Student Creativity in Modelling Design and Building Information During Online Learning at SMK Negeri 2 Salatiga

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Abstract. Student creativity is an important part of multi-competency which is very needed in the XXI Century. Creativity is also an important skill for DPIB students as prospective Architecture students. The purpose of this study was to find out how much creativity level of SMK students in Modelling and Building Information Design Skills Competence (DPIB) when online learning was applied with all the limitations of teaching. Student creativity is measured based on the architectural creativity framework, namely Accountability (fluency in generating ideas), Innovative (seeing solutions to a problem with a different way of thinking), Originality (the ability to generate new ideas or old ideas into new ideas), Aesthetics (the value of beauty), and Systematic (ability to process design elements). The results of this study indicate the average value of each aspect of creativity, namely accountability, innovation, originality, aesthetics and systematic, respectively, is 74, 82, 76, 64, and 56. The recapitulation results of the measurement of creativity level show that 4% of students belong to the category of students. Very creative, 25.9% belong to the category of creative students, 11.1% belong to the category of students who are less creative while with the largest percentage of 59.3% students are classified as having a level of creativity in the category of quite creative.

Keywords: Student Creativity · Online Learning · Design and Building Information

1 Introduction

One of the real changes that a nation must pay attention to is changes in the industrial era, every nation must respond to changes by adapting quickly. As a developing country, the existence of the Indonesian nation will be taken into account if this nation is able to respond to these changes. The industrial revolution 4.0 was first published in Germany in 2011. The change in the industrial era 4.0 comes to replace the industrial era 3.0 which is marked by cyber-physical and manufacturing collaboration. There are four design principles of Industry 4.0, one of which is interconnection (connection), namely the ability of machines, devices, sensors, and people to connect and communicate with

each other via the Internet of Things (IoT) or Internet of People (IoP). This rule requires norm, security and collaboration efforts [1].

Broadly speaking, the changes in the industrial era 4.0 as a phase of the technological revolution that changes the way humans do activities with a complex scope and transformation from a different previous life. Humans are required to have the ability to predict the future very quickly, seeing the changes and uncertainties in technology that continues to grow rapidly. So that they can compete in the world of work with competencies that are in accordance with the needs of these developments. Indonesia must respond to change in a structured and comprehensive way, involving the public, private, education and civil society sectors so that changes in the industrial era 4.0 can be managed into a great opportunity. The challenge begins with improving the quality of Human Resources (HR) through quality education.

Vocational High Schools are prepared to produce middle-level workers according to competence. Vocational High Schools have more complex challenges in facing the industrial era 4.0. In addition to producing superior human resources, vocational schools are also required to contribute in reducing the unemployment rate in Indonesia. To be more relevant to the competencies needed by the world of work and the 4.0 era, it is necessary to change the education system. In order to improve the quality and competitiveness of Indonesian human resources, broadly speaking, one of them is about aligning the SMK curriculum with competencies according to the needs of student graduates to meet the demands of the world of work in the 4.0 era [2].

The solution from learning 4.0 according to the Directorate of Learning and Student Affairs says that mastery of competence 4.0 is the need for a new literacy movement to face the era of the industrial revolution 4.0 such as data literacy, technological literacy, and human literacy. These three competencies are predicted to become skills that are very much needed in the industrial era 4.0 in vocational and vocational higher education. The adaptation of the new literacy movement can be integrated by making adjustments to the curriculum and learning system in response to the industrial era 4.0 which needs to be developed for vocational education, both vocational and higher education in XXI Century learning". This means that broadly speaking, vocational education institutions such as Vocational High Schools that have study programs or majors do not need to change to new majors, but rather follow the context of XXI Century learning [3].

Learning in the XXI Century prioritizes students to learn independently and construct their own knowledge, educators are here as facilitators to guide. So that blended learning is appropriate in the 4.0 era and is applied especially in vocational schools. The XXI century contains multiple competencies: 1. Critical thinking, problem solving, collaboration, and creativity and innovation, 2. Digital literacy skills include information literacy, media literacy, and Information and Communication Technology (ICT) literacy, 3. Career and life skills include flexibility and adaptation, initiative, social and cultural interaction, productivity and accountability, leadership and responsibility [4]. In the national standard of vocational education or Madrasah Aliyah Vocational (MAK) it contains competency areas for SMK/MAK graduates, one of which is XXI Century learning and skills, such as critical thinking and being able to solve problems, be creative, be able to work together, and communicate. These competencies are skills needed in the

XXI Century and the Industrial 4.0 era in vocational and vocational education such as SMK.

The competency of Modelling and Building Information Design (DPIB) skills applies blended learning with online learning activities of approximately 80% and offline learning activities of approximately 20%. Offline learning is carried out based on procedures designed by the school while still implementing strict health protocols. In the online learning process, the platforms used by SMK N 2 Salatiga to support the learning are Microsoft Teams and WhatsApp, but it is different from most of the DPIB Skills Competency learning which generally contains practical material so that there are several obstacles including facilities and infrastructure, learning that does not controlled, learning practices that do not go well, and so on [5].

Student creativity which is one part of the multi-competencies needed in the XXI Century [4], then the National Standard for Vocational Education/MAK creativity is also one of the competency areas for SMK/MAK graduates and even becomes one of the skills required when entering the world of work in the industrial era 4.0 [6]. Creativity is also an important skill for DPIB students as prospective students of Architecture, because creativity is an ability that has an important role in architect design performance [7]. In accordance with the statement "DPIB expertise competency as a major in Architectural Engineering at a secondary vocational school with a focus on manual drawing competence and with computer software related to planning drawings, building implementation, interior and exterior [8]. The aspect of creativity in an architect is to produce products that are innovative, aesthetic, functional, original, accountable, and systematic in processing design elements [7].

Based on the description above, researchers are interested in measuring the level of creativity of students when doing online learning. Because based on what we did when implementing the online learning system with all the limitations of teaching and referring to the results of evaluating student scores that were not good, whether student creativity would have poor creativity or student creativity would be high.

2   Method

This study uses the ex post facto method, namely research conducted after an incident has occurred. In addition, this research includes quantitative research because the data obtained are in the form of numbers and data analysis uses descriptive statistics. This research was conducted at SMK N 2 Salatiga, the competency of Building Modelling and Information Design (DPIB) skills, with a research sample of class XII students in the 2021–2022 academic year with the middle criteria or having undergone the Software Application and Building Interior Design (APLPIG) subjects. 71 respondents. All respondents involved in this study including 13 students as the sample of the instrument trial and 58 students as the research sample. The research was conducted in the period from March 28 to September 5, 2021. The focus of this research is to determine the level of creativity of students who have taken APLPIG subjects with a focus on assessment of student drawing products, where the process of students producing products requires cognitive understanding with the support of effective aspects so that students' drawing skills can be channelled. The creative level of students is measured using an

instrument in the form of a creativity test with figural questions based on indicators that have been adjusted to the characteristics of the sample based on aspects of creativity, namely accountability, innovation, originality, aesthetics, and systematic based on the architectural creativity framework. Referring to the instrument used by Pratitis [9] with the characteristics of the instrument that has been adjusted to the sample of this study.

This research variable uses a variable in the form of the level of student creativity, which is also called using a mono variable or a single variable in a study. Research variables are basically anything that is determined by the researcher to be studied so that information is obtained about it, then conclusions are drawn [10].

In collecting data, the researcher used a test with a figural form of question, the test consisted of 5 questions, each of which represented an aspect to be measured, namely question no. 1 representing the accountable aspect, question no. 2 innovative aspects, question no. 3 originality, question no. 4 aesthetics, and problem no 5 is systematic. In this study, the instrument was made referring to the instrument used by Pratitis with the characteristics of the instrument that had been adapted to the existing sample. Data processing is carried out by researchers in stages, namely the first activity of scoring student creativity tests with assessment rubric guidelines made based on scoring criteria indicators that have been adjusted to indicators of creativity aspects and sample characteristics [8]. Then proceed to the data processing stage, in this stage the researcher uses Microsoft Excel application software and SPSS version 23 (Statistical Product and Service Solution).

3   Results and Discussion

There are several results of the calculation of the data presented in this study consisting of 3 parts, namely the first regarding the results of students' scores on each aspect of the ability of the creativity being tested, then the results of calculating the creativity of each student cumulatively and the results of the recapitulation of the overall level of creativity. The following are the results of the recapitulation of the value of students' creativity levels in each aspect of creativity measured using figural test questions which are summarized in Table 1.

Table 1 shows the results of the recapitulation of the level of creativity in each aspect of creativity which has an overall average of students with various scores but not much

Table 1. Recapitulation of Student Creativity Level Values in Every Aspect of Creativity

Aspect of Creativity	Mark			Mo	SD
	Minimum	Maximum	Average		
Accountable	33	92	74	81	11
Innovative	65	98	82	90	8
Originality	60	95	76	68	9.5
Aesthetics	20	95	64	65	16
Systematic	20	93	56	44	19.5

Table 2. DPIB Student Creativity Level Category by Frequency

Category	Fr	%
Very creative	2	3.7%
Creative	14	25.9%
Pretty Creative	32	59.3%
Less Creative	6	11.1%
Total	54	100%

different in each aspect. This value is obtained from the assessment of each test question where each question represents each aspect of creativity that is measured. It can be seen that the innovative aspect has the highest score with an average value of 82. While the average value of aesthetic and systematic abilities of DPIB students is lower than other aspects of creativity, especially the systematic aspect is the lowest, meaning that students' ability to organize elements -design elements using design principles and poor design principles,

Table 2 shows the results of the recapitulation of the creativity of DPIB class XII students as a whole on the measured creativity aspect, the results showed that students who got the results of the very creative category were only 4%, students belonging to the creative category included the percentage of 25.9%, and then 59,3% of students belong to the quite creative category, for the less creative category students cover 11.1%, while for the very less creative category it is not found in the results of this study. Of the 54 respondents the maximum score or the highest score of students is 90 points while the minimum score or lowest score obtained by students is 51 points, with an average student score of 70 points. The interpretation of the creativity level score in this study has 5 categories or criteria, namely, Very Creative, Creative, Quite Creative, Less Creative and Very Less Creative. From the total frequency of 54 students, 32 students are classified as quite creative, 14 students are in the creative category, 6 students are in the less creative category and 2 students are in the very creative category.

In this study, the concept of creativity that is intended is how students' creativity when completing the task of drawing building designs. Regarding the science of architecture where "architectural engineering is a science that is identified with more than one scientific investigation, planning is the main movement, in planning compositional works, modelers are directed and concentrate on the basic standards of plans, especially correct, great and fun [11]. The competence of DPIB expertise at SMK Negeri 2 Salatiga also focuses on the competence of drawing manually and with computer software, relating to planning drawings for the implementation of the building which includes the interior and exterior of the building, including part of the Architectural Engineering competence, but at intermediate level competencies. Based on these criteria, the researcher took the concept of creativity based on the results of the Pratitis study in his dissertation research entitled Development of Creativity Tests in the Field of Architecture [9].

In contrast to creativity in general, the concept of creativity in the field of architecture is a cognitive process that involves innovation, imagination and originality, involves

the skills of associating ideas and flexibility to produce new combinations, so that the aspect of creativity in an architect is to produce products that are innovative, aesthetic, functional, original, accountable, and systematic in processing design elements [9].

Broadly speaking, the level of creativity of DPIB students is categorized as quite creative, this is in line with Prakoso's research [12] which aims to determine the profile of student creativity, where the results of the recapitulation of creativity also show that students are considered to be quite creative with a percentage of 83.33%. The researcher analyzed that the majority of students belonged to the category that was quite creative because of the influencing factors, where the individual factors were less open to stimuli from outside or within the individual and the adaptability of each individual. In addition, it is also influenced by external factors, namely the educational environment which has a large enough influence on students' creativity, including facilities that do not support students where based on the observations of researchers, students cannot fully utilize school facilities because offline learning is limited.

In line with the demands of the application of online learning that changes the previous learning system, it certainly affects student learning outcomes, especially student creativity. Siswono's research results [13] states that "there is a relationship between mobile learning media and students' creative thinking skills, mobile learning can develop students' thinking skills, practice problem solving skills and improve mastery of subject matter. The measurement theory above can be said to be quite different from the drawing activity in the design process on the creativity test, which is defined as a hands-on activity. Where materials and activities will be maximized if carried out with direct or face-to-face learning models where hands on activities in classes like this usually have a level to attract different students' interests (even tend to be better) in participating in learning when compared to other activities. Classical learning that relies on lectures and notes using paper-and-pencil [9].

However, this does not mean that online learning activities cannot be carried out, "a learning goal will be achieved if the planning and methods used can influence the potential and abilities of students and this success will be achieved if students are involved in the thinking process [14]. Thus, if online learning is to be carried out optimally, it is necessary to have careful planning beforehand as well as a relevant and interesting learning system that is tailored to the needs of students so that students' interest in learning is high so that it can stimulate the development of student creativity.

4   Conclusion

Based on what has been discussed in the analysis of research results that aim to measure the creativity level of students of DPIB skill competence for Class XII SMK Negeri 2 Salatiga in the 2021–2022 academic year during online learning, the researchers concluded that the results of the recapitulation of students' creativity levels were categorized as creative enough with a percentage of 59, 3%.

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