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Basic Literacy Skills of Vocational High School Students Based on Their Perceptions

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Abstract: Literacy in vocational high schools (VHS) plays an important role in improving the quality and success of graduates to be ready to face the world of technology-based work. However, the lack of literacy is still a major challenge for VHS students. This study aims to (1) describe the basic literacy skills of VHS students based on their perceptions, and (2) identify weaknesses in the basic literacy skills of VHS students. This study uses a descriptive quantitative approach. The sample consisted of 134 students from mechanical and automotive engineering vocational programs. Data collection was conducted using a closed questionnaire as an instrument. Then, the collected data is analyzed using descriptive statistics. The research results show that (1) the majority of vocational school students' literacy skills are at a moderate level, namely reading and writing 59.7%, numeracy 64.9%, science 69.4%, digital 67.9%, and culture 51.5%. (2) Among these, the lowest scores were in numeracy, with an average score of 63.89. This confirms that VHS students perceive numeracy as a different challenge and irrelevant to their field. This finding could be due to the limited integration of numeracy concepts into vocational learning; improvement of numeracy skills in vocational settings is essential to enhance students' abilities in technical fields. For future research, combining test-based evaluation with reported surveys would be more complete to obtain a more precise and objective assessment of literacy competency among VHS students. In addition, further research needs to explore the role of teaching methods and examine the impact of digital learning media on their literacy performance, especially in numeracy skills.

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INTRODUCTION

Technological developments have brought fundamental changes in various aspects of life, including education, which acts as the main foundation in facing this transformation. In the rapidly evolving digital era, mastering multi-faceted literacy is a crucial need for Vocational High School (VHS) students to adapt and compete in the 21st-century workforce (Tınmaz et al., 2022). The expanding influence of technology has made digital literacy an essential skill in educational settings (Khan, 2018). As an institution that focuses on applied skills, vocational education demands mastery of new literacies-such as data, digital, and human literacy-to ensure VHS graduates are highly competitive in the industry 4.0 era (Mukhlisin et al., 2022). Thus, literacy in VHS plays an important role in improving the quality and success of graduates to be ready to face the world of technology-based work.

In addition to digital literacy, it is important to consider other important literacy domains for VHS students. To improve competitiveness and ability to face the challenges of the 21st century, Indonesians must master six basic literacies, as agreed by the World Economic Forum in 2015, including reading and writing literacy, numeracy literacy, science literacy, digital literacy, financial literacy and cultural literacy. Mastery of these literacies must be accompanied by the development of critical thinking skills in problem-solving, creativity, communication and collaboration (Han et al., 2017).

Despite its crucial role in vocational education, literacy development in Indonesian VHS remains a significant challenge. Various assessments indicate that Indonesian students struggle with fundamental literacy skills, particularly in reading, numeracy, and science (OECD, 2016). The low literacy rates among

VHS students hinder their ability to acquire specialized knowledge, adapt to industry demands, and compete in an increasingly digital and globalized workforce. Addressing these literacy challenges is essential to enhance vocational education outcomes.

Literacy in vocational education encompasses multiple dimensions. Reading and writing literacy is a fundamental skill critical for academic and life success. Literacy goes beyond just the ability to read and write but also encompasses the ability to understand, interpret, and communicate effectively (Rupley et al., 2008). Numeracy literacy is proficiency in mathematical concepts and problem-solving, indispensable for many vocational fields. Jackson et al. (2021) describe it as "the ability to access, use, interpret, and communicate mathematical information to manage real-world demands. Science literacy is also crucial for engineering-based vocational programs. It involves understanding and applying scientific principles in technical tasks (National Academies of Sciences, Engineering, and Medicine, 2016).

Furthermore, it is imperative to emphasise the significance of cultural literacy, which is defined as the knowledge and appreciation of diverse cultural perspectives and traditions. This concept is particularly crucial in the context of navigating an increasingly globalized workforce and fostering cross-cultural collaboration (Khan, 2018). Cultural literacy is defined as the ability to understand, implement, and determine differences and similarities in one's attitudes, habits, beliefs, and communication (Riani et al., 2018). The integration of these diverse literacy skills into vocational education curricula and learning experiences is essential to empower students to thrive in the digital age (Khan, 2018; Tınmaz et al., 2022; Mukhlisin et al., 2022).

Numerous initiatives have been undertaken to enhance literacy in Indonesia. Nevertheless, challenges persist, particularly in ensuring that all students possess the requisite literacy skills. Notwithstanding this, a 2016 survey by Central Connecticut State University placed Indonesia 60th out of 61 countries, a mere one level above Botswana (Ramona & Supriatna, 2021). This finding underscores the necessity to fortify literacy skills in Indonesia, particularly among students. Reading activities have not been the focus of sufficient attention, particularly within the context of non-language subjects. In the study of normative, adaptive, and productive subjects, it is often observed that teachers do not employ text materials to cultivate higher-order thinking skills. This issue is further compounded by the minimal reading interest exhibited by students in Indonesia, which is a mere 0.01% of the total population (Darwanto et al., 2022).

Indonesia's science literacy is still low, as evidenced by the Pisa survey in 2015, ranking 64th out of 72 countries with a score of 403 and 63rd out of 69 countries in the numeracy literacy skills survey, with a score of 386 (OECD, 2016). Other data based on a survey 2020 digital literacy or the ability to utilize information and communication technology in Indonesia, show that the level of digital literacy in Indonesia has not yet reached the “good” level, with an index score of slightly above 3 out of 5 (Katadata Insight Center, 2020).

Issues regarding VHS students' literacy skill levels have been a longstanding concern in education. The ability to comprehend and critically engage with complex texts is essential for success in vocational programs, yet many students face significant challenges in developing these skills. Previous research indicates that in vocational education, the integration of reading and writing tasks, particularly through scenario-based approaches, has shown promise in enhancing literacy skills, leading to improved text quality among students (Konstantinidou et al., 2023). Furthermore, vocational contexts require students to engage with a diverse range of specialized texts, necessitating a nuanced understanding of disciplinary reading practices (Parkinson & MacKay, 2016).

Similarly, a review of teaching strategies for supporting VHS students' reading literacy emphasized the need for targeted instructional approaches that go beyond general reading comprehension. Vocational educators must teach the core content of their disciplines and explicitly address the unique literacy demands of their subject areas through integrated reading instruction. Developing these skills is critical for ensuring VHS students can successfully transition from the classroom to the workplace.

The implementation of literacy programs in VHS aims to nurture students' character through the integration of the school literacy ecosystem. Research has shown a significant correlation between school library-based learning and academic achievements, underscoring the critical role of literacy, including both traditional and digital competencies, in enhancing the quality of education (Anto et al., 2021).

Schneider & Foot (2013) emphasize the importance of proficient literacy skills in VHS, particularly for students majoring in mechanical and automotive engineering. Effective communication, both written and oral, is crucial in conveying complex concepts and solutions to diverse learners.

Previous research has review on literacy across all vocational fields (Lamada et al., 2019), while other research has focused on one aspect of literacy, such as digital (Noviyanto & Wijanarka, 2023), reading and writing (Konstantinidou et al., 2023; López et al., 2024), numeracy (Hall, 2014), scientific (Arthur, et al., 2021), and cultural literacy (Hui & Cheung, 2015). Meanwhile, manufacturing and engineering fields have not been revealed. Whereas literacy for manufacturing technology and engineering VHS students is an important demand for skill formation today, especially in the machining and automotive engineering programmes. Despite the increasing demand for technical skills in these fields, there is still a lack of study on how VHS students in mechanical and automotive engineering programs perceive their literacy competencies.

To address this gap, given the critical role of literacy in vocational education and the challenges faced by VHS students in Indonesia, it is imperative to assess their literacy skills with a focus on reading and writing, numeracy, science, digital, and cultural literacy. This study aims to (1) describe the basic literacy skills of VHS students based on their perceptions, and (2) identify weaknesses in the basic literacy skills of VHS students. Understanding students' perceptions of their literacy skills is fundamental as their perceptions reflect how they perceive their literacy skills. Perception data aims to explore students' beliefs, motivations, and attitudes towards literacy learning, which can provide insights that standardized ability tests may not. According to Bandura (1997) and Schunk & DiBenedetto (2020), self-perception or an individual's belief in their own ability (self-efficacy) has a major influence on academic performance and achievement in various contexts.

METHOD

Research Design

This study is descriptive quantitative research as it seeks to provide a detailed overview of a specific scenario, facilitating the visualization and analysis of data in an organized manner. Descriptive quantitative research is characterized by its objective nature, relying on numerical data to conclude the phenomenon under study (Mohajan, 2020). In addition, this approach systematically describes the facts or characteristics of a particular population or a particular field factually and accurately (Abdullah et al., 2022).

The stages of the research conducted are illustrated in Figure 1 below. A coherent explanation of the research stages after determining the research design is given in the next subsection.

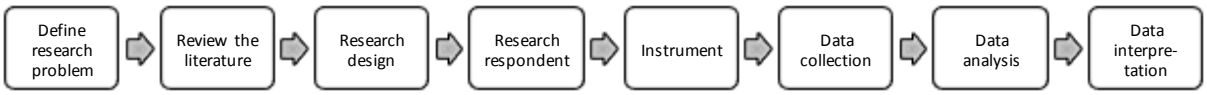

Figure 1. Research stage

Respondents

The research population comprises students from state and private VHS in Palangka Raya City, specifically in manufacturing technology and engineering, especially those with mechanical engineering and automotive engineering vocational programs. There were four schools that met the specified criteria. The selection of class XI students was informed by the fact that these students would be undergoing the Minimum Competency Assessment, a program designed to facilitate learning improvements during their school career. The total population of 220 students was reduced to a sample size of 134 with a random sampling technique, as outlined by Isaac Michael's formula, with a margin of error of 5% (Sarwono, 2006). Table 1 shows VHS students as respondents relevant to the research.

Table 1. Research Respondents

School Name	Field of Expertise	Vocational Program	Specialization	Quantity
VHS A	Manufacturing technology and engineering	Mechanical Engineering	Machining Technology	30
		Mechanical Engineering	Welding Technology	30
		Automotive Engineering	Light Vehicle Technology	30
		Automotive Engineering	Motorcycle Technology	30
VHS B	Manufacturing technology and engineering	Automotive Engineering	Motorcycle Technology	24
VHS C	Manufacturing technology and engineering	Automotive Engineering	Light Vehicle Technology	33
		Automotive Engineering	Motorcycle Technology	33
VHS D	Manufacturing technology and engineering	Automotive Engineering	Motorcycle Technology	10
Total				220

Table 2. Research instrument grid

Variable	Subvariable	Indicator
Literacy Skill	Reading and Writing	• Reading ability • Benefits of reading • Reading frequency • Processing information • Writing behavior
	Numeracy	• Number concept skills and arithmetic operations • Ability to use symbols and numbers • Analyzing tables
	Science	• Scientific knowledge ability • Identifying statements • Ability to draw conclusions
	Digital	• Computer operation skills • Ability to build information • Utilizing internet access • Presenting information • Communication and publication skills
	Cultural	• Understanding cultural complexity • Knowledge of local culture • Cultural awareness

Instrument

The Research instrument uses a closed questionnaire with a Likert scale with five answer choices. The questionnaire is used to obtain respondents' opinions on a statement or phenomenon about students' perceptions of their literacy skills. Questionnaire statement items are developed based on research variables, sub-variables, and indicators, which were developed into three statements for each indicator (see **Table 2**). Instrument validity testing was carried out on 30 students outside the research sample. The results of the instrument validity test using the product moment correlation technique showed that there are 24 instrument items whose values are below the *r table* (0.349). Consequently, the invalid items are revised, particularly for indicators that have not been fulfilled. The Cronbach's Alpha coefficient value for the instrument reliability test is 0.647, indicating a high degree of reliability for the research instrument.

Data Collection

The revised questionnaires were then printed and distributed to the respondents at the predetermined locations, namely at four VHSs. The research team took a direct approach by explaining the instructions, the importance of honesty in filling out the questionnaire, and guaranteeing that all information provided is confidential and used only for research purposes. Respondents then filled in the

questionnaire independently with guidance from the research team and teachers.

After the filling process, the completed questionnaires were collected and checked to ensure that there was no missing or incomplete data. The collected data were then manually inputted into the computer system for further analysis. This offline data collection method was chosen to ensure that all respondents had an equal opportunity to provide answers without depending on internet access or digital devices, and school policies on smartphone use were also considered.

Data Analysis

The results of the respondents' statements (questionnaires) were entered into the Microsoft Excel application and then analyzed using the Statistical Package for the Social Sciences (SPSS). The data were first converted into scores with a range of 20-100 and then analyzed descriptively (for example, frequency distribution, mean, and percentage). Data on literacy levels in reading and writing, numeracy, digital, science, and culture were divided into three categories: low, medium, and high. The research data was also presented in the form of tables or diagrams to facilitate interpretation.

Data Interpretation

The data interpretation stage in this study is reviewed in the discussion section, which aims to interpret the results obtained with reference to theory and previous research findings related to literacy skills and also convey the limitations of the research that may affect the findings.

RESULT

Basic Literacy Skill of Vocational High School Students

a. Reading and Writing

Literacy can be said to be the initial meaning of literacy, but the meaning has changed over time. In the context of this study, it is related to literacy, which at first was often understood as literacy, in the sense of not being illiterate, so reading and writing activities are synonymous with reading and writing activities. In this literacy, the indicators measured are reading ability, reading benefits, reading frequency, processing information, and writing behavior (Siddikova, 2024). The following are the research results for literacy skills across schools.

Table 3. Frequency distribution of reading and writing literacy

Category	Interval	Frequency	Percentage
Low	53 - 66	47	35,1%
Moderate	67 - 79	80	59,7%
High	80 - 92	7	5,2%
Total		134	100,0%

Based on Table 3, the majority of VHS students (59.7%) exhibited moderate literacy levels, while 35.1% were classified as low, and only 5.2% demonstrated high literacy proficiency. These findings suggest that while most students have basic reading and writing competencies, they may struggle with more complex reading and writing tasks. The significant proportion of students in the low category highlights persistent challenges in literacy development within vocational education. Limited literacy skills can affect students' ability to engage with technical materials, interpret instructions, and effectively communicate their ideas professionally.

b. Numeracy

Numeracy literacy refers to the ability to apply fundamental knowledge, principles, and mathematical processes in everyday life. This includes activities such as technical calculations, financial management, and interpreting tables. In this study, three key indicators of numeracy literacy are measured: the skills related to number concepts and arithmetic operations, the ability to use symbols and numbers, and the ability to analyze tables. The following presents the research findings regarding students' numeracy literacy skills.

Table 4. Frequency distribution of numeracy literacy

Category	Interval	Frequency	Percentage
Low	42 - 56	15	11,2%
Moderate	57 - 70	87	64,9%
High	71 - 84	32	23,9%
Total		134	100,0%

Based on Table 4, most VHS students (64.9%) demonstrated moderate numeracy literacy, while 23.9% were in the high category and 11.2% in the low category. This indicates that the majority of students possess basic numeracy skills but may still face difficulties with more complex mathematical concepts. Meanwhile, students in the high category demonstrate strong problem-solving abilities, including interpreting numerical data from technical diagrams, tables, and machine specifications. In contrast, only 11.2% of students were in the low category, suggesting that VHS students generally have stronger numeracy skills compared to reading and writing literacy.

c. Science

Science literacy is regarded as a multidimensional concept, encompassing not only a comprehension of scientific knowledge but also the capacity to think at a high level and apply the knowledge obtained to everyday life. It also involves an understanding of the relationship between science and other disciplines. The construct of science literacy comprises three distinct indicators: scientific knowledge ability, identifying statements, and the ability to draw conclusions. The following presents the results of the study on the average student's science literacy skills.

Table 5. Frequency distribution of science literacy

Category	Interval	Frequency	Percentage
Low	46 - 61	22	16,4%
Moderate	62 - 76	93	69,4%
High	77 - 92	19	14,2%
Total		134	100,0%

Based on Table 5, most VHS students (69.4%) demonstrated moderate science literacy, while 14.2% were in the high category and 16.4% in the low category. This indicates that while the majority have a basic understanding of scientific concepts, they require further development in applying scientific knowledge within vocational settings. A small proportion (14.2%) showed strong science literacy, suggesting their ability to integrate scientific principles into problem-solving and technical applications. Conversely, 16.4% of students struggled with basic scientific concepts, which could hinder their ability to master vocational skills requiring scientific understanding.

d. Digital

Digital literacy is the ability to understand and use information in various forms from a wide range of sources accessed through computer devices or other gadgets. The assessment of digital literacy comprises five indicators: computer operation skills, ability to build information, utilizing internet access, presenting information, communication, and publication skills. The following presents the results of the average research on students' digital literacy skills.

Table 5. Frequency distribution of digital literacy

Category	Interval	Frequency	Percentage
Low	41 - 59	15	11,2%
Moderate	60 - 78	91	67,9%
High	78 - 96	28	20,9%
Total		134	100,0%

Based on Table 5, most VHS students (67.9%) have a moderate level of digital literacy, indicating a basic understanding of digital technology. However, they still face challenges in more complex aspects, such as utilizing digital resources for technology-based learning and productive communication. A total of 28 students (20.9%) reached the high category, indicating that they are able to operate digital devices well and select and evaluate information critically. In contrast, 15 students (11.2%) were still in the low category, which is smaller than the low category in reading-writing and numeracy. This shows that although most students are familiar with digital technology in their daily lives, there are still gaps in its effective utilization for learning.

e. Cultural

Cultural literacy is defined as the ability to understand, implement, and determine differences and similarities in one's attitudes, habits, beliefs, and communication (Riani et al., 2018). The cultivation of cultural literacy has been demonstrated to engender numerous advantages in diverse realms of life. Of particular pertinence is its role in the development of a civilized nation. The study measured three indicators of cultural literacy: understanding cultural complexity, knowledge of local culture, and cultural awareness. The following will present the findings of the research on students' cultural literacy.

Table 6. Frequency distribution of cultural literacy

Category	Interval	Frequency	Percentage
Low	57 - 71	9	6,7%
Moderate	72 - 86	69	51,5%
High	87 - 100	56	41,8%
Total		134	100,0%

Table 6 shows that most VHS students (51.5%) have a moderate level of cultural literacy, 41.8% are in the high category, and only 6.7% are in the low category. This indicates that while most students understand cultural values, they still need support in applying these concepts in social and professional settings. The high percentage in the upper category suggests strong cultural awareness, enabling effective interaction with diverse backgrounds. Meanwhile, the small proportion in the low category indicates limited exposure to multicultural environments or culture-based education.

Weaknesses Basic Literacy Skills of Vocational High School Students

Figure 1 presents the differences in students' literacy skills across VHS. Then, the analysis of the data as a whole produced an average score of 84.30 for cultural literacy, indicating its superiority, as shown in Figure 2. Digital literacy received a mean score of 70.56 in the next ranking, which put it in second place. The average score for reading and writing literacy was 68.40, followed by science literacy (68.14) in fourth place and numeracy literacy (63.89) in fifth overall. Consequently, it can be said that VHS students' numeracy scores are the lowest of the five literacy skill domains.

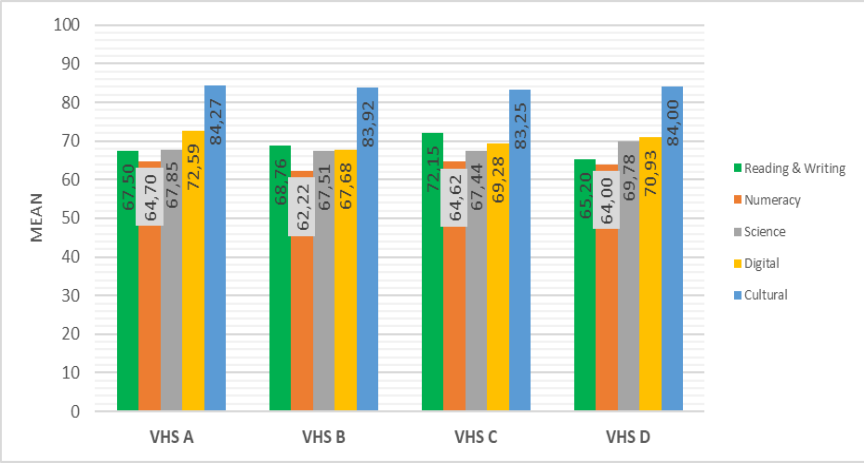

Figure 1. Overall literacy levels of VHS students

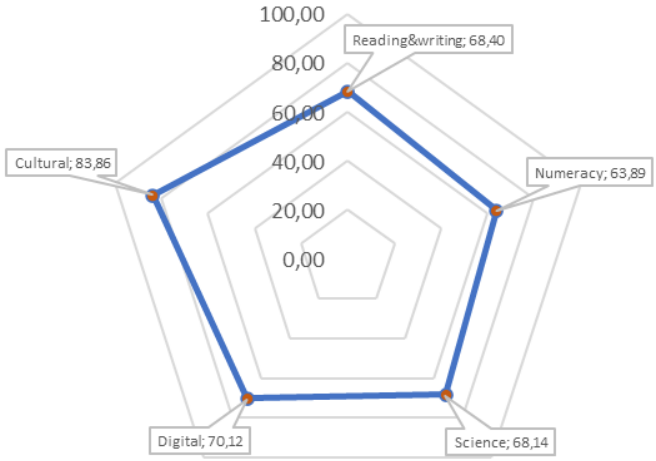

Figure 2. Average score of literacy skills of VHS students

DISCUSSION

Findings about reading and writing literacy indicate a gap in literacy skills that may hinder VHS students' ability to engage with technical materials and workplace communication. This aligns with previous research suggesting that literacy proficiency is a key factor in academic and professional success (Rittner, 2018). Moreover, in today's digital era, literacy education also plays a crucial role in fostering critical thinking skills, enabling students to evaluate information sources and identify misinformation (Prasastiningtyas et al., 2024).

Enhancing VHS students' employability requires strengthening their literacy, writing, and technical skills. Vocational literacy, particularly in mechanical and automotive engineering, is essential for developing competencies that align with industry demands. Studies indicate that low literacy proficiency in VHS students often correlates with difficulties in understanding technical manuals, interpreting symbols, and completing field-specific writing tasks (Parkinson & Mackay, 2016; Rahmawati, 2017). This skills gap can lead to inefficiencies in the workplace, contributing to lower productivity and limited career advancement opportunities (Maulana et al., 2022; Widayana, 2023).

Given these challenges, structured interventions in vocational education—such as integrating technical writing modules, enhancing reading comprehension strategies, and incorporating workplace literacy training—are necessary. Effective writing skills are crucial for documentation and communicating technical concepts clearly and ethically in professional environments (Kafrawi & Evizariza, 2022). Addressing these literacy deficiencies can significantly improve students' ability to meet industry requirements and reduce the unemployment rate among vocational graduates.

The findings about numeracy literacy align with previous studies indicating that numeracy literacy is essential in developing students' critical thinking and mathematical reasoning (Hall, 2014; Pratiwi et al., 2024). Research shows that students with strong numeracy skills can effectively apply mathematical concepts to real-life situations, improving their problem-solving abilities (Hall, 2014). This study supports this argument, as 23.9% of students demonstrated high numeracy literacy, which correlates with their ability to analyze technical data and perform mathematical calculations relevant to their field. However, the fact that 64.9% of students remain at a moderate level indicates that many still face challenges in higher-order mathematical thinking, requiring targeted instructional strategies to enhance these skills. Therefore, enhancing numeracy literacy in vocational education is essential, particularly in technical fields requiring precise mathematical calculations and data interpretation. Addressing the challenges faced by students in the moderate and low categories will better prepare them for industry demands and real-world problem-solving scenarios.

The findings about science literacy align with previous studies indicating that science literacy is crucial in vocational education, particularly in mechanical and automotive engineering. A strong foundation in science literacy enhances students' ability to understand technical manuals, interpret engineering symbols, and apply scientific data in real-world problem-solving (Parkinson & Mackay, 2016;

Cencelj et al., 2019). Research shows that students with strong science literacy can better engage with complex topics, such as climate change and biotechnology, which are increasingly relevant in engineering (Kelp et al., 2023). This is particularly important for VHS students, as 69.4% of them remain at a moderate level of science literacy. This finding supports the argument that vocational education needs to enhance science-based learning through applied and industry-relevant contexts (Arthur et al., 2021; Maulana et al., 2022).

One of the key challenges in developing science literacy is that many VHS students are not accustomed to reading and interpreting complex engineering texts or manuals. Science literacy also involves understanding engineering symbols and diagrams, such as technical schematics and machine component identification (Parkinson & Mackay, 2016). To address these gaps, implementing effective teaching models, such as guided inquiry, has been shown to enhance students' scientific literacy skills, particularly in vocational education (Yulianti et al., 2022). Case-based learning scenarios further improve conceptual understanding, enabling students to engage with more advanced technical tasks (Rahmat et al., 2023). The integration of digital learning media, such as science-based vocational e-modules, has also been found to support independent learning and strengthen conceptual mastery (Maulana et al., 2022).

The findings about digital literacy show that although most students have a fairly good level of digital literacy, not all students can utilize it optimally in a vocational context. This is in line with previous research, which shows that access to technology and the quality of digital-based learning affect students' competence in the world of work (Purwaningrum et al., 2022). In this context, the finding that 67.9% of students are in the medium category indicates that most students still need to improve their digital skills to meet industry demands. Previous studies also revealed that digital literacy affects work readiness by 2.99% in mechanical engineering programs, indicating the importance of technology reinforcement in vocational learning (Noviyanto & Wijanarka, 2023).

The implications of these findings suggest that improving digital literacy is critical in supporting the work readiness of VHS students. These skills contribute to technical understanding and improve competence in adapting to rapidly evolving industrial technology (Anwar & Sudira, 2022). Therefore, it is necessary to strengthen digital-based learning programs, such as e-learning and industrial technology training, to improve students' competence in the technology-based workplace.

The findings about cultural literacy align with previous research, indicating that VHS students benefit from culturally integrated education (Hui & Cheung, 2015). While 51.5% of students have a foundational understanding of cultural values, greater engagement in activities that foster cultural awareness is needed. The high percentage in the upper category suggests that school and community efforts in promoting cultural literacy have been effective. However, the predominance of students in the moderate category highlights the need for additional initiatives to enhance their ability to navigate multicultural environments.

Research shows that VHS students in technical fields, such as mechanical and automotive engineering, benefit from culturally enriched curricula that enhance interpersonal skills and cross-cultural communication (Hui & Cheung, 2015). Strengthening cultural literacy is crucial for preparing students to collaborate in diverse workplaces, where understanding different perspectives can improve teamwork. Therefore, integrating culturally immersive learning experiences—such as industry collaborations, intercultural workshops, and workplace simulations—can enhance students' adaptability in globalized work environments.

Numeracy is one of the basic literacy skills that must be mastered by VHS students, especially in mechanical and automotive engineering programs. In this field, students are expected to be able to interpret measurements, analyze technical data, and apply mathematical reasoning in various practical tasks. Based on the results presented in Figures 2 and 3, the study's findings indicate that numeracy skills had the lowest average score compared to other literacy domains. This suggests that while students may develop proficiency in reading and writing, they struggle to integrate mathematical concepts into their learning process, limiting their ability to apply numeracy in real-world vocational contexts. This discrepancy may be attributed to the nature of vocational education, where students tend to prefer hands-on practice over theoretical learning. Many VHS students, particularly those in mechanical and automotive engineering, perceive numeracy as a difficult challenge and irrelevant to their field of study.

In this research context, numeracy encompasses basic arithmetic operations, symbol recognition, numerical reasoning, and the ability to analyze data from tables or charts. These skills are essential in mechanical and automotive engineering fields, where students must read technical manuals, measure components accurately, and interpret engineering diagrams. Xiang et al. (2022) stated that numeracy is the foundation of technical understanding in automotive professional training. Students require numerical proficiency to interpret technical measurements, perform torque calculations, and apply mechanical concepts in vehicle repair. A strong grasp of numbers and formulas enhances their ability to accurately diagnose engine trouble and use measuring tools. Other literature highlights more specific applications of numeracy in mechanical engineering practice. For instance, an understanding of scale, proportion, and dimensions is essential in engineering drawings to ensure design accuracy. Similarly, operating conventional or programming CNC machines demands a solid grasp of trigonometry and coordinate systems. In welding, accurate heat calculations, electrode lengths, and welding angles rely heavily on numerical competency (Mills, 2022). However, the study results show that many VHS students still struggle with this skill because they prefer practical tasks to abstract computation. As a result, they may fail to recognize the relevance of numbers to the characteristics of their vocational field, further impacting their skill development.

External factors, such as the perceived difficulty of mathematics learning, lack of resources, and insufficient social and familial support, contribute to students' low numeracy performance (Lilianou et al., 2024). Additionally, rigid and overly academic curricula that fail to integrate numeracy with vocational tasks further alienate students from the subject (Dinç et al., 2018). Without clear connections between mathematical concepts and hands-on applications, students may struggle to interpret technical instructions, leading to difficulties in numeracy-related tasks.

Learning activities related to mathematics are often perceived as irrelevant to students' career aspirations in vocational education, which decreases student motivation and engagement (Muhrman, 2022). Negative attitudes towards mathematics, reinforced by low self-efficacy and rigid mindsets, further contribute to disinterest (Dinç et al., 2018). These misconceptions may persist without targeted interventions and hinder students' problem-solving abilities in vocational contexts (Maizendra & Armiati, 2018). To address this issue, integrating numeracy with literacy-based approaches, such as reading technical manuals, analyzing real-world case studies, and using applied problem-solving methods, may enhance students' understanding and motivation to engage with mathematical concepts in meaningful ways.

Research Limitations, Advantages, and Recommendations

The limitation of this study is the use of a closed questionnaire based on a Likert scale that relies on student perceptions. This can cause the results of the study to depend on the subjectivity of the respondents, so there is potential bias in filling out the questionnaire. However, perception data has the advantage of exploring students' beliefs, motivations, and attitudes toward literacy learning, which can provide insights that standardized proficiency tests cannot provide. Another limitation of this study is that it considers in-depth other variables related to external factors such as teaching quality, family support, or access to digital learning resources that can affect students' literacy mastery. The advantage of this study is that direct data collection allows for face-to-face interaction between researchers and respondents, thus minimizing misunderstandings in questionnaire completion. To address the limitations of this study, future research needs to combine test-based evaluation with reported surveys to get a more precise and objective assessment of literacy competence among VHS students. In addition, further research is needed to explore the role of learning methods in shaping VHS students' literacy development and examine the impact of digital learning tools on their literacy performance. Strengthening these aspects will provide a more accurate understanding of vocational literacy and support the development of effective educational strategies in vocational education.

CONCLUSION

The basic literacy skills of VHS students in Palangka Raya, particularly in mechanical and automotive engineering programs, are predominantly at a moderate level across all assessed domains:

reading and writing (59.7%), numeracy (64.9%), science (69.4%), digital literacy (67.9%), and cultural literacy (51.5%). These findings indicate that students' literacy competencies remain in the moderate category.

Among the five literacy domains, cultural literacy had the highest mean score (84.30), followed by digital literacy (70.56), reading and writing literacy (68.40), science literacy (68.14), and numeracy literacy (63.89). This confirms that vocational students perceive numeracy as a difficult challenge and irrelevant to their field of study. The lower numeracy literacy scores may be attributed to the limited integration of numerical concepts into vocational learning, leading to lower engagement and practical application among students.

The implications of the research include several aspects that can be applied directly in the vocational education environment, especially related to the learning process, by integrating numerical concepts that are more applicable to the vocational context. With a contextual approach that links with industrial practice, students can better understand the relevance of the material in engineering tasks and calculations that are often encountered in the industry. Strengthening numeracy and science literacy skills in vocational settings is essential to enhance students' problem-solving abilities in technical fields.

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REFERENCES

Abdullah, K., Jannah, M., Aiman, U., Hasda, S., Taqwin, Z.F.N., Masita, Ardiawan, K.N., Sari, M.E. (2022). *Metodologi penelitian kuantitatif*. Pidie: Yayasan Penerbit Muhammad Zaini

Anto, A., Fauziah, I., & Hendriyono. (2021). Hubungan pembelajaran berbasis perpustakaan sekolah dengan prestasi belajar siswa di SMK negeri 4 palangka raya pada tahun pelajaran 2020/2021. *Jurnal Teknologi Pendidikan, 1*(2), 13-20. https://doi.org/10.37304/jtekpend.v1i2.3019

Anwar, C., & Sudira, P. (2022). Literacy of vocational high school teachers majoring in automotive light vehicle engineering the need for essential skills in the industrial revolution 4.0. *Journal of Education Technology, 6*(4), 625-633. https://doi.org/10.23887/jet.v6i4.46580

Arthur, R., Maulana, A., Febiansyah, R., & Kidung, K. (2021, March). Scientific literacy of vocational school students in building construction. *In Journal of Physics: Conference Series (Vol. 1833, No. 1, p. 012036)*. IOP Publishing. https://dx.doi.org/10.1088/1742-6596/1833/1/012036

Bandura, A. (1997). Self-Efficacy: The Exercise of Control. New York: Freeman.

Cencelj, Z., Aberšek, M. K., Abersek, B., & Flogie, A. (2019). Role and meaning of functional science, technological and engineering literacy in problem-based learning. *Journal of baltic science education, 18*(1), 132-146. https://dx.doi.org/10.33225/jbse/19.18.132

Darwanto, D. H., Khasanah, M., & Putri, A. M. (2022). Penguatan literasi, numerasi, dan adaptasi teknologi pada pembelajaran di sekolah. *Eksponen, 11*(2), 25. https://doi.org/10.47637/eksponen.v11i2.381

Dinç, E., Memnun, D. S., & Aydın, B. (2018). Teaching mathematics at vocational hhigh schools and student attitudes and approaches towards this course. *International Journal of Social Sciences, 4*(1), 507–524. https://doi.org/10.20319/pijss.2018.41.507524

Hall, G. (2014). Integrating real-world numeracy applications and modelling into vocational courses. *Adults Learning Mathematics, 9*(1), 53–67. https://eric.ed.gov/?id=EJ1068221

Han, W., Susanto, D., Dewayani, S., Pandora, P., Hanifah, N., Miftahussururi, M., ... & Akbari, Q. S. (2017). *Materi pendukung literasi numerasi*. Jakarta: Kemdikbud.

Hui, S. K. F., & Cheung, H. Y. (2015). Cultural literacy and student engagement: The case of technical and vocational education and training (TVET) in Hong Kong. *Journal of Further and Higher Education*, 39(4), 553-578. https://doi.org/10.1080/0309877X.2014.938263.

Jackson, C., Mohr-Schroeder, M.J., Bush, S.B., Maiorca, C., Roberts, T., Yost, C., & Fowler, A. (2021). Equity-oriented conceptual framework for K-12 STEM literacy. *International Journal of STEM Education*, *8*,

1-16. https://doi.org/10.1186/s40594-021-00294-z
Kafrawi, M., & Evizariza. (2022). Meningkatkan kemampuan menulis kreatif untuk siswa SMK labor pekanbaru. *BIDIK: Jurnal Pengabdian kepada Masyarakat, 3*(1), 43-46. https://doi.org/10.31849/bidik.v3i1.11420
Katadata Insight Center. (2020). *Status literasi digital indonesia 2020*. Jakarta: Kominfo
Kelp, N. C., McCartney, M., Sarvary, M. A., Shaffer, J. F. , & Wolyniak, M. J. (2023). Developing science literacy in students and society: theory, research, and practice. *Journal of Microbiology and Biology Education, 4*(2), 1-4. https://doi.org/10.1128/jmbe.00058-23
Khan, M. Y. (2018). New technologies and digital literacy in education: a shifting paradigm. In *Pakistan Social Sciences Review, 2*(1), 108-118. https://doi.org/10.35484/pssr.2018(2-i)09
Konstantinidou, L., Madlener-Charpentier, K., Opacic, A., Gautschi, C., & Hoefele, J. (2023). Literacy in vocational education and training: scenario-based reading and writing education. *Reading and Writing, 36*(4), 1025-1052. https://doi.org/10.1007/s11145-022-10373-4.
Lamada, M., Rahman, E. S., & Herawati, H (2019). Analisis kemampuan literasi siswa SMK negeri di kota Makassar. *Jurnal Media Komunikasi Pendidikan Teknologi dan Kejuruan, 6*(1), 35-42. https://doi.org/10.26858/mekom.v6i1.12000
Lilianou, L., Phanalasy, O., Vongbounsy, P., Bounphone, K., & Thanavanh, P. (2022). Factors that affect high school students making them not like mathematics. *Souphanouvong University Journal Multidisciplinary Research and Development, 8*(2), 282-286. https://doi.org/10.69692/SUJMRD0802250.
López, J., Rivas, J. L., Silva, E. G., Vega, J., Orozco, R. G., Contreras, M. D. H., Huizar, S. K. M., & Soto Sánchez, R. E. (2024). The importance of identifying the causes of lack of reading comprehension in vocational school high school students at "universidad de guadalajara". *International Journal of Human Sciences Research*. https://doi.org/10.22533/at.ed.5584172420051
Maizendra, R., & Armiati. (2018, December). Professional competency-based mathematics learning devices in the mechanical and automotive engineering program high school. *In 2nd International Conference on Mathematics and Mathematics Education 2018 (ICM2E 2018)* (pp. 339-342). Atlantis Press. https://doi.org/10.2991/icm2e-18.2018.77
Maulana, A., Puspita, A. J., Pangastuti, K. K., Daryati, D., & Arthur, R. (2022, November). The concept of literacy vocational-based e-module of technical mechanical subject. In *Journal of Physics: Conference Series* (Vol. 2377, No. 1, p. 012068). IOP Publishing. doi: 10.1088/1742-6596/2377/1/012068
Mills, K. R. (2022). *Mathematics in workplace settings: Numeracy in the mechanical engineering trades* (Doctoral dissertation, The University of Waikato).
Mohajan, H. K. (2020). Quantitative research: a successful investigation in natural and social sciences. *Journal of Economic Development, Environment and People, 9*(4), 50–79. https://doi.org/10.26458/jedep.v9i4.679
Muhrman, K. (2022). How can students in vocational education be motivated to learn mathematics?. *Nordic Journal of Vocational Education and Training, 12*(3), 47–70. https://doi.org/10.3384/njvet.2242-458X.2212347.
Mukhlisin, M., Gani, H. A., & Purnamawati, P. (2022). The overview of needs analysis for development learning model based on digital in vocational education. *Advances in Social Science, Education and Humanities Research, 654*, 105-108. https://doi.org/10.2991/assehr.k.220402.023
National Academies of Sciences, Engineering, and Medicine. (2016). *Science Literacy: Concepts, Contexts, and Consequences*. Washington, DC: The National Academies Press. https://doi.org/10.17226/23595.
Noviyanto, A. T., & Wijanarka, B. S. (2023). Influence of emotional intelligence, digital literacy, and student self-efficacy on job readiness of the mechanical engineering skills program at vocational schools in Yogyakarta City. *International Journal of Social Science and Human Research, 6*(10), 5830-5836. https://doi.org/10.47191/ijsshr/v6-i10-03
OECD. (2016). *PISA 2015 results (volume II): policies and practices for successful schools*. Paris:OECD Publishing. doi:10.1787/9789264267510-en

Parkinson, J., & Mackay, J. (2016). The literacy practices of vocational training in carpentry and automotive technology. *Journal of Vocational Education & Training, 68*(1), 33-50. https://doi.org/10.1080/13636820.2015.1104714

Prasastiningtyas, W., Ubaidillah, A. Z., Aprianti, I., & Nurfadilah, L. (2024). Improving literacy in the digital age: unleashing critical thinking potential. *TOPLAMA, 2*(1), 18-27. https://doi.org/10.61397/tla.v2i1.218

Pratiwi, S. A., Peni, N. R. N., & Prabowo, A. (2024). Study on literacy numeracy towards students'logic mathematics: a literature review. *Numeracy, 11*(1), 58-69. https://doi.org/10.46244/numeracy.v11i1.2601

Purwaningrum, D., Suhaeni, S., Pramesti, R. M., Agustina, A. R., Juwita, R., Hanum, Z., Putri, S., Udin, N., Hartono, H., Prakoso, E. P., Udiono, T., & Suranto, D. (2022). Digital reading during the pandemic: exploring vocational students' perceptions in language literacy. *Journal of Linguistics Literature and Language Teaching, (6)*2, 353-364. https://doi.org/10.30743/ll.v6i2.6013

Rahmat, M. H., Suryanto, A. E., Lumbantobing, M. A., & Dinata, P. A. C. (2023). Pengembangan perangkat pembelajaran case-based learning pada mata kuliah elemen mesin. *Jurnal Taman Vokasi, 11*(2), 155164. https://doi.org/10.30738/jtvok.v11i2.16233

Rahmawati, A. (2017, October). Literacy practice in vocational engineering education: is it necessary? (a case study on the concrete construction course). *International Conference on Teacher Training and Education 2017 (ICTTE 2017)* (pp. 18-31), Atlantis Press. https://doi.org/10.2991/ictte-17.2017.3

Ramona, N., & Supriatna, N. (2021, September). Historical literacy as strengthening character education. *In 6th International Conference on Education & Social Sciences (ICESS 2021)* (pp. 224-231), Atlantis Press. https://doi.org/10.2991/assehr.k.210918.042

Riani, D., Mayuni, I., & Sulistyaningrum, S. D. (2018). Cultural literacy praxis in teaching and learning english at SMPN 14 Padang. *International Journal of Language Education and Cultural Review (IJLECR)*, 4(2), 137–142. http://journal.unj.ac.id/unj/index.php/ijlecr/.

Rittner, M.A. (2018). Impact of literacy on student readiness in math and science classroom. *Honors Projects*. 356. https://scholarworks.bgsu.edu/honorsprojects/356.

Rupley, W. H., Nichols, W. D., & Blair, T. R. (2008). Language and culture in literacy instruction: Where have they gone?. *The Teacher Educator, 43*(3), 238-248. https://doi.org/10.1080/08878730802055180

Sarwono, J. (2006). *Metode Penelitian Kuantitatif dan Kualitatif*. Yogyakarta: Graha Ilmu.

Schneider, J. L., & Foot, R. (2013). Teaching strategies to support vocational education students' reading literacy. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas, 86*(1), 32-36. https://doi.org/10.1080/00098655.2012.731021

Schunk, D. H., & DiBenedetto, M. K. (2020). Motivation and social cognitive theory. *Contemporary Educational Psychology, 60*, 101832, doi: https://doi.org/10.1016/j.cedpsych.2019.101832

Siddikova, Sh.A. (2024). Assessment of educational achievements of students "PISA". (2024). *International Journal of Advance Scientific Research, 4*(1), 52-55. https://doi.org/10.37547/ijasr-04-01-09

Tınmaz, H., LEE, Y.-T., Fanea-Ivanovici, M., & Baber, H. (2022). A systematic review on digital literacy. *Smart Learning Environments, 9*(1), 21. https://doi.org/10.1186/s40561-022-00204-y

Widayana, G. (2023, February). The influence of technical skills and 21st century skills on the job readiness of vocational students. *In Proceedings of the 5th International Conference on Vocational Education and Technology, IConVET 2022*, 6 October 2022, Singaraja, Bali, Indonesia. DOI 10.4108/eai.6-10-2022.2327433

Xiang, Q., Qiu, F., Wang, J., Zhang, J., Zhu, J., Zhu, L., & Zhang, G. (2022). Engineering design and evaluation of the process evaluation method of auto repair professional training in virtual reality environment. *Applied Sciences, 12*(23), 12200. https://doi.org/10.3390/app122312200

Yulianti, E., Rahman, N. F. A., Mustikasari, V. R., & Nurjanah, L. F. (2022, October). Improving students' abilities in scientific literacy: An initial step towards science and engineering education. *In AIP Conference Proceedings* (Vol. 2433, No. 1). https://doi.org/10.1063/5.0072909.