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Literacy of Vocational High School Teachers Majoring in Automotive Light Vehicle Engineering The Need for Essential Skills in The Industrial Revolution 4.0

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ABSTRAK

Revolusi industri 4.0 mengubah pola kehidupan manusia. Salah satu perubahannya adalah keterampilan esensial yang harus dikuasai oleh pekerja. Dunia otomotif mengalami perkembangan yang pesat, sehingga tenaga kerja yang memasuki bidang ini harus dipersiapkan secara matang. Sebagai transfer pengetahuan dan pembentuk calon tenaga kerja yang handal, guru harus mengetahui keterampilan esensial yang akan diajarkan kepada siswa untuk menghadapi tantangan revolusi industri 4.0. Penelitian ini bertujuan untuk menganalisis tingkat literasi guru SMK jurusan Teknik Kendaraan Ringan Otomotif terhadap kebutuhan keterampilan esensial di era Revolusi Industri 4.0. Penelitian menggunakan pendekatan kuantitatif deskriptif dengan menggunakan desain penelitian survey. Penelitian ini melibatkan 168 guru SMK jurusan Teknik Kendaraan Ringan Otomotif sebagai sampel penelitian. Pengumpulan data menggunakan kuesioner dengan instrumen skala likers empat pilihan dan dianalisis menggunakan analisis deskriptif. Hasil penelitian menunjukkan bahwa tingkat literasi guru SMK jurusan Teknik Kendaraan Ringan Otomotif terhadap kebutuhan keterampilan esensial di era revolusi industri 4.0 termasuk dalam kategori tinggi. Keterampilan essensial meliputi keterampilan digital dan informasi memperoleh prosentase 75,05%, keterampilan berpikir memperoleh 75,33% serta keterampilan hidup dan karir memperoleh 76,13%. Meskipun secara keseluruhan dalam kategori tinggi, namun ada beberapa item literasi guru terhadap keterampilan essensial yang perlu ditingkatkan.

ABSTRACT

Industrial revolution 4.0 changes the pattern of human life. One of the changes is the essential skills that workers must master. The automotive world is experiencing rapid development, so workers entering this field must be prepared carefully. As a transfer of knowledge and forming a reliable workforce candidate, teachers must know the essential skills that will be taught to students to face the challenges of the industrial revolution 4.0. This study aims to analyze the literacy level of SMK teachers majoring in Automotive Light Vehicle Engineering towards the essential skill needs in the Industrial Revolution 4.0 era. The research uses a quantitative approach using a survey research design. This study involved 168 SMK teachers majoring in Automotive Light Vehicle Engineering as the research sample. Collecting data using a questionnaire with a four-choice Likers scale instrument and analyzed using descriptive analysis. The results showed that the literacy level of SMK teachers majoring in Automotive Light Vehicle Engineering towards essential skill needs in the era of the industrial revolution 4.0 and included in the high category. Essential skills include digital and information skills obtaining a percentage of 75.05%, learning skills obtaining 75.33%, and life and career skills obtaining 76.13%. Although overall, in the high category, there are several items of teacher literacy on essential skills that need to be improved.

1. INTRODUCTION

The industrial revolution has a history ranging from industry 1.0, 2.0, and 3.0 to industry 4.0, and each phase of the industry is a real challenge of change (Singh & Tilak, 2020; M. Xu et al., 2018). Industry 1.0 has the characteristics of production mechanization to support the effectiveness and efficiency of human activities; Industry 2.0 have characterized by mass production and standardization of quality; Industry 3.0 has the characteristics of mass customization and flexibility of automation and robot-based manufacturing. Industry 4.0 have characterized by cyber-physical collaboration and manufacturing (Jones & Pimdee, 2017; L. Xu et al., 2018). The Industrial Revolution 4.0 is the merging of embedded production system technologies with intelligent production processes to pave the way for a technological era that will fundamentally change industrial value chains, production value chains, and business models (Lund & Vildåsen, 2022; Zhong et al., 2017). Technological developments in the era of the industrial revolution 4.0 promise many new benefits and impacts for humans (Benešová & Tupa, 2017; Chirumalla, 2021). It is closely related to the concepts of digitizing

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automation, robotization, interconnection, and additive manufacturing driven by artificial intelligence and machine learning (Chenoy et al., 2019). Industrial revolution 4.0 fundamentally changes how we live, interact and work (Loumpourdi, 2021; Neumann et al., 2021). Increased flexibility, better quality, good processes, and increased work productivity are the benefits of technological developments in the industrial revolution 4.0 (Chirumalla, 2021; L. Xu et al., 2018; Zhong et al., 2017). Although there are many benefits from the industrial revolution 4.0 for industry, humans still face challenges. Challenges faced in the industrial era 4.0 include issues of information technology security, reliability, and stability of production machines, lack of adequate skills, reluctance to change by stakeholders, and the loss of many jobs due to switching to automation (Benešová & Tupa, 2017; Spoettl & Tūtlys, 2020). This era will bring about changes in the acquisition of knowledge and skills (Lund & Vildåsen, 2022; Wichmann et al., 2019). Of the challenges above, what is crucial is the challenge of adequate knowledge and mastery of skills in a job. Essential skills in the era of the industrial revolution 4.0 emerged and dominated work in recent years (Wilert Puriwat & Tripopsakul, 2020; Spurk, 2021). Essential skills are indispensable in the world of work in the era of the Industrial Revolution 4.0 because these skills help support work (Churchill, 2020; Wichmann et al., 2019). Labour inequality in some developing countries in terms of skills and practical knowledge is a critical issue (Abdurrahman et al., 2022; Forster & Bol, 2018; Jones & Pimdee, 2017). Some people in every country are unaware of the development and impact of the industrial revolution 4.0 on skills in their lives (Loumpourdi, 2021; Wilert Puriwat & Tripopsakul, 2020). It is necessary to increase human knowledge and skills in responding to the times (Loumpourdi, 2021). Especially in the social and economic fields, innovation, knowledge, technology, and creativity must integrate into all activities (Wilert Puriwat & Tripopsakul, 2020; M. Xu et al., 2018).

Essential skills in the industrial revolution 4.0 era that need masters are digital and information skills, thinking skills, and life and career skills (Benešová & Tupa, 2017; W. Puriwat & Tripopsakul, 2020). Digital and information skills lead to the ability to operate or design Internet of Thing-based technology as an essential technology in the era of the industrial revolution 4.0 (Benešová & Tupa, 2017; Zhong et al., 2017). The emergence of technology-based tools in the industrial revolution 4.0 has caused many workforces to worry about adapting to unfamiliar contexts (Garzón-Artacho et al., 2021). Life and career skills are also necessary because these skills are often used in everyday life (Wilert Puriwat & Tripopsakul, 2020). Life and career skills are life skills in facing the challenges of the times, especially the challenges of facing the era of the industrial revolution 4.0 (Chenoy et al., 2019; Garbie, 2017). Thinking skills are more towards the human ability to review problems in the era of the industrial revolution 4.0, then create so that problems can be resolved. In adjusting to environmental conditions, thinking skills require a dynamic nature (Kavenuke et al., 2020; J. W. Müller, 2021). Dynamic abilities require continuous action and must an applied in everyday life (Chirumalla, 2021). Tend to focus more on individual roles and self-commitment to encourage dynamic abilities in the face of change (Alqudah et al., 2022; Novitasari et al., 2020). Change emphasizes the importance of self-management, which includes self-direction driven by the value of change and flexibility (Hirschi & Koen, 2021; Wang & Wanberg, 2017). The level of individual understanding requires an awareness of how humans learn as individuals and as members of society and organizations (Akintolu & Letseka, 2021). Developing innovation is considered part of the strategic key because it contributes to human skills (Chirumalla, 2021). Intuitive perception opens people's minds to capture new knowledge and develop creativity (A. M. Müller et al., 2021). Therefore, essential skills a needed in carrying out life activities.

Some Industries are changing the complete digitization and intelligence of manufacturing processes (Dito & Pujiastuti, 2021; Muja et al., 2019). The manufacturing industry, especially the automotive sector, has a significant role in the Indonesian economy (Dito & Pujiastuti, 2021). Indonesia has the highest growth in the motor vehicle industry in Southeast Asia (Purwantoro et al., 2018). The main reason for retaining employees is their insight and mastery of skills about current manufacturing processes (Benešová & Tupa, 2017). Vocational education must answer the demands of the industrial revolution 4.0, where humans and technology are associated with facilitating new potentials (Benešová & Tupa, 2017; Wilert Puriwat & Tripopsakul, 2020). Such continuous knowledge and skills become a challenge for teachers to prepare for changes in the skills taught to students (Abdurrahman et al., 2022; Sudana et al., 2019a). According to current conditions, teachers an expected to improve students' personalization and individualization abilities in terms of knowledge and skills (Spoettl & Tūtlys, 2020). In the era of the industrial revolution 4.0, the quality of teachers is essential (Dito & Pujiastuti, 2021; Fauziah et al., 2021; Matete, 2021). Literacy has become one of the challenges teachers have to face to incorporate essential skills into their professional work (Garzón-Artacho et al., 2021; Van Der Wal et al., 2017). Teachers need to prepare themselves well to provide skills to students to be ready to enter the world of work and provide helpful knowledge for life (Abdurrahman et al., 2022; Pusriawan & Soenarto, 2019). They understand that the context of the industrial revolution 4.0 era a needed for teachers because of the importance of transferring essential skills and current knowledge to students (Gracia et al., 2021).

Literacy is needed to address the skills gap during the industrial revolution 4.0 (Astuti et al., 2021). Literacy is the ability that empowers humans to integrate more advanced thinking into life processes, even in

their decision-making (Wilert Puriwat & Tripopsakul, 2020; Toivonen et al., 2021). Literacy that must possess in this modern era is digital, technological, and human literacy (Prifti, 2020). Literacy can contribute to planning and policymaking and reduce the complexity of human skills in the era of the industrial revolution 4.0 (Lund & Vildåsen, 2022; Toivonen et al., 2021). It focuses exclusively on Science, Technology, Engineering, and Mathematics (STEM) which a designed to help humans respond to perceptions of the critical skill demands of the Industrial Revolution 4.0 era (Heru et al., 2021; Loumpourdi, 2021). The application of literacy is an early phase that has the potential to lead humans to use existing technology in carrying out activities. Therefore, we need people who can think to apply in the face of change (Loumpourdi, 2021; Prifti, 2020). Based on the description above, it is necessary and essential to master literacy in life (Garbie, 2017). The results of previous studies have shown that literacy of essential skills positively influences worker performance (Van Der Wal et al., 2017). This study aims to analyze the literacy level of SMK teachers majoring in Automotive Light Vehicle Engineering on the need for essential skills in the Industrial Revolution 4.0 era. However, several discussion points on this issue have not a revealed in detail. The literacy level of the essential skills in numerical terms is not known. It is essential to investigate, especially for vocational teachers who play a crucial role in providing essential skills to students. This research will focus on the literacy level of Vocational High School teachers to the need for essential skills in the era of the industrial revolution 4.0. The description of the literacy level of Vocational High School teachers can be an evaluation for related parties to develop essential skills that workers must master in the era of the industrial revolution 4.0.

2. METHOD

This research is descriptive quantitative research using a survey research design to describe the literacy level of Vocational High School teachers to the essential skill needs in the Industrial Revolution 4.0 era. The population in this study is a teacher majoring in Automotive Light Vehicle Engineering in Central Java who is in charge of productive subjects. The sample can be from private schools and public schools representing each district. In the data collection process, 168 teachers participated in the research. The characteristics of the respondent's data showed in Table 1.

Table 1. Respondent Data

Characteristics	Category	F	%
Gender	Male	157	93,50
	Female	11	6,50
Age	21-30 year	63	37,50
	31-40 year	72	42,86
	41-50 year	24	14,29
	> 51 year	9	5,36
Teaching experience	< 1 year	8	4,76
	1 -5 year	59	35,12
	6 – 10 year	42	25
	11 – 15 year	37	22,02
	> 15 year	22	13,10
School	Public	13	37,14
	Private	22	62,86

It collects data using a questionnaire containing statements related to literacy in digital and information skills, literacy in thinking skills, and literacy in life and career skills. The research instrument used is a google form-assisted questionnaire that uses a Likert scale design with four answer choice scales, namely Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD). The following is a grid of Vocational High School teacher literacy level questionnaires on essential skill needs in the Industrial Revolution 4.0 era, shown in Table 2.

Table 2. Grid of Research Instruments

Number	Variable	Indicator
1	Literacy in digital skills and informon	Information technology knowledge Computer programming or coding Information data processing Data Analysis Knowledge

Number	Variable	Indicator
		Data information technology security
		Work smart in using technology
		Smart technology products
		Technology development design
		Industrial digital intelligence
2	Literacy in thinking skills	Innovative thinking
		Creative thinking
		Critical thinking
		Problem solving
3	Literacy in life and career skills	Adaptability
		Flexibility
		Collaboration
		socialize
		Self-management
		Time management
		English language
		Job career

(Benešová & Tupa, 2017; Wilert Puriwat & Tripopsakul, 2020)

The literacy level of Vocational High School teachers towards the essential skill needs in the Industrial Revolution 4.0 era is determined based on the criteria, showed in Table 3. After obtaining the results of the indicator category, each variable a then concluded. Conclusions are interpreted in through bar chart images.

Table 3. Literacy Level Categories

Interval Score	Category
$Mi + 1{,}5\ SDi \leq M \leq Mi + 3{,}0\ SDi$	Very high
$Mi + 0\ SDi \leq M \leq Mi + 1{,}5\ SDi$	high
$Mi - 1{,}5\ SDi \leq M \leq Mi + 0\ SDi$	low
$Mi - 3{,}0\ SDi \leq M \leq Mi - 1{,}5\ SDi$	Very low

(Mardapi, 2012)

3. RESULT AND DISCUSSION

Result

The research results are several facts related to the literacy level of Vocational High School teachers in the Department of Automotive Light Vehicle Engineering regarding the need for essential skills in the era of the industrial revolution 4.0. Teachers as educators are identical with having broad knowledge abilities. In learning the industrial revolution 4.0, teachers must involve technology and information in carrying out their professional work. The following are the results of processing Vocational High School teacher literacy questionnaire data on digital and information skills in the Industrial revolution 4.0 era. Teacher Literacy Level on Digital and Information Skills to Industry 4.0 in Table 4.

Table 4. Teacher Literacy Level on Digital and Information Skills to Industry 4.0

Number	indicator	%	Category
1	Information technology knowledge	79,61	High
2	Computer programming or coding	65,92	Low
3	Information data processing	75,15	High
4	Data Analysis Knowledge	70,68	Low
5	Data information technology security	63,99	Low
6	Work smart in using technology	76,19	High
7	Smart technology products	84,97	Very High
8	Technology development design	81,55	Very High
9	Industrial digital intelligence	77,38	High
Total		**75,05**	**High**

Overall literacy of Vocational High School teachers majoring in Automotive Light Vehicle Engineering towards digital skills and information is 75.05%. These results a included in the criteria for the high category.

However, several items an included in the low category criteria, namely, literacy in programming or computer coding, which is 65.92%, knowledge of data analysis is 70.68%, and data information technology security is 63.99%. In this section, the literacy level of Vocational High School teachers majoring in Automotive Light Vehicle Engineering towards digital and information skills in the era of the industrial revolution 4.0 needs to an improved on indicators of knowledge of basic computer programming, knowledge of data analysis, and knowledge of data information technology security. Thinking skills are essential skills that workers must possess. The following are the results of processing data literacy for Vocational High School teachers majoring in Automotive Light Vehicle Engineering on thinking skills in the era of the industrial revolution 4.0. Teacher Literacy on Thinking Skills in The Industrial Revolution 4.0 showed in Table 5.

Table 5. Teacher Literacy on Thinking Skills in The Industrial Revolution 4.0

Number	Indicator	%	Category
1	Innovative thinking	75,89	High
2	Creative thinking	75,00	High
3	Critical thinking	75,15	High
4	Problem solving	75,30	High
Total		**75,33**	**High**

Overall, the level of teacher literacy on thinking skills in the era of the Industrial revolution 4.0 was 75.33%. These results an included in the high category criteria. Thus teacher literacy on thinking skills in Industry 4.0 needs to be improved broadly and deeply to obtain results in the very high category. An understanding of life and career skills is needed to live life in the era of the industrial revolution 4.0. The results of data processing on the literacy level of Vocational High School teachers majoring in Automotive Light Vehicle Engineering on life and career skills in the era of the Industrial revolution 4.0 showed in Table 6.

Table 6. Teacher Literacy on Life and Career Skills in the Industrial Revolution 4.0

Number	Indicator	%	Category
1	Adaptability	76,49	High
2	Flexibility	75,45	High
3	Collaboration	85,57	Very High
4	socialize	86,01	Very High
5	Self-management	75,30	High
6	Time management	75,00	High
7	English language	57,29	Low
8	Job title	77,98	High
Total		**76,13**	**High**

Overall, the data analyzed regarding the literacy of Vocational High School teachers majoring in Automotive Light Vehicle Engineering on life and career skills in the Industrial revolution 4.0 era was 76.13%. These results a included in the high category. Some indicators are still in the low criteria, namely English language skills, 57.29%. A diagram that interprets the results of each variable in this study is presented in Figure 1. Based on Figure 1, the literacy of Vocational High School teachers majoring in Automotive Light Vehicle Engineering towards life and career skills occupies the highest position among other variables, with 76.13%. Then literacy on thinking skills as a whole got 75.33%, and literacy on life and career skills got a percentage of 75.05%.

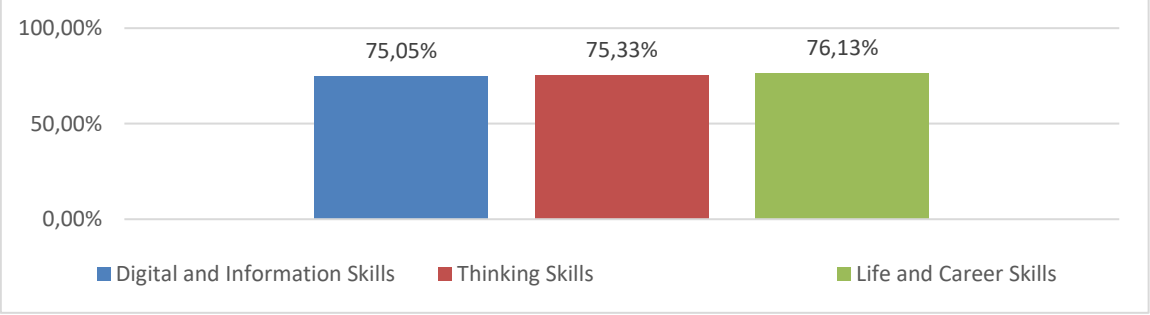

Figure 1. Diagram of the Literacy Level of Vocational High School Teachers in The Automotive Light Vehicle Engineering Department Regarding the Essential Skill Needs in the Era Of The Industrial Revolution 4.0.

Discussion

In the era of the industrial revolution 4.0, essential skills a needed in the manufacturing sector, including the automotive sector (Ally, 2019; Sharma, 2019). The results of this study indicate that literacy in digital and information skills is included in the high category. Although it is included in the high category, literacy for digital and information skills requires special attention in the era of the industrial revolution 4.0 (Elisa Pérez Gracia et al., 2021; Tampang & Wonggo, 2018). The internet of things (IoT)-based technology is increasingly being applied in industry to support work (Chirumalla, 2021). IoT-based technology has been provided to impact the manufacturing industry (Chirumalla, 2021; Liu et al., 2021). One view is effective and efficient in doing work (Spoettl & Tūtlys, 2020). In vocational education, the teacher's role is crucial in providing essential skills for students (Garzón-Artacho et al., 2021). Teachers must be able to review the needs for digital skills and information in the industry (Wilert Puriwat & Tripopsakul, 2020). In research, the importance of apprenticeship programs for teachers to industry to know the skills needed in industry as teaching capital (Forster & Bol, 2018). Awareness of knowing technological developments in specific fields and supporting good work to be instilled in a teacher (Leeferink et al., 2019). Literacy in digital skills and information will not be realized if workers' awareness of the context of their application in life is still lacking (Deja et al., 2021; Jang et al., 2021). Educators also need accuracy in reviewing the application of digital and information skills in the era of the industrial revolution 4.0 (Ally, 2019; Giovanni & Komariah, 2019).

Teacher literacy on thinking skills is in the high category. As in research that an understanding of thinking skills is also very much needed by teachers in the era of the industrial revolution 4.0 (A. M. Müller et al., 2021; Van Der Wal et al., 2017). Thinking skills lead to structured thinking based on existing sources (Rahmawati et al., 2019; M. Xu et al., 2018). Understanding how to think critically is a fundamental thing that must a mastered in the era of the industrial revolution 4.0. The world of work requires thinking skills so that workers do not misinterpret the information that they will use as a consideration in making decisions (Lund & Vildåsen, 2022; Ritter et al., 2020). Therefore, as a giver of knowledge, the teacher must understand how to develop critical thinking skills (Zimmer et al., 2021). It should have been noted that vocational high school students are expected after graduation to be ready to work and face the challenges of changing industrial revolution 4.0 (Bakar, 2018; Singh & Tilak, 2020). The literacy of Vocational High School teachers majoring in Automotive Light Vehicle Engineering on thinking skills in the era of the industrial revolution 4.0 also needs to be improved. Thinking skills are the basis for being creative and taking action in a better direction (Dito & Pujiastuti, 2021; Muja et al., 2019). Analytical thinking skills contribute to making decisions and carrying out activities that require consideration (Heru et al., 2021; Sudana et al., 2019a). In addition, the ability to think is also a trigger for a person to develop and adapt to developments in the era of the industrial revolution 4.0 (Sudana et al., 2019b; Min Xu et al., 2018). The resulting generation expects to be able to make fundamental changes for the future in the face of all developing transformations (Dito & Pujiastuti, 2021). The teacher's overall life and career skills an included in the high category in the literacy section. Teacher literacy on life and career skills is a life skill in facing the challenges of the times, especially the challenges of facing the industrial revolution era 4.0 (Garbie, 2017; Hirschi & Koen, 2021). It will not be easy for prospective workers who cannot adapt to work (Spoettl & Tūtlys, 2020; M. Xu et al., 2018). The result is an increase in unemployment because they cannot adjust to developments in the 4.0 industrial revolution era in their work (Spoettl & Tūtlys, 2020). One step that can a taken is to maximize the skills of Vocational High School graduates to have a good view of life and career skills (Singh & Tilak, 2020). This problem needs to an addressed through professionalism and teacher literacy, and skills development as a strategy to encourage educational change and improvement (Fauziah et al., 2021; Prasojo et al., 2020). Professionalism and teacher development hope to produce prospective tough workers who have abilities in their fields (Matete, 2021). In addition, the importance of teacher experience on job competencies in the field strongly supports teachers' understanding of life and career skills (Hirschi & Koen, 2021). This research contributes to the development of knowledge in Vocational Education. With the literacy level of Vocational High School teachers' essential skills, it can be used as evaluation material for relevant agencies to improve and improve the workforce's ability. In this study, there are limitations; the population taken is not broad. The recommendation for further research is to determine the literacy level of essential skills of a population taken more broadly, such as a single country.

4. CONCLUSION

Literacy of Vocational High School teachers majoring in Automotive Light Vehicle Engineering towards essential skill needs in the era of the industrial revolution 4.0 shows in the high category. Meanwhile, several indicators on the variables showed results in the low category. Literacy on digital and information skills that need to be improved to obtain a high category is knowledge of basic computer programming, data analysis, and data information technology security. Then the literacy variable on life and career skills that need improvement in English. Essential skills are generally needed in work to carry out professional work the need for

mastery of skills in adjusting to the times. Vocational education teachers must master and teach the skills needed in the world of work to students. Various training on honing essential skills needs to be improved.

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