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Escalation of Vocational Student Capabilities through Mapping of Humanware Skill and Infoware Skill Components in the Era of Society 5.0

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Abstract

The objectives of this study include (1) mapping the components of Humanware skills for vocational students; (2) mapping infoware skills for vocational students; (3) mapping the capabilities of vocational students. The method in this study uses descriptive qualitative. Research subjects include universities, vocational high schools (SMK), and industry. The research location is focused on East Java. The research instruments were in the form of questionnaires and documentation. The results of this study include (1) components of humanware skills for vocational students, including the ultimate creativity component, the achievement orientation component, the cooperation orientation component, the orientation to efficiency component, the risk management component, and the discipline and honesty component; (2) Infoware skill components for vocational students, including components of access to the latest information, component linkage of information to the target, component relevant information updates, and component ability to communicate between levels; and (3) components of vocational student capabilities, including systematic communication, collaborated and collaborated, work environment adaptation, structured troubleshooting, and time and risk management.

Keywords: Students Capability, Humanware Skills, Infoware Skills, Society 5.0.

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Introduction

Capabilities are related to the era of society 5.0. In the era of society 5.0, community activities are always related to the use and development of digital technology(Alvarez-Cedillo et al., 2019; imşek & Yazıcı, 2021). The use of digital technology raises various social challenges and opportunities. The emergence of various social problems also colored the emergence of this era. On the other hand, various innovations have emerged related to the development of digital-based technology in various fields of life (Endah, 2021). Education is one of the fields that can make humans adapt to various problems. Especially in the field of vocational education, students as educated subjects must have qualified capabilities. Capability is a determining factor for the success of vocational students in a career in industry. The industrial world is always changing and advancing toward the use and development of digital technology(Apdillah et al., 2022). This is because the challenges of vocational students in the world of work are related to the development of the era of society 5.0.

The capability of vocational students is an important factor in encouraging the advancement of vocational education. Concretely, vocational students play a role in the success of the implementation of vocational education in a country(Sutrisno, 2021). The capability of vocational students has a relationship with humanware skills. Humanware skills of vocational students are related to the ability of students to utilize and develop technology in the era of society 5.0. This means that the success of a country in facing the era of society 5.0 is determined by the humanware skills of vocational students. Various steps to revitalize vocational education are marked by the emergence of lighter programs based on vocational education pilot institutions(Hadi et al., 2019; Khurniawan et al., 2021; Snell, 2019). However, the grand design for the direction of developing vocational education has not been well conceptualized. Synchronizing the world of work with vocational education is still fragmented by various barriers. The problems that arise are indicated by the quality of vocational education graduates who have not been well absorbed by the world of work. The world of work requires the ability of students to be able to adapt to digital technology. So far, there has been no mapping of the humanware skills of vocational students to support the development of vocational education in a country. Mapping vocational students' humanware skills focus on the needs of vocational education institutions, schools, and industry so that the mapping of humanware skills of vocational students becomes important.

The development of information in the era of society 5.0 is very fast. This is marked by the ease of obtaining various information according to the desired needs. The ability to filter and use information is a critical factor in the success of a country in improving the quality of its people. Students are an indicator of the success of a country's human development. So that students must have the ability to utilize and develop various information in the current digital era. The infoware skill component plays a role in increasing the capabilities of vocational students in the era of society 5.0. This component is related to the characteristics of information for the use and development of technology towards efforts to solve various problems that arise in the era of society 5.0(Antesty et al., 2020; Mukhadis, 2009; Taqavi, 2020). Especially in the field of vocational education, the development of student infoware skills is important to realize. However, the mapping of student skill component needs has not yet been carried out by vocational higher education institutions as the epicenter of the advancement of a country's vocational education. This results in the low quality of graduates in utilizing and developing information through digital technology. The problem that is currently the focus of the development of vocational education is developing its students' capabilities. Student capabilities are influenced by humanware skills and infoware skills. If these two components are not developed, it will affect the quality of graduates produced by vocational education. Referring to the problems related to the low quality of graduate vocational students in terms of capability level, this study has three objectives. First, mapping the components of humanware skills for vocational students. Second, mapping infoware skills for vocational students. Third, mapping student capabilities.

Methodology

This study uses a qualitative method. The type of design chosen was descriptive qualitative. Research locations include universities, vocational high schools (SMK), and industries in East Java. The selection of this location refers to the number of vocational and industrial education institutions in East Java. Informants in this study were lecturers at universities, teachers in vocational schools, and employees in the industry. The data collection procedure begins with the process of identifying the location based on the specified criteria. The criteria are intended to enrich research data using vocational education institutions under the auspices of the government and the private sector. In addition, the number of participants used has a balance from the selected location. After determining the location, followed by the distribution of the instrument component of the humanware skill of vocational students, the component of infoware of the skills of vocational students, and the skill capability of vocational students. The research instrument was a semi-open questionnaire and documentation. Data analysis was carried out with qualitative description.

ResultsandDiscussions

The research results section is divided into three components, including 1) the humanware skill component of vocational students, 2) the infoware skill component for vocational students, and 3) the skill capability component of vocational students. More details are shown in the following sub-section.

Vocational Student Skill Humanware Component

The humanware skill component of vocational students is measured through 6 aspects, including 1) the ultimate creativity component, 2) the achievement orientation component, 3) the cooperation orientation component, 4) the orientation to efficiency component, 5) the risk management component, and 6) the discipline and honesty component. . The component of ultimate creativity is measured through three indicators, including 1) problem-solving intelligence, 2) structured imaginativeness, and 3) conceptualized intuition. The results of measurements of the components of the ultimate creativity of vocational students are presented in Figure 1.

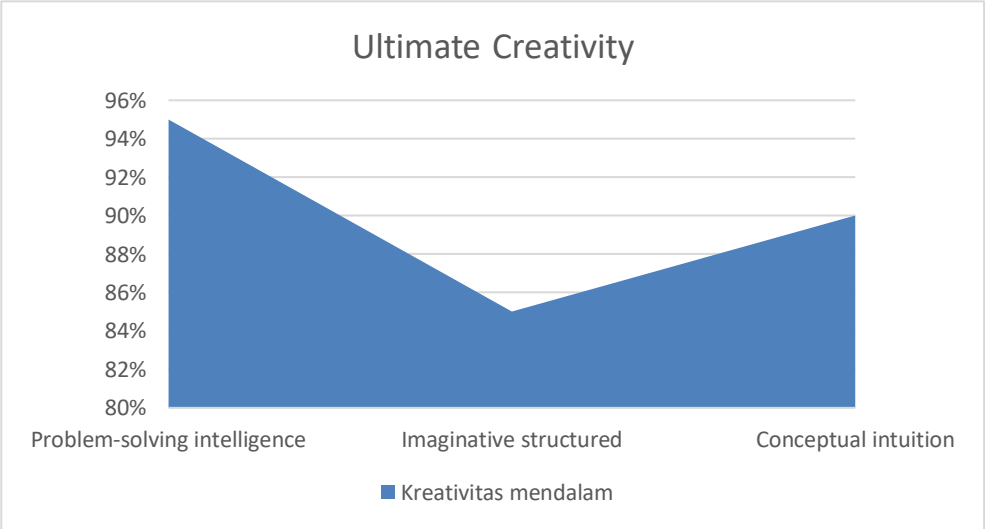

Figure 1. Ultimate creativity component indicator

Figure 1 presents the results of measuring the ultimate creativity component of vocational students in the form of the level of development needed for each indicator. The mapping results in Figure 2 show that the level of need for developing problem-solving intelligence is 95%, the level of need for structured imaginative development is 85%, and the level of need for developing conceptual intuition is 90%. The measurement results in Figure 2 can explain that the need to

develop vocational students' humanware skill component includes three indicators. The achievement orientation component is measured through three indicators: 1) pursuing success, 2) increasing courage, and 3) competitive attitude. The results of the measurement of the achievement orientation component of vocational students are presented in Figure 2.

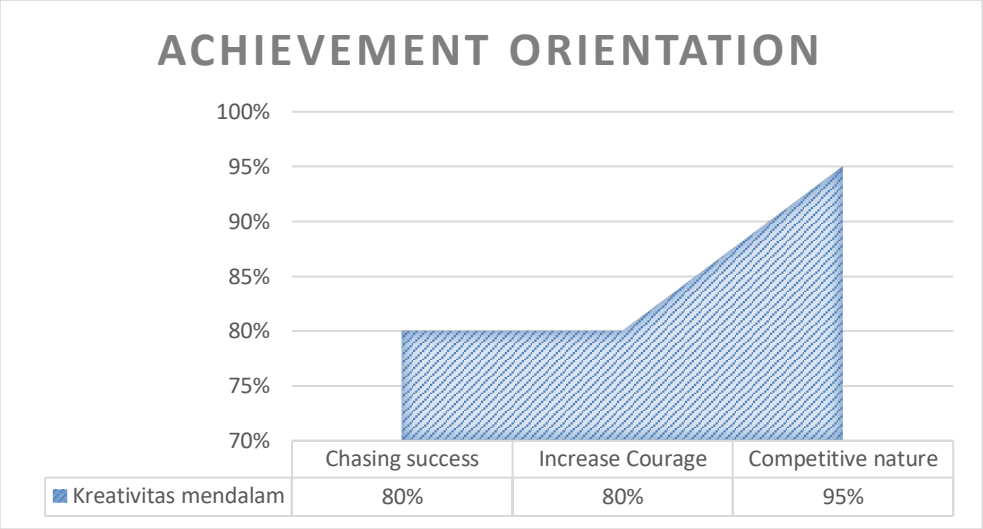

Figure 2. Indicator Component achievement orientation

Figure 2 presents the results of measuring the achievement orientation component of vocational students in the form of the level of development needed for each indicator. The mapping results in Figure 3 show that the level of development needed to pursue success is 80%, the level of development needed to increase courage is 80%, and the level of development needed for competitive traits is 95%. The measurement results in Figure 3 can explain that the need to develop vocational students' achievement orientation component includes three indicators. The cooperation orientation component is measured through three indicators, including 1) group spirit, 2) increasing appreciation, and 3) social sensitivity. The results of measurements of the cooperation orientation component of vocational students are presented in Figure 3.

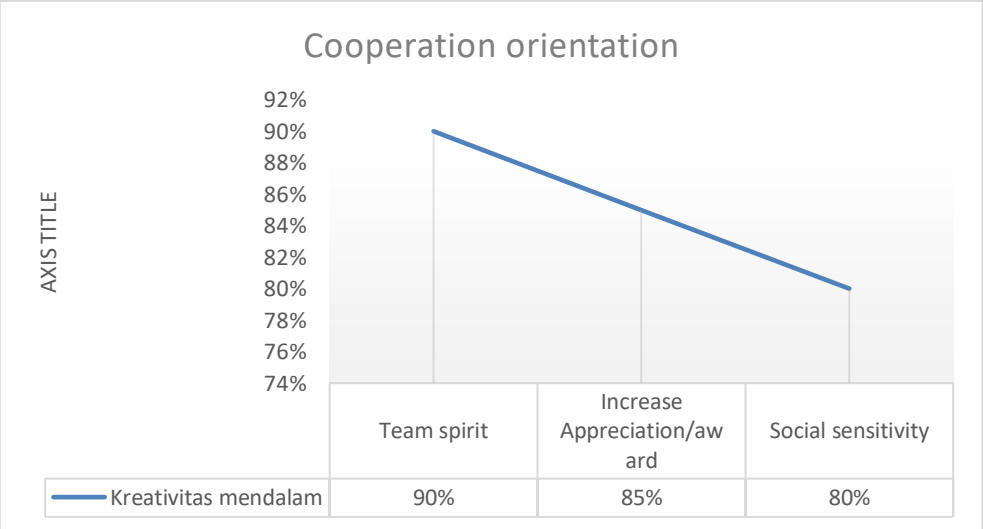

Figure 3. Indicators of the cooperation orientation component

Figure 3 presents the results of measuring the cooperation orientation component of vocational students in the form of the level of development needs of each indicator. The mapping results in Figure 4 show that the level of need for developing group spirit is 90%, the level of

development needs for increasing appreciation is 85%, and the level of need for developing social sensitivity is 80%. The measurement results in Figure 4 can explain that the need to develop the cooperation orientation component of vocational students includes three indicators. The orientation to efficiency component is measured through three indicators: 1) willingness to work hard, 2) increased awareness, and 3) being responsible. The results of measurements of the orientation to efficiency component of vocational students are presented in Figure 4.

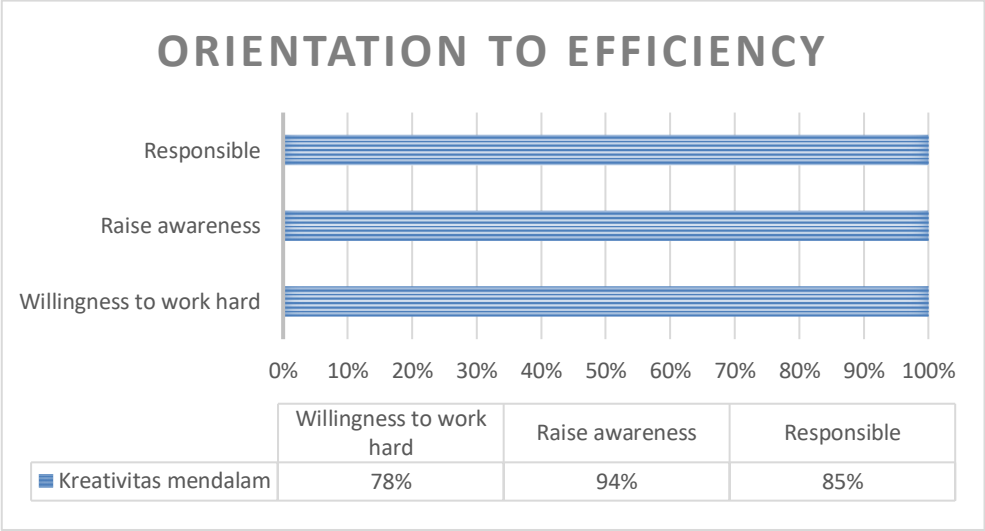

Figure 4. Orientation to efficiency component indicator

Figure 4 presents the results of measuring vocational students' orientation to the efficiency component in the form of the level of development needed for each indicator. The mapping results in Figure 4 show that the level of development needs for willingness to work hard is 78%, the level of development needs to increase awareness is 94%, and the level of development needs is responsible for 85%. The measurement results in Figure 5 explain that the need to develop the orientation to efficiency component of vocational students includes three indicators. The risk management component is measured through three indicators: 1) willingness to experiment, 2) willingness to change for the better, and 3) willingness to take the initiative. The results of the measurement of the risk management component of vocational students are presented in Figure 5.

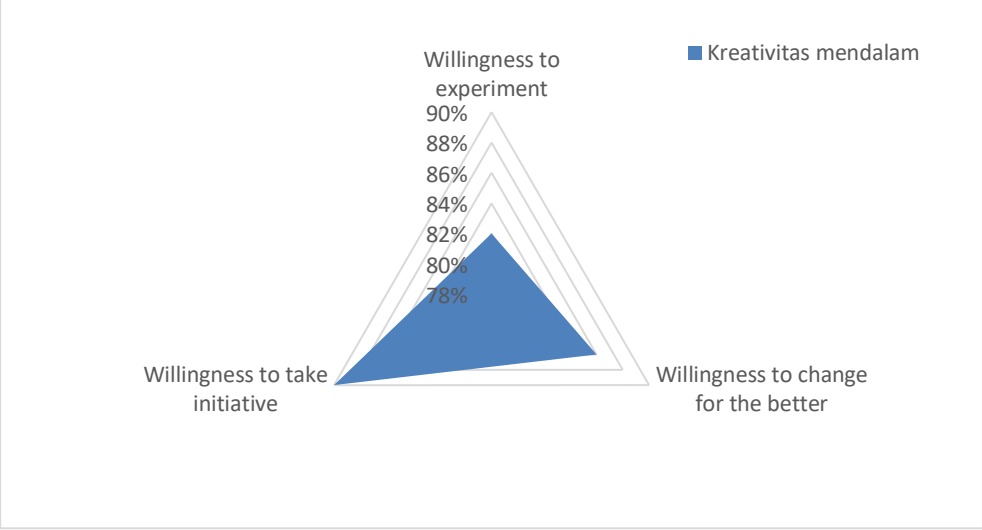

Figure 5. Indicators of risk management components

Figure 5 presents the results of measuring the risk management component of vocational students in the form of the level of development needs of each indicator. The mapping results in Figure 6 show that the level of need for developing the willingness to experiment is 82%, the level of need for developing a willingness to change for the better is 86%, and the level of need for developing the willingness to take the initiative is 90%. The measurement results in Figure 6 can explain that the need for developing a risk management component for vocational students includes three indicators. The discipline and honesty component is measured through three indicators: 1) achieving goals, 2) focusing on the future, and 3) mapping risks and results. The results of the measurement of the risk management component of vocational students are presented in Figure 6.

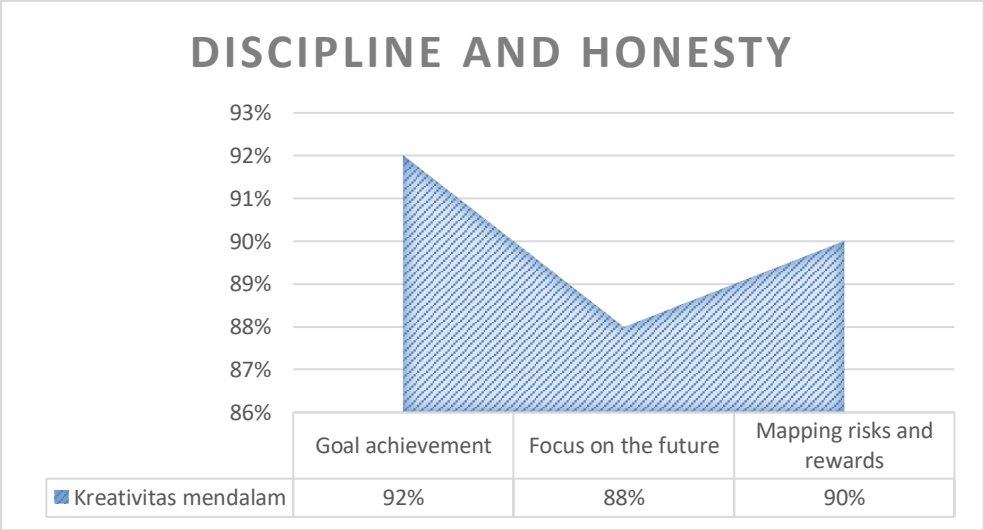

Figure 6. Discipline and honesty component indicators

Figure 6 presents the results of measuring vocational students' discipline and honesty components in the form of the level of development needed for each indicator. The mapping results in Figure 7 show that the level of development needs to achieve the target is 92%, the level of development needs to focus on the future is 88%, and the level of development needs to map risks and outcomes is 90%. The measurement results in Figure 7 can explain that the need for developing discipline and honesty for vocational students includes three indicators.

Vocational Student Skill Infoware Component

The infoware skill component of vocational students is measured through 4 aspects, including 1) the component of access to the latest information, 2) the component of linkage of information to the target, 3) the component of relevant information updates, and 4) the component of the ability to communicate between levels. Access to the latest information is measured through three indicators: 1) providing information, 2) processing information, and 3) interpreting information data. The results of the components of access to the latest information for vocational students are presented in Figure 7.

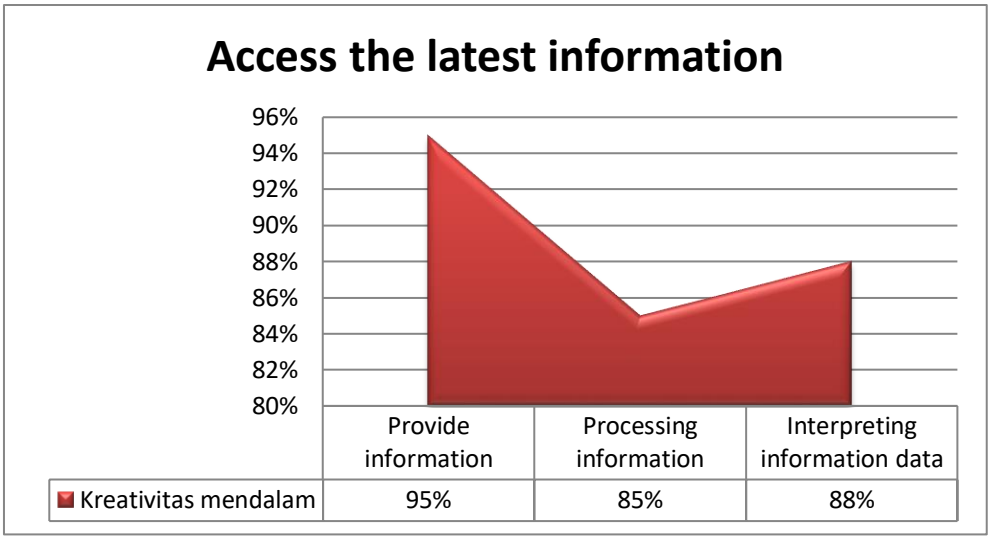

Figure 7. Indicator component access the latest information

Figure 7 presents the measurement results of the access to the latest information component of vocational students in the form of the level of development needed for each indicator. The mapping results in Figure 8 show that the level of development needed for providing the information is 95%, the development needs for processing information is 85%, and the level of development needs for interpreting information data is 88%. The measurement results in Figure 8 can explain that the need for developing access to the latest information components for vocational students includes three indicators. The linkage component of information to the target is measured through three indicators: 1) analyzing the information, 2) adjusting the information data for the purpose, and 3) selecting the main points of information.

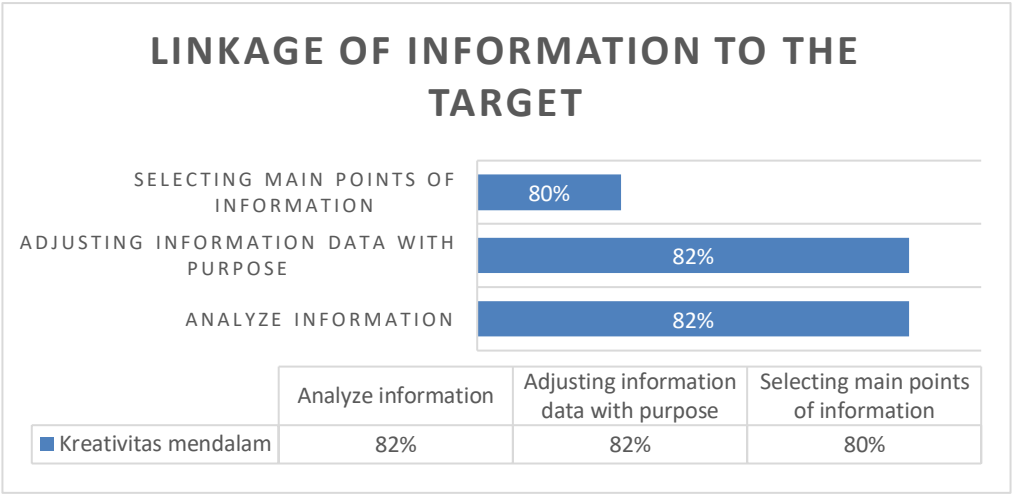

Figure 8. Indicator component linkage of information to the target

Figure 8 presents the results of measuring the linkage of information to the target component of vocational students in the form of the level of development needs of each indicator. The mapping results in Figure 9 show that the level of need for developing the ability to analyze information is 82%, the level of development needs for adjusting information data with objectives is 82%, and the level of development needs for selecting main points of information is 80%. The measurement results in Figure 9 can explain that the need for developing the linkage of information components to the target vocational students includes three indicators. The relevant information updates component is measured through three indicators: 1) digging up the latest information, 2) determining the level of information accuracy, and 3) selecting new relevant information.

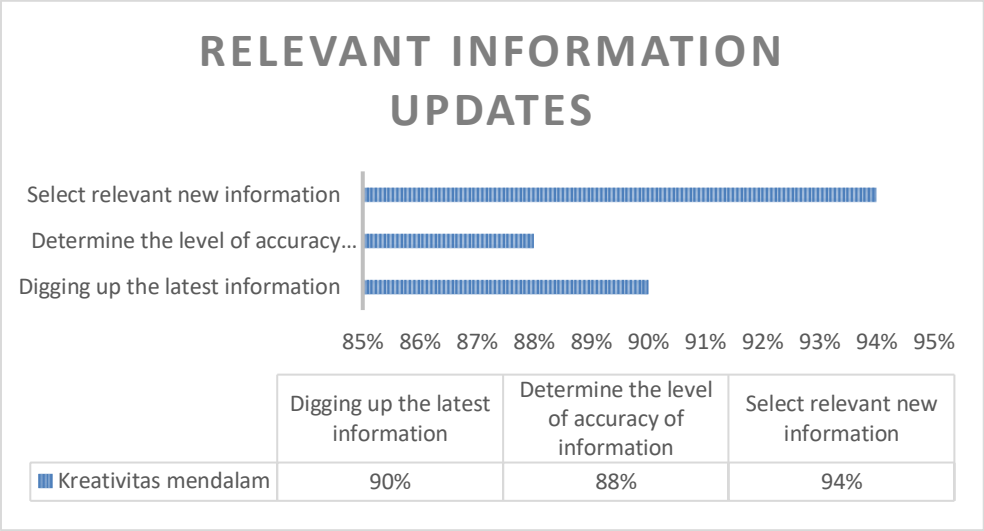

Figure 9. Relevant information updates component indicator

Figure 9 presents the results of the measurement of vocational students' relevant information updates component in the form of the level of development need for each indicator. The mapping results in Figure 10 show that the level of development needed for exploring the latest information is 90%, the level of development needed determines the accuracy of the information at 88%, and the level of development needed for selecting relevant new information is 94%. The measurement results in Figure 10 can explain that the need for developing components of relevant information updates for vocational students includes three indicators. The ability to communicate between levels is measured through two indicators, including 1) actualizing information and 2) conveying information and data specifically.

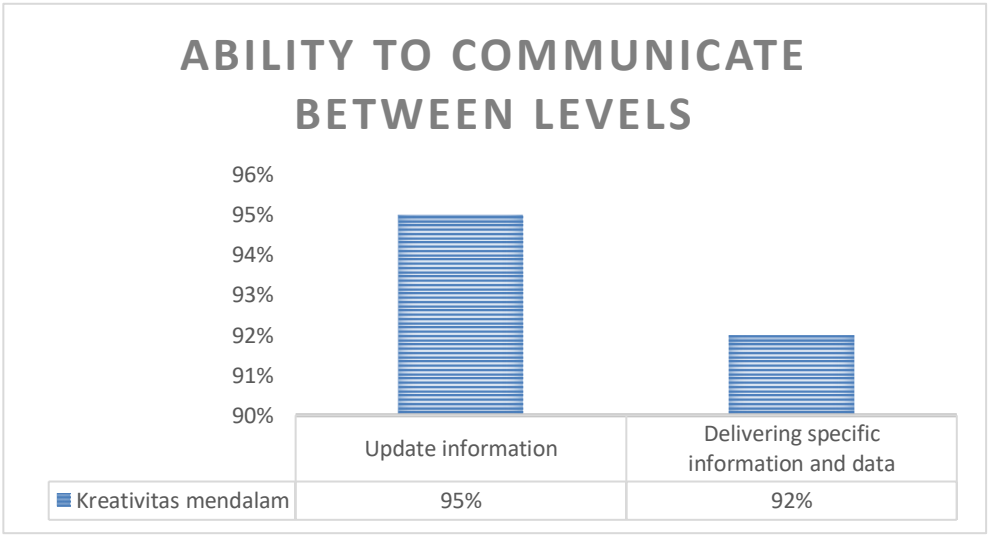

Figure 10. Indicator component of the ability to communicate between levels

Figure 10 presents the results of measuring the composition of the ability to communicate between levels of vocational students in the form of the level of development needs of each indicator. The mapping results in Figure 11 show that the level of need for developing the ability to actualize information is 95%, and the level of development needs for conveying information and data is explicitly 92%. The measurement results in Figure 11 can explain that the need to develop the ability to communicate components between levels of vocational students includes two indicators.

Components of Vocational Student Skill Capabilities

The competency component of vocational students' skills is measured through 5 aspects, including 1) systematic communication, 2) collaborated and collaboration, 3) work environment adaptation, 4) structured troubleshooting, and 5) time and risk management. The results of the measurement of the component capabilities of vocational students are presented in Figure 11.

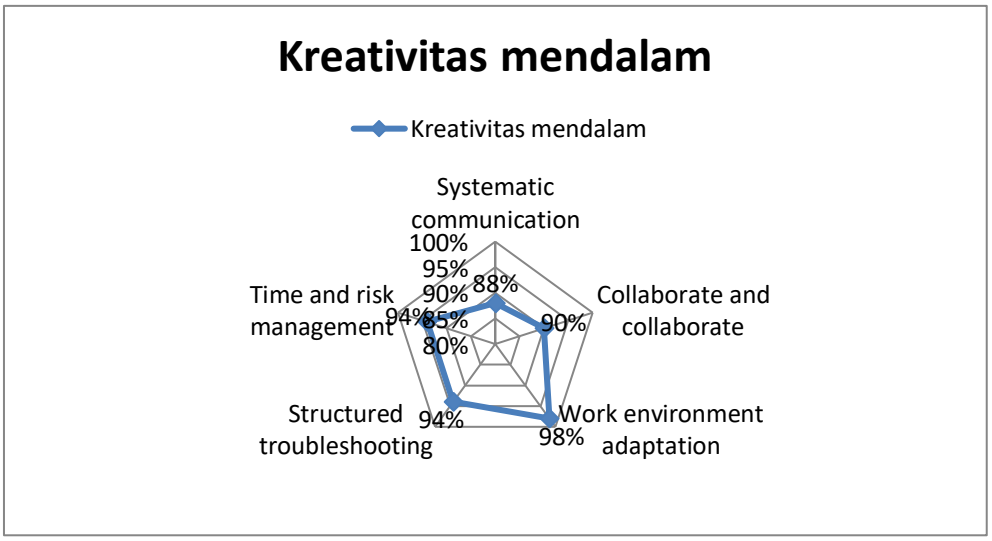

Figure 11. Relevant information updates component indicator

Figure 11 presents the results of measuring the component capabilities of vocational students in the form of the development needs of each aspect. The mapping results in Figure 12 show that the level of need for systematic communication development is 88%, the level of need for developing collaborated and collaborated is 90%, the level of development needs for work environment adaptation is 98%, the level of development needs for structured troubleshooting is 94%, and the level of time development needs and risk management by 94%. The measurement results in Figure 12 can explain that the need for developing components of vocational student skills includes five aspects.

Discussion

In the discussion section, it is divided into three components, including 1) humanware skills of vocational students in the era of society 5.0, 2) infoware skills for vocational students in the era of society 5.0, 3) skill capabilities of vocational students in the era of society 5.0, 4) humanware skills and infoware skills in improving the capability of vocational students in the era of society 5.0.

Humanware Skills of Era Society Vocational Students 5.0

The component of ultimate creativity has a significant influence in mapping the needs for developing humanware skills. Humanware development focuses on increasing student creativity according to technological developments. In society 5.0, the role of student empowerment in a society based on human creativity is the key to success(Yamada, 2021). Student creativity has a relationship with problem-solving intelligence, which has an essential meaning in developing humans in society 5.0. The problem-solving ability has a complex way of thinking according to the reality of life closely related to various social problems. In the era of society 5.0, structured imaginative abilities have an essential role in developing technological innovation. The demand for capabilities that are continually improved requires conceptualized intuition. This ability plays a vital role in following the characteristics of the era of society 5.0(Mukhadis et al., 2021; Putra, Ulfatin, et al., 2022). The achievement orientation component has a significant influence in mapping the need for humanware skill development. This follows the concept of the era of society 5.0, which is human-centered to solving social problems using the latest

technology(Potočan et al., 2021). The development of humanware skills in the achievement orientation component prepares humans to have enthusiasm for pursuing success. In addition, increasing student courage needs to be developed further. The era of society 5.0 with high demands and the complexity of the problems emphasized the importance of developing competitive nature in students to succeed in society.

The cooperation orientation component has a significant influence on the mapping of humanware skill development needs. This component contributes to the integral role of the individual with technological advances for sustainable development(Narvaez Rojas et al., 2021). The development of humanware skills in terms of the cooperation orientation component emphasizes the aspect of good cooperation between students. This is indicated by increasing group spirit, giving awards, and having social sensitivity. Following the concept of society 5.0, humans are the main actors in various social challenges and problems. Therefore, cooperation between humans can form a modern society according to improving the quality of human life. The orientation to efficiency component has a significant influence in mapping the need for humanware skill development. In addition to competence, according to engineering, vocational students must acquire skills to integrate various disciplines to face challenges in the era of society 5.0(Barbieri et al., 2021). The orientation to efficiency component emphasizes the importance of efficiency in solving social challenges and problems. The development of the orientation to efficiency component includes hard work, increased awareness, and responsibility. Vocational students have a strategic role in realizing an increase in orientation to efficiency in the concept of the era of society 5.0. This is related to the world of work that quires the hum to work efficiently according to the specified target.

The risk management component has a significant influence in mapping the need for humanware skill development. Hum society 5.0 is increasingly dependent on artificial intelligence systems(Gladden, 2019). So that various risks of problems that were previously unimaginable will arise. The risk management component emphasizes the importance of good managerial skills in dealing with emerging job risks. The development of the risk management component refers to the willingness to experiment, the ability to change for the better, and initiative. This follows the concept of productive human development to adapt in the era of society 5.0. In society 5.0, the world of work is full of various occupational risks, both in humans and the technological equipment used. Discipline and honesty components have a significant influence in mapping the need for humanware skill development. Discipline and honesty are essential keys to the success of vocational students in the era of society 5.0. Discipline and honesty are oriented toward achieving goals, focusing on the future, and mapping risks and results. This ability is relevant to society 5.0, which emphasizes changes in human quality over time. Society 5.0 brings modern society, the center of civilization, with various technologies(Fukuda, 2020). The center of human civilization is determined by the level of discipline and honesty of the people of a country.

Infoware Skills of Era Society Vocational Students 5.0

The component of access to the latest information has a significant role in mapping the infoware needs of vocational students in the era of society 5.0. The component of access to the latest information is formed by the ability of students to provide information, process information, and interpret information. The development of these three components is critical in increasing access to information. So that vocational students can develop access to the latest information, following the principles of human development in the era of society 5.0, which is based not only on the ability to adapt to changes in digitalization but also on being a leader of transformational change(Sá et al., 2021). This can be realized if students can access the latest information quickly and easily. The linkage component of information to the target contributes to mapping the infoware needs of vocational students in the era of society 5.0. The linkage of information to the target component is formed by the ability of students to analyze information, adjust information data to the purpose, and select the main points of information. The synergy of various innovation application capabilities is an essential point in the era of society 5.0(Carayannis et al., 2021). It is oriented to the linkage of various information to create an innovation. Developing these three components is the key to increasing students' ability to filter information according to their needs so that the linkage of the information needed can achieve

the set targets(Putra, Heong, et al., 2022; Subandi et al., 2021).

The relevant information updates component has contributed to mapping the infoware needs of vocational students in the era of society 5.0. The relevant information updates component is formed by the ability of students to explore the latest information, determine the level of accuracy of the information, and select relevant new information. The development of these three components is the key to increasing students' ability to choose the latest relevant information according to their field. So that later, students will not be left behind with new information according to the development of scientific disciplines, especially in the vocational field. The ability to select and update information plays a role in actualizing students' abilities as developing individuals(Castagnetti & Schmacker, 2020). The component of the ability to communicate between levels contributes to mapping the infoware needs of vocational students in the era of society 5.0. The component of the ability to communicate between levels is formed by the ability of students to actualize information and convey information and data precisely. Developing these three components is the key to increasing students' ability to determine the latest information according to their level of expertise. The role of internet technology determines sustainable human development, which gave rise to the era of society 5.0. So that students are required to be able to communicate well(Roblek et al., 2020).

Era Society Vocational Student Capability 5.0

The results of the analysis of qualitative descriptive research show that the capabilities of vocational students in the era of society 5.0 were formed by the need for frequent communication, collaboration, work environment adaptation, structured troubleshooting, and time and risk management. Systematic communication refers to the ability of students to restructure various information into complete knowledge following the needs of the era of society 5.0. In the era of society 5.0, the world of vocational education prepares students to process various important information. Significant information spread on digital platforms displays various technological advances. So that mastery of technology as a characteristic of human development in society 5.0 can be facilitated. This follows the reality of the digital divide that occurred in the era of society 5.0 (Sá et al., 2021). Student collaboration with other people in social life in society 5.0 is a determining factor for success. The cooperation factor has a function to increase the effectiveness of solving various problems that arise following the emergence of artificial intelligence-based technology. This, of course, should be the primary concern of the world of vocational education. In the era of society 5.0, the role of cooperation between individuals becomes vital because each individual cannot be avoided from the development of current industrial technology(Narvaez Rojas et al., 2021). Often technological developments in the industry cannot be followed by vocational education. Various challenges faced in the development of advanced technology often hinder vocational education to improve practical laboratory facilities. The facilities in the vocational student practicum laboratory should be able to follow the needs of the industry as a strategic partner for vocational education.

The world of work is an essential partner of vocational education in the era of society 5.0. So that the adaptability of students in the work environment must be prepared in vocational education. The essential adaptability means students' flexibility in fulfilling all duties and responsibilities in the workplace industry. This follows the concept that success in the workplace is influenced by an essential factor of one's adaptability. The adaptation in question relates to various human characters, technologies, and rules in the world of work. Adaptation to the world of work is intended to clarify roles and changes in job characteristics as needed (Takao et al., 2021). This concept is a reference in the current implementation of vocational education, which often does not follow the needs of the world of work in the future. The complexity of the problems in the era of society 5.0 is caused by the massive development of the latest technology in all areas of life. Especially in the field of education and industry, where students work has a significant impact. The paradigm shift and student mindset evidence this. So that the ability to solve problems in a structured manner following applicable rules and concepts must be possessed by vocational students, the problem-solving ability can be improved with the use of technology(Gunawan et al., 2020). The use of artificial intelligence technology can solve complex problems in vocational education or the world of work. The speed of technological development has an impact on increasing various risks and accelerating time. Referring to these two things, all

countries compete to develop their human qualities. The quality of students in risk and time management has a strategic role in determining its success. In addition to mastering hard skills, students in society 5.0 are required to master soft skills related to management. Students' risk management abilities can be improved through decision-making theory(Buriachok et al., 2021). The ability to make decisions regarding the risks experienced during study and work is the key to student success.

Humanware Skills and Infoware Skills in Improving the Capability of Vocational Students Era Society 5.0

Efforts that need to be made to increase vocational students' capability in this qualitative descriptive study are viewed from two components, namely humanware skills and infoware skills. In terms of the humanware skill component, the efforts that need to be made to develop the capabilities of vocational students can be made by increasing students' creative abilities, student work enthusiasm, student collaboration, work efficiency, risk management, discipline and honesty. The synergy of these various components can improve the capabilities of vocational students in the era of society 5.0 by increasing humanware skills. This is related to the technology management component to improve student capabilities(Wulandari & Ferry, 2021).In terms of the infoware skill component, the efforts that need to be made to develop the capabilities of vocational students can be made by increasing access to students' abilities in processing the latest information, connecting various information according to goals, updating knowledge with information, and communicating information at various levels. The synergy of these various components can improve the capabilities of vocational students in the era of society 5.0 through increasing infoware skills. The technology development component has a significant role in technological progress(Taqavi, 2020; Wijewardhana et al., 2021). Information and technology are integrated into the characteristics of society 5.0, which affects all fields, including vocational education. Vocational education graduates, as agents of improving the quality of a nation's people, play an essential role in being at the forefront of responding to these challenges.

Factors that affect the humanware skills of vocational students include five aspects. These aspects are creativity, achievement award, cooperation, efficiency, management, discipline, and honesty. This follows the concept of humanware skills, which emphasizes the student factor as the actor in the utilization, development, and preservation of technology according to the development of the era of society 5.0. The concept of humanware skills is related to the characteristics of the human role following technological developments(Carlisle & Merry, 2019; Song et al., 2019). Students, as educated human beings, have more roles in improving the economy of a country by optimizing the industrial world. Factors that affect vocational students' infoware skills include five aspects. These aspects are information updates, information linkages, the relevance of new information, and communication. This follows the concept of infoware skills, which emphasizes the information factor as the utilization and development of technology according to the development of society's era of society 5.0. So the concept of infoware skills is related to the characteristics of the role of information(Antesty et al., 2020; Bobrova et al., 2019). Information that continues to grow affects the direction of the needs of a nation in the world arena.

Capability improvement is the culmination of the synergy of various competencies possessed by students following the development of the era. The development of student capabilities in work has a role in accelerating their careers(Ashford et al., 2018). This has a positive impact on the absorption of productive workers who are constantly innovating. In addition, the campus world is certainly increasingly trusted by the industrial world as a strategic partner for vocational education. The development of student communication skills in the work environment can positively impact the effectiveness of the work carried out. The synergy between roles in work can shorten the duration of working time. This, of course, has a long-term impact on saving expenses. Good communication can promote more solid cooperation between work divisions following their duties and responsibilities. So that various problems and work risks can be overcome jointly between workers. Effective collaboration in the world of work has the strategic effect of increasing profits.

Conclusion

This study shows that mapping humanware skills and infoware skills can escalate the capabilities of vocational students. The humanware skills of vocational students can be improved through the mapping of 6 component aspects. Mapping 4 component aspects can improve the Infoware skills of vocational students. This study has limitations on the research sample, which covers one province. Therefore, the recommendation for further research can use a more comprehensive sample coverage either through formal, informal, or non-formal education within the scope of developing vocational education to face the era of society 5.0 in modern society.

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