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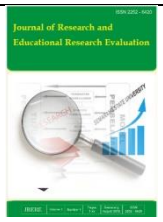

Development of Instruments to Measure Self-Confidence and Creative Thinking in Mathematics Learning for Vocational High School Students

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Abstract

This study was a Research and Development that aimed to develop in order to gain a standard instrument for measuring self-confidence and creative thinking in mathematics learning. The instrument for measuring self-confidence and creative thinking in the mechanical engineering expertise program used the development of test and non-test instruments. This study uses a large scale with a total of 210 students of class X (Vocational High School) SMK Negeri 1 Lambu Bima District. The research used an instrument development model that used a test and a non-test Mardapi Theory with 10 steps. The ten steps of developing this instrument produce a valid and reliable instrument product, simplified into three steps. There were a preliminary stage, development stage, and evaluation stage. The preliminary stage consists of determining the specifications of the writing of the instrument and determining the scoring. The development stage consists of instrument review by an expert. testing. analysis. and revision. The evaluation stage consists of assembling and refining the instrument. The validity and content reliability analysis used the Aiken formula and the Hoyt formula for construct validity using Exploratory Factor Analysis (EFA) and reliability using Cronbach's Alpha. Based on the results of research in the field the measuring instrument for self-confidence and creative thinking is said to be valid and reliable. It has a value of 0.3 with an average of 0.747. The conclusion of the research: the instrument is feasible to use. While the contribution of this research is this instrument can measure the increase of self-confidence and creative thinking in mathematics learning.

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INTRODUCTION

Based on the Amendment to Ministerial Regulation 4 concerning Guidelines for the Implementation of Learning for the Year 2020/2021 based on the results of the government's evaluation. it is essential to have face-to-face learning from students who experience problems in implementing distance learning considering that practical learning in vocational schools is needed to ensure graduates have competencies that are in accordance with the industrial world, business world and the world of work one of the components needed in the implementation of the education system in Indonesia is related to something, education, that is the curriculum in Indonesia, in general, is always developing. this is done with reference to national education standards to achieve educational goals.

Education, in its own domain, has become an inseparable part of our individual lives even from the very beginning of each of our lives it is not surprising that it occurs which is described as a field of action in its own right according to Hogan (2006) is a practical aspect of education because it has been revisited, that education should be seen as a tool for various authorities such as institutions. high schools and so on. Education will always be encouraging in community life and continuously prepare future leaders. The subject matter will require more study, especially on the similarities and differences in education according to Skaggs & Bodenborn (2006) so it can be argued that the importance of the process of implementing education in different districts to suit the needs and goals of each community, then it is generally effectively influencing the behavior and personality of students.

The curriculum that is used in Indonesia today is the 2013 curriculum. The 2013 curriculum emphasizes the active role of students in learning and the teacher's role is only as a facilitator, or often referred to as learning-centered. Changes in the education curriculum in Indonesia to the 2013 curriculum, which is adjusted to the educational goal of creating a learning atmosphere and learning process so that students actively develop their potential. As is the case in learning mathematics such as the subject material of the area of trigonometric triangles, students find it difficult because teachers are still using the lecture method and have not implemented instrument development at one of the SMK Negeri 1 schools, Bima Regency.

The implementation of the 2013 curriculum is applied to all levels of education, including the Vocational High School (SMK) level. One of the characteristics of students in vocational high schools (SMK) is students who have entered the age of 15-18 years. According to Santrock (2003) the age range of 15-18 years is classified as a teenager. During adolescence, there were many developmental tasks that must be completed, one of which is independence. According to Nurhayati (2011) independent learning is a process in which individuals take full responsibility and take the initiative in diagnosing learning needs, formulating learning objectives. identifying learning resources, selecting and implementing learning strategies and evaluating learning outcomes. One of the tasks of students is to be able to take responsibility for their own learning, so as not to depend on others and be able to organize themselves at the right time to ask for help from others and when they do not need help from others. others in learning.

Self-confidence can increase students' high interest in the learning process as well as in mathematics, the higher the student's confidence, the higher the affective response and intention to continue learning mathematics according to Sheldrake et al. (2014). Although it seems uncertain whether overly confident or accurately evaluated beliefs will be most beneficial. it is concluded that lack of confidence can be detrimental or limiting in various ways according to Bouffard & Narciss (2011). According to Wixted et al., (2015) the problem of retrospective belief

assessment is especially important when the results of a memory test have material consequences, as in testimony to the discussion of this can assess a confidence in context or test related to that problem. Choice recognition test by choosing an option can increase a person's confidence. The confidence that accompanies the identification of decisions in the situation will be a very important reference for discussion to find out whether self-confidence is highly interpretable in assessments and tests. Hendriana et al. (2014) stated that someone who has strong self-confidence will be motivated to achieve success. Regarding the mathematical optimization of students' communication skills, according to LaForce et al., (2017), that self-confidence is an important factor, so the hope is that all students can increase their self-confidence.

According to Widyaningtyas & Farid (2014), self-confidence is a belief in humans, the spirit to face life's challenges by improving a job, especially in oneself Confidence is still low experienced by students in Indonesia. Students have a low level of self-confidence (Agustyaningrum & Widjajanti, 2013). Therefore, increasing students' low self-confidence and improving their ability in math skills requires innovation in school learning models. One of the learning models that can improve learning outcomes is the area of trigonometric triangles for skills in mathematics subjects.

According to Sugiarto (2009), the characteristics of people who lack self-confidence that we often observe are: often avoiding eye contact (bowing/looking), often throwing tantrums to release anxiety, not talking much (often answering moderately). when asked, such as: "yes" or "no", even just nodding to activities in class and outside the classroom (passive), does not want to ask for help or ask strangers, has a fever stage at certain times and it is difficult. According to Lindenfield & Kamil (1997), confident people are people who feel satisfied with people who have high self-confidence and will always be grateful because they are satisfied with what they have that is in him. People who are not confident have a negative self-concept and lack confidence in their abilities so they often ask for self-confidence. Therefore, the problem of Self-confidence in the individual is a priority that must be built to achieve maximum adjustment.

Self-confidence is one of the essential requirements for individuals to develop their activities and creativity as an effort to achieve achievement. However, self-confidence does not grow by itself. Self-confidence grows from a healthy interaction process in the individual's social environment and takes place continuously and continuously. Confidence does not just appear in a person, there is a certain process in his personality so that self-confidence appears. According to Syed et al., (2014), self-confidence can motivate learning this is that self-confidence can interpersonally increase creative thinking self-confidence, and students can have a high level of learning motivation. In terms of self-confidence, it can improve creative thinking and improve problem-solving skills which help build student confidence to strengthen student learning and improve understanding of mathematics learning such as finding the area of data and area of triangles trigonometry.

Ortiz & Prakoso (2002) stated that "Self-confidence is believing in one's own abilities and being able to rely on oneself". Supported by Salirawati (2012) suggested "Self-confidence is an attitude of confidence in one's own ability to fulfill every desire and hope". Anwar et al (2012) conveyed that one of the important roles in mathematics achievement is the ability to have a high level of creative thinking because of the ability to relate, analyze and change the knowledge and experience that has been possessed to think critically and creatively so that in decision making efforts solving problems in everyday life can produce a creative mind.

Rohmah (2020) stated that in learning mathematics students need to be faced with lessons that solve a problem so that students

are able to do creative thinking and problem-solving skills by choosing to develop ideas and ideas so that indirectly in solving problems students are required to think creatively. Alhaddad & Kusuma (2015) stated that problem-solving learning in mathematics subjects also has a significant effect on students' creative thinking skills, if students have the ability to want to learn from basic elements to more complex functions, they will still have the ability to learn. think creatively and be able to solve problems in mathematics.

Desmita (2011) explained that student learning independence arises when students find themselves in a position of increased self-confidence. The basic skills that must be possessed in learning mathematics include the four main components of fluency, flexibility, originality, and elaboration. mathematics subjects whose components consist of problem-solving learning activities, and student creativity can be developed optimally when the teacher has high enough skills in the teaching and learning process. This shows that creative thinking is a skill to be able to implement a new idea in solving a problem.

Results of an interview with a math teacher (Nunung, S.Pd) at SMK Negeri 1 Lambu District, Bima Regency on March 11, 2021, at 07.33 WIT revealed that there are several things that cause students to lack confidence in following mathematics subjects including the following: 1). Lack of adequate facilities, so students can only receive lessons from the teacher, 2). Students do not feel comfortable in class because students are afraid of their schoolmates, 3). Not sure of answers and always afraid of being wrong when given group assignments, 4). The relationship with parents who are too spoiled so they don't feel at home at school, so most teachers still teach using the lecture method when teaching besides that. Teachers have not assessed self-confidence and creative thinking, especially in mathematics subjects with the subject area of trigonometric triangles.

Based on Ministerial Regulation No. 60 of 2014 the purpose of the 2013 curriculum is to prepare Indonesian people to have the ability to live as individuals and citizens who are faithful, productive, creative, innovative, and effective, and able to contribute to people's lives, nations, countries, and civilizations of the world. Therefore, creative thinking skills are very important to learn and develop. This is in accordance with the opinion of Hong (2014) who says that the ability to think creatively must be one of the important skills of the 21st century, students must acquire and use it. However, in reality, students' mathematical creative thinking skills are currently still low.

Long & Aleven (2017, p. 416) stated that with active student learning, creative thinking skills and knowledge can be increased and the learning process is useful for honing students' thinking skills. There are three terms related to thinking skills, which are actually quite different, namely higher-order thinking, complex thinking, and critical thinking. Creative thinking is a cognitive operation that is needed in the thinking process that occurs in students when they receive lessons from schools given by teachers according to Arter et al. (2016).

The ability to think creatively mathematically is a very important ability for a person to have Pangestu & Yunianta (2019) but in reality, students' mathematics learning outcomes at school have not shown encouraging results, especially in the aspect of mathematical creative thinking according to Teti (2015). According to Agustiani (2006), self-concept is a picture that a person has about himself that is formed through the experiences he gains from interactions with the environment. Self-concept also means an organized collection of beliefs and self-perceptions about oneself. Self-concept is an individual's understanding of oneself which includes physical self, personal self, family self, social self, moral self, ethics, emotional aspirations, and achievements that have been achieved by students who are currently pursuing formal education.

Learning mathematics, students' creative thinking skills are very important. This is because students' creative thinking skills greatly affect student achievement or success in learning. The process that a person undertakes to obtain alternative answers through the development of a problem or problem is the definition of creative thinking ability (Fadilah, 2016). In other words, creative thinking is a mental activity that considers new information with an open mind related to sensitivity to problems and can connect ideas in solving problems (Desi et al., 2013).

The importance of creative thinking skills that are starting to be grown in students starting from the school level must be a concern for all of us as educators. This ability, it will create the next generation of creative people who are able to create opportunities for their future lives. This meant that this ability is reasonable if it gets attention in the implementation of mathematics learning. With students who are mathematically creative, of course, it will be very easy for students to be creative in other ways. Including creativity in other subjects. Be creative in solving problems to be creative in facing global competition. The ability to think creatively is a person's ability to give birth to something new, either in the form of ideas or real works that are relatively different from those that have existed before. The purpose of this development research is to find out how to analyze students' confidence and creative thinking in participating in mathematics lessons and to generalize the factors of confidence and creative thinking of students at SMK Negeri 1 Lambu, Bima Regency.

METHOD

This research was carried out at SMK Negeri 1 Lambu, Bima Regency in the 2021/2022 academic year with a total of 210 respondents who had used the 2013 curriculum for class X majoring in mechanical engineering for content validity, an instrument using four experts, then expert judgment was analyzed using Hoyt's formula with ANOVA approach assisted by SPSS software. This instrument development research uses SPSS to analyze instrument test data in the field. with the ANOVA approach assisted by SPSS software. To calculate the validity of the content of an instrument based on expert judgment using the Aiken's V formula because it uses 4 experts, the analysis results from the expert review will result in each item being accepted, accepted with corrections, and rejected. The formula for Aiken's V is as follows.

$$V = \frac{\Sigma s}{\mathrm{n}\,(c-1)}$$

Notes:
S = r – lo
Lo = the lowest number of validity assessments (in this case = 1)
C = the highest score of validity assessment (in this case = 4)
R = the number given by an assesor
N = number of assesor

If the validity coefficient is less than 0.30 according to (Azwar, 2014) then the item can be said to be inadequate (invalid), on the contrary, if the validity coefficient is 0.3 then the item can be said to be adequate or valid. This study uses the steps proposed by Mardapi (2016) which consists of 10 steps.

However, in the ten steps of developing this instrument, the final result is a valid and reliable instrument product in manual form. The ten steps of developing this instrument are then divided into three, namely: 1) preliminary stage, 2) development stage, and 3) evaluation stage.

This preliminary stage consisted of determining instrument specifications, writing instruments, and determining to score. The development phase consists of instrument review by experts, testing, analysis, and revision. The evaluation phase consists of assembling and refining the instrument. The construct validity test was carried out by

analyzing the construct of performance indicators.

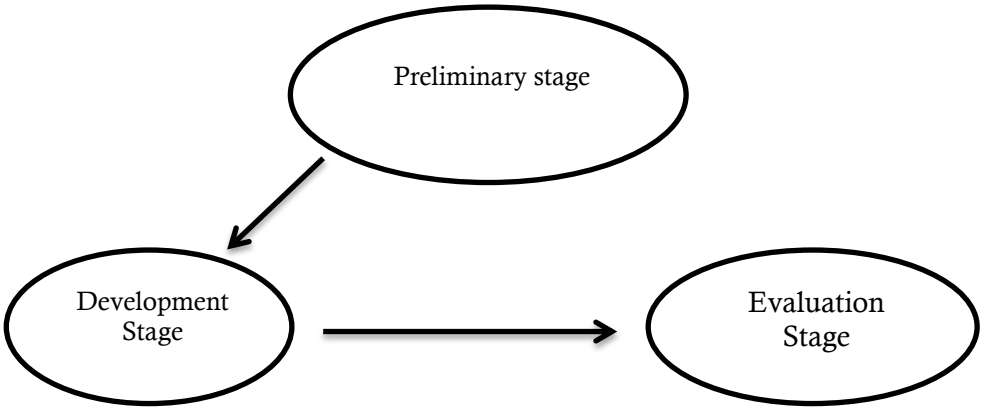

Figure 1. Schematic of instrument development steps

Construct validity will be analyzed by applying factor analysis. Testing the construct validity of an instrument is done by using Explanatory Factor Analysis (EFA). The exploration factor analysis was calculated using the SPSS version 16.0 program tool. An exploratory approach is used to see how many factors are needed to explain the indicator relationship, a confirmatory approach is used to test whether the number of factors gained empirically is in accordance with the number of factors that have been compiled with the theoretical number of factors.

The construct validity test used factor analysis can be run if the KMO value > 0.5, and construct validity can be met if the correlation value > 0.5, Eigenvalue 1, and Factor Loading 0.3 (Azwar, 2016).

RESULT AND DISCUSSION

The results of the research on developing self-confidence and creative thinking instruments were in the form of a student self-assessment questionnaire consisting of 12 indicators and 12 question items (table 1).

Regarding the analysis of the content validation results from the four assessment experts who were analyzed using the Aiken's V formula, it showed that the overall coefficient of each item is greater than the valid criteria, namely 0.30, and based on the test all items can be said to be valid because the test results show that on average there are more than 0.30 (Azwar, 2014).

The test results show that of all instrument items that have been developed as many as 12 valid items with an average coefficient level on the self-confidence measuring instrument of 0.85. Meanwhile, for creative thinking the average is 0.81 of the ten steps carried out in this research, which are used with ten steps of development assessment, there were: 1) determine instrument specifications, 2) writing instruments, 3) determine the scale of the instrument, 4) reviewing the instrument, 5) doing trials, 6) analyzing the instrument, 7) assembling instruments, 8) carry out measurements, and 9) interpret measurement results.

Table 1. Overview of Students' Confidence Measuring Instruments Following Math Subjects

Aspect	Indicator	Item Number
Students work on the questions carefully	Positive attitude towards yourself	1
Students are able to solve problems with correct results	Ability to complete tasks	2
Students do math assignments without asking friends for help	Don't expect help from friends	3
Students try to advance when the teacher gives math problems	Have competence	4
Students have fun learning confidence	Be calm	5
Students try to get good results in math lessons	Do not be afraid to achieve	6
Students give feedback to the teacher to re-explain the questions given	Do not hesitate to act	7
Students discuss with their peers about the difficulty of math problems	Dare to express opinions Dare to express ideas	8
Students can solve the problem using two answers and then discuss it with colleagues	Have self-confidence Always optimistic	9
Students master the questions that are done by themselves and do not believe in the work of friends	Rely on their self	10
Students can re-check the work that has been done		11
Students do not expect help from friends' work		12

Based on the indicators, each variable and sub-variable can be arranged and the items of the instrument are designed. the relationship between variables and sub-variables, indicators, and the design of instrument items arranged in tabular form is called the instrument grid for measuring students' confidence and creative thinking in other words the instrument grid is a table that shows the relationship between variables and sub-variables variables, indicators and the design of instrument items. The overview for developing self-confidence measuring instruments (table 2) and creative thinking of students with mechanical engineering skills in following math subjects (table 3).

Table 2. Grid of Students' Creative Thinking Instruments Subject Math Area of Trigonometric Triangle

Aspect	Indicator	Item Number
Students work on the area of a triangle with the correct answer	Generates many answers and is worth correct	1
Students solve the problem of the area of a triangle using two answers and the same result	Can think of more than one answer	2
Students give feedback and suggestions to the teacher to re-explain the area of a triangle	Gives lots of ways and suggestions for doing things	3
Students like to discuss with their colleagues about the difficulty of the area of a triangle		
Students have confidence in learning the area of a triangle which is very fun	Able to generate various kinds of ideas with different approaches	4
Students don't believe in friends' answers		
	Generate ideas and opinions, varied	5

Students re-examine the area of a triangle that has been done	answers and statements Seeing the problem from a different point of view	6
Students give an example of the area of a triangle to a colleague	Looking for a different direction	7
Students let friends who find it difficult in the task of measuring the area of a triangle	Giving an unusual answer, different from the others, which is rarely given by most people	8
I invite my colleagues to work on LKS questions related to the material for the area of a triangle	Thinking of an unusual way	9
I always pay attention to the teacher's explanation about the area of the flat shape so that I don't find it difficult	Develop, enrich, an idea	10
I want to be mastering the area of a triangle in a math textbook	Able to generate ideas and situations	11
	Make an opinion then it becomes more interesting	12

Table 3. Indicators of Creative Thinking Following Mathematics Subject Students

Aspect	Indicator
Fluency	Creates many answers and is worth correct
	Can think of more than one answer
	make more than one answer
Flexibility	Able to create various kinds of ideas with different approaches
	Creates various ideas and opinions, answers, or statements
	Seeing the problem from a different point of view
Originality	Give an unusual answer, different from the others, which is rarely given by most people.
	Can give birth to a new expression
	Think of an unusual way
Elaboration	Develop an idea.
	Able to generate ideas and situations
	Make opinions more interesting.

Based on the results of research by Lintang et al. (2017) the final result of achieving the self-confidence indicator of experimental class students has reached 73% of the high criteria, while 49% of the control class belonged to the low criteria. Students' self-confidence is said to increase if the achievement of the student's self-confidence indicator is at least included in the high criteria. The increase in self-confidence in the experimental class was calculated using the N-Gain formula of 0.302 which was included in the medium category, and the control class of 0.019 was included in the low category. The conclusion was that the self-confidence of the experimental class students increased.

Research results by Gaol et al. (2017) developed a self-confidence character assessment instrument in the form of a self-assessment questionnaire by students consisting of 8 indicators with a total of 31 items. Based on the table of content validation results of experts analyzed with the Aiken's V formula, it showed that the overall coefficient of each item is greater than the valid criteria of 0.30, and based on these results if the validity coefficient of 0.30 means the item can be said to be valid (Azwar, 2014:143). The test results

show that the overall instrument items developed with 31 items are valid with an average coefficient level of 0.850.

Table 4. Confidence Instrument of Content Reliability Test

Tests of Between-Subjects Effects Dependent Variable: Assesor Score					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	25.417[a]	46	.553	1.105	.654
Intercept	493.571	1	493.571	987.141	.020
P	.733	3	.244	.489	.752
B	17.049	11	1.550	3.100	.419
P * B	7.467	32	.233	.467	.847
Error	.500	1	.500		
Total	520.000	48			
Corrected Total	25.917	47			

a. R Squared = .981 (Adjusted R Squared = .093)

$$R_{xx} = \frac{MK_B - Mk_{in}}{MK_B} = \frac{1.550 - 0.233}{1.550} = 0.85 \text{ (Reliable)}$$

Reliability is shown by coefficients if the numbers range from 0.0 to 1.0 and the higher the reliability coefficient approaches 1.0, the higher reliability (Azwar, 2012). Then, from the results of the reliability analysis of the content of self-confidence, there are results of 0.85 with the category of the student's confidence level being very high so that in this case the data is reliable.

Table 5. Creative Thinking Instruments of Content Reliability Result

Tests of Between-Subjects Effects Dependent Variable: Assesor Score					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	24.479[a]	46	.532	1.064	.663
Intercept	530.742	1	530.742	1061.485	.020
P	1.818	3	.606	1.212	.569
B	15.105	11	1.373	2.746	.442
P * B	8.226	32	.257	.514	.827
Error	.500	1	.500		
Total	565.000	48			
Corrected Total	24.979	47			

a. R Squared = .980 (Adjusted R Squared = ,059)

$$R_{xx} = \frac{MK_B - Mk_{in}}{MK_B} = \frac{1.373 - 0.257}{1.373} = 0.81 \text{ (Reliable)}$$

Based on the assessment by experts that the results of the analysis of the validity and reliability of the creative thinking instrument obtained were between 0 to 1.00, the number 0.81 in the assessment results above can be interpreted as a fairly high coefficient. Azwar (2012). Then from the results of the reliability analysis of the content of creative thinking, there were results of 0.81 with the category of students being very high in creative thinking so in this case, the data is reliable.

The results of research by Gaol et al. (2017) titled Development of Instruments to

Measure Self-Confidence and Creative Thinking in Mathematics Learning for Vocational High School Students that the analysis of the content validation results of experts who were analyzed Aiken's V Formula showed that the overall coefficient of each item was greater from valid 0,30 and based this results if the coefficient validity same or greater from 0,30 that's mean items can be said valid. The research showed that the overall item of instruments developed with 31 items is valid with an average coefficient level is 0.850.

CONCLUSION

Based on the results of the expert assessment of the form of the instrument for measuring confidence and creative thinking of students at SMK Negeri 1 Kecamatan Lambu, Kabupaten Bima which was developed on the self-assessment instrument by students, the results from item 1 to item 12 on the self-confidence measuring instrument can be interpreted as a coefficient. which is quite high because it has a value of 0.85 (reliable) while the creative thinking instrument has a value of 0.81 (reliable). This shows that the results of the item are in the valid and reliable category. b. Fill the instrument in the form of a checkmark or checklist with a Likert scale using strongly agree (SS), agree (S), disagree (TS), and strongly disagree (STS) with a number scale of 4,3,2,1 and based on the filling guideline, the results of the expert validity test as a whole indicate that the instrument developed is valid and reliable. while the results of the data analysis of students' creative thinking according to the range of values, namely 13.8% of students were in the medium category, 79.04% of students were in the high category and 7.14% of students were in the very high category. The instrument is feasible to use. It also can measure the increase of self-confidence and creative thinking in mathematics learning.

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