Challenges, Opportunities, Solutions to Creativity Competencies of Students of Building Engineering Vocational Schools

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ABSTRACT

A key component of education in the twenty-first century is creativity, which may help pupils solve challenges and change with the times. The 2015 Global Creativity Index (GCI) shows that Indonesian pupils generally have poor levels of creativity. By identifying strengths, weaknesses, opportunities, and threats (SWOT). in the industry as well as gaining an understanding of the components - crucial factors in developing strategies for increasing creativity skills - this study seeks to evaluate the phenomena of creative abilities of vocational students. A closed questionnaire was used in this mixed-method study, which included 165 vocational students from Surakarta, Central Java, as participants. Data were gathered through surveys and interviews. Processing survey data involved descriptive statistical analysis. The SWOT theory, which is frequently used in strategic thinking as a beneficial tool for extrapolating internal (strengths/weaknesses) and external (opportunities/ threats), was also used in the data analysis process. According to the study's findings, students' creative abilities can be gauged by their quickness in questioning, ability to brainstorm, ability to map problems from different domains, and ability to integrate ideas that were deemed sufficient. A very good rating was given to the skill of asking for group opinions when working on student assignments. The following are some of the opportunities, obstacles, and solutions: project completion, identifying learning resources, generating ideas, comprehending learning, developing new ideas, understanding the project as a whole, inspiration sources, and how to handle challenges. It is anticipated that the study's findings will improve instruction and student satisfaction with it. Implications With the help of the innovation of highly skilled vocational students majoring in building engineering, the outcomes of these findings are anticipated to help improve the quality of learning.

Keywords: Building Engineering, Creativity Competencies, Vocational Schools.

1. INTRODUCTION

One of the important skills to develop in learning is student creativity [1]. The creativity aspect is something that needs to be instilled in every learning, where this aspect is one of the indicators that determine the excellence of students [2]. Creativity is considered a core competency or skill in 21st-century education, where schools have a role to play in helping learners become creative problem solvers [3]. One aspect of effective teaching and learning is that instructors must have the ability to combine creativity, innovation, and cutting-edge technology [4]. Creative ability in learning demands something new to be created. The key to creativity is innovation, discovery, and problem-solving, which can affect human life [5]. According to investment theory, creativity requires six different but interrelated resources that are: intellectual skills; knowledge; thinking styles; creative functions; motivation; the environment [6]. The highest aspect of a student's creative thinking ability is knowledge and the use of resources [7]. There is a relationship between creativity and intelligence [8];[9]. The ability to create creativity can be done by learning through involvement in the project industry [10] and through participation in the organization of workshops as well as research trips outside the university with direct observation of objects in the field accurately able to stimulate creativity and the ability to analyze critically

[11]. The level of creativity is based on three indicators, namely, the field of technology, the field of talent, and the level of tolerance [12], [13].

Creative thinking can trigger students' ability to find solutions to problems in everyday life. Student creativity is required to be able to adapt to the times. However, the level of creativity of students in Indonesia tends to be still low. This is evident in the results of the creativity level survey conducted by the Martin Prosperity Institute in the Global Creativity Index (GCI) in 2015, Indonesia's creativity is relatively low compared to other countries. According to the data, Indonesia ranks 115th out of 139 countries. One of the factors that influence the low creativity of students is the learning model strategy designed in learning activities [14]. This low level of creativity is also experienced in vocational high school education units in Indonesia.

Research on students' creativity abilities has been discussed by many researchers before, Examples include the use of creative thinking to boost students' creative self-efficacy and cognitive motivation [1], the use of STEM to foster creativity in vocational mathematics education [2], the use of project-based learning [3]; [15], the use of e-learning platforms and digital tools to foster creativity in higher education [4], necessary improve 21st century skills to produce competitive graduate candidates in vocational education [16], the function of online tools in encouraging creativity in English students [17], but the creative ability of students, especially in vocational high schools majoring in building engineering, has not been studied much. This study aims to explore the creative ability of vocational high school students and the learning activities carried out by students in terms of creative abilities. In exploring this creative ability using SWOT theory, which is mostly applied in thinking strategies as a useful approach to extrapolating internal strengths/weaknesses and external opportunities/threats/threats [18].

Furthermore, this study analyzes the phenomenon of the creative ability of vocational high school students to identify strengths, weaknesses, opportunities, and threats in the sector as well as gain insight into key factors in establishing development strategies. The results of these findings are expected to contribute to improving the quality of learning with the support of high competence of creativity students of vocational high school majors in building engineering.

2. METHOD

A mixed method was used in this study, with an explanatory sequential design to answer the research questions that had been formulated [19]. This design guides research scientifically from quantitative to qualitative properties [20]; [21]. In the first stage, a survey was conducted to answer the first research questions addressing the problems faced by vocational high school students concerning creativity skills from the perspective of students [22]. In the second stage, the first research questions are also qualitatively investigated by written interviews [23]. One hundred sixty-five students from various vocational high schools in Surakarta in Central Java Province were recruited using convenience sampling techniques [9]. The demographic information of the survey sample is given in Table 1 below:

Table 1. Demographic information of SMK student survey and student interview sample.

Indicator	Criterion	Survey		Interview	
		Total	(%)	Total	(%)
Gender	Male	87	52.73 %	31	68.89 %
	Female	78	47.27 %	14	31.11 %
School Institutions	Vocational School A	56	33.94 %	10	22.22 %
	Vocational School B	65	39.39 %	20	44.44 %
	Vocational School C	24	14.55 %	5	11.11 %
	Vocational School D	15	9.09 %	5	11.11 %
	Vocational School E	5	3.03 %	5	11.11 %

In the selection of participants, students used purposive sampling techniques [24] by setting several criteria, including participants who were easily accessible through online communication, were willing to voluntarily take part in this research, and had adequate experience in learning in the field of building construction.

2.1. Data collection and analysis

Survey to determine student creativity competence using questionnaires with instruments adopted from valid and reliable instruments used in previous research [25]. The questionnaire negotiated the creative elements of vocational high school students. The indicators of creative thinking include the ability to solve problems from different angles, the ability to ask questions quickly, the ability to brainstorm, the ability to map problems

from different domains, the ability to combine ideas, and the ability to seek input from groups. Furthermore, qualitative investigations involve interviews to unearth detailed and contextual data regarding students' creativity competencies. Some questions, as a guide in the interview, refer to indicators of creativity ability [25].

Quantitative data were analyzed using descriptive statistics [26]. The results of the data analysis of this questionnaire are used to determine the creativity competence of students in vocational high schools. In interpreting the value of coordination, creativity uses mean (μ) and standard deviation (σ). The formula of the range of achievements is indicated as the equation on Tabel 2 [27]. Qualitative data was analyzed using content analysis [28]. This analysis uses the help of NVivo 12+ software.

Table 2. Interpretation of scores based on norms.

Criterion	Predicate
Score ≥ μ + 1,5 σ	A (Excellent)
μ + 0,5 σ ≤ Score < μ + 1,5 σ	B (Good)
μ - 0,5 σ ≤ Score < μ + 0,5 σ	C (Enough)
μ - 1,5 σ ≤ Score < μ - 0,5 σ	D (not enough)
Score < μ - 1,5 σ	E (very less)

3. RESULTS AND DISCUSSION

3.1. Quantitative Findings

The results of this survey data analysis are used to determine the creativity competence of students in vocational high schools, especially building engineering majors. The average value and standard deviation calculated based on the equations in Table 2 can be used to calculate the interpretation of the data. The average score of each indicator of a student's creative ability is shown in Figure 1.
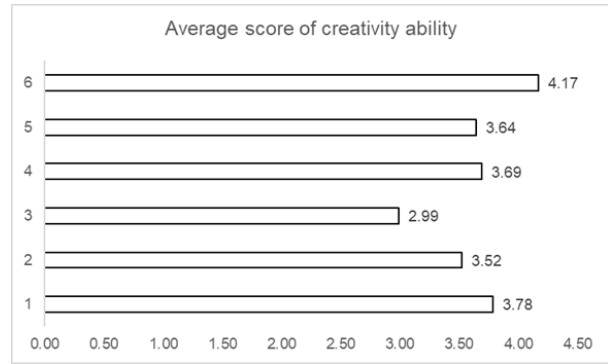
Figure 1. The average score of creativity ability.

Based on the interpretation of the data in Table 2 and the average score on each indicator of student creativity competence, the level of creativity of each indicator is shown in the following Tabel 3:

Table 3. Scores Creative Thinking Indicators.

No.	Creative Thinking Indicators	Criterion
1	The ability to solve problems from different points of view	Enough
2	The ability to ask questions appropriately	Enough
3	Ability to do brainstorming	Enough
4	Ability to map problems from different domains	Enough
5	Ability combining ideas	Enough
6	Ability to find input from groups	Excellent

The capacity to brainstorm, ask questions rapidly, map out problems from many domains, and mix various ideas is a key indicator of a student's creativity ability. These are sufficient in and of themselves. Naturally, this calls for serious attention, and encouraging pupils' inventiveness is a problem for teachers. A very good grade was given to the skill of asking the group for opinion when completing student lesson tasks. This component contributes to the growth of creative skills, which should be given priority in the classroom.

3.2. Qualitative Findings

The data obtained through the interview was processed using NVivo 12+ software to transcribe the interview results into the theme. The following are the results of interview transcripts grouped into several themes, as in Table 4.

Table 4. Interview indicators and theme codes.

Indicator	Code	Theme	Highest activity
Ability to solve problems from different points of view.	Complete the project	Search for information on the internet, the attitude of learning really (doing tasks as quickly and as soon as possible), doing it yourself, working with help from friends, understanding the assigned project tasks, learning from package books, and discussions between friends.	Search for information on the internet

	Learning Resources	Internet, package books, asking family, getting information from friends through Field Work Practices, and based on information from the community.	Package book and via the internet
Ask questions quickly.	Understanding learning	Pay attention to the teacher, review the material obtained, ask questions, record the material described, browse the internet, do practice questions with practice discussions between friends, and focus on the material presented.	Pay attention to the teacher and review the material.
Brainstorming	Come up with ideas	Browse the internet, look for references, review materials, exchange ideas, relax the body, try to think critically and positively, and do literacy activities.	Browse the internet and look for references.
Map the problem from a different domain.	Facing difficulties	Ask teachers, be calm, look for references, browse the internet, exchange opinions, and pray.	Ask the teacher, be calm, and look for references
Combining multiple ideas.	Generate new ideas	Exchange ideas, search the internet, ask teachers, see a suitable learning environment, and read books.	Exchange ideas and search the internet.
The ability to seek input from the group while working on student lesson assignments.	Thoroughly understand	Review the material, ask experts, summarize the material, listen carefully, practice questions, understand the core of the material, discuss between friends, and do hands-on practice.	Review the material and ask the expert.
	Inspire	Work hard, get maximum grades, see friends, motivate yourself, talk to parents, and discuss and communicate with teachers.	Work hard and get the maximum value

3.3. Discussion

Guided by the theory of Strengths, Weaknesses, Opportunities, Threats (SWOT) analysis, namely analyzing students' creativity abilities from strengths, weaknesses, opportunities, and threats. Quantitative data on students' creativity ability on the element of the ability to solve problems from different angles, ask questions quickly, brainstorm, map problems from different domains, and combine various ideas all of these elements are classified as sufficient assessment. This finding is a weakness (Weakness) of student competence. This certainly requires serious attention and becomes a challenge and opportunity (Opportunities) for instructors how to boost students' creativity skills. The element of the ability to seek input from the group when doing student lesson assignments has a very good ranking. This finding becomes the strength (Strengths) of students' creativity competencies that must be maintained. In line with his research on team learning models, The direct effect of team efficacy on team interactions is moderated by psychological safety, and team interactions are positively related to team creativity [3].

Meanwhile, qualitative data through interviews obtained results, including the way that students do the most when working on projects is by looking for as much information on the internet and coordinating with friends. The learning resources that students use the most are package books and information from the internet; searching the internet and looking for references is the way students come up with ideas; in understanding student learning, focus on paying attention to the teacher and asking questions, the way students come up with new ideas is by exchanging ideas and searching the internet, the way students understand the material thoroughly is to review the material and ask the teacher, the way to find self-inspiration is to get maximum scores, the way students face difficulties, namely by asking the teacher and looking for information on the internet.

From the findings of the interview that student learning activities are very close to optimizing internet technology facilities and students have high motivation, which can be seen from the activeness of learning engagement [29]. Internet technologies, such as the use of social media by students, are positively related to creativity [30]. Hence the importance of the coexistence of creativity and technology in the future [29]. This is a challenge for instructors, namely the ability to combine creativity, innovation, and cutting-edge technology [4]. Teacher creativity can increase through job satisfaction [31]. This opportunity is very important because if it is not immediately met by students' learning needs, students will feel that they have lost hope this can be a threat to learning.

This section reports on the key results of a SWOT analysis by first presenting positive images that emerge from strengths and opportunities, then discussing weaknesses and threats that may hinder the development of creative abilities based on SWOT results. The following sections discuss key factors for students' creativity and ability-building strategies. Figure 2 summarizes the main SWOT results and key factors.

Strengths	Weaknesses
• The ability to seek input from the group while working on lesson assignments. • Student learning activities are very closely related to the optimization of Internet technology facilities. • Students have high motivation, as can be seen from the fact that learning is involved.	• The ability to solve problems from different angles. • Ask questions quickly. • Brainstorming. • Mapping problems from different domains combining different ideas.
• Opportunity	• Obstacles
• Instructor's ability to combine creativity, innovation, and cutting-edge technology.	• Declining competitiveness of graduates. • Students will feel hopeless if their learning needs are not met.

Key strategy factors for the development of creative competencies of vocational high school students
• Through Project-Based Learning (PjBL) strategies can improve good lifelong learning skills such as problem-solving, creativity, and communication skills [32]. • A team-based learning model needs to be applied to maintain the ability of students to seek input from the group when doing student lesson assignments [3]. • Learning media is focused on the use of Internet information technology following the progress of the times [29]. • Instructors should always exercise the ability to combine creativity, innovation, and cutting-edge technology [4]. • The use of case-based reasoning (CBR) technology with a creativity support system (CSS) can increase individual creativity [33]. The problem-solving learning model needs to be applied to increase student creativity. • STEM learning models can increase student creativity [2].

Figure 2. SWOT and key factors for the development of the creative ability of vocational school students.

The results of this mixed research aim to explore the creative ability of students, especially vocational high schools majoring in building engineering, which can be used to improve the quality of learning by optimizing student learning creativity competencies.

4. CONCLUSION

The building engineering majors' level of creativity is sufficient when measured by their capacity to think creatively, ask questions rapidly, brainstorm, map problems from multiple areas, and mix numerous categorized concepts. It is a very strong skill to be able to ask the group for input when working on assignments. The most significant actions taken by students to cultivate their creativity include:

- Students collaborate with pals and gather as much data from the internet as they can while working on a project.
- Packaged books and online data are the primary learning tools used by pupils.
- In coming up with ideas, the internet is a place to search for information.
- Students attempt to pay attention to the teacher in order to understand learning.
- Students review the content and consult the teacher to ensure that they fully comprehend it.
- How to get the most out of inspiration.
- When faced with challenges, pupils consult their teacher and look up information online.

Project-based learning strategies (PjBL), team learning, and the provision of learning media focused on the usage of online information technology in line with the times are all suggested methods to boost student creativity. The utilization of case-based reasoning technologies, STEM learning paradigms, and the capacity to mix creativity, innovation, and cutting-edge technology must always come first for teachers.

AUTHORS' CONTRIBUTIONS

Sri Sumarni: Determination of topics, Structuring Background, writing theories and concepts, designing methods, Analyzing data.

Fahrudin Ali Fikri, Vernanda Atik Dewi Sasanti, Riska Nurhayati, Diva Jaira Arlesa Priyono, Mita Sofia, Fadia Husna Nabila: Search for data and analyze data.

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