Understanding AI Usage in Academics among Vocational High School Students

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ABSTRACT

The purpose of this study is to gauge the degree of knowledge that high school students pursuing vocational training have about using artificial intelligence in the classroom and to pinpoint the variables that impact that knowledge. As artificial intelligence (AI) permeates more and more industrial sectors, it is imperative that vocational high school students understand AI and be prepared for its future. Using a mixed-methods approach, this study included 500 Indonesian students enrolled in vocational high schools who represented a range of academic levels through qualitative interviews and quantitative surveys. The study's conclusions show that students at vocational high schools have differing levels of comprehension about artificial intelligence (AI), with a variety of factors like socioeconomic status, school curriculum, and access to technology playing a major influence. The research's ramifications include suggestions for creating more efficient.

Keywords: Artificial Intelligence, Vocational High School, Student Understanding, Preparedness

1. INTRODUCTION

The progress in artificial intelligence (AI) technology has brought about significant changes in various sectors, including education [1][2][3]. The use of artificial intelligence (AI) into the educational system has shown significant potential in recent years for enhancing teaching and learning methodologies [4]. Artificial intelligence (AI) has the potential to enhance teaching and learning in education by providing more efficient, customised, and adaptable techniques [5][6][7]. Research suggests that incorporating AI into education can enhance student learning results by as much as 25% when compared to conventional techniques [3][4][3][7].

Vocational high schools have a crucial role in equipping a competent workforce that is well-prepared to tackle the demands of contemporary industries. With the increasing adoption of AI in many industries, it has become more and more important for vocational high school students to understand and make use of AI technology [6][8][9][10]. Proficiency in artificial intelligence (AI) is essential for vocational education programs as it enables students to effectively adapt to the transformative shifts in the digital world. Research indicates that students who possess a strong comprehension of artificial intelligence (AI) tend to be more adaptable and have greater prospects for employment [8][11] [10].

Integrating AI into vocational education poses some challenges, regardless of the circumstances. The primary issues are the digital gap and the inequitable access to AI technologies [10]. The text highlights a notable disparity in the availability and understanding of AI technology among urban and rural schools, as well as among schools with different levels of resources [12][13][14][15][16]. Some schools and localities may lack the necessary resources to incorporate AI-

powered tools and technology into their educational programs, which could exacerbate the disparity in AI literacy across pupils. This gives rise to apprehensions regarding the possibility of a progressively expanding disparity in skills in the future if not adequately resolved [7].

There are ethical concerns regarding the use of AI in [17][18]. Although AI offers numerous benefits, its implementation also raises ethical concerns, particularly around the privacy of student data and the potential for algorithmic prejudice. It is crucial to offer AI ethics education to students in order to guarantee the appropriate application of this technology [19][20].

Vocational high school students' comprehension and preparedness for the AI era are still restricted [21][7]. Vocational high school students possess a rudimentary understanding of the significance of artificial intelligence, but their grasp of the subject matter and their ability to apply it in practical settings are still limited [11][10][22][23]. The results suggest that a minuscule proportion of vocational high school students possess a sense of assurance when it comes to using AI-driven applications for academic purposes [24][23]. The results emphasise the importance of conducting additional study and creating effective methods to improve AI knowledge among vocational school students [24].

The implementation of AI in vocational education has demonstrated both promising and demanding advancements [24][25][23]. By incorporating artificial intelligence (AI) into vocational high school courses, students' problem-solving abilities can be enhanced by as much as 40% [11][10] . AI-based intelligent tutoring systems can enhance information retention in vocational high school students by up to 30% when compared to conventional teaching techniques, as demonstrated by studies conducted by [26]. Nevertheless, if not thoroughly handled, there is a possibility that algorithmic bias in educational AI systems could have a negative influence on specific student groups [27]. The ethical implications of utilising AI in education have been subject to examination, highlighting the necessity of constructing a comprehensive framework for AI ethics in vocational education [28]. The efficacy of AI in enhancing learning outcomes relies heavily on the preparedness and comprehension of both teachers and students towards this technology [25].

This study investigates the perceptions of high school students engaged in vocational training about the implementation of artificial intelligence in the classroom. The main topics addressed are the student's level of knowledge, the factors that influence it, the impact of the digital divide on AI accessibility and comprehension, and the extent to which students grasp the ethical implications of utilising AI in educational settings. The study aims to offer a thorough understanding of the AI literacy of high school students in vocational programs, along with the difficulties they face while incorporating this technology into their classroom.

The objective of this study is to assess and analyse the comprehension level of vocational high school students in utilising artificial intelligence (AI) in academic settings, as well as to determine the elements that impact this comprehension. Moreover, the study seeks to assess the impact of the digital divide on students' ability to access and understand AI technology, while also promoting awareness among students about the ethical uses of AI in education. The research will use these findings to create recommendations aimed at improving AI literacy among vocational high school students. The goal is to make a substantial contribution to the development of more efficient curricula and educational strategies that incorporate AI technology in secondary vocational education.

This research is expected to significantly contribute to the development of effective teaching methods that will address the gap between the requirements of modern industry and vocational education. As a result, it will better prepare students in vocational schools for the future of artificial intelligence.

2. LITERATURE REVIEW

2.1 Education and Artificial Intelligence

The significance of artificial intelligence in education is increasing [5][11][24]. In the end, artificial intelligence has the ability to revolutionise the way we educate and acquire knowledge. Researchers have identified several important applications of artificial intelligence (AI) in education, including intelligent tutoring systems, automated assessment, and personalised learning [25][29]. AI-driven solutions provide the capability to customise the learning experience according to the specific needs of each student. They also offer real-time feedback and coaching, as well as automate certain educational activities to improve learning outcomes and efficiency [30][31].

Research has shown that intelligent tutoring systems powered by artificial intelligence (AI) can improve student knowledge retention by up to 30% when compared to conventional teaching methods. Nevertheless, the possibility of algorithmic bias in these systems gives rise to issues about the impartiality of evaluation and customisation of the learning process [26][32]. It emphasises the importance of thoroughly assessing the ethical consequences of integrating AI into education to guarantee that this technology is employed to maintain fairness and offer equitable chances to all students [19][33][34].

2.2 Vocational Education and Technology

Vocational education provides students with distinct preparation for the workforce that is becoming more reliant on digital technology [35]. Incorporating technology, such as artificial intelligence (AI), into vocational education curricula is of utmost importance [36]. Experts contend that proficiency in artificial intelligence (AI) will be an essential competency for prospective vocational high school graduates in the future [22][8][10].

Acquiring proficiency in artificial intelligence is essential for vocational high school students to thrive in the digital economy. Although AI is becoming increasingly important in the workplace, there is a lack of study on the extent of AI literacy among vocational high school students. Current research indicates that the incorporation of AI-related concepts and techniques into vocational education is not progressing adequately. There is a lack of sufficient class time and limited chances for students to acquire practical skills in data processing, programming, and AI applications [10].

The digital gap, which mostly impacts students from poor families, can worsen the difficulties in cultivating AI literacy among vocational high school students [37]. Addressing these disparities and ensuring equitable access to AI education is crucial in preparing all students for the technical demands of the modern workforce [22][20][10].

Longitudinal studies have shown that the incorporation of artificial intelligence (AI) into vocational high school courses might enhance students' problem-solving

skills. This research emphasises the potential of artificial intelligence (AI) as both a subject of study and a tool for enhancing learning. In order to effectively incorporate AI technology and develop the essential abilities in students, vocational education institutions need to modify their curricula and teaching methods [4].

2.3 Digital Literacy among Adolescents

In the digital era, having knowledge of digital literacy, which includes a thorough understanding of artificial intelligence (AI), has become significantly more crucial. There exists a notable disparity in access to digital resources among pupils residing in urban and rural locations, as well as among schools with different degrees of available resources. This prompts enquiries over the fairness of individuals' ability to obtain AI-driven education [38][39]. The unequal access to digital technologies and AI-driven educational tools poses a threat of widening educational disparities, which may result in certain student populations being left behind in their exposure to and understanding of these revolutionary technologies [17][20][34].

Despite the increasing recognition of the significance of artificial intelligence (AI), vocational high school students currently possess little understanding and practical skills in this field [10]. According to [40], a mere 30% of students possess the necessary confidence to effectively utilise AI-based applications for their academic assignments. This emphasises the necessity of improving AI literacy and practical experience for vocational high school students in order to better equip them for the growing incorporation of AI technology in today's industrial and academic settings.

3. METHODS

This study employed a mixed-methods approach, integrating both quantitative and qualitative methodologies to thoroughly evaluate the level of comprehension among vocational high school students regarding artificial intelligence (AI) and the factors that influence it. The survey includes vocational high school students from multiple areas in Indonesia. A stratified selection method was used to choose a sample of 500 students from 10 vocational schools located in five provinces. This sample encompasses a variety of academic areas and socio-economic backgrounds. The study instruments include of an online survey aimed at objectively evaluating students' understanding of AI, as well as semi-structured interview guides meant for in-depth qualitative exploration of students' viewpoints and experiences with AI.

The data gathering approach consisted of two stages: initially, an online survey was issued to the complete sample, followed by in-depth interviews with a subsample chosen based on the survey results. The quantitative data underwent data analysis, whereas the qualitative interview data underwent theme analysis, statistical inferential analysis, and descriptive analysis. This study employed a triangulation technique, which involved combining emotional and quantitative data to enhance the validity of the findings. This comprehensive methodology is anticipated to offer a comprehensive and thorough analysis of vocational high school students' grasp of AI in the academic setting and determine the crucial aspects that affect their knowledge.

4. RESULTS AND DISCUSSION
4.1 Result

Table 1. Socio-demographic data of respondents

Characteristic	Category	Sum	Percentage

Gender	Man	275	55%
	Woman	225	45%
Age	15-16 year	150	30%
	17-18 year	300	60%
	19-20 year	50	10%
Majors	Computer and Network Engineering	150	30%
	Electrical Engineering	100	20%
	Office Administration	75	15%
	Accountancy	75	15%
	Mechanical Engineering	50	10%
	Other	50	10%
School Location	Urban	300	60%
	Rural	200	40%
Economy Level	Top	50	10%
	Intermediate	300	60%
	Bottom	150	30%
Internet Access	High access (>6 hours/day)	200	40%
	Medium access (3-6 hours/day)	200	40%
	Low access (<3 hours/day)	100	20%
Device Ownership	Smartphone	475	95%
	Laptop/PC	250	50%
	Tablet	75	15%

Source: Processed Primary Data (2024)

Table 2. SEM_PLS Result Data

Analytical Aspects	Result	Interpretation
Measurement Model (Outer Model)		
Convergent Validity (AVE)	All constructs > 0.5	Good convergent validity
Validity of Discrimination (Fornell-Larcker)	Fulfilled	Validity of good discrimination
Reliability (Cronbach's Alpha)	All constructs > 0.7	Good internal reliability
Model Struktural (Inner Model)		
R-Square Understanding AI (PAI)	0.68	Moderate
R-Square AI Skills (KAI)	0.72	Strong
AT -> PAI	0.42 ($p < 0.001$)	Significant
KS -> PAI	0.38 ($p < 0.001$)	Significant
LSE -> PAI	0.25 ($p < 0.01$)	Significant

MAI -> PAI	0.20 (p < 0.05)	Significant
PAI -> KAI	0.65 (p < 0.001)	Significant strong positive
Analysis		
AI Understanding Level	Installment-install: 2.8/5	Moderate
AI Understanding Distribution	15% excellent, 35% enough, 50% limited	Understanding gap
Most Influential Factors	Technology Access (β = 0.42)	Most significant
The Digital Divide	r = 0.58 (p < 0.001)	Strong correlation
Understanding AI Ethics	Installment-install: 3.2/5	Pretty good
PAI-KAI Relationship	β = 0.65 (p < 0.001)	Strong positive correlation

Source: Processed Primary Data (2024)

Discussion

This study provides comprehensive insights into the knowledge and ability of Indonesian Vocational High School (SMK) students in the field of Artificial Intelligence (AI). The study's findings, derived from socio-demographic data and analysis, indicate a modest level of artificial intelligence comprehension among vocational school students, with an unequal distribution. These findings indicate the pressing need to enhance AI literacy in vocational education.

The investigation indicates that vocational school students possess a moderate level of comprehension regarding AI, as evidenced by an average score of 2.8 out of 5. A disparity in comprehension was uncovered, with a mere 15% of participants demonstrating exceptional understanding, 35% possessing satisfactory understanding, and the remaining 50% having limited or minimal understanding. These findings are consistent with the research conducted by [22], which revealed that vocational school students had a limited degree of comprehension and practical abilities in AI, while being aware of its significance. Nevertheless, the outcomes of this study indicate a greater proportion compared to the findings of [22], who indicated that just 30% of students expressed confidence in utilising AI-based applications for academic tasks.

The existence of this discrepancy in understanding is a result of the intricate nature of incorporating AI education into the vocational curriculum. This supports the claim made by [11] that the incorporation of AI concepts and techniques in vocational education is now falling behind. There is a lack of sufficient class time and limited chances for students to acquire hands-on experience in data processing, programming, and AI applications. These findings validate the necessity of implementing systematic initiatives to enhance AI literacy at the vocational secondary education level.

The Structural Equation Modelling (SEM) Smart PLS analysis identified four primary factors that influence vocational school students' comprehension of the use of Artificial Intelligence (AI) in the academic setting. These components are Access to Technology (AT), School Curriculum (KS), Socio-economic Background (LSE), and Interest in AI (MAI). The study found that access to technology was the most significant factor (β = 0.42, p < 0.001), highlighting the crucial role of technological infrastructure in facilitating AI learning. These findings corroborate the assertion made by [41] regarding the need to tackle the digital gap in the realm of AI education. This aligns with the findings of [39] research, which underscores the significance of technology accessibility in rural education.

The School Curriculum is the second most influential factor (β = 0.38, p < 0.001), emphasising the crucial impact of curriculum content and organisation in shaping pupils' understanding of AI. These findings corroborate [35] claim regarding the necessity of modifying vocational education curricula to successfully incorporate AI technology. The socio-economic background (β = 0.25, p <

0.01) and interest in AI (β = 0.20, p < 0.05) had significant effects. This supports the conclusions of [17] regarding the possibility of artificial intelligence exacerbating socio-economic inequalities if not managed with caution.

Additional analysis revealed a significant association between access to technology and understanding of artificial intelligence (r = 0.58, p < 0.001). those that have extensive access to technology obtain an average score of 3.5 in AI understanding, but those with limited access only attain a score of 2.1. The findings of this study confirm that the digital divide significantly impacts students' ability to understand and utilise AI technologies. The results of this study are consistent with the previous research conducted by [42], which emphasises the significant differences in digital access and resources among urban and rural pupils, as well as among schools with different technological infrastructures. Furthermore, it corroborates the contention made by [38] regarding the need to tackle disparities in the accessibility, acceptance, and utilisation of ICTs in rural regions.

The findings of this study validate the transformational potential of artificial intelligence (AI) in education, namely in the field of artificial intelligence in education (AIEd), notably at the vocational level. The relatively low level of AI comprehension (2.8/5) suggests that vocational school students have a basic understanding of AI, but they still need to improve their competency in AI literacy. This is consistent with the research conducted by [5] and [4], which suggests that artificial intelligence has the capability to improve the educational process. The significant association between AI comprehension and proficiency (β = 0.65) underscores the necessity of a comprehensive strategy in AI education, which merges theoretical knowledge with practical application. Endorses the contention made by [25] regarding the positive impact of effectively integrating artificial intelligence on students' academic performance.

However, the difference in the understanding of AI, with 50% of individuals having a limited comprehension, indicates an imbalance in the accessibility and quality of AI education. [17] and [34] have voiced worries over the possibility of AI exacerbating the education gap if not properly addressed. Students who possess a moderately strong grasp of AI ethics (3.2/5) demonstrate their knowledge of the ethical consequences associated with AI, aligning with the suggestions of [19] and [20] regarding the significance of AI ethics education. However, there is definitely room for improvement, given the complexity and importance of ethical issues in the development and use of AI.

This research highlights the significant importance of technology, particularly artificial intelligence (AI), in contemporary vocational education. The β coefficient of 0.42 demonstrates that access to developing technology is the most impactful factor in AI understanding. This finding supports the points made by [36] and [35] regarding the significance of integrating technology into vocational curriculum. Nevertheless, the disparity in technology availability, as seen by the relationship between the digital divide and knowledge of artificial intelligence (r = 0.58), is a substantial obstacle. These findings align with the research conducted by [22] and [10], which highlight the disparities in access to and comprehension of AI technology among vocational school students.

The school curriculum places significant emphasis on updating the vocational curriculum to incorporate AI principles and applications, which is the second component with a coefficient of 0.38. This corroborates the assertions made by [8] and [11] regarding the advancement of AI proficiency in vocational education. The difference in the level of proficiency in AI skills and theoretical understanding (R-Square KAI = 0.72 vs PAI = 0.68) indicates that vocational education tends to place more emphasis on practical aspects. However, it also highlights the importance of maintaining a balanced and harmonious relationship between theoretical knowledge and practical implementation in the field of AI education, as suggested by [43] and [44].

The study's findings shed light on the digital literacy of vocational school teenagers, particularly their knowledge of artificial intelligence (AI). The user's AI understanding is rated at a moderate level of 2.8 out of 5, indicating a certain amount of awareness regarding digital

technologies but a notable lack of in-depth knowledge concerning AI. This is consistent with the discoveries made by [42] regarding the disparities in digital literacy among adolescents. The disparity in the level of AI comprehension, with 15% being outstanding, 35% being adequate, and 50% being limited, is indicative of a wider digital divide, as highlighted by [38] and [39].

The presence of a robust association (r = 0.58) between the digital gap and AI comprehension validates the influence of unequal technology access on the digital literacy of adolescents. The digital environment faced by teenagers is characterised by varying levels of internet access, with 40% having high access, 40% having moderate access, and 20% having low access. Additionally, there are variances in device ownership, with 95% of teenagers owning smartphones and 50% owning laptops or PCs. These factors contribute to the complexity of the digital landscape for teenagers. These findings corroborate the assertions made by [17] and [20] regarding the capacity of digital technologies, such as AI, to exacerbate educational disparities if not properly addressed.

The limited level of trust in utilising AI-based applications for academic projects, with just approximately 30% expressing confidence, suggests a disparity between the availability of AI technology and the actual proficiency in using it. This is consistent with the conclusions of [22] and [42] about the necessity of enhancing accessibility and proficiency in utilising AI technology.

The discovery of these results is crucial for the formulation of AI curriculum and instructional approaches in vocational institutions. Initially, it is important to implement a methodical endeavour to incorporate AI subjects into the vocational curriculum for TKJ and other majors. This is in line with the suggestions made by [11] to modify the curriculum and teaching approach in order to successfully incorporate AI technology. Moreover, educational establishments must improve students' technical accessibility by furnishing them with computer gadgets and high-speed internet. This corroborates the contention made by [41] regarding the significance of tackling the digital gap within the realm of AI education. Furthermore, teachers must possess a comprehensive comprehension of AI and the corresponding skills in order to properly educate students. This is consistent with the conclusions of [42] about the importance of teachers' AI digital competencies in the time following the pandemic. Furthermore, partnering with industry can offer students an authentic opportunity to engage with AI applications in a professional setting. This corroborates [8] contention regarding the significance of AI competencies for prospective vocational school graduates. Furthermore, it is crucial to prioritise ethical considerations in AI education, as suggested by [20], who emphasise the significance of resolving ethical dilemmas while utilising AI in K-12 environments.

This study highlights the importance of a thorough approach to integrating AI education within the vocational education system in Indonesia. This study contributes to the current understanding of AI literacy in vocational education by providing empirical evidence on the factors that affect vocational high school students' understanding of AI and the impact of the digital divide. To improve the preparedness of vocational high school students for the AI era, it is important to understand and address the hurdles that are commonly identified. This will ensure that they become skilled users of technology, critical thinkers, and pioneers in using AI for the betterment of society.

Theoretical and Practical Implications

This research significantly enhances our understanding of the adoption and utilisation of AI in vocational education, with a specific focus on its impact on literacy. The findings about the factors that influence the understanding of AI, such as technology accessibility, educational curriculum, and socio-economic status, contribute to the development of theoretical frameworks that explain the diffusion of technological innovation in education. The robust correlation between AI comprehension and proficiency reinforces the constructivist learning hypothesis, which underscores the significance of conceptual knowledge in cultivating practical abilities.

The research also enhances the existing body of knowledge on digital alignment by illustrating the impact of disparities in technology availability on both overall digital literacy and the

comprehension of sophisticated technologies such as AI. This introduces a fresh perspective to the theories surrounding digital inequality and its influence on schooling in the modern technological age.

These findings carry significant ramifications for legislators, school administrators, and educators. The significance of technology availability and appropriate curricula in improving AI comprehension underscores the necessity for investing in technical infrastructure in vocational schools and creating curricula that incorporate AI principles and applications.

The discrepancies in AI comprehension, which are influenced by socio-economic status and the geographical location of schools, highlight the necessity for initiatives aimed at diminishing digital inequality. This may encompass initiatives that offer technical items to pupils from economically disadvantaged backgrounds or schools located in rural regions. The significant correlation between AI comprehension and proficiency underscores the significance of a teaching methodology that integrates both theoretical knowledge and practical application. Teachers possess the capacity to develop teaching strategies that integrate AI principles and provide opportunities for students to use their knowledge in real-world tasks.

CONCLUSION

This study offers in-depth insights on the knowledge and proficiency of artificial intelligence (AI) among vocational high school students in Indonesia. It uncovers the challenges involved in incorporating AI into vocational education. The current level of AI comprehension, which is moderate and unevenly distributed, highlights the pressing necessity to improve AI literacy. The key factors that determine AI comprehension, such as technological accessibility and educational curriculum, are vital areas that require investigation. The existence of a digital divide, as evidenced by the significant relationship between access to technology and comprehension of artificial intelligence, highlights the critical need to address inequality. The correlation between AI comprehension and proficiency underscores the importance of a comprehensive methodology that combines theoretical knowledge with practical application. Students' awareness of AI ethics is relatively good, but there is still potential for development. The findings suggest many important recommendations: the implementation of curricula that incorporate AI principles and applications, enhancing technological accessibility through infrastructure investment, and implementing thorough training programs for teachers. Encouraging industry-education relationships is crucial to offer practical experiences and guarantee the curriculum's relevance.

To foster the sustainable development of AI education, it is imperative to do further research, such as longitudinal studies, to assess the enduring impact of AI education on graduates' job opportunities. It is essential to prioritise the implementation of inclusive policies to reduce the digital divide and ensure equitable access to AI education for all pupils. Subsequent investigations should encompass longitudinal and comparative studies conducted in other locations and countries. It is imperative to create standardised evaluation tools to evaluate the level of AI literacy among vocational high school pupils. Studying the efficacy of different intervention tactics might offer valuable direction for the establishment of policies and educational practices concerning AI. There is a need for increased focus on AI ethics, which involves engaging in conversations on the proper utilisation of AI. By implementing these ideas and doing additional research, it is anticipated that AI teaching in Indonesian vocational high schools can be enhanced to equip students with the necessary skills and knowledge to navigate the complexities and possibilities of the AI era. Incorporating AI into vocational education necessitates a comprehensive strategy that takes into account technology, curriculum, teacher preparation, industry collaborations, and inclusive policies. This approach ensures that all students may reap the advantages of the AI revolution in education and the job market.

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