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Developing Creativity Assessment Instruments for Building Engineering Vocational High School Students Based on Self-Assessment in Creative and Entrepreneurial Product Subjects

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ABSTRACT: The purpose of this study is to design a creativity assessment device that is valid and reliable and able to provide opportunities for students to evaluate their abilities. This research is development research using development methods with ADDIE stages. This study uses a quantitative descriptive approach. Non-test self-assessment worksheets are used in the creation of creativity tools. The validity of the data was assessed by the expert's team with assessment aspects covering material, construction, and language aspects. The Aiken equation with the coefficient V Aiken is used as a decision rule in determining the validity of the instrument. This study involved 5 expert teams and 72 building engineering vocational students in Surakarta as research respondents. The results showed that the self-assessment-based creativity assessment instrument was valid and reliable so it was suitable for use by vocational students. This study provides a significant contribution to educational assessment in vocational schools, especially in the aspect of creativity needed to support entrepreneurship. The existence of a valid and reliable self-assessment-based creativity assessment instrument allows students to better recognize and develop their creative abilities independently. This instrument also provides insight for teachers and institutions in designing teaching programs that are more in line with the needs of increasing creativity. The results of this study have the potential to direct educational policies that emphasize the development of creative and entrepreneurial skills in vocational schools, which can ultimately improve the quality of graduates so that they are ready to compete in the world of work and entrepreneurship.

Keywords: creativeness, instrument development, self-assessment, vocational students.

I. INTRODUCTION

Vocational education is one of the human resource development institutions that have an important role in the transformation of new competencies [1]. Vocational school learning is focused on increasing competencies to build independence and prepare a work-ready generation. However, there are a lot of graduates from vocational high schools who are unemployed [2]. It is also mentioned by Central Bureau of Statistics in Indonesia, which conveys that the unemployment rate in Indonesia is dominated by vocational school graduates. Based on these problems, the Indonesian government focuses on the entrepreneurship education model and revises the existing curriculum by encouraging students to become entrepreneurs [3]. Entrepreneurs must be creative in creating new insights, knowledge, and potential innovations [4]. In this

case, schools have an important role in helping students to acquire creativity skills [5]. So that through the subject of Creative Products and Entrepreneurship, it is hoped that it can improve creativity skills and be able to foster entrepreneurial interest in vocational students.

Creativity has been associated with students' interest in the field of entrepreneurship, where the higher the level of creativity, the more entrepreneurial interest tends to be encouraged as well [6]. Creativity is not only an important motivator for entrepreneurial interests [7], But creativity is also important throughout the entrepreneurial process, from the initial concept and the search for new ideas to the implementation process [8].

All children have creativity, but if it is not developed, students will only imitate what other people do without trying to find answers themselves [9]. Creativity is an individual ability inherent in each child and his development can be influenced by internal and external factors [10], [11]. are considered to affect creativity is motivation [12]. Motivation is the encouragement to improve workability by setting learning objectives, standard results to be obtained, and assessment of learning outcomes [13]. Highly motivated students show higher levels of creativity as well [14]. While the motivation itself can be influenced by the feedback received by students [15]. This is in line with the research [16] which mentions that giving feedback can enhance and develop students' creativity.

Giving feedback to students has the potential to help them assess themselves more accurately, develop and demonstrate a range of soft skills, boost their engagement, and help them take ownership of their learning [17]. Giving feedback to oneself compared to feedback provided by teachers can provide increased depth and breadth of information [18]. Possessing the ability to evaluate oneself and receive feedback on the accuracy of that assessment and learning performance might increase learning [19].

Many studies have explored creativity assessment instruments, emphasizing their importance in educational settings [20]. However, most research lacks a focus on self-assessment, which can empower students to evaluate their creative processes and outcomes. Self-directed learning (SDL) has been shown to significantly improve motivation and creativity among vocational students [21]. Incorporating self-assessment can further enhance these benefits, fostering independent learning and innovative thinking. The unique challenges faced by building engineering students, such as the need for practical skills and creativity in product development, necessitate tailored assessment tools [22]. Current assessments often overlook the specific needs and contexts of these students, limiting their effectiveness.

To examine and assess pupils' academic performance, teachers have employed a variety of evaluation methods [23]. One of the assessment techniques that can provide students to evaluate and provide feedback to themselves regarding learning outcomes is a self-assessment-based assessment technique. Many studies support self-assessment as a useful practice in the development of student assessment evaluation [24], [25], [26]. Self-assessment has been shown to support student learning [27], rubrics may offer a promising platform of assessment [28]. Thus, researchers believe that self-assessment can provide feedback that motivates and fosters the creativity of vocational students, especially in the subjects of Creative Products and Entrepreneurship.

This study specifically focuses on Building Engineering students because this field not only demands technical skills in construction, but also requires creative and innovative thinking skills in designing and developing construction solutions that are more efficient, environmentally friendly, and in accordance with the needs of modern industry. Some of the reasons for choosing to focus on building engineering students include: the construction industry's need for creativity and entrepreneurship [29], gaps in vocational education, the context of creative product and entrepreneurship subjects, the lack of assessment instruments specific to building engineering [30], relevance to education policy and human resource development [31].

For this reason, this study aims to 1) develop a model of creativity assessment instruments based on self-assessment; and 2) test the validity of self-assessment-based creativity assessment. This research is expected to fill the existing gap and provide a significant contribution to the development of more creative and innovative vocational education.

1. CREATIVITY

Creativity is the use of imagination or original ideas in creating a work of art [32]. Creative ability in learning requires something new to be created. The key to creativity is innovation, discovery, and problem solving that can affect human life. [33]. Creative thinking ability has several aspects that can be used as a benchmark to determine the level of creative thinking of students. Creative thinking is directly influenced by lecturer support in strengthening students' creative self-efficacy, and is slightly influenced by friends and family [34].

There are several indicators of creative thinking ability, namely flexibility, originality, and imagining [35]. Whereas [36] mentions several characteristics of creative thinking, namely 1) flexibility, 2) originality, 3) many thoughts, 4) wondering, 5) thinking quickly and independently, 6) open to criticism, 7) rationalism, 8) being able to find different solutions, 9) realizing and defining problems, 10) suggesting possible solutions. The characteristics of creative thinking are four aspects of creative thinking ability consisting of fluency, flexibility, originality, and elaboration [37]. The following are indicators of creative thinking abilities developed [41].

Tabel 1. Creative Thinking Skills Indicators.

Aspects of Creative Thinking Skills	Indicators of Creative Thinking Skills
Fluency	Having many ideas/concepts
	Working faster and more than others
	Generating answers by solving problems or questions smoothly
	Having many alternative answers and problem solving
Flexibility	Generates varied ideas, answers, and statements
	Has various approaches to solving problems
	Sees problems from different perspectives
	Does not use old mindsets as a starting point ukur
Originality	Ability to create new and unique terms
	Ability to combine several parts or elements
	Using unusual ways to express oneself, and being able to explore possible solutions
Elaboration	Adding or detailing an object or idea, so that it becomes more developed
	Having reasons that can be justified
	Analyzing critical problems by always asking questions

2. SELF ASSESSMENT

Self-assessment is a process that can describe how students obtain information and reflect on learning [42]. Self-assessment is useful in increasing motivation [43], final exam scores [44], and learning engagement [45]. Kunandar (2014: 134) explains that self-assessment is an assessment technique by asking students to express their strengths and weaknesses in terms of achieving spiritual and social attitude competencies.

Work [47] says related to the influence of self-assessment on the learning outcomes of vocational school students is that by implementing self-assessment-based assessments, students are not only active during the learning process but students can also be involved in each series of learning including formulating learning objectives, determining tasks to be done, to monitoring the implementation of assessments and providing feedback. Literature studies obtained from [48] show that there are several advantages to using self-assessment, including: (1) it can foster students' self-confidence. Students' self-confidence will grow because in practice they are given the trust to assess themselves, (2) students are aware of their strengths and weaknesses. This is because when they make an assessment, they must introspect on their strengths and weaknesses, (3) it can encourage, accustom and train students to be honest, because they are required to be honest and objective in making assessments.

3. CREATIVITY ASSESSMENT TOOLS IN VOCATIONAL EDUCATION

Assessing creativity within vocational education has garnered significant attention in recent years, recognizing creativity as a pivotal skill for students navigating the complexities of the modern workforce. This literature review examines contemporary studies on creativity assessment tools, particularly within vocational education, highlighting five international journal references from the past five years.

The integration of creativity into higher vocational teacher education was explored. The research identified that while creativity is acknowledged as essential, its practical application in curricula remains inconsistent. Lecturers employed various strategies, such as peer reviews and encouraging experimentation, to foster creativity among students. However, the study highlighted a need for standardized assessment tools to effectively measure and promote creative competencies in vocational settings [49]. The creative thinking levels of vocational students within the context of 21st-century learning. Utilizing Torrance's creative thinking indicators, the study assessed students' performance and found that traditional educational approaches often stifled creative potential. The authors advocated for the development of assessment instruments that align with modern pedagogical practices to better evaluate and enhance creativity among vocation students [50].

II. MATERIAL AND METHOD

1. INSTRUMENT DEVELOPMENT

This research uses a development method with the ADDIE stage. This method is still widely used by researchers in developing educational products [51, 52]. Which includes the Analysis, Design, Development, Implementation, and Evaluation stages [53, 54]. At this stage, a needs analysis is carried out consisting of interviews or observations as well as literature studies that support the development. In this study, interviews were conducted with subject teachers, and observations were made with direct observation during the learning process of Creative Products and Entrepreneurship (CPE) at a building engineering vocational school in Surakarta.

The design stage is the stage where researchers plan and design instruments which begins with formulating creativity indicators, compiling grids, and drafting instruments. At the development stage, the instrument that has been prepared is tested for validation by experts, if it is said that the instrument is valid then tested on a limited test before a broad trial is carried out at the implementation stage. The evaluation stage is carried out at the end of each stage, namely the expert validation stage and the product trial stage.

2. RESEARCH SUBJECTS

Research respondents were selected by purposive sampling technique [55], and obtained 20 respondents for the limited trial and 72 respondents for the trial. The respondent was a building engineering vocational student in Surakarta who received the subject of Creative Products and Entrepreneurship. This research specifically focuses on building engineering students because this field not only demands technical skills in construction, but also requires creative and innovative thinking skills in designing and developing construction solutions that are more efficient, environmentally friendly, and in accordance with the needs of modern industry.

In this study, the purposive sampling technique was used to select respondents and instrument validators. Purposive sampling is a sampling method based on specific criteria deemed relevant to the research objectives [55]. This technique was chosen because it allows researchers to obtain participants with specific characteristics that align with the research focus, namely students' creativity in the Creative Products and Entrepreneurship subject at Vocational High Schools in Building Engineering. The experts who act as instrument validators are five building engineering education lecturers with assessment aspects that include material, construction, and language aspects.

This study involves two stages of instrument testing:

Limited Trial, which includes a sample of 20 vocational high school Building Engineering students in Surakarta. This sample size is sufficient to test the instrument's clarity, understand initial student responses, and identify potential improvements in readability and technical feasibility. The limited trial aims to prevent systematic errors before implementing the instrument on a larger scale.

Field Trial (Larger Scale), which involves a sample of 72 vocational high school Building Engineering students in Surakarta. This sample size was chosen based on validity and reliability studies in instrument development. According to the literature on instrument development, a sample size between 30 and 100 is generally adequate for analyzing instrument validity and reliability using statistical methods such as exploratory factor analysis (EFA) or reliability testing with Cronbach's Alpha [56].

Sample Representativeness, although this sample size does not fully represent the entire population, 72 respondents are considered sufficiently representative of vocational high school Building Engineering students in the research area, as they share similarities in curriculum, teaching methods, and learning experiences related to Creative Products and Entrepreneurship.

Instrument Validators, consisting of a sample of 5 lecturers in Building Engineering Education. This number aligns with expert validation principles, where five experts are commonly used in instrument evaluation based on Aiken's V or the Content Validity Index (CVI) to assess the quality of the instrument in terms of content, construction, and language [57, 58].

3. DATA COLLECTION AND ANALYSIS TECHNIQUES

In data collection, the text is used in the form of expert validation sheets of instruments to experts [59], Meanwhile, questionnaire research data at the product trial stage is distributed online through Google Forms [60]. The data obtained from the expert validation test is then tested for validity with the Aiken validity formula [61, 62]. Aiken's validity formula is as follows:

$$V = \sum s/[n(c-1)] \qquad (1)$$

Where V = Aiken coefficient of validity, s = r − lo, lo = lowest validity assessment figures, c = highest validity assessment figures, r = highest validity assessment figures. The validity of the question/statement is said to be valid if the value v > v Aiken table.

Meanwhile, the validity of the product trial data from respondents was calculated using Pearson product-moment correlation [63] with the decision rules for the correlation test is:

If $r_{count} > r_{table}$ then the research instrument is said to be valid.

If $r_{count} < r_{table}$ then the research instrument is said to be invalid.

The reliability of the questionnaire test results from respondents was calculated using Cronbach's Alpha [64], by decision the research instrument can be said to be reliable if the value of Cronbach's Alpha is more than 0.60.Validate and test reliability can be done by using the help of the IBM Statistical SPSS program [3]. In this research, researchers used the help of the IBM Statistics SPSS 22.0 version program

III.DATA ANALYSIS

1. ANALYSIS STAGE

Various data supporting the research are gathered for the analysis stage through instructor interviews for PKK subjects, classroom learning observations, and literature studies. Based on the results of the needs analysis, information was obtained that one of the projects implemented in the CPE subject was a project to create a newsletter in the field of buildings which was carried out in groups. This building bulletin or what can be called a magazine is a creative product that contains the design and inspiration of a simple residential house which can include plans, looks, budget designs, to spatial inspiration. The project is structured with stages starting from the planning process, making newsletter designs, making newsletter contents, finishing,

printing, and the last stage is selling newsletters. The completion of the project will later be used as a business opportunity for students, can foster student interest in entrepreneurship, and increase student creativity.

In CPE learning in vocational schools, the problem was found that no assessment instrument was able to measure student creativity and provide opportunities for students to evaluate their respective thoughts and actions. Seeing this, researchers are interested in developing self-assessment-based assessment instruments to measure the level of creativity of vocational students.

2. *DESIGN STAGE*

The design stage includes planning the design of the assessment instrument to be developed, and the preparation of a preliminary draft of the creativity assessment instrument. The creativity assessment grid consists of aspects and indicators of assessment. These aspects and indicators are derived from several earlier sources that are narrowed down in a conceptual framework. The following is a conceptual framework developed in formulating aspects and indicators of creativity show in Figure 1.

Based on various sources [35-39,65] elaborated into four aspects of creativity which include aspects of fluency, flexibility, originality, and elaboration. This aspect was then developed by researchers into 14 indicators.

Furthermore, these indicators are compiled into a self-assessment-based creativity assessment instrument in PKK learning in the form of assessment using a Likert scale with a range of points 1-5, with 1 indicating "strongly disagree" to 5 indicating "strongly agreeing" [3]. The instrument prepared has 30 question items with 18 positive statements and 12 negative statements presented in Table 2.

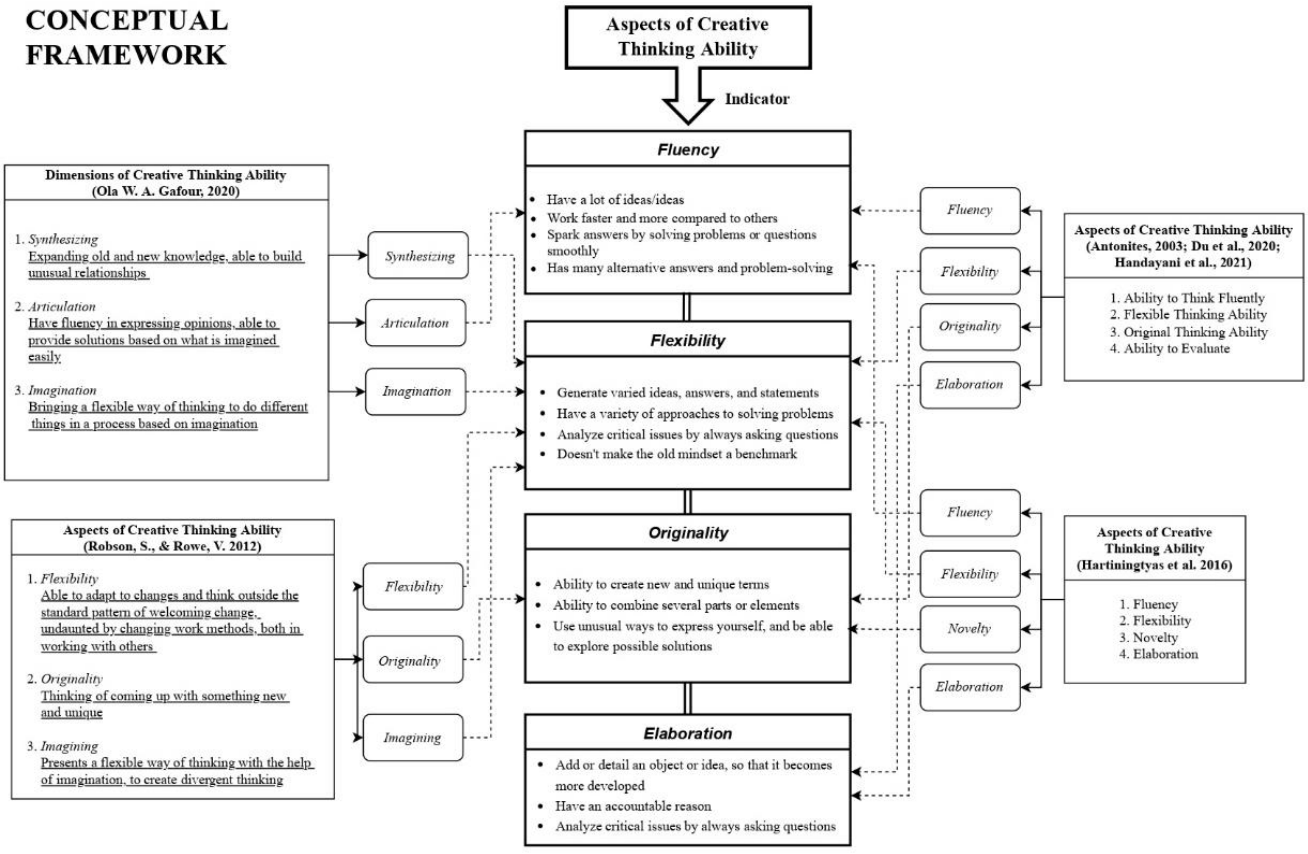

FIGURE 1. Conceptual framework.

Table 2. Statement item on the draft instrument.

No	Statement
1	I give a lot of advice to group friends when discussing newsletter content
2	I tend to be quiet and only listen to the opinions that friends give in group discussions
3	I have a big role to play in completing project tasks to be completed on time
4	I spend more time just determining the theme of the newsletter
5	I was able to express a solution easily to solve the problems that exist in the group
6	I have difficulty answering the questions given by the teacher in the PKK learning process
7	I often ask friends for help in answering questions given by teachers
8	I provide many options regarding determining the theme of the newsletter to match what the group wants
9	I give up easily when the solution I provide is not able to solve the problem
10	I prefer to work on the project assignments given by the teacher in another way
11	I have a hard time coming up with newsletter design ideas to make them more diverse and varied
12	In solving a problem, I prefer a solution by talking "one-on-one."
13	I am easily provoked by the opinions of other friends when solving problems
14	I always position myself as someone else to solve problems
15	I only look at a problem from one point of view
16	If the tools are needed in creating newsletter work, I use other tools that are not the function (e.g. using 3D CAD applications, Corel, Solid Work)
17	I am not imitating the example of the newsletter given by the teacher instead of developing it
18	I enjoy compiling the content of newsletters using my language
19	I was able to create a newsletter that showed the characteristics of our group
20	I create newsletter content based on other people's work that I write
21	I was able to combine the designs that my friend gave me as newsletter content
22	I combine the content of the newsletter based on the sources that have been collected
23	I am guided by one reference source that fits the theme of my group newsletter
24	I put all my images on the newsletter project as a form of self-expression
25	I developed a lot of newsletter content such as adding an aesthetic component of the space and an explanation of the layout
26	I was able to think of any eventuality that occurred at the planning stage of the newsletter project
27	I had difficulty explaining the detailed parts of drafting a cost budget
28	I am trying to fulfill my obligation to account for an action I take
29	I love to ask questions and try to dig up information from other friends
30	I tend to say agree and abide by the advice people give to the

3. DEVELOPMENT STAGE

The development stage consists of instrument validation tests by experts. Expert validation is carried out by five experts with assessment aspects covering material, construction, and language aspects. Expert

validation aims to determine the feasibility of the product being developed and improve the quality of the product. The data obtained in this expert validation test is quantitative as primary data and the input suggestions provided are qualitative for product improvement. The data obtained from the expert validation stage were analyzed using the Aiken formula as seen in equation (1).

Assessment instruments that have gone through the improvement stage and have passed expert validation tests then carried out product trials on 20 vocational student respondents (excluding students taken in broad trials) who were randomly selected. The results obtained from this validity and reliability test are then evaluated before the trial is carried out in a broad trial.

4. IMPLEMENTATION STAGE

An extensive trial was conducted on vocational students with a total of 72 respondents who received Creative Products and Entrepreneurship subjects. The extensive trial was carried out by filling out a self-assessment-based creativity assessment instrument through the google form. The results obtained from this extensive trial will then be tested for validity with Pearson correlation product moment, while the reliability of the instrument is analyzed with Cronbach's alpha.

5. EVALUATION STAGE

At the end of each stage of the study, the instrument is analyzed at the evaluation stage. The collected data is checked at the evaluation stage to see if the resulting product can be considered feasible, valid, and reliable. The evaluation is carried out in three stages, namely the expert validation stage, the limited trial stage, and the extensive trial.

1.1. Expert Validation Test

The data obtained at the expert validation stage are then analyzed with the Aiken validity formula equal to the formula of equation (1). The Vtable value for the five validators is 0.80 [62]. Table 3 shows the results of the expert validation analysis.

Table 3. Expert validation results.

No	Aspects Studied	V	Criteria
1	Material	0.95	Valid
2	Construction	0.87	Valid
3	Language	0.83	Valid

Based on the expert validation analysis that has been carried out, it is produced that the self-assessment-based creativity assessment instrument is valid from the aspects of the material, construction, and language. Thus, assessment instruments can be trialed at a limited test stage.

1.2. Limited Trial

Data obtained from 20 respondents at the limited trial stage tested the validity of constructs using Pearson Product Moment correlation and obtained the following analysis results. Table 4 shows results of problem item validity test on limited trial.

Table 4. Results of problem item validity test on limited trial.

Statement	R_{count}	R_{table}	Criteria
I give a lot of advice to group friends when discussing newsletter content	0.732	0.444	Valid
I tend to be quiet and only listen to the opinions that friends give in group discussions	0.567	0.444	Valid
I have a big role to play in completing project tasks to be completed on time	0.607	0.444	Valid
I spend more time just determining the theme of the newsletter	0.198	0.444	Invalid

I was able to express a solution easily to solve the problems that exist in the group	0.551	0.444	Valid
I have difficulty answering the questions given by the teacher in the PKK learning process	0.594	0.444	Valid
I often ask friends for help in answering questions given by teachers	0.736	0.444	Valid
I provide many options regarding determining the theme of the newsletter to match what the group wants	0.539	0.444	Valid
I give up easily when the solution I provide is not able to solve the problem	0.547	0.444	Valid
I prefer to work on the project assignments given by the teacher in another way	0.788	0.444	Valid
I have a hard time coming up with newsletter design ideas to make them more diverse and varied	0.779	0.444	Valid
In solving a problem, I prefer a solution by talking "one-on-one."	0.682	0.444	Valid
I am easily provoked by the opinions of other friends when solving problems	0.602	0.444	Valid
I always position myself as someone else to solve problems	0.525	0.444	Valid
I only look at a problem from one point of view	0.536	0.444	Valid
If the tools are needed in creating newsletter works, I use other tools that are not their function (e.g. using 3D CAD applications, Corel, Solid Work)	0.732	0.444	Valid
I am not imitating the example of the newsletter given by the teacher instead of developing it	-0.263	0.444	Invalid
I enjoy compiling the content of newsletters using my language	0.647	0.444	Valid
I was able to create a newsletter that showed the characteristics of our group	0.603	0.444	Valid
I create newsletter content based on other people's work that I write	0.044	0.444	Invalid
I was able to combine the designs that my friend gave me as newsletter content	0.518	0.444	Valid
I combine the content of the newsletter based on the sources that have been collected	0.541	0.444	Valid
I am guided by one reference source that fits the theme of my group newsletter	-0.212	0.444	Invalid
I put all my images on the newsletter project as a form of self-expression	0,531	0.444	Valid
I developed a lot of newsletter content such as adding an aesthetic component of the space and an explanation of the layout	0.597	0.444	Valid
I was able to think of any eventuality that occurred at the planning stage of the newsletter project	0.729	0.444	Valid
I had difficulty explaining the detailed parts of drafting a cost budget	0.645	0.444	Valid
I am trying to fulfill my obligation to account for an action I take	0.521	0.444	Valid
I love to ask questions and try to dig up information from other friends	0.506	0.444	Valid
I tend to say agree and abide by the advice people give to the projects I'm working on	-0.216	0.444	Invalid

The table above shows that in question items number 4,17,20,23, and 30 are on invalid criteria. Question items that do not meet the decision rules on the validity of the construct must be removed from the instrument provided that each indicator has a representative question item and has been said to be valid. Thus, the number of items in the creativity assessment instrument is reduced from 30 items to 25 items.

Furthermore, question items that are on valid criteria are carried out with reliability tests to determine the reliability of the data produced in the limited trial. The results of the reliability test of the creativity assessment instrument in the limited trial are presented in the following Table 5.

Table 5. Results of question item reliability test in limited trial.

Cronbach's Alpha	N of Items
0.931	25

From the table above, it is known that the value of Cronbach's Alpha is 0.931 and it is concluded that from the results of the reliability test, it is shown that each question item has very strong reliability. Thus, an assessment instrument with 25 question items can be tested at a limited test stage.

1.3. Extensive Trials

Data obtained from extensive trials conducted on 72 respondents were then tested for construct validity using Pearson Product Moment correlation. The results of the calculation of the validity of the question item with the correlation of Pearson Product Moment at the extensive trial stage are presented in the following Table 6.

Table 6. Results of the question item validity test on the broad trial.

Statement	R_{count}	R_{table}	Criteria
I give a lot of advice to group friends when discussing newsletter themes	0.593	0.232	Valid
I tend to be silent and only listen to the opinions that friends give in determining the theme of the newsletter	0.350	0.232	Valid
I have a big role in the completion of the newsletter project to be completed on time	0.720	0.232	Valid
I can express solutions easily to solve the problems that exist in the group	0.665	0.232	Valid
I have difficulty answering the questions given by the teacher in the PKK learning process	0.530	0.232	Valid
I often ask friends for help in answering questions given by teachers	0.244	0.232	Valid
I provide many options regarding determining the theme of the newsletter to match what the group wants	0.727	0.232	Valid
I give up easily providing solutions but can't solve the problem	0.418	0.232	Valid
I can give different ideas compared to others	0.480	0.232	Valid
I find it difficult to come up with newsletter design ideas to be more diverse	0.249	0.232	Valid
I was able to solve the problem by way of an approach	0.520	0.232	Valid
I am easily influenced by the opinions of other friends when looking for a way out of the problem	0.305	0.232	Valid
I always empathize with the opinions of others in solving problems	0.455	0.232	Valid
I only look at a problem from one point of view	0.334	0.232	Valid
In newsletter content creation, I use a variety of applications, not only those taught in schools	0.442	0.232	Valid
I prefer to structure the content of the newsletter using my language	0.570	0.232	Valid
I was able to create a newsletter that could show the character of the group	0.729	0.232	Valid
I can combine the designs my friend gave me as newsletter content	0.683	0.232	Valid
I was able to develop myself to find a wide variety of solutions	0.499	0.232	Valid
I put all my images on the newsletter project as a form of self-expression	0.702	0.232	Valid
I can attest to the revelation I gave	0.653	0.232	Valid
I can think of any eventuality that happens at the planning stage of the newsletter project	0.727	0.232	Valid
I had difficulty explaining the detailed parts of drafting a cost budget	0.421	0.232	Valid
I try to fulfill my obligations by accounting for the actions I take	0.632	0.232	Valid
I love to ask questions and try to dig up information from other friends	0.697	0.232	Valid

Valid findings are obtained for each item based on the validity test of the question, allowing the use of Cronbach's Alpha to conduct an instrument reliability test. The results of the reliability test of the creativity assessment instrument on the broad trial are presented in the following Table 7.

Table 7. Results of question item reliability test on limited trial.

Cronbach's Alpha	N of Items
0.889	25

From the table above, it is known that the value of Cronbach's Alpha is 0.889 and it is concluded that from the results of the reliability test on each of the question items that have been tested, it is on very strong criteria.

6. DISCUSSIONS

Since vocational school graduates must be able to work for themselves, creativity is seen as being crucial to assisting students in coming up with innovative ideas and goods that are worth selling. Entrepreneurs must be creative in creating new insights, knowledge, and potential innovations [5]. This research develops a creativity assessment instrument based on self-assessment with a form of non-test assessment. Aspects of creativity developed include aspects of fluency, flexibility, originality, and elaboration. It is also supported by aspects of creativity obtained from various sources, including fluency, flexibility, novelty, originality, elaboration, and imagining [35, 65].

Self-assessment has been shown to support students' self-reflection and metacognition, encouraging them to independently evaluate and improve their abilities [66]. This approach is very much in line with 21st century competencies, where the ability to continuously develop and adapt is very important [67].

The development of the assessment tool follows the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model which is known to be effective in designing accurate and reliable instruments [68]. The main steps in this method include: (1) Analysis: Identification of specific assessment needs for the competencies of SMK building engineering students, (2) Design: Preparation of a self-assessment sheet format by considering the suitability of creativity aspects, (3) Development: Creating and testing the assessment tool in the form of a non-test self-assessment sheet, (4) Implementation: Testing the assessment tool in class to evaluate validity, (5) Evaluation: Using validation by a team of experts and the Aiken V coefficient to measure the reliability and accuracy of the instrument.

Validation methods involving Aiken's coefficient (V Aiken) help measure the consistency of results, especially when assessing subjective dimensions, such as creativity [69]. This ensures that the developed instrument truly reflects the aspects of creativity that are intended to be measured.

The results of the study indicate that this assessment instrument has high validity and reliability based on expert assessment. The four aspects of creativity, namely fluency, flexibility, originality, and elaboration, have a strong theoretical basis in the creativity literature, where these dimensions have been empirically proven to support effective creativity evaluation in various fields, including engineering education [70]. Recent studies have also shown that self-assessment can increase students' self-confidence, give them space to explore ideas without fear of being wrong, and increase in-depth understanding of the skills being learned [71-73]. In addition, with validation from five experts and applied to 72 students, this tool makes a significant contribution to the development of creative skills in vocational schools, which are often less systematically accommodated [74, 75].

With high validity, this tool can be an effective assessment tool for vocational schools. Self-assessment in measuring creativity supports more independent learning, allowing students to assess and develop their own abilities [76]. This method also has the potential to be applied more widely in other vocational education settings, increasing students' capacity to generate creative ideas systematically.

However, self-evaluation is often also susceptible to various biases that can affect the accuracy and objectivity of the evaluation. Common potential biases such as individuals tend to assess their abilities or

performance higher (overestimation) or lower (underestimation) than reality [77]. How to overcome this involves strategies such as assessments derived from various sources to provide a more holistic perspective and reduce personal subjectivity. The use of structured reflection with clear guidelines or standards also helps individuals evaluate themselves more objectively. Self-awareness training and metacognitive learning can train individuals to recognize and control biases that arise in their self-evaluation [78, 79].

IV. CONCLUSION

The self-assessment-based assessment instrument developed in this study was created specifically to assess the creativity of vocational students in the field of building engineering. The instrument has been rated valid by five experts in material, construction, and language aspects. It can be concluded that a self-assessment-based assessment instrument is practical to use in Creative Products and Entrepreneurship subjects in vocational schools based on the fact that a valid and reliable instrument was produced at the product trial analysis stage with 72 vocational student respondents. The measurement tool developed in this study can be used to evaluate the learning process and can be adapted to other contexts, besides creative products and entrepreneurship in building engineering education. The limitation of this study refers to the selection of only one university; however, further research can include more universities to create a more balanced sample in one country.

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Author contribution

Conceptualization, S.S.; methodology, S.S. and V.A.D.S.; software, V.A.D.S.; formal analysis, S.S., V.A.D.S and I.N.S.; writing—original draft preparation, S.S. and V.A.D.S.; writing—review and editing, S.S., V.A.D.S and I.N.S.; All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

Data Availability Statement

Data are available from the authors upon request.

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