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Development of Assessment Instruments Mathematic Creative Thinking Ability on Junior High School Students

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Abstract

The development of creative thinking skills is one focus in learning mathematics. The ability to think creatively is needed in solving mathematical problems including the steps in the formulation, interpretation, and resolution of models or problem solving. This study aims to develop an instrument of assessment of creative thinking skills in mathematics in junior high school subjects. Research using the Borg & Gall development method. Data collection through the provision of test descriptions. The test instruments were validated by 7 experts who were analyzed using the Aiken'V formula and the field test of creative thinking ability was analyzed using the construct validity of Confirmatory Factor Analysis (CFA), reliability was analyzed using Alpha Cronbach. The results of the validation from the experts show validity ≥ 0.75 Aiken's table that all items are valid, Test the validity of the items from the 4 item test items tested, all 4 item description items are valid with a coefficient> 0.3, and the value of the reliability coefficient > 0.6, construct validity value of KMO of 0.831 with a significance of 0,000 for 4 items that make up 4 factors according to the dimensions of aspects of creative thinking namely fluency, flexibility, authenticity and detail. The profile of mathematical creative thinking abilities in small and large scale trials is quite creative. The final product of the research is a valid, reliable and practical mathematical creative thinking appraisal instrument. The assessment of mathematical creative thinking can be used by the teacher to get information about how the creative thinking abilities possessed by each of the eighth grade students of Junior High School.

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INTRODUCTION

The development of technology and information at this time can not be denied is the fruit of the ability of human creative thinking (Siswono, 2018, p.1). The ability to think creatively becomes a demand along with the increasingly complex life problems that must be faced by humans. Development of a nation depends on human resources. Human resources are determined by education. Quality human resources are needed to solve the problems. Solving problems requires a new idea. One of the goals of the education system is to encourage someone to be creative. This has been outlined in Peraturan Menteri Nomor 20 Tahun 2016 so students through mathematics learning can have the ability to think creatively (Permendikbud, 2016).

The ability to think creatively for students is very important in the era of global competition because the level of complexity of the problems in all aspects of modern life is getting higher. Creative thinking is classified as high level competencies (high order competencies) and can be seen as a continuation of basic competencies in mathematics learning (Samsiyah, 2015, p.23).

The development of creative thinking skills is one focus in learning mathematics. The ability to think creatively is needed in solving mathematical problems including the steps in the formulation, interpretation, and settlement of models or planning problem solving (Panjaitan, 2017, p.2).

Research on creative thinking conducted by Nurmasari et al (2014) explains that creative thinking in mathematics and in other fields is part of life skills that need to be developed especially in the face of an increasingly tight information age and competitive atmosphere. Swarabama (2013) from Universitas Pendidikan Ganesha explained that creative thinking is important to be nurtured and developed because by being creative people can realize themselves. Liliawati (2011) in the Jurnal Pengajaran MIPA shows that creativity needs to be developed from an early age because it is expected to become a provision in solving problems. Therefore, the assessment of creative thinking is needed to provide feedback during the teaching process, and be able to make children smooth and flexible in thinking, able to see a problem from various points of view, and able to give birth to many ideas.

Furthermore, from the results of an interview with a mathematics teacher at SMP Plus Salafiyah Pemalang on Monday, 18 February 2019, information was obtained that the teacher had not yet carried out an assessment of creative thinking abilities, but did so in an attitude assessment judging by his value analysis. And the assessment instruments used still use observation sheets. A similar opinion was expressed by one of the mathematics teachers at SMP Al Manshuriyah Pemalang, that there were no assessment instruments specifically measuring mathematical creative thinking abilities. This shows that the teacher has not yet assessed the ability to think creatively with relevant instruments.

Assessment is a very important activity in learning mathematics (Budiman, 2014, p.140). Assessment can provide constructive feedback for both teachers and students. The results of the assessment can also provide motivation for students to perform better. Even assessment can influence learning behavior because students tend to direct their learning activities towards the estuary of the teacher's assessment. Therefore we need the right and correct assessment instruments.

The quality of learning achievement assessment instruments directly influences the accuracy of the status of students' learning outcomes. Therefore, the position of the instrument for evaluating learning outcomes is very strategic in the decision making of teachers and schools related to the achievement of students' learning outcomes, including the ability to think creatively, and to find out the creative thinking abilities of students in mathematics, an instrument that can truly identify these abilities (Siswono, 2007, p.1).

To find out how much the level of creative thinking ability of junior high school students towards mathematics, an assessment instrument is needed. Then the researchers intend to develop an

assessment instrument that is able to measure the level of mathematical creative thinking ability of junior high school students.

METHODS

This research is a research and development (Research and Development). The product developed in this study is an instrument of mathematical creative thinking ability assessment. The instrument consists of instrument lines, test instruments in the form of descriptions, and scoring guidelines and instructions for use.

The development model used refers to the development of the Borg & Gall (2003) instrument which was modified in 9 steps, namely: (1) introduction; (2) planning; (3) initial product development; (4) small-scale trials; (5) Refinement of the initial product; (6) large-scale trials; (7) product improvement; (8) product practicality test; (9) final product (Alfansuri, 2018).

Data collection techniques used are test, documentation, observation, interviews, and questionnaires. Analysis of the data in the instrument development process that is, the initial product is validated by experts to get a valid instrument content. Furthermore, the instrument was tested on a limited basis to students in SMP Plus Salafiyah Pemalang. The results of testing the instrument of critical thinking ability are measured empirical validity by using the Product Moment formula. While the reliability test uses the Alpha Croanbach formula. The level of difficulty of the questions and the distinguishing features are also measured. The democratic character assessment instrument measured is validity and reliability using SPSS 16.0 software.

RESULTS AND DISCUSSION

The results of the research on the development of a confident character assessment instrument in the form of a self-assessment questionnaire by students consisting of 4 indicators of creative thinking namely authenticity, flexibility, authenticity and detailing with a total of 4 item items. Analysis of the results of the experts' content validation analyzed by the Aiken's V formula (Aiken's, 1980, p.956) shows that the overall coefficient of each item is greater than the valid criteria in the Aiken's table and based on these results if the validity coefficient A Aiken's table is 0, 75 means that the item can be said to be valid (Aiken's, 1985). The test results show that all instrument items developed with 4 item description items are valid. The results of the content validity can be seen in Table 1.

Small-scale trials test item validity and instrument reliability. Item validity was analyzed by correlation formula using SPSS version 16.0. The requirement used is the Pearson correlation coefficient, the test must be greater than 0.3 (for 25 samples). If it is less than 0.3, then the item valuation instrument for which r correlation is considered invalid. The results of the analysis of the ability to think creatively in a small scale test, that all 4 items have a correlation coefficient rtest > 0.3. This small scale trial obtained 4 valid items that can be used for large scale trials. The reliability analysis of the mathematical creative thinking assessment instrument in this small-scale trial used the Alpha Croanbach reliability test with SPSS 16.0 software. Alpha Croanbach reliability measurement results obtained instrument reliability coefficient of 0.797.

Good reliability is when the index is equal to or greater than 0.60 (Sugiyono, 2016, p. 184), this is in accordance with his opinion (Sujarwanto 2015, p. 785). The results of this analysis can be concluded that the mathematical creative thinking ability assessment instrument has a high level of reliability in small scale trials. Large-scale trials test the construct validity and instrument reliability. The condition used is the Pearson correlation coefficient must be greater than 0.3 (for 86 samples). If it is less than 0.3, then item grading instrument correlation is considered void / not used / invalid. The number of items tested is 4 items. The results of the analysis of the validity of the instruments for evaluating mathematical creative thinking abilities on a large scale test, there are 4 items that have a correlation

coefficient > 0.3. This shows that 4 items about the instrument are valid.

Table 1. Results of Evaluation of Instrument Validators for Mathematical Creative Thinking Ability

No. Item	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Score Total	V Index	R Critical	Information
1	4	5	3	5	5	5	5	32	0.893	0.75	Valid
2	4	5	4	5	5	5	5	33	0.929	0.75	Valid
3	4	5	4	5	5	5	5	33	0.929	0.75	Valid
4	4	5	4	4	5	5	5	32	0.893	0.75	Valid

The next test is to test the construct validity of the creative thinking skills assessment instruments. The construct validity test for the instrument of evaluating the ability to think creatively using Confirmatory Factor Analysis (CFA). Valid data are based on explanatory factor analysis procedures, if the data meet the requirements of the Keizer-Meyer-Olkin Measure of Sampling Adequacy (KMO MSA)> 0.8 (Guilford, 1982; Purwanto, 2012) and factor loading> 0.3 (Purwanto, 2012; Alfansuri, 2018) then, the data is feasible and can be continued for validity testing. Test results can be seen in Table 2.

Table 2. Construct Validity Test Results

KMO and Bartlett's Test		
KMO coefficient		0,824
Bartlett Test	Chi-square	185,830
	Price	
	Degrees of freedom	6
	Significant	0,000

Based on SPSS data results obtained KMO value > 0.8, 0.824 and Chi-Square significance of 0.000 this criterion shows that large-scale test results are stated to be eligible for further confirmatory factor analysis.

The next step is the Rotated Component Matrix, which is to describe the grouping of items into several factors. In this study, the four items after extraction grouped into four core components according to the aspects of creative thinking. The results after the Rotated Component Matrix was performed that item 1 was confirmed in factor factor 1, namely the fluency aspect of 0.893; Item 2 is confirmed in the factor 2 component, which is the flexibility aspect of 0.898; Item 3 is confirmed in the factor 3 component, which is the aspect of authenticity (originality) of 0.878; and Item 4 is confirmed in the factor 4 component, namely the elaboratioin aspect of 0.789 for the results can be seen in Table 3.

Tabel 3. Rotated Component Matrix Test

Rotated Component Matrix[a]

	Component			
	1	2	3	4
Item_1	.893	.252	.255	.271
Item _2	.249	.898	.258	.253
Item _3	.264	.271	.878	.294
Item _4	.357	.333	.374	.789

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 5 iterations.

The reliability analysis of the mathematical creative thinking assessment instrument in this large-scale trial used the Alpha Croanbach reliability test with the SPSS 16.0 program. The Alpha Croanbach reliability measurement results obtained the value of the instrument reliability coefficient of 0.881.

Good reliability is when the index is equal to or greater than 0.60 (Sugiyono, 2016, p.184) an instrument is declared reliable if the reliability coefficient is at least 0.6. this is the same as his opinion (Sujarwanto 2015, p. 785). The results of this analysis can be concluded that the mathematical creative thinking ability assessment instrument has a very high level of reliability in large-scale trials.

Based on the results of preliminary studies conducted by researchers through interviews, observations, and document studies to find out the factual conditions of mathematical creative thinking assessment instruments used in Pemalang district junior high school, especially in SMP Plus Salafiyah Pemalang, it was found that the mathematical creative thinking assessment instruments used today are still only comprehensive and measure affective, whereas it can measure the cognitive realm as well. Seeing the form of instruments that exist today, it is necessary to develop cognitive instruments that are able to measure students' mathematical creative thinking.

Creative thinking needs to be developed early because it is expected to become a provision in dealing with problems in life. One of the goals of creative thinking is that students have the skills to develop reasoning skills in thinking inductive and deductive analysis (Liliawati, 2011, p.93).

Guilford and Torrance in Munandar (2014, p.64) that to measure the ability to think creatively can be formulated as abilities that reflect aspects of fluency, flexibility, originality, and elaboration.

The results of calculations from the teacher practicality sheet on the assessment of mathematical creative thinking, obtained information that the assessment instruments for all aspects have the lowest practical score of 51 and the highest is 61 of 5 teacher respondents. Based on the specified score criteria, it was concluded that each respondent assessed the mathematical creative thinking assessment instrument of junior high school students was practical to use.

From the small-scale trial data with up to 25 students, the percentage of mathematical creative thinking assessment scores, found 5 students have very categories, 5 students have creative categories, 12 students have enough categories and 3 students have less creative categories, and 0 students who get no categories creative.

In a large-scale trial with 86 students as a sample, the percentage of creative thinking assessment scores obtained 25 students in the very category, 18 students in the creative category, 28 students in the creative category, 15 students in the less creative category, and 0 students in the category not creative. Therefore it can be concluded that the mathematical creative thinking ability of small and large-scale trial students is quite creative.

The final result of the development of the instrument was made in the form of a guidebook that functions for the way of using the instrument of creative thinking abilities by the teacher. This is in accordance with the opinion, (Puji Astuti, W. Wibawanto, H. And Khumaedi, M; 2015; Yumaroh, Wahyu Lestari, Masrukan; 2014) stated that the final results of the study resulted in development products that were valid, reliable and realized in the form of guidelines.

CONCLUSION

The development of the mathematical creative thinking ability assessment instrument in class VIII of SMP Plus Salafiyah obtained information that the assessment conducted by teachers at SMP Plus Salafiyah, one of the obstacles was the absence of an instrument specifically measuring the ability to think creatively in mathematics, only an observation sheet of attitudes that it is still subjective, and there is no scoring, so the instrument does not meet valid and reliable criteria.

The validity of the contents for the four items in the description of the ability to think creatively on the mathematical creative thinking ability assessment instrument developed was declared valid based on the study of experts of 7 people with a significant value obtained based on the Aiken's table on each item.

The validity of items on a large scale trial of 4 items obtained a significant correlation coefficient. The construct validity using Confitmatory Factor Analysis (CFA) obtained by Keizer Meyer Olkin Measure (KMO) and the value of a significant loading factor, so that 4 instrument items were confirmed in 4 factors, namely fluency, flexibility, flexibility, originality. and elaboration. Therefore, it can be concluded that the measurement model instrument of its formulation comes from the theory of creative thinking ability which includes aspects of fluency, flexibility, authenticity and detail.

Mathematical creative thinking ability assessment instruments that have been developed according to each user have a very good category with a percentage of ideals can be interpreted that the assessment instruments developed are practical.

Small-scale trial data with a sample of 25 students, it can be concluded that the mathematical creative thinking ability of small-scale pilot students is quite creative. While in large-scale trials with 86 students as samples it can be concluded that the mathematical creative thinking ability of large-scale trial students is quite creative. So, it can be concluded that the criteria of VIII grade students of SMP Plus Salafiyah Pemalang have the ability to think mathematically creative is quite creative.

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