miniatur mesin conveyor untuk praktik Programmable Logic Controller (PLC) di SMK. Journal of Innovation Research and Knowledge, 2024. 3(9), 2027–2076.
12. Suharsimi, Arikunto. Dasar-dasar Evaluasi Pendidikan. Jakarta: Bumi Aksara. 2013.

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