



The Development of Test Instrument on The Excretion System to Measure Creative Thinking Skills

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Abstract: The creative thinking ability test instrument is a form tool to measure student creative thinking skills. This study aims to develop a creative thinking ability test instrument and determine its validity level. The research method used in developing the test instrument is the Borg and Gall development method (1983). The research instrument used in this study was a validation sheet. The results of this study indicate that the research and development process carried out by the researchers is a potential problem, data collection, planning, product design development, design validation, and design revision. The validity level of the creative thinking ability test instrument on the concept of the human excretion system that the researcher developed was in the valid category with a value of 76.94%. The test instrument for the ability to think creatively on the concept of the human excretion system is valid for use in student trials.

Keywords: Test instrument, creative thinking, excretion system

Abstrak: Instrumen tes kemampuan berpikir kreatif merupakan bentuk alat untuk mengukur kemampuan berpikir kreatif siswa. Penelitian ini bertujuan untuk mengembangkan instrumen tes kemampuan berpikir kreatif dan mengetahui tingkat kevalidannya. Metode penelitian yang digunakan dalam mengembangkan instrumen tes adalah metode pengembangan Borg and Gall (1983). Instrumen penelitian yang digunakan dalam penelitian ini adalah lembar validasi. Hasil penelitian ini menunjukkan bahwa proses penelitian dan pengembangan yang dilakukan peneliti adalah potensi masalah, pengumpulan data, perencanaan, pengembangan desain produk, validasi desain, dan revisi desain. Tingkat kevalidan instrumen tes kemampuan berpikir kreatif pada konsep sistem ekskresi manusia yang peneliti kembangkan adalah pada kategori valid dengan nilai sebesar 76,94%. Instrumen tes kemampuan berpikir kreatif pada konsep sistem ekskresi manusia tersebut valid untuk digunakan pada uji coba kepada siswa.

Kata kunci: Instrumen tes, berpikir kreatif, sistem ekskresi

▪ INTRODUCTION

The ability to think creatively is needed in the world of education to develop the potential of students to become creative humans. This is in line with the demands of competence in the 2013 curriculum (Ministry of Education and Culture, 2013) and learning abilities in the 21st century, namely being able to implement science in scientific research, solve problems, and make creative works of everyday life through creative thinking skills. In addition, it is also in line with the daily life of students in keeping up with the times and technology where students are expected to be able to take advantage of their creative thinking skills in creating creative works.

Creative thinking skills are part of higher order thinking skills (HOTS) that students must have (Istiyono et al., 2014). Creative thinking skills are basically skills

that arise because they often solve problems using different methods (Kiryak & Çalik, 2017). Creativity shows that all children have creative thinking skills at various levels (Turkmen & Sertkahya, 2015). In the current information age, creative thinking is considered important for educated people to face a world that is changing rapidly (Anwar, et al., 2012). The ability to think creatively is the ability to think about new ideas in ways, methods, and solutions (Verlinden, 2005). Creative thinking is a thought process that is oriented towards good and correct answers that need to be trained to students because it can help students respond to a problem from various points of view and is able to generate many ideas in solving the problem (Kusumaningrum and Djukri, 2016; Perry and Karpova, 2017).

According to Elaine (2014), creative thinking is a habit of the mind trained by paying attention to intuition, turning on the imagination, revealing new possibilities, creating amazing perspectives, and generating unexpected ideas. Nuswowati et al. (2017) argued that creative thinking has four indicators, namely fluence is the ability to generate many ideas, flexibility is the ability to generate various ideas, originality, the ability to generate new original ideas, and elaboration is the ability to develop or add to ideas. to generate more detailed and innovative ideas. Creative thinking skills are skills to use creative ideas and techniques that are broadly unlimited; create new, useful ideas; describe, reconcile, analyze, and evaluate existing ideas to develop and maximize creative efforts (Putranta and Supahar, 2019). The creative thinking process requires openness and self-discipline, courage to take risks, and tolerance for differences.

In realizing the competency requirements in current and future curricula, appropriate tools are needed according to the criteria for creative thinking, one of which is through a test instrument. The test instrument is a measuring tool in the form of test questions to gather information about a person's abilities. Tests regarding creative thinking skills that have developed earlier are the test of divergent thinking, Torrance test of creative thinking verbal (Kim, 2006), tests for creative thinking-drawing production (TCT-DP), Packet's creativity assessment (Williams, 1980) and inventory khatena (Munandar, 2016). These tests are presented globally to measure the level of creative thinking of students.

The assessment instrument must meet the requirements of substance (content), construction and language and have evidence of empirical validity and produce scores that can be compared between schools, between regions and between nationalities (Minister of Education and Culture Regulation, 2016). In addition, standard assessment instruments must be valid, reliable, and free from irrational elements (Mardapi, Kumaidi & Kartowarigan, 2011). The assessment model also needs to be considered, because it can affect the ability to think creatively and understand conceptual (Van den Berg, 2008). The right test instrument can motivate students to learn through appropriate creative thinking skills in everyday problems (Putranta & Supahar, 2019).

There are not many researches regarding the development of a test of students' creative thinking abilities in learning, and so is the integration of concepts. Florida, et al. (2015) stated that there were still few questions that specifically trained students' creative thinking skills. This is in accordance with the research of Redhana (2015) which states that teachers are not aware of the existence of tests to measure students' creative thinking skills so that the teacher has never made the test. It is also in line with the conclusion of the results of the interview with the science teacher at SMP Unggulan Uswatun Hasanah, namely that they have not used integration in the preparation of questions, there is still a lack of the teacher's ability to develop questions with a creative

thinking perspective, only using aspects of original thinking (suggesting new ideas / ideas) in making questions. Therefore, it is necessary to develop a creative thinking ability test instrument using integrated concepts. The integration of the concepts in question is a link between the main concepts and the supporting concepts (Murfiah, 2017). According to Putranta & Supahar (2019), the way to improve creative thinking skills is to practice solving problems in life frequently. Then for the transfer of creativity skills, it can be done by authentic assignments by teachers at schools (Anwar et al., 2012). Creativity can be encouraged globally by stimulating creative thinking styles, applying divergent thinking processes involved in problem solving, and using various strategies to produce creative products (Rabanos and Torres, 2012).

The purpose of this study was to develop a creative thinking ability test instrument and determine its validity level. This test instrument can be used to measure and develop students' creative thinking skills, especially in the concept of the human excretion system at the junior high school level.

▪ METHOD

This study uses a research and development method which refers to the Borg and Gall development method with 10 stages of development. However, in this study, researchers only arrived at three stages, namely

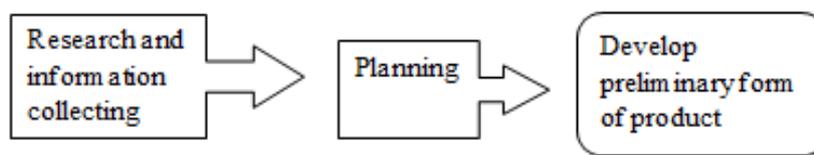


Figure 1. Research design modified from Borg & Gall (1983)

The research design was accompanied by two development steps by Sugiyono (2017), namely design validation and design revision as well as steps to develop learning outcomes tests (Mardapi, 2018), starting from compiling test specifications, writing test questions, and analyzing test questions.

Thus, the research and development process that researchers carry out is potential problems, data collection, planning, product design development, design validation, and design revision. Activities at the potential problem stage and data collection are field studies and literature studies. The field study was carried out at SMP Negeri 3 Cilegon and SMP Unggulan Uswatun Hasanah. Meanwhile, design validation was carried out by two expert lecturers from FKIP Untirta science education and two expert teachers from SMP Negeri 3 Cilegon and SMP Unggulan Uswatun Hasanah. The validity used is logical validity which is validity based on the results of reasoning, which is tested by experts in their fields. Design validation experts are learning evaluation experts, material experts, and educators.

The collection of validation data from these experts used a test instrument validation questionnaire which included three aspects of assessment, including aspects of substance, construction, and language. The results of the questionnaire data obtained were processed qualitatively to obtain the percent value sought (NP) by means of the raw score obtained (R) divided by the ideal maximum score (SM) then multiplied by 100% as a fixed number (Purwanto, 2013). The qualitative calculation results are interpreted into the validity criteria using intervals, including: (1) 81% - 100% = very

valid, (2) 61% - 80% = valid, (3) 41% - 60% = quite valid, (4) 21% - 40% = less valid, (5) 0% - 20% = very less valid (modification from Riduwan, 2012)

▪ RESULT AND DISCUSSION

The research and development process that is carried out is potential problems, data collection, planning, product design development, design validation, and design revision.

1) Potentials and Problems

Potential and problems were obtained from the results of field studies, namely the results of interviews with junior high school science teachers regarding the assessment of learning outcomes and students' creative thinking skills in schools. The results of the analysis of the interview data are as follows: (a) In the preparation of questions, they have not used cohesiveness such as concept cohesiveness. This is because the curriculum in schools has not fully used integration in learning, especially in the assessment of cognitive aspects. (b) The teacher's ability is still lacking in developing questions that contain aspects of creative thinking. This is due to the lack of continuous procurement of training in creative thinking questions arrangement. Ongoing training, which is about the preparation of critical thinking questions and learning media. (c) In making questions, new teachers use one aspect of creative thinking, namely the aspect of original thinking (suggesting new ideas / ideas). This is because the original aspect is easier and identical in reflecting the ability to think creatively, which also corresponds to the phase of student cognitive development.

2) Data Collection

Data Collection obtained from literature studies on tests of creative thinking skills and curriculum. The literature study conducted was an analysis of tests of creative thinking skills and an analysis of the Class VIII SMP Science learning curriculum.

a. Analysis of creative thinking ability test questions

The tests regarding creative thinking skills that are available are *the test of divergent thinking*, *the Torrance test of creative thinking verbal* (Torrance in Kim, 2006), *the test for creative thinking-drawing production (TCT-DP)*, and *the creativity assessment packet* (Williams, 1980). The creative thinking ability test that will be developed is based on the Torrance test of verbal creative thinking. This is because to support and develop questions made by the teacher, which only uses one aspect of creative thinking, namely the aspect of original thinking. Original thinking that is raised by the teacher in the question is in the form of expressing new ideas / ideas. The characteristics of the questions express ideas in the form of preventive solutions and efforts to maintain health and care for each other.

b. Analysis of the class VIII SMP science learning curriculum

The curriculum used at SMPN 3 Cilegon and SMP Unggulan Uswatun Hasanah Cilegon is the 2013 curriculum. The demands of the two basic competencies of the excretory system and addictive substances in the curriculum are to analyze disturbances in the excretory system as well as efforts to maintain the health of the system and introduce a hazardous substance to minimize its presence in body. The assessment of the two basic competencies is still independent, there is no integration that supports

each other. In fact, the concept of the excretory system and the concept of addictive substances have interrelated power to support each other.

c. Student Needs

Students have the right to get educational services according to their talents, interests, and abilities. The rights of these students can be fulfilled through educational units operated by educators, namely teachers. Teachers are required to create an educational atmosphere that is meaningful, fun, creative, dynamic, and dialogical (The Law of The Republic of Indonesia Number 20 of 2003). The talents, interests, and abilities that students want to develop can be through a creative educational atmosphere where starting from honing and developing students' creative thinking skills so that students can be skilled in creating or solving problems. This is in line with the results of interviews with teachers, namely creative students in terms of asking questions, answers, and expressing new ideas. Creative possessed by these students reflects that students have reached the ability to think creatively, namely thinking fluently and thinking original. In order to support and hone students' creative thinking skills, it takes practice questions that have characteristics of developing students' creative thinking abilities.

d. Planning

The data collected from the data are analyzed, then the aspects of creative thinking, competency outcomes, and integration are determined which will be used in the preparation of test questions. The following is an explanation of the aspects of creative thinking, competency outcomes, and cohesiveness that the authors use:

Aspects and indicators of creative thinking in developing test instruments

The creative thinking ability test used is the *Torrance test of creative thinking verbal*. The aspects of creative thinking skills used are 4 aspect scales with 6 Torrance sub tests and 8 indicators which are described in table 2 below:

Table 2. Aspects and indicators of creative thinking ability test

No.	Aspects of Creative Thinking	Torrance sub test	Creative Thinking Indicators
1.	Think fluently	Asking questions / statements a. Guess cause and effect b. Proposition of advantages and disadvantages	Come up with lots of ideas, answers, problem solving, or questions a. Provide many ways or suggestions for doing things in guessing cause or effect. b. Provide many ways or suggestions for doing various things in terms of profit and loss.
2.	Think flexible		Generate a variety of ideas, answers, or questions. Can see a problem from different points of view.
3.	Original	Giving birth to new	Being able to give birth to new

No.	Aspects of Creative Thinking	Torrance sub test	Creative Thinking Indicators
	thinking	expressions (product updates) Unusual use	and unique expressions. Think of unusual ways to express yourself
4.	Think of detailing	Incomplete image	Adding or detailing, details of an object, idea or situation so that it is more interesting.

Competency achievements in the development of test instruments

The following competency achievements are indicators that already exist between the excretion system concept and the concept of addictive substances.

Table 3. Analysis of science curriculum for class viii of junior high school

Basic competencies	Indicators of competence achievement	
3.10. Analyze the excretory system in humans and understand disorders of the excretory system and efforts to maintain the health of the excretory system.	Terms	
		3.10.1. Describe the parts of the organs for the removal of waste substances in the excretory organs including the waste products for consumption of addictive substances.
		3.10.2. Identify the function of the excretory system organs after consuming addictive substances.
		3.10.3. Describe a schematic of the formation process in the excretory organs.
	Main	3.10.4. Analyzing the relationship between structure and function in the excretory organs.
		3.10.5 Understand disorders of the excretory system.
	Enrichment	3.10.6 Understand the efforts to maintain the health of the excretory system.
		3.10.7 Designing a healthy lifestyle to maintain the excretory system.
	3.10.8 Formulate a hypothesis	

Basic competencies	Indicators of competence achievement
3.6. Describe various additives in food and beverages, addictive substances, and their impact on health (addictive substances).	<p style="text-align: right;">of disorders that occur in the excretory organs.</p> 3.6.1 Describes various addictive substances. 3.6.2. Describe the mechanism of addictive substances in the body. 3.6.3. Explain the impact of using addictive substances on health.
	Main

The integrated model in developing test instruments

The concept used by researchers is the concept of the human excretion system. The concept uses connected integration by selecting KD 3.10 as the main KD and is linked to KD 3.6, the concept of addictive substances. The choice of this concept is seen from the characteristics of the two basic competencies chosen which have a fairly important role, namely regarding maintaining the health and stability of the body's excretory system and introducing a hazardous substance to minimize its presence in the body. This is also supported by the opinion of the science teacher from SMPN 3 Cilegon, namely that this concept has characteristics in terms of inviting students to care about the health of organs and the excretory system.

After determining the three, a grid of creative thinking skills tests was carried out. The grid includes basic competencies, competency achievement indicators, creative thinking aspects, creative thinking aspect indicators, and question indicators. The grid is arranged by linking the concept of the excretory system and the concept of addictive substances to the achievement indicators and question indicators. The integration of these indicators must contain and achieve indicators of the creative thinking aspects used.

Product design development

Product design development is the process of designing a product, namely writing questions and test answer rubrics. Writing test questions is the process of clearly describing the indicators on the grid into question questions. The development of a test instrument for the ability to think creatively on the concept of human excretion systems and addictive substances consists of 30 items in description, including 10 questions for fluent thinking, 10 questions for flexible thinking, 6 questions for original thinking, and 4 questions for detailed thinking. The test questions are made according to the indicators of competency achievement and creative thinking indicators. Test questions are arranged based on indicators of competency achievement. The test answer rubric was created using a score range of 3, 2, 1 on each item. Score 3 is the highest score while score 1 is the lowest score. The value can be seen from the complexity of the answer keywords.

Design validation

Validation activities are carried out to determine the success rate of design making. If there are deficiencies, then corrections are made. The draft of the creative thinking ability test instrument is logically validated by experts in their fields, including two lecturers from the Science Education Department and two science teachers from SMPN 3 Cilegon and SMP Unggulan Uswatun Hasanah Cilegon using a validation questionnaire. The following are the results of the validity per item test instrument from the experts:

a. Expert Lecturer

Table 4. Validity results per item question by expert lecturers

No	Expert 1		Expert 2	
	Score	Annotation	Score	Annotation
1.	80.00%	Valid	83.33%	Very Valid
2.	78.33%	Valid	81.67%	Very Valid
3.	78.33%	Valid	80.00%	Valid
4.	80.00%	Valid	81.67%	Very Valid
5.	80.00%	Valid	81.67%	Very Valid
6.	76.67%	Valid	80.00%	Valid
7.	76.67%	Valid	80.00%	Valid
8.	78.33%	Valid	80.00%	Valid
9.	78.33%	Valid	81.67%	Very Valid
10.	76.67%	Valid	81.67%	Very Valid
11.	71.67%	Valid	80.00%	Valid
12.	75.00%	Valid	81.67%	Very Valid
13.	76.67%	Valid	80.00%	Valid
14.	80.00%	Valid	76.67%	Valid
15.	76.67%	Valid	80.00%	Valid
16.	73.33%	Valid	61.67%	Valid
17.	75.00%	Valid	81.67%	Very Valid
18.	76.67%	Valid	80.00%	Valid
19.	75.00%	Valid	81.67%	Very Valid
20.	76.67%	Valid	78.33%	Valid
21.	73.33%	Valid	78.33%	Valid
22.	76.67%	Valid	81.67%	Very Valid
23.	76.67%	Valid	80.00%	Valid
24.	80.00%	Valid	81.67%	Very Valid
25.	78.33%	Valid	81.67%	Very Valid
26.	76.67%	Valid	80.00%	Valid
27.	80.00%	Valid	78.33%	Valid
28.	80.00%	Valid	78.33%	Valid
29.	76.67%	Valid	80.00%	Valid
30.	80.00%	Valid	78.33%	Valid

Table 4 shows the percentage of validation results by two expert lecturers on 30 items developed with 12 assessment components divided into three aspects, namely the substance aspect, the construction aspect, and the language aspect. After analyzing the validation of the items by expert lecturers, it is known that the 30 items developed reached the intervals of 61% - 80% and 81% - 100%. The percentage of the final score that reaches the interval of 61% - 80% on the items is declared valid. The test items that

are declared valid are questions number 3, 6, 7, 8, 11, 13, 14, 15, 16, 18, 20, 21, 23, 26, 27, 28, 29, 30. The percentage of the final score that reaches interval 81% - 100% on the item then the question is declared very valid. In questions number 1, 2, 4, 5, 9, 10, 12, 17, 19, 22, 24, 25 obtained different validity results between expert lecturers 1 and expert lecturers 2. However, the questions on that number are still included in the category valid.

b. Expert Teacher

Table 5. Validity results per item question by expert teachers

No	Expert 1 (SMPU Uswatun Hasanah Cilegon)		Expert 2 (SMPN 3 Cilegon)	
	Score	Annotation	Score	Annotation
1.	78.33%	Valid	68.33%	Valid
2.	93.33%	Very Valid	78.33%	Valid
3.	93.33%	Very Valid	66.67%	Valid
4.	78.33%	Valid	68.33%	Valid
5.	91.67%	Very Valid	83.33%	Very Valid
6.	91.67%	Very Valid	68.33%	Valid
7.	91.67%	Very Valid	66.67%	Valid
8.	91.67%	Very Valid	68.33%	Valid
9.	95.00%	Very Valid	65.00%	Valid
10.	95.00%	Very Valid	63.33%	Valid
11.	96.67%	Very Valid	68.33%	Valid
12.	96.67%	Very Valid	76.67%	Valid
13.	96.67%	Very Valid	75.00%	Valid
14.	96.67%	Very Valid	75.00%	Valid
15.	96.67%	Very Valid	68.33%	Valid
16.	95.00%	Very Valid	80.00%	Valid
17.	95.00%	Very Valid	80.00%	Valid
18.	90.00%	Very Valid	68.33%	Valid
19.	76.67%	Valid	70.00%	Valid
20.	93.33%	Very Valid	68.33%	Valid
21.	78.33%	Valid	61.67%	Valid
22.	96.67%	Very Valid	61.67%	Valid
23.	80.00%	Valid	65.00%	Valid
24.	91.67%	Very Valid	76.67%	Valid
25.	95.00%	Very Valid	65.00%	Valid
26.	95.00%	Very Valid	71.67%	Valid
27.	78.33%	Valid	66.67%	Valid
28.	78.33%	Valid	73.33%	Valid
29.	93.33%	Very Valid	68.33%	Valid
30.	91.67%	Very Valid	66.67%	Valid

Table 5 shows the percentage of validation results by two expert lecturers on 30 items developed with 12 assessment components which are divided into three aspects, namely the substance aspect, the construction aspect, and the language aspect. After analyzing the validation of the items by the teacher, it is known that the 30 items developed reached the intervals of 61% - 80% and 81% - 100%. The percentage of the final score that reaches the interval of 61% - 80% on the items is declared valid. The test items that were declared valid were questions number 1, 4, 19, 21, 23, 27, 28. The

percentage of the final score that reached the 81% - 100% interval on the questions was declared very valid. The test items that were declared very valid were question number 5. In questions number 2, 3, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20, 22, 24, 25, 26, 29, 30 obtained different validity results between expert teacher 1 and expert teacher 2. However, the questions on that number are still included in the valid category.

The results of the validity of the design of the creative thinking ability test instrument can be seen in table 6 below:

Table 6. Results of the validity of the instrument based on the judgement of evaluators

Aspects of the assessment	Evaluator				Score	Percentage score
	I	II	III	IV		
Material	15	16	17	12	60	75.00 %
Constrution	31	35	42	27	135	75.00%
Language	20	20	22	20	82	82.00%
Total	66	71	81	59	277	
Final Score (%)	73.33	78.89	90	65.56	76.94	
Information	Valid	Valid	Very Valid	Valid		
Average	76.94 (Valid)					77.33%

Notes: Evaluator I, II, III, IV are Expert Lecturer 1, Expert Lecturer 2, Expert Teacher 1, and Expert Teacher 2 respectively

Table 6 shows the results of the data processing of the validity value of the test instrument design from each expert. The validity value obtained from the experts varies, but the average result reaches 76.94% which is still included in the valid category. The average value of the percentage of the test instrument design based on the aspects of all experts is 77.33% which is included in the valid category.

Revision design

Suggestions from the validation results are used to improve and perfect the test instrument design being developed. Suggestions for improvement from experts can be seen in table 7 below.

Table 7. Suggestions for improvements

No.	Adviser	Suggestion	Revision
1.	Expert Lecturer 1	There is still a relationship between one problem and another.	The questions are not related to each other.
2.	Expert Lecturer 2	Images / table data / text readings are given a clear identity or title. Avoid using the word under / over in the question, use identity to refer.	Images, tables, text have been added with the title. In question questions that have pictures / tables / text, you have used the identity of the image / table / text to refer.
3.	Expert Teacher 1	Adjust the question indicator with the competency achievement indicator. Include the integrity of KD	The question indicator is in accordance with the competency achievement indicator The integration of the concept

No.	Adviser	Suggestion	Revision
		into the competency achievement indicators.	has been included in the competency achievement indicators.
4.	Expert Teacher 2	The images, text, and tables used as stimuli will match the questions on the items. The stimulus in the form of text must be complex in information according to the question.	Pictures, text, and tables as stimuli have been adjusted to the questions. Information has been complexed according to the questions

The ability to think creatively is a competency to be achieved in the current curriculum as well as in the 21st century learning, it is very necessary to be prepared. These competency demands must be followed by the provision of valid tools to measure and develop students' creative thinking. This creative thinking ability must be measured and developed through appropriate tests. The development of this creative thinking ability test instrument can help educators in the field to measure and develop students' creative thinking. Therefore, the development of a creative thinking ability test instrument is very important in order to be able to prepare students to think in generating new ideas in terms of methods, methods, or solutions.

The results of the validity per item show that the 30 items of the developed test instrument can be used to be tested on students, because they meet the standard requirements for the assessment instrument through the three aspects used. This is in line with Permendikbud (2016) which states that the assessment instruments used by education units in final examination assessments must meet the requirements of substance, construction, and language through validation from experts in their fields. Based on the aspect of the assessment which obtained a percentage of 75% in the material and construction aspects as well as 82% in the language aspect indicated that the test instruments developed were good. These three aspects play an important role in the success of making a test, namely in terms of the achievement of the measured indicators, clarity of sentences and test presentation, and the use of good, correct and communicative language according to the level of student development.

▪ CONCLUSION

Based on the research results obtained, it can be concluded that the research and development process carried out by researchers is a potential problem, data collection, planning, product design development, design validation, and design revision. The validity level of the creative thinking ability test instrument on the concept of the human excretion system that the researcher developed was in the valid category with a value of 76.94%. Based on these results, the test instrument for the ability to think creatively on the concept of the human excretion system developed is valid for use in student trials. There is a limitation in this research, namely the creative thinking ability test instrument on the concept of the human excretion system developed only up to the design revision stage and only on certain concepts so it is necessary to follow up in this development research.

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