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Analysis of Students' Work Readiness Based on Self-Efficacy of Vocational High School in The Building Information Modelling Technology Era

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Abstract: This research was conducted based on social phenomena related to the high level of student anxiety in facing the development of the digital era when carrying out industrial practices due to low confidence in students' abilities. BIM is software for simulating all information in a three-dimensional model that is not only an image, but also a development project system, management, method, and work steps. Therefore, this study aims to determine the relationship between students' self-efficacy and work readiness of Vocational High Schools in facing the Building Information Modelling (BIM) technology era that developed during construction work. BIM as a form of a management information system requires middle-class employees to work jointly as a team. In the field of AEC, the process of planning and design, development, as well as maintenance is performed collaboratively. Furthermore, a total of 360 students in West Java were selected as participants using proportional stratified random sampling. Data were collected using product-moment analysis. The results showed that self-efficacy was positively and significantly related to work readiness with a correlation coefficient of r= 0.692 and p-0.000 where p<0.05. This means that the increase in self-efficacy helps to develop work readiness and vice versa. The coefficient of determination shows that self-efficacy and other variables contribute 47.9% and 52.1%, respectively, to students' work readiness in facing the BIM technology era. This can be interpreted that the higher the self-efficacy, the lower the presentation anxiety and vice versa. Based on the results of this study as recommendations for improvement, it is necessary to carry out additional learning activities to increase student skills, so that student confidence will increase when working.

Keywords: Relationship, collaborative, proportional, determination, Vocational High School

1. Introduction

Construction work is conventional because it has problems or conflicts that occur from design changes to logistics planning (Nelson & Sekarsari, 2019; Saari et al., 2021). These problems lead to an increase in costs due to long-time repairs and disruption of activities (Kia, 2014). Therefore, it requires a concept or an approach that makes it(Borrmann et al., 2018; Camargo et al., 2020; Capron & Audrin, 2021; Eastman et al., 2011; Li et al., 2020; Milyutina, 2018; Succar, 2009) easy to arrange things to reduce this problem (Kolosnichenko et al., 2021).

Currently, Building Information Modeling (BIM)(Ding, Niu, et al., 2020; Mariah, 2009; Marmo et al., 2020) is the technical approach that was developed to assist the construction process. It is one of the models developed (Li, J. et al., 2020; Nelson & Sekarsari, 2019; Sacks et al., 2020) in the form of a management information system (MIS). MIS(Abualdenien & Borrmann, 2020; Lang et al., 2020; Li, J. et al., 2020; Li. Y. et al., 2020; Nelson & Sekarsari, 2019; Sacks et al., 2020) plays an important role in organizations and businesses because it provides useful

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information as feedback to properly run the system. Generally, it consists of several interrelated components including hardware, software, human resources, supporting devices, and networks. In early 2017, BIM become one of the models in MIS which was developed in the United States(Hunhevicz et al., 2021; Kjartansdóttir et al., 2017; Mellado & Lou, 2020). BIM as a technology in the field of Architecture, Engineering, and Construction helps to simulate all the project information into a three-dimensional model (Darko et al., 2020; Eastmen et al., 2008; Mellado & Lou, 2020). In Indonesia, the use of BIM receive a positive response from the construction community because the AEC sector provides tremendous benefits in saving time, costs, and the required employees (Su et al., 2020; Xu et al., 2020).

According to Nelson & Sekarsari (2019), BIM is implemented by State-Owned Enterprises (BUMN) and several large companies. Therefore, its usefulness in the construction sector is limited to answering the question of how to make efficient use of employees, time, and cost requirements (Huang, X et al., 2020; Lu et al., 2020; Ma et al., 2020). The application of BIM is not only using software including Autodesk Revit, ArchiCAD, AECOSim, and others, but needs to be defined as a system, management, method, or steps for working on a project (Kia, 2014; Mellado & Lou, 2020; Underwood & Isikdag, 2010). This is implemented due to the information from all aspects of the building that is managed and projected into three-dimensional models.

However, the Vocational High Schools graduates of the Building Information Modeling and Design programs (Ganiyu et al., 2020; Mellado & Lou, 2020; Saari et al., 2021; Saeed et al., 2021) are all middle-class employees. Students as one of the products of learning at *Desain Pemodelan dan Informasi Bangunan* (DPIB) Vocational High School(Permana et al., 2019) are expected to have good thinking, skills, and spiritual abilities. Therefore, vocational education enables people to survive and adapt in a group while in the working environment. Vocational High School as an educational institution produces employees at the middle level to focus on practical learning activities rather than theory. This does not mean that graduates are ready to work but are influenced by various internal or external factors. Therefore, self-efficacy is one of the internal factors that influence work readiness.

According to Browne & Millington, (2015), Vocational High School students are aged 16-19 years which enables them to get work readiness coaching because they have a nature that is easy to adapt and learn, valuable, as well as independent (Browne & Millington, 2015). Several studies showed that the working world is closely related to the environment and relationships that require good mental, physical, or psychological readiness. This is associated with good communication skills because everything requires seriousness and special abilities. Mental readiness is one of the special abilities that need to be possessed by a prospective job seeker because it helps to generate self-efficacy in dealing with the workplace as a new environment (Romijn et al., 2020).

According to Bandura (2012), self-efficacy is one of the internal conditions that affect work readiness. Therefore, students have a positive impression of feeling confident to get a job if they succeed in recognizing their abilities(Bandura, 2012). The more a person recognizes their abilities, the greater the opportunity to get a job (Pasetto et al., 2020; Utami & Hudaniah, 2013). Furthermore, students with high self-efficacy can deal with the working world and vice versa.

Self-efficacy improves undergraduate skills because it is related to the learning objectives of changing one's behavior. This study aims to determine students' self-efficacy level at Vocational High Schools facing work in the BIM technology era (Ding, Liu, et al., 2020; Ding, Niu, et al., 2020). It emphasizes the relationship between self-efficacy and undergraduates' work readiness in BIM. Also, the study formulation is (1) how is students' self-efficacy level at vocational high school in West Java help to face the BIM Technology era? (2) How is the work readiness of DPIB Vocational High School students facing the BIM technology era? and (3) Is there a relationship between self-efficacy and work readiness of DPIB Vocational High School students facing the BIM technology era?

2. Students' Self-Efficacy Concept

This study explains that self-efficacy reveals a relationship between positive educational outcomes and experiences (Klassen et al., 2011; Wyatt, 2014). Self-efficacy help to navigate the internal psychic world of knowledge and social aspects (Haase et al., 2018; Gosia Marschall & Watson, 2021; Kim et al., 2021; Klassen & Chiu, 2010) of professional learning. According to Bandura (2012), it enables people to become producers of social-environmental outcomes(Bandura, 2012). Also, this presents self-efficacy in a constructivist frame as a self-scheme, a dynamic self-model that is responsive to experiences, memories, the social world, and future possibilities(Klassen & Chiu, 2010).

The self-efficacy theory becomes important in the theme of students' work readiness because it navigates the internal psychic world of knowledge and the social aspects of professional learning (Andretta & Mckay, 2020; Buenconsejo et al., 2020; Datu & Yuen, 2020; Marschall, G. & Watson, 2019; Yao et al., 2021). According to Bandura (2012), self-scheme enables "a person to become producers of social-environmental outcomes". Self-efficacy is the assessment of people's ability to organize and perform the actions needed to achieve certain performance (Bandura, 2012). This assessment is oriented towards students' domain, task, and context. The study of Bandura (2012) showed that self-efficacy is evaluated, developed, and modified through information related to people's abilities in contextual activities. This information is obtained from modelled behaviour and observational learning, social persuasion, as well as active experience (Lang et al., 2020).

According to Bandura (2012), strong self-efficacy tends to underlie people's mindset, feelings and drives to reflect all the abilities possessed(Bandura, 2012; Jendra, 2020). Furthermore, self-scheme directs people to understand their

condition realistically (Huang, L., et al., 2020; Klassen & Chiu, 2010; Utami & Hudaniah, 2013) and adjust job expectations (Huang, L., et al., 2020; Klassen & Chiu, 2010; Utami & Hudaniah, 2013). Self-efficacy is one of the most influential aspects of self-knowledge in human life because it influences people in determining the actions to achieve their goals(Bandura, 2012; Yeh et al., 2021). However, self-scheme is people's belief to master a situation and get positive results (Capron & Audrin, 2021; Gosia Marschall & Watson, 2021).

2.1 Evaluation with Self-Schemata

Self-schemata are cognitive dynamic representations of self-related information or active knowledge about oneself (Marschall, G. & Watson, 2019; Marschall, G. & Watson, 2021). It acts as a bridge between perception and action because it regulates and guides the processing of self-related information contained in people's social experiences. It also serves as a selection mechanism that facilitates future imagination (Bandura, 2012; Marschall, G. & Watson, 2021). According to Browne & Millington,(2015), the development of self-knowledge becomes a cognitive construction that is not only a mechanical audit of one's performance but as a person who does not approach the task without an idea from the environment (Browne & Millington, 2015; Li, L., et al., 2020). This set of people develops self-contained systems structured with extensive and rich semantic networks. Furthermore, self-schemata affect what people seek, how they interpret and organize the information generated, and what is being retrieved from memory.

There is a phenomenological shift related to self-efficacy from the people's mind to calculate and rationalize the world based on sensory input before it is integrated with actions and behaviour. This engages in constant interaction with a changing, complex, and unpredictable while it remains a self-abstraction. Therefore, self-efficacy is indicated as the process in which self-schemata respond to experience(Watson & Marschall, 2019). This refers to people's interpretation or making of meaning in the context of their experience. This study uses the work readiness of *Desain Pemodelan dan Informasi Bangunan* (DPIB) Vocational High School as the sampling and aims to analyse the meaning and interpretation that supports the adaptation of students' self-schemata.

2.2 Characteristics, Classifications, and Sources of Self-efficacy

Self-efficacy is the evaluation of a person's abilities or competence to perform a task, achieve goals, and overcome obstacles(Schechtman, 2015; Utami & Hudaniah, 2013; Yada et al., 2021). It is the ability to drive motivation, cognition, and actions required to fulfil the demands of the situation (Bandura, 2012; Lang et al., 2020; Nuutila et al., 2021). Self-efficacy is obtained, changed, improved, and lowered through one or a combination of four sources, including (1) performance accomplishment, (2) vicarious experiences, (3) social persuasion, and (4) emotional physiological states (Bandura, 2012; Lang et al., 2020; Morris et al., 2016). Performance accomplishment is a past achievement, while vicarious experience is obtained through social models. However, social persuasion is a sense of trust and the reality about what is being persuaded.

Self-efficacy changes are influenced by four functions (Bandura, 2012; Schechtman, 2015), including (1) cognitive, (2) motivation, (3) effective, and (4) selection. Meanwhile, its level is influenced by three aspects, namely (1) Magnitude which is generated through the process of thinking, making decisions, and acting, (2) Generality which is directed to the individual's beliefs, and (3) Strength directed to a person's commitment in facing a problem(Bandura, 2012; Lang et al., 2020).

Therefore, self-efficacy helps people in forming positive thoughts which motivate them to act. Students with high self-efficacy tend to know their abilities to feel confident and optimistic while completing a task. People who are not sure of their abilities always think pessimistically while performing activities.

2.3 Work Readiness

Work readiness is the harmony between people's physical, mental, and ability to complete a task. It is the readiness of responding to a situation and the developmental level of maturity to practice something(Baharuddin et al., 2017; Cabrera, 2020; Sagita et al., 2020). Work readiness is indicated as people's ability to complete certain tasks(Makki et al., 2016). There are 4 (four) aspects that affect one's work readiness, including (1) aspects of mental, emotional, and physical development; (2) physical and spiritual maturity; (3) positive experiences at work; and mastery of expertise in the field. According to Browne & Millington, (2015), indicators of industrial work readiness include: (1) having logical and objective thinking; (2) aspects of sufficient knowledge and skills; (3) having the motivation to work; (4) being able to adapt to the environment; (5) able to cooperate with other people; (6) responsibility; (7) can control themselves; (8) can keep up with technological developments; and (9) critical (Browne & Millington, 2015; Ganiyu et al., 2020; Haase et al., 2018).

3. Methods

This study is correlational because it aims to determine the relationship between students' self-efficacy and work readiness at Vocational High Schools in facing the BIM technology era. A total of 360 students from 10 schools were selected as participants using probability with proportional stratified random sampling. Table 1 below shows the

selection of 10 schools based on district and city.

Table 1- Schools and Respondents

Location	School Name	Student	
		Number	Grade
City	State Vocational High School 5 Bandung	46	11
	State Vocational High School 6 Bandung	46	11
	Vocational High School PU N West Java Province	34	11
District	State Vocational High School 1 Cirebon	34	11
	State Vocational High School 1 Sukabumi	32	11
	State Vocational High School 7 Baleendah	30	11
	State Vocational High School 1 Cilaku	32	11
	State Vocational High School 9 Garut	36	11
	State Vocational High School 2 Ciamis	34	11
	State Vocational High School 1 Sumedang	36	11
10 Schools			

Source: research document, 2021

This research was conducted in the 2020/2021 academic year in 10 schools in the province of West Java, Indonesia, grouped by school location, namely in districts and cities. Data were collected through a questionnaire containing closed questions using a Likert scale. The first step is to test the instrument, namely testing its validity and reliability. The validity test is intended to measure the level of measurability of the instrument both from the validity of the content, criteria, and structure. After completion, it is followed by a reliability test aimed at measuring the consistency of the instrument with the re-test method and Cronbach's alpha coefficient. An example of an item for measuring self-efficacy is "How confident are you that you can complete this task well?". This item is included in the valid and reliable items. The next step was analyzed by calculating the trend test for students' self-efficacy and work readiness as well as the Respondent Achievement Level (TCR). The initial steps of analysis include data collection, reduction, presentation, and drawing conclusions(Creswell, 2010; Miles, Huberman, & Saldana, 2014).

This study aims to determine the relationship between self-efficacy and work readiness in facing the BIM technology era. Data processing and statistical calculations were examined using IBM SPSS version 25.00. The results are interpreted by examining the probable error index (p-value) ranging from 0.05 to 0.01. The result is insignificant if the statistical test gets a p-value > 0.05, while it becomes significant if the p-value is 0.05. Data were described into 2 categories, including high and low. The T-score formula is used to determine the rarity in each category.

4. Results and Discussion

4.1 Results

A questionnaire that includes cognitive, motivational, affective, and selective functions is used to answer the question of how students' self-efficacy faces the BIM technology era. The results are positive because out of 360 respondents, 267 (74.17%) are in the high category, as shown in Fig. 1.

Fig. 1 - The results of calculating the level of self-efficacy

Table 2 shows the TCR of the 6 work readiness indicators.

Table 2 - TCR based on the elements of self-efficacy function

Indicator	n	TCR	TCR Idx	Criteria
Cognitive Function	360	1.184,26	82.24%	Good
Motivation Function	360	1.211,76	84.15%	Good
Affective Function	360	1.166,69	81.02%	Good
Selective Function	360	1.157,47	80.38%	Good
Total mean			81.95%	Good

Source: Author Analysis, 2021

The results are classified as "good" with TCR index of 81.95%. Fig. 2 shows TCR data based on the students' self-efficacy function.

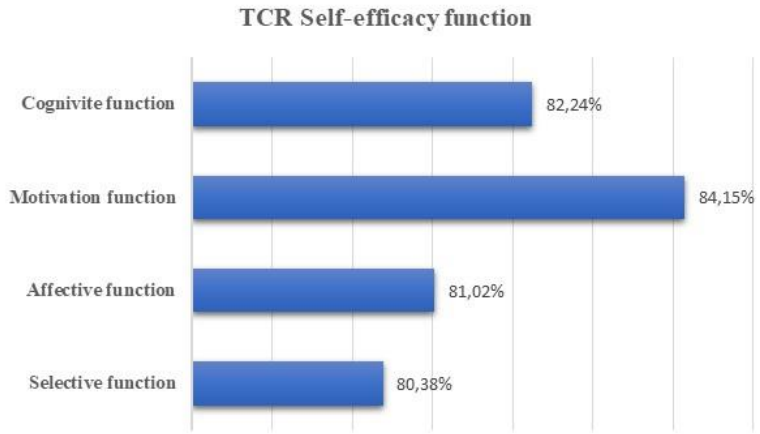

Fig. 2 - Graph of students' self-efficacy TCR index based on function indicators

Based on these elements, the prominent function is the motivation of 84.15%, followed by cognitive, affective, and selective. A questionnaire that includes magnitude, generality, and strength is used to answer the question of how students' self-efficacy faced the BIM technology era. The results are positive because out of 360 participants, 279 (77.5%) are in the high category. Table 3 shows TCR from the three levels of self-efficacy.

Table 3 - TCR based on the levels of self-efficacy aspect

Indicator	n	TCR	TCR Idx	Criteria
Magnitude	360	1.141,49	79.27%	Sufficient
Generality	360	1.171,15	81.33%	Good
Strength	360	1.186,27	82.38%	Good
Total mean			80.99%	Good

Source: Author Analysis, 2021

The results are classified as "good" with TCR index of 80.99%. Fig. 3 shows TCR data based on students' self-efficacy.

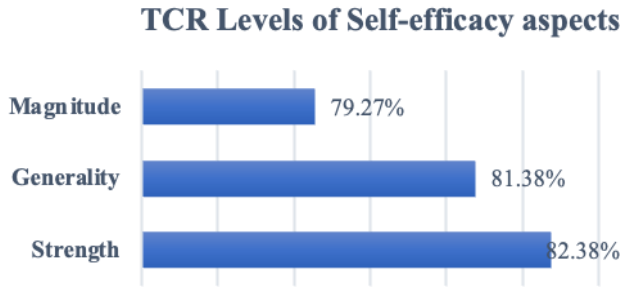

Fig. 3 - Graph of students' self-efficacy TCR index based on the levels of self-efficacy aspect

Based on students' self-efficacy in facing the BIM technology era, the prominent level is the strength of 82.38%, followed by generality and magnitude.

These results answer the question regarding work readiness and the Building Information Design program faced in the BIM technology era. Data were collected using a questionnaire distributed to 360 students. The results are positive because out of the selected participants, 286 (79.44%) are in the high category. A total of 7 indicators, including responsibility, knowledge, skills, interests, logical thinking, cooperation, and flexibility are used in this questionnaire. Table 4 shows the TCR of the 7 work readiness indicators.

Table 4 - TCR based on work readiness indicators

Indicator	n	TCR	TCR Idx	Criteria
Responsibility	360	1.170,72	81.30%	Good
Knowledge	360	1.187,71	82.48%	Good
Skills	360	1.094,69	76.02%	Sufficient
Interests	360	1.177,06	81.74%	Good
Logical thinking	360	1.126,51	78.23%	Sufficient
Cooperation	360	1.228,32	85.30%	Good
Flexibility	360	1.158,48	80.45%	Good
Total mean			80.79%	Good

Source: Author Analysis, 2021

The results are classified as "good" with a TCR Index of 80.79%. Fig. 4 shows TCR data on the students' work readiness.

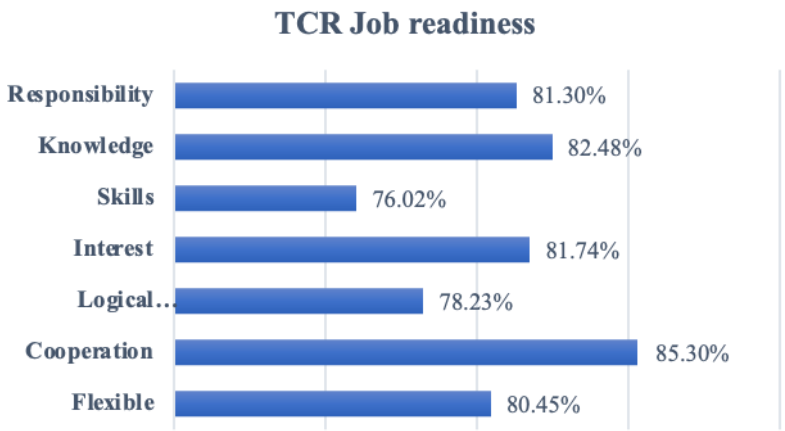

Fig. 4 - Graph of student work readiness TCR index based on work readiness indicators

Fig. 1 shows that the best indicator is cooperation, followed by knowledge, interests, responsibility, flexibility, logical thinking, and skills. Based on the calculation using the T-score formula, the data description of self-efficacy and work readiness variables are indicated as follows.

4.2 Self-efficacy

Table 5 shows the categorization results of the self-efficacy scale data, which is divided into 2 high and low categories.

Table 5 - T-score for self-efficacy

Category	Interval	Frequency	Percentage
High	T-score ≥ 50	279	77.5%
Low	T-score < 50	81	22.5%
Total		360	100%

Table 5 indicates 279 students (77.5%) out of 360 respondents are in the high category and the remaining 81 (22.5%) have low self-efficacy.

4.3 Work Readiness

Table 6 shows the categorization results of students' work readiness data, which is divided into 2 high and low categories.

Table 6 - T-score for student work readiness

Category	Interval	Frequency	Percentage
High	T-score ≥ 50	286	79.44%
Low	T-score < 50	74	20.56%
Total		360	100%

Table 6 shows 286 students (79.44%) out of 360 respondents are in the high category and the remaining 74 (20.56%) have low work readiness.

Relationship between Students' Self-efficacy and Work Readiness (Correlation Value Calculation)

Based on table 7, data analysis indicates that the level of self-efficacy has a relationship with work readiness with the value of the Pearson correlation coefficient r-value = 0.692 (r = 0.000). This shows that students' self-efficacy is positively and significantly related to work readiness in facing the BIM technology era. Therefore, the increase in self-efficacy help to develop students' work readiness and vice versa. Table 7 shows the product-moment correlation test results.

Table 7 - Product moment correlation results

Correlations			
		Self-Efficacy	**Work Readiness**
Self-Efficacy	Pearson Correlation	1	.692**
	Sig. (2-tailed)		.000
	N		360
Work Readiness	Person Correlation	.692**	1
	Sig. (2-tailed)	.000	
	N	360	360
**. Correlation is significant at the 0.01 level (20tailed)			

Coefficient of Determination Calculation Results

Based on Table 8, self-efficacy effectively contributes to students' work readiness in Vocational High School with a determination value of 47.9% whereas the remaining 52.1% is influenced by other factors. Table 8 shows the coefficient of determination calculation results.

Table 8 - Coefficient of determination

Model	R	R Square	Adjusted R Square
1	.692[a]	.479	.466

5. Discussion

Based on the results of the research that has been done, it can be concluded that the relationship between self-efficacy and work readiness of DPIB Program Vocational High School students in facing the BIM technology era has a positive relationship and is classified as a strong relationship. Most of the 360 respondents had high self-efficacy (77.5%) and most had a high level of work readiness (79.44%).

According to Bandura, (2012), students' self-efficacy has a positive relationship with work readiness. Therefore, the increase in self-scheme tends to develop the readiness to enter the working world. The analysis results showed that the majority of students have work readiness in the good category with 79.44%. Meanwhile, the low section is caused by a lack of skills and knowledge, expectation, as well as self-development and optimism. Students with high work readiness overcome obstacles or problems because they have the knowledge and skills, as well as effective understanding needed in a job.

Based on the data obtained, undergraduates' self-efficacy is in a good category where each indicator has a different level. The indicators with the highest and lowest levels are strength and magnitude with values of 82.38% and 79.27%, respectively. Students tend to be confident while dealing with stressful situations or problems if they have high self-efficacy. This condition is in line with the opinion of Bandura, (2012) on how people's ability promotes the growth of motivation and cognition to achieve a certain result. Self-efficacy allows students to be confident in performing tasks or actions. Also, it increases through the learning process that is inseparable from fostering material. Self-efficacy tends to improve the scope of a job to increase students' work readiness.

This study is in line with Bandura, (2012) and Utami & Hudaniah, (2013) that people with high self-efficacy always feel ready to work, while those who are unsure feel restless were forced to perform a task. Therefore, the majority of students are confident in their drawing abilities to deal with a problem. Based on Table 4, undergraduates tend to answer agree and strongly agree with the mean score in the good category. This means that their self-efficacy due to the strength aspect is in the high section.

However, this aspect has the highest TCR index of 82.38% in the good category. This shows the direction of people's commitment to persist and try to overcome a problem. Meanwhile, commitment is the keyword in this strength aspect because people with high self-efficacy are committed to achieving their goals. This is in line with Bandura (2012) that a person with commitment needs to be sure of his abilities. Furthermore, this strength aspect is indicated from the academic, social, and self-regulatory sides. This is supported by Browne & Millington, (2015) and Morris et al., (2016) that people with high self-efficacy become competent to perform a task, achieve goals, and overcome obstacles. Therefore, self-scheme is achieved due to cognitive processes in the form of people's decisions and expectations (Schechtman, 2015; Märtsin, 2019; and Yada et al., 2021).

Meanwhile, the generality aspect has a TCR index of 81.33% in the good category. This aspect is more directed to people's beliefs in performing a task. Therefore, DPIB Vocational High School students fall in the good section due to the confidence they possess in their abilities. According to Bandura, (2012), the generality aspect emphasizes more on people's beliefs on what can be performed with their skills. Therefore, self-efficacy emphasizes the component of self-confidence in dealing with future situations that are not predicted because it is full of pressure. It combines with the environment, previous behaviour, and other personal variables to produce an outcome. This means that students with high self-efficacy are fully prepared to face different existing situations despite being unpredictable and stressful. The aspects that specify how people have a high score for the generality indicator include academic competence, free time usage, and commitment to learning.

The magnitude aspect has a TCR index of 79.27% in the sufficient category. This shows that most students have fairly good self-efficacy but still need the opportunity to be developed through continuous and early training. Therefore, support and motivation from family and the environment are needed to achieve confidence in a person's abilities. The role of teachers, parents and people's responses is necessary for students as reinforcement. Furthermore, undergraduates who have confidence overcome obstacles or problems because they are prepared to face the working world.

A task becomes easy if the student faces it without any obstacles but uses self-efficacy to solve a difficult one. In this study, some students select to show avoidance behaviour while facing difficult conditions. This is in line with the magnitude indicator that has a TCR index of 79.27%. Furthermore, students' mental status, talents, learning achievement, and self-characteristics need to be assessed to avoid or correct their weaknesses. This enables undergraduates to be more confident in their ability to solve problems and achieve certain goals.

Based on Table 4, students' work readiness has a TCR index of 80.79% in the good category. Meanwhile, cooperation is the highest indicator with 85.30% followed by knowledge, interest, responsibility, and flexibility, while skills and logical thinking are in the sufficient category. The strength aspects have a TCR index of 85.3% because the cooperation factor ranges from planning, design, implementation, and operations through the development of management information systems requires good teamwork. The BIM technology era leads to the completion of work from architectural, civil, mechanical, electrical, and others due to the conventional work that is performed in stages (Succar, 2009 and Hunhevicz et al., 2021). Furthermore, BIM technology enables work to be carried out jointly due to deficiencies and errors that are minimized in the planning and design process during construction.

The knowledge indicator with a TCR index of 82.8% becomes the subsequent capital for students in preparing and equipping themselves for work. This is related to undergraduates' ability in identifying things that are prepared and needed to become drafters. Knowledge is one of the aspects that need to be possessed by people in the working world because it helps in becoming experts. Therefore, work readiness is a person's capacity to develop abilities and expertise (Bandura, 2012).

Interest as the third indicator becomes the main capital for students' work readiness with a TCR index of 81.74%. This shows that undergraduates select the DPIB Vocational High School due to their selection and desires. Responsibility as a strength factor is another indicator with a TCR index of 81.3%. The basic concept of this indicator is self-discipline and self-control which includes how undergraduates complete the assigned tasks within the time allotted. Based on the responses, students have responsibility for the tasks given during learning.

Meanwhile, skills and logical thinking are the weak indicators with a TCR index of 76.02% and 78.23%, respectively. These two indicators need to be improved along with technological developments. Self-view is one of the influencing aspects because it allows people who are ready to work to know their abilities to think logically and objectively. This sufficient score provides an illustration of how Vocational High School students improve their skills and logical thinking to enter the working world.

The results showed that self-efficacy is positively and significantly related to students' work readiness in facing the BIM technology era with a correlation coefficient of r = 0.692 in the "moderate" category. In this study, the effect of self-scheme on work readiness is 47.9% and the remaining is influenced by other variables. The analysis results showed that students' self-efficacy and work readiness are at a good level. Therefore, the increase in people's self-efficacy tends

to improve their work readiness because undergraduates feel confident in their abilities before facing the working world. This is in line with Bandura, (2012) that a person's self-efficacy is indicated through his ability to achieve certain goals. This is supported by Schechtman (2015) that self-scheme does not only affects one's actions but also thoughts and feelings. Meanwhile, the differences in self-efficacy and work readiness are caused by the difficulty levels of the task faced because people need to go through a process of thinking, making decisions, and acting.

6. Conclusion

Generally, self-efficacy is correlated with students' work readiness at DPIB Vocational High School in the BIM technology era. This study result showed that the increase in self-efficacy help to improve work readiness. This means that students feel confident in their abilities before facing the working world. However, skills and logical thinking are the two weak indicators that need to be improved along with technological developments. Self-view is one of the influencing aspects because it allows people who are ready to work to know their abilities and limitations to think logically as well as objectively. This means that students need to improve their skills and logical thinking to enter the working world. As a recommendation for improving and increasing student confidence, it is necessary to carry out additional learning activities to increase student skills. So that students' self-confidence will increase when working and being able to compete. In other studies, it can be examined from other internal and external factors.

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References

Abualdenien, J., & Borrmann, A. (2020). Advanced Engineering Informatics Vagueness visualization in building models across different design stages. *Advanced Engineering Informatics*, *45*(December 2019).

Andretta, J. R., & Mckay, M. T. (2020). Children and Youth Services Review Self-efficacy and well-being in adolescents : A comparative study using variable and person-centered analyses. *Children and Youth Services Review*, *118*(June), 1–7.

Baharuddin, F. R., Syafrudie, H. A., Sudjimat, D. A., & Syam, H. (2017). The Contribution of Work Environment and Motoric Cognition on Work Readiness of Vocational High School Student. *Advances in Social Science, Edu. and Humanities Research (ASSEHR), Vol. 149 2nd Int. Conf. on Edu., Sci., and Tech. (ICEST 2017)*, *149*(Icest), 112–114

Bandura, A. (2012). On the Functional Properties of Perceived Self-Efficacy Revisited. *J. of Management*, *38*(9–44).

Borrmann, A., Koch, C., König, M., & Beetz, J. (2018). Building Information Modeling : Why ? What ? How ?: Technology Foundations and Industry Practice. *Semantic Enrichment for BIM*, *February 2019*, 1–24.

Browne, E., & Millington, K. A. (2015). *Social Development and Human Development: Topic guide.* GSDRC, University of Birmingham / HEART.

Buenconsejo, J. U., Alfonso, J., & Datu, D. (2020). Growth and fixed mindsets about talent matter for career development self- efficacy in selected Filipino adolescents. *Children and Youth Services*, *118*(September), 1–6.

Cabrera, W. C. (2020). Development and Validation of Work Readiness Assessment Scale for Home Economics Graduates. *International Journal of Economics Development Research*, *1*(2), 70–109.

Camargo, A., Çelik, P., & Storme, M. (2020). Cultural self-efficacy increases creativity in bicultural dyads: Evidence from two dyadic divergent thinking tasks. *Thinking Skills and Creativity*.

Capron, I., & Audrin, C. (2021). Improving self-efficacy and creative self-efficacy to foster creativity and learning in schools. *Thinking Skills and Creativity*, *42*(July).

Creswell, J. W. (2010). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. SAGE Publications.

Darko, A., Chan, A. P. C., Yang, Y., & Tetteh, M. O. (2020). Computers in Industry Building information modeling (BIM) -based modular integrated construction risk management – Critical survey and future needs. *Computers in Industry*, *123*(103327).

Datu, J. A. D., & Yuen, M. (2020). Students ' connectedness is linked to higher gratitude and self-efficacy outcomes. *Children and Youth Services Review*, *June 2020*.

Ding, Z., Liu, S., Luo, L., & Liao, L. (2020). A building information modeling-based carbon emission measurement system for prefabricated residential buildings during the materialization phase. *Journal of Cleaner Production*, *April*.

Ding, Z., Niu, J., Liu, S., Wu, H., & PII:, J. Z. (2020). An approach integrating Geographic Information System and Building Information Modelling to assess the Building Health of Commercial Buildings. *J. of Cleaner Production*, Feb.

Eastman, C., Teicholz, P., Sacks, R., & Liston, K. (2011). *BIM Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers, and Contrctors*. John Wilet & Sons, Inc.

Eastmen, C., Teicholz, P., Sacks, R., & Liston, K. (2008). *BIM Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers, and Contractors*. John Wiley and Sons, Inc.

Ganiyu, S. A., Oyedele, L. O., Akinade, O., Owolabi, H., Akanbi, L., & Gbadamosi, A. (2020). Developments in the Built Environment BIM competencies for delivering waste-ef fi cient building projects in a circular economy. *Developments in the Built Environment*, *4*(June).

Haase, J., Hoff, E. V, Hanel, P. H. P., & Innes-ker, Å. (2018). A Meta-Analysis of the Relation between Creative Self-Efficacy and Different Creativity Measurements A Meta-Analysis of the Relation between Creative Self-Ef fi cacy and Different Creativity Measurements. *Creativity Research Journal ISSN:*, *0419*(30 January), 1–16.

Huang, L., Zhang, T., & Huang, Y. (2020). Effects of school organizational conditions on teacher professional learning in China : The mediating role of teacher self-e ffi cacy. *Studies in Educational Evaluation*, *66*(October 2019).

Huang, X., Mayer, R. E., & Usher, E. L. (2020). Better together : Effects of four self-efficacy-building strategies on online statistical learning. *Contemporary Educational Psychology*, *63*(October), 14.

Hunhevicz, J. J., Motie, M., & A, D. M. H. (2021). Digital building twins and blockchain for performance-based (smart) contracts. *Automation in Construction*, *133*(103981).

Jendra, A. F. (2020). *Pengaruh Efikasi Diri Terhadap Kecemasan Presentasi Siswa Kelas XI di SMA Negeri 1 Wuryantoro*[The Effect of Self-Efficacy on Presentation Anxiety of Grade XI Students at SMA Negeri 1 Wuryantoro]. *4*(1), 138–159.

Kia, S. (2014). Review of BIM Software Packages Based on Assets Management. *Amirkabir University of Technology*, *May*.

Kim, M., Oh, J., & Beomsoo Kim. (2021). Experience of digital music services and digital self-efficacy among older adults: Enjoyment and anxiety as mediators. *Technology in Society*, *67*(101773).

Kjartansdóttir, I. B., Mordue, S., Nowak, P., Philp, D., & Snæbjörnsson, J. T. (2017). *Building Information Modelling (BIM)*. Civil Engineering Faculty of Warsaw University of Technology.

Klassen, R. M., & Chiu, M. M. (2010). Effects on Teachers ' Self-Efficacy and Job Satisfaction : Teacher Gender , Years of Experience , and Job Stress. *Journal of Educational Psychology*, *102*(3), 741–756.

Klassen, R. M., Tze, V. M. C., Betts, S. M., & Gordon, K. A. (2011). Teacher Efficacy Research 1998 – 2009 : Signs of Progress or Unfulfilled Promise ? *Educational Psychology Review*, *23*(3), 21–43.

Kolosnichenko, M. V, Yezhova, O. V, Pashkevich, K. L., Kolosnichenko, O. V, & Ostapenko, N. V. (2021). The Use of Modern Digital Technologies in the Design and Tech. VET in Ukraine. *J. of Tech. Edu. & Training*, *13*(4), 56–64.

Lang, W., Hui, E. C. M., Chen, T., & Li, X. (2020). Understanding livable dense urban form for social activities in transit-oriented development through human-scale measurements. *Habitat International*, *104*(August), 102238.

Li, J., Afsari, K., Li, N., Peng, J., Wu, Z., & Cui, H. (2020). A review for presenting building information modeling education and research in China. *Journal of Cleaner Production*, *259*(120885), 1–17.

Li, L., Liu, Y., Peng, Z., Liao, M., Lu, L., Liao, H., & Li, H. (2020). Peer relationships , motivation , self-efficacy , and science literacy in ethnic minority adolescents in China : A moderated mediation model. *Children and Youth Services Review*, *119*(September), 1–8.

Li, Y., Cao, K., & Cao, K. (2020). Establishment and application of intelligent city building information model based on BP neural network model. *Computer Communications*, *February*.

Lu, X., Yang, Z., Xu, Z., & Xiong, C. (2020). Advances in Engineering Software Scenario simulation of indoor post-earthquake fire rescue based on building information model and virtual reality. *Ad. in Eng. Software*, *143*(February).

Ma, J. W., Czerniawski, T., & Leite, F. (2020). *Automation in Construction Semantic segmentation of point clouds of building interiors with deep learning : Augmenting training datasets with synthetic BIM-based point clouds*. *113*(September 2019).

Makki, B. I., Javaid, M. U., & Bano, S. (2016). Level of Work Readiness Skills , Career Self-Efficacy and Career Exploration of Engineering Students. *MFC-IEFR Journal of Engineering & Scientific Research*, *4*(December), 91–96.

Mariah, S. (2009). *Developing Soft Skills for the Work Readiness in Industry of Voc*. *High School Students*. 203–211.

Marmo, R., Polverino, F., Nicolella, M., & Tibaut, A. (2020). Automation in Construction Building performance and maintenance information model based on IFC schema. *Automation in Construction*, *118*, 17.

Marschall, G., & Watson, S. (2019). Social Cognitive Theory as an Integrated Theory of Mathematics Teachers' Professional Learning. *Conference of the International Group for the Psychology of Mathematics Education (PME-43) South Africa: University of Pretoria*.

Marschall, Gosia, & Watson, S. (2021). Teacher self-ef fi cacy as an aspect of narrative self-schemata. *Teaching and Teacher Education*, *109*(1–10).

Märtsin, M. (2019). Beyond Past and Present : Meaning Making , Narrative Self and Future-Orientation. *Integrative Psychological and Behavioral Science*, *53*, 669–678.

Mellado, F., & Lou, E. C. W. (2020). Building Information Modelling, Lean and Sustainability: An integration framework to promote performance improvements in the construction industry. Felipe. *Sus. Cities and Society*, *June*.

Miles, M. B., Huberman, A. M., & Saldana, J. (2014). *Qualitative data analysis: A methods sourcebook* (3rd ed.). Sage.

Milyutina, M. A. (2018). Introduction of Building Information Modeling (BIM) Technologies in Construction. *International Conference Information Technologies in Business and Industry*, *1015*(042038), 1–5.

Morris, D. B., Usher, E. L., & Chen, J. A. (2016). Reconceptualizing the Sources of Teaching Self-Efficacy : a Critical Review of Emerging Literature. *Educational Psychology Review*, *29*(4), 795e833.

Nelson, & Sekarsari, J. (2019). Faktor yang memengaruhi Penerapan Building Information Modelling (BIM) dalam Tahapan Pra Konstruksi Gedung Bertingkat [Factors Influencing the Application of Building Information Modeling (BIM) in the Pre-Construction Stages of High-rise Buildings]. *Jurnal Mitra Teknik Sipil*, *2*(4), 241–248.

Nuutila, K., A, A. T., Tuominen, H., Moln´ar, G., & Niemivirta, M. (2021). Mutual relationships between the levels of and changes in interest , self-efficacy , and perceived difficulty during task engagement. *Learning and Individual Differences*, *92*(October).

Pasetto, M., Giordano, A., Borin, P., & Giacomello, G. (2020). Integrated railway design using Infrastructure-Building Information Integrated Modeling railway design using Information The case study of the port of Venice The case study of the port of Venice. *AIIT 2nd International Congress on Transport Infrastructure and Systems in a Changing World (TIS ROMA 2019), 23rd-24th September 2019, Rome, Italy (TIS ROMA 2019), 23rd-24th September 2019, Rome, Italy*, *00*(2019).

Permana, A. Y., Aprilia, D. I., & Teniola, N. Q. I. (2019). Teacher Skills Through the Development of Design a nd Develop Learning Program Taedes 401 (gov . au) for Building Core Skill a nd Employability Skills for Vocational High School. *Advances in Social Science, Education and Humanities Research*, *379*(Veic), 385–395. https://www.atlantis-press.com/proceedings/veic-19/125927437

Romijn, B. R., Slot, P. L., Leseman, P. P. M., & Pagani, V. (2020). Teachers ' self-efficacy and intercultural classroom practices in diverse classroom contexts : A cross-national comparison. *International Journal of Intercultural Relations*, *79*(December 2019), 58–70.

Saari, A., Rasul, M. S., Yasin, R. M., Rauf, R. A. A., Ashari, Z. H. M., & Pranita, D. (2021). Skills sets for workforce in the IR4.0: Expectation from authorities and industrial players. *J. of Tech. Edu. and Training*, *13*(2), 1–9.

Sacks, R., Girolami, M., & Brilakis, I. (2020). Building Information Modelling , Arti fi cial Intelligence and Construction Tech. *Developments in the Built Environment*, *4*, 1–9.

Saeed, E., Yaqoot, I., & Mat, N. (2021). Determination of Training Material and Organisational Culture Impact in Vocational Training Effectiveness in Bahrain. *Journal of Technical Education and Training*, *13*(4), 1–14.

Sagita, M. P., Hami, A. E., & Hinduan, Z. R. (2020). Development of Indonesian Work Readiness Scale on Fresh Graduate in Indonesia. *Jurnal Psikologi*, *19*(3), 296–313.

Schechtman, M. (2015). Personal Identity and the Past. *Philosophy, Psychiatry, & Psychology*, *12*(1), 9–22.

Su, S., Wang, Q., Han, L., Hong, J., & Liu, Z. (2020). BIM-DLCA : An integrated dynamic environmental impact assessment model for buildings. *Building and Environment Journal*, *183*.

Succar, B. (2009). Automation in Construction Building information modelling framework : A research and delivery foundation for industry stakeholders. *Automation in Construction*, *18*(2), 357–375.

Underwood, J., & Isikdag, U. (2010). *NoHandbook of Research on Building Information Modeling and Construction Informatics: Concepts and Technologies*. Hershey.

Utami, Y. G. D., & Hudaniah. (2013). Self Efficacy dengan Kesiapan Kerja Siswa Sekolah Menengah Kejuruan [Self Efficacy with Vocational High School Students' Work Readiness]. *J. Ilmiah Psikologi Terapan (JIPT)*, *01*(01), 40–52.

Watson, S., & Marschall, G. (2019). How a trainee mathematics teacher develops teacher self-efficacy. *Teacher Development*, *23*(4), 469–487.

Wyatt, M. (2014). Towards a re-conceptualization of teachers' self-efficacy beliefs: tackling enduring problems with the quantitative research and moving on. *International Journal of Research and Method in Education*, *37*(2), 166–189.

Xu, Z., Zhang, L., Li, H., Lin, Y., & Yin, S. (2020). Automation in Construction Combining IFC and 3D tiles to create 3D visualization for building information modeling. *Automation in Construction Journal*, *109*(April 2019).

Yada, A., Leskinen, M., Savolainen, H., & Schwab, S. (2021). Meta-analysis of the relationship between teachers ' self-efficacy and attitudes toward inclusive education *. *Teaching and Teacher Education*, *109*.

Yao, X., Yu, L., Shen, Y., Kang, Z., & Wang, X. (2021). The role of self-efficacy in mediating between professional identity and self-reported competence among nursing students in the internship period: A quantitative study. *Nurse Education in Practice*, *57*(103252).

Yeh, C., Lin, H., Wang, Y., Wang, Y., & Lo, C. (2021). The International Journal of Management Education Investigating the relationships between entrepreneurial education and self-efficacy and performance in the context of internet entrepreneurship. *The International Journal of Management Education*, *19*(August).