P-ISSN: 1693-1246
E-ISSN: 2355-3812
December 2022

Jurnal Pendidikan Fisika Indonesia 18 (2) (2022) 134-143
DOI: 10.15294/jpfi.v18i2.32117

http://journal.unnes.ac.id/nju/index.php/jpfi

The Development of Creative Thinking Test Instruments with Torrance Indicators on Direct Current Electricity Materials

Y I Tanjung*, I R Nasution
Physics Education Program, Faculty of Mathematics and Natural Sciences, Medan State University, Indonesia
E-mail : yuly@unimed.ac.id

Received: 21 September 2021. Accepted: 28 September 2022. Published: 31 December 2022

Abstract

Direct current electricity matter is one of the many physics subjects containing concepts, principles and applied electricity where many problems can be solved with multiple solutions. Efforts to solve problems with multiple solutions and ideas can build students' creative thinking. So this study aims to develop test instrument for creative thinking on Direct Current Electricity that meets the criteria for a good test instrument including validity, reliability, level of difficulty, discriminating power, and student responses. This type of research is Research and Development (R&D) with a modified Borg & Gall model consisted of research and information collecting, planning, develop preliminary form of product, preliminary field testing, main product revision, main field testing and operational product revision. Based on data analysis from the aspect of content validation of the test instrument by experts, seven valid items were obtained from the eight questions developed. Based on field testing, it was obtained that the reliability was in high category. In the aspect of difficulty level, the five questions are in easy category and two questions are in medium category. The distinguishing power of this test instrument is in the range of bad category, sufficient category, and good category. The results of the response test showed that respondents agreed that this test instrument was categorized as good to use. Overall, the results of the study indicate that the test instrument has met the requirements of a good test including validity, item analysis and response testing. Thus, the test instrument is feasible to train and measure students' creative thinking.

Key words: Test Instruments, Torrance Indicator, Creative Thinking, Direct Current Electricity.

INTRODUCTION

Improving the quality of education in Indonesia has been outlined in the development of the 2013 curriculum, which has been revised now and is in the process of being evenly distributed in its implementation in all schools in Indonesia. The development of the revised 2013 curriculum adapts to the development of science and technology in the 21st century. This is in accordance with the opinion of Nugroho (2018) which states that the curriculum must be dynamic in keeping with the changing times. Within the framework of 21st century learning, it appears that the curriculum is one of the fundamental and decisive.

One of the bases for developing the 2013 curriculum is high-level thinking skills in students. The 2013 curriculum presents a new paradigm in the education delivery system in Indonesia. Education is not only oriented for developing knowledge, but also balancing the mastery of knowledge with attitudes and skills of students (Purwanto & Winarti, 2016).

One of the goals of education system is to encourage someone to be creative. Creative thinking is a cognitive aspect to generate and develop new ideas, which is the development of previously ideas and skills to solve problems divergently (from various points of view) (Mardhiyana & Sejati, 2016).

Therefore, the ability to think creatively is very necessary to be developed in schools. This is in line with the statement of Munandar (2012) which suggests reasons why creativity in students needs to be developed. First, by being creative, people can realize themselves (Self-Actualization). Second, the development of creativity, especially

in formal education, is still inadequate. Third, creative activities are not only useful but also provide satisfaction. Fourth, creativity allows humans to improve their quality of life. From the explanation above it can be seen that creativity has an important role in life, so that creativity needs to be developed, especially in the younger generation who carry out the ideals of being the nation's successor (Islami, Putri & Nurdwiandari, 2018).

Creative thinking is one of the high-order thinking skills, which is a thinking process that is not just to generate and develop new ideas, new ideas as a development of ideas that have been born before and skills to solve problems divergently (from various angles). McGregor (2007) defines creative thinking as thinking that leads to ways of gaining new insights, new approaches, new perspectives, or new ways of understanding something. This is in line with the opinion of Anwar & Aness (2012) which states that creative thinking is a way of generating ideas that are obtained from several applied methods. Creative thinking usually involves problem solving, use s certain aspects of intelligence, for example language, mathematics and interpersonal.

Based on TIMSS (Trends in International Mathematics and Science Study) and PISA (Program for International Student Assessment) results, the thinking skills of Indonesian students are still relatively low, especially in science. The latest TIMSS results in 2015, the scientific literacy of Indonesian students is ranked 45th out of 48 participating countries with an average score of 397. Similar conditions can be seen from the latest PISA results in 2015, the scientific literacy of Indonesian students is ranked 62 from 70 participating countries with a score of 403, although it increased from the previous year, the score was still below the average score of the OECD (Organization for Economic Cooperation and Development) countries, which was 493 (Mursidik, Samsiyah & Rudyantoet, 2015). The results of the TIMSS and PISA studies show that students' thinking skills are still low. Students do not yet have the skills to become creative thinkers and problem solvers.

According to Munandar (2012) creative thinking is to provide various possible answers based on the information given with an emphasis on the diversity of numbers and suitability. Creative thinking is very important to be developed in children. Munandar (2012) explains the important reasons for creative thinking, namely: (1) it can realizing basic needs in human life, (2) being able to see various possible solutions to a problem so that children become flexible in thinking and able to see a problem from various perspectives, and are able to give many ideas, (3) useful and provide satisfaction to individuals, (4) enables humans to improve their quality of life.

Physics is a science that studies natural phenomena . The rapid development of science and technology today is inseparable from the progress of physics which is basic for the application of technology and produces many new discoveries in the field of science and technology, so that physics is one of the important lessons to be mastered by students. Physics has the opportunity to train students' creative thinking skills (Pratama & Istiyono, 2015).

Coon & Mitterer (2014) said that creative thinking or creativity is a problem-solving activity carried out through an unconsciously experiential process which includes fluency in generating a number of ideas, flexibility, using time in producing various types of solutions, and the novelty of ideas or solutions produced. Creative thinking has several aspects, including fluency, flexibility, elaboration, and originality. (Istiyono, Dwandaru & Rahayu, 2018). This aspect of creative thinking is very suitable to be developed through learning Physics such as Direct Current Electricity.

The material of Direct Current Electricity is one of the subjects of Physics which contains concepts, principles and applications of electricity where there are found many problems that can be solved with various solutions such as the arrangement of electrical component circuits so that they can be used to train students' creative thinking. Through the test instrument that is prepared based on the indicators of creative thinking, it is hoped that the information received by students will not be obtained directly. Students must think in a multidimensional way, avoiding

seeing things from only one perspective and creating new things (Istiyono, Dwandaru & Rahayu, 2018).

The development of creative thinking test instruments can be carried out for various types of physics material at the high school level. Merta, Rosidin, Abdurrahman & Suryatna (2017) stated, especially for higher-level students, it is not enough for them to only master low-level thinking skills (LOTS), but also have to be able to achieve high order thinking skills (HOTS). .

In the physics learning process so far, teachers rarely provide HOTS test instruments. Based on the results of Herpiana & Rosidin's research (2018), the assessment instrument is still a rote or memory test instrument even though the instrument currently needed is an instrument that can measure critical and creative thinking skills with criteria that can design student activities in understanding concepts, applying strategies and tactics in solve the problem.

Asriadi & Istiyono (2020) stated that physics teachers needed an accurate assessment model to assess students' creative thinking skills more comprehensively. However, in reality, the existing instruments only direct students to answer closed-ended, namely giving problems that have been solved well formulated, has a right or wrong answer and the correct answer is unique (there is only one solution) so that students are not given the freedom to seek and find their own answers to a problem or problem in question according to their own point of view which causes students to be less able in solving complex problems that require creative thinking processes. This is due to the different level of creative thinking ability among students (Batlolona, Diantoro & Latifah, 2018)

Closed-ended answer technique makes almost all students have the exact same answer starting from the language and writing. So it can be said that many students are unable to share their opinions or solutions from their thoughts. Even though some students answered the questions with their own sentences or thoughts. Solving problems with sentences and the results of their own thoughts is one indicator of creative thinking. Therefore, a creative thinking test instrument is needed.

Many teachers are not aware of problem solving accompanied by the ideas possessed by students. The teacher only makes questions whose solutions are only in accordance with the examples that have been given so far. While some students tend to solve problems by providing free ideas in their minds (Nasution, 2021). This fact becomes a reference that it is important to develop creative thinking test instruments so that students can provide ideas or solutions from themselves in solving problems so that not many students have the same answers or imitate their friends. Sadiq (2011) stated that creativity is related to the ability to develop ideas. Although the students have the same answers but the process is different, it can be said that students are able to think creatively in solving problems.

The majority of students have not been able to answer questions using creative indicators such as flexible thinking, fluent thinking, new ideas, and elaboration. Student answers' do not meet the characteristics of creative thinking and solving problems based on creative thinking processes, solving problems in a variety of ways and creating new methods of solving problems (Argarini, Budiyono & Sujadi, 2014).

Creative indicators such as flexible thinking, fluent thinking, originality and elaboration can be built through practice with a creativity test that refers to Torrance's theory. Torrance (1990) stated that the main criteria or characteristics of creativity are fluency, flexibility, originality and elaboration. Fluency is the number of original ideas generated. Flexibility is the ability to generate various kinds of ideas with different approaches. Originality can be interpreted as authenticity of the resulting answer or something new. While elaboration can be judged from the details of the ideas generated.

These four indicators that characterize an individual's creative thinking process can be made in the form of a creative thinking test instrument. Therefore, it is necessary to develop creative thinking test instruments on direct current electricity materials that meet the eligibility standards of test instruments so that it can be used to train and measure students' creative thinking.

Based on the problems raised, the purpose of this study is to develop a set of creative thinking test instruments with Torrance indicators on direct current electricity and to test the feasibility of creative thinking test instruments including validity, reliability, level of difficulty, discriminatory power and response tests.

METHOD

This research is a development research using modified R&D from Borg & Gall (1983) by carrying out seven stages, namely 1) Research and information collecting, 2) Planning, 3) Develop preliminary form of product, 4) Preliminary field testing, 5) Main product revision, 6) Main field testing, 7) Operational product revision. The research subjects were students in class XII MIPA 1 consisting of 30 students.

The development of the Borg & Gall modification used in this study uses seven stages. The following is an explanation of the steps taken at each stage:

The research and information collection phase is conducted to collect information about the potential and existing problems. At this stage, material selection and school selection are carried out.

The product planning stage (Planning) is carried out to design the test instrument to be developed. The steps taken in this stage are determining the type of test instrument to be developed, making a grid of test instruments, designing a validity questionnaire and designing a student response questionnaire.

The product draft development stage (Develop Preliminary Form of Product) is carried out by creating creative thinking skills questions and designing scoring guidelines.

The Preliminary Field Testing phase is carried out by testing the test instruments that have been developed on the initial research subjects to determine the feasibility of the test instruments. The testing of this test instrument was carried out by validating the test instrument carried out by five validators consisting of three Unimed physics lecturers on behalf of Dr. Dewi Wulandari, S.Si., M.Sc., Drs. Juniar Hutahaean, M.Si., Dr. Nurdin Siregar MS, and two physics teachers at SMA Negeri 21 Medan on behalf of Anita Hafni Harahap, S.Pd., Misrokiah Husni BB, S.Pd., who then processed the validation results by looking for empirical scores from each validator

The Product Revision Stage (Main Product Revision) is carried out by revising (improving) the creative thinking item items in accordance with the validation results that have been obtained from the expert team, namely by following the suggestions and comments that have been given.

Field Testing Stage (Main field testing) is carried out by providing revised test instruments to the students of class XII MIPA 1 (Science program) SMAN 21 Medan who have studied the related subject matter namely direct current electricity, they have to answer questions contained in the test instrument, the goal is to find out the extent of their thinking to get answers with solutions from their own minds.

At the stage of product improvement, the results of field trials (Operational Product Revision) were tested for student responses by providing student response questionnaires regarding student readability on creative thinking questions to determine student responses to the test instrument.

RESULTS AND DISCUSSION

The results of this study are in the form of a product of a creative thinking test instrument for direct current electricity that meets the feasibility test of a good instrument. The preparation of this test instrument went through seven stages of development. Here are the results of each stage of development:

(1) Research and Information Collecting

Activities carried out at this stage are research and data collection in the form of material selection and school selection. According to Basic Competencies of XII class in senior high school, direct current electricity material are suitable to be develop as a creative thinking tests.

(2) Planning
The activities carried out at this stage are planning the type of test instrument, making a grid of test instruments, designing a validity questionnaire and designing a response questionnaire. At the product planning stage, test grids were obtained based on the syllabus, creative thinking aspects with Torrance indicators and knowledge aspects, validity questionnaire grids, response questionnaire grids, scoring guidelines and scoring rubrics .

(3) Develop Preliminary Form of Product
Activities carried out at this stage are making test instruments and designing scoring guidelines and scoring rubrics. At the product draft development stage, test instrument specifications were produced according to the grid, items using Torrance indicators, scoring guidelines and scoring rubrics .

(4) Preliminary Field Testing
The activities carried out at this stage are the initial trial stage by validating the test instrument. At this stage, the results of the validator's assessment were obtained from the aspect of the suitability of the test instrument with the feasibility grid and indicators covering the material, construct and language domains.

(5) Main Product Revision
Activities carried out at the product revision stage are revising the test instruments. At this stage, the results of improving the test instrument are obtained based on the validator's input. The validator inputs are divided into several aspects, namely a) the material aspect, first the limitation of questions and answers that are expected to be clear with the validator's input, questions must be clear about what to look for and the second assessment indicator is the content of the material in accordance with the measurement objectives with validator input, namely there are questions that are not in accordance with the measurement objectives so that they must be replaced, b) the construction aspect, the assessment indicator in this domain is there are clear instructions for working on the problem, this is in accordance with the input from the validator, improvements to the instructions for working on the questions to make them clearer, and c) the language aspect, the assessment indicator in this domain is using good and correct language on questions, input from the validator is to correct the question sentence that is still difficult to understand.

(6) Main Field Testing
The activities carried out at the field trial stage are conducting a feasibility test of the test instrument which included reliability, difficulty level and discriminatory power, obtained 7 valid questions and could reveal creative thinking with an answer score of 30 students in the range of 50-98.

(7) Operational Product Revision
Activities at the stage of product improvement as a result of field trials are to test student responses and analyze the data obtained. The results obtained at this stage are students' responses to the test instrument by 83% with a good category and that response becomes the basis for the final improvement of the creative thinking test instrument.

Data from product feasibility testing including validity, reliability, level of difficulty, differentiating power and response test were processed and analyzed to determine the feasibility level of each criterion.

Based on the results f expert validation using Lawshe's (1975) Content Validity Result (CVR), it was found that seven question was declared valid and one question was declared invalid. This shows that the five experts agree with the seven points of the direct current electrical material test instrument as shown in Table 1.

Table 1. Test Instrument Validity

Question	CVR	Information
1,3,4,5,6,7 dan 8	1	Valid
2	0,6	Invalid

The Interpretation of the result of the results of the validity of the test instrument is in a pie chart as shown Figure 1.

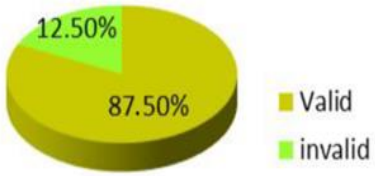

Figure 1. Test Instrument Validity

Based on the results of validity, question number 2 was not valid so it was not continued for testing reliability, level of difficulty and discriminating power.

In testing the reability of the test in this study was calculated using the Alpha formula. By using this using this formula it is know the reability of the test instrument in this study is 0.75 and is in the high reability category.

Based on the level of difficulty obtained from the research results on the develop test instrument, four questions are in the easy category and three questions are in the medium category. As in Table 2.

Table 2. Instrument Difficulty Level

Question Number	Value Range	Category
5 and 7	0,50-0,65	Medium
1,2,3,4, and 6	0,71	Easy

The interpretation of the results of the difficulty level of the test instruments in a pie chart is as shown in Figure 2.

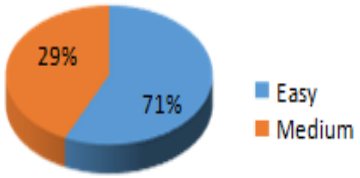

Figure 2. Difficulty Level of Test Instruments

The discriminatory power obtained from the results of research on the developed test instrument, data obtained that the distinguishing power of this test instrument was in the range 0.1857-0.423 where two questions were in the bad category, three questions were in the sufficient category and two questions were in the poor category. good. As in Table 3.

Table 3. Distinguishing Power of Test Instruments

Question Number	Value Range	Category
2 and 6	0,00-0,20	Bad
3,4, and 5	0,21-0,40	Enough
1 and 7	0,41-0,70	Well

The interpretation of the results of the different test instruments in the diagram is as shown in Figure 3.

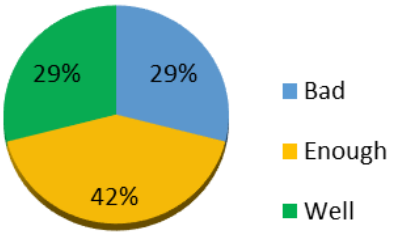

Figure 3. Differential Power of Test Instruments

Students responses obtained based on the response questionnaires that have been given to students are calculated by finding the % of the averange value obtained. This questionnaires is used to determine student responses regerding the test instrument that has been developed so that it can strengthen the results of testing the feasibility of the test instrument. Based on the results of the study, it was found that students' responses based on each indicator is presented in Table 6.

Table 6. Student Response

No	Statement	Response (%)
1	Questions use language that is easy to understand	90
2	Questions use sentences that do not cause double meaning	78
3	The questions given are in accordance with the material that has been studied	88
4	The statements given in the questions use sentences that are interconnected and related, so that the information given in the sentences is easy to catch and understand	83
5	The instructions for working on the questions are clear, making it easier for me to answer questions.	83
6	Presentation of pictures, graphs and tables in questions is clear and easy to understand.	83
7	The questions asked in the test challenged me to answer them	80
8	The questions asked in the test are according to my level of knowledge	77
9	The questions asked in the test prompted me to give various answers	88
10	The questions on the test led me to be able to provide my own solutions based on what was in my mind	88
11	The questions asked led me to freely provide further solutions smoothly regarding the concept of direct current electricity	81
12	When I am given questions from the subject that I have studied, I can immediately imagine the steps for solving them	76
		83

Students give input for improving the creative thinking test instrument product so that the product meets all the requirements of a good instrument and can be understood by students. The requirements for a good instrument include validity, reliability, objectivity, practicability, and economy (Arikunto, 2009) . In this study limited to validity, reliability and item analysis. Item analysis needs to be done to examine the questions on the test in order to obtain a set of questions that have adequate quality (Sudjana, 2009). The specific purpose of item analysis is to look for good test items, good test items and the reasons these items are said to be good or not good (Purwanto, 2009). Thus, the feasibility of this test instrument is reviewed based on the validity and analysis of the items which include reliability, level of difficulty and differentiability of the test instruments.

Based on the results of Lawshe's validity conducted in this study, it was found that from 8 items developed, the validity of the questions was 87.50%, where seven questions were declared valid and one item was declared invalid with an average CVR generated of 0.95. The results of this study are in line with research by (Benefits & Nuhairiyah, 2013) obtained an average CVR result of 0.94 where of the 20 questions tested, all questions were found to be valid by undergoing revision. Research (Tanjung & Bakar, 2019) also stated that validation results from the expert showed that 30 test instrument items that had been developed all questions were declared valid with minor revisions with the average presentation of instrument validity results being 75.6%, so revisions were made and the questions can proceed to the field trial stage. In this study, after revisions were made in accordance with the validator's suggestions, using the CVR index, 13 out of 15 items were valid and could be said to be essential. Test instruments that have met content validity and validity testing are appropriate for future tests (Rahmawati, Rustaman, Hamidah, & Rusdiana, 2018).

Based on the results of reliability testing, a score of 0.756 was obtained. The results are in the high category. This is in accordance with (Hinton, Brownlow, Memurray & Cozens, 2004). If the reliability score is in the range of 0.70-0.90 then the reliability is in the high category. It means that if the questions are tested several times, they will still give the same results. This study is also in line with (Wulandari, Yamtinah & Saputro, 2015) which

obtained a reliability score of 0.89 with reliability in the high category. The instrument is said to be reliable and acceptable if the Cronbach alpha coefficient value is 0.7 with a 95% confidence level (p: 0.05) (Hadisan, Susanti, & Robiyanto, 2017). Therefore, the creative thinking skills test instrument developed is acceptable because it has a reliability value of r > 7.

In terms of difficulty level, the 7 questions tested were in the score range of 0.5-0.8. So the results obtained stated that 71% of the questions were in the easy category and 29% of the questions were in the medium category.It means that the test instrument developed is quite good, because the questions are said to be good if the questions are not too easy and not too difficult. If the questions are too easy, the questions do not stimulate students' thinking and if they are too difficult, the students can become discouraged and do not have the enthusiasm to work on the questions. In this instrument, questions that are in accordance with the level of difficulty of 29% are appropriate for use. The results of this study are in line with research conducted by Muttaqin & Kusaeri (2017) which obtained a difficulty level score in the range of 0.53-0.7. This fact is supported by (Lichtenberger, Wagner, Hofer, Stern, & Vaterlaus, 2017) which states that the level of difficulty of cognitive learning outcomes tests describes the level of difficulty of the high, medium, and low ranges.

From the difference factor, the large group will only be taken, namely the top group with the top 27% score and the bottom group with the 27% lowest score (Arikunto, 2009). In this study, the researcher made the top 50% score as the upper group and the lowest 50% score as the lower group. Therefore, the data obtained with a score in the range of 0.18-0.42. The data obtained were 29% of the questions had poor discriminatory power with indexes of 0.18 and 0.02, 42% wass sufficient with an index of 0.2 to 0.3, and 29% was good with an index of 0.4. Based on these results , there were 2 questions that had a power of difference below 0.02, so it was said that the questions were not good so that from 7 questions developed, only 2 questions met all the instrument's eligibility criteria. The meaning of this difference factor is that if smart and not smart students can answer the question correctly then this question has no distinguishing power, whereas if smart and not smart students both cannot answer the question then this question also has no distinguishing power. While the research conducted by (Muttaqin & Kusaeri, 2017) obtained a different power score in the range of 0.24-0.36 with a sufficient category.

From the results of testing student responses in this study, a value of 83% was obtained, meaning that students showed a positive response to the developmental creative thinking test instrument. This is in line with research conducted by Kartini & Putra (2020), where the student response results obtained were 83.07% with a very good category, so that Android-based learning media for students can be used.

Based on the results of the study, 5 questions were feasible and met the criteria for creative thinking skills, namely (1) questions based on contextual problems, (2) questions that met the fluency indicator, meant that the questions were made capable of producing many original ideas, (3) questions that met the flexibility indicator meant that the questions were made capable of producing various kinds of ideas with different approaches, (4) the questions met the originality indicator, meant that the questions made were capable of producing originality or something new, (5) the questions met the elaboration indicator, meant the questions made were capable of producing detailed ideas.

Creative thinking skills are an aspect of higher order thinking skills (Sani, 2019). This is in line with research by (Tanjung & Dwiana, 2019) that the research results obtained 10 questions were appropriate for training students' critical thinking skills. Knowledge obtained from higher-order thinking processes is easier to transfer, so students who have a deep conceptual understanding of an idea are more likely to apply it to solve new problems (Ramos, Dolipas & Villamor, 2013).

CONCLUSION

Based on field tests obtained a reliability of 0.756 (in the high category). In terms of difficulty level, the seventh item is in the range of 0.5-0.8 where five questions are in the easy category and two questions are in the medium category. The difference factor of this test instrument is in the range of 0.028-0.423 where two questions are in the poor category, three questions are in the sufficient category, and two questions are in the good category. The results of the response test showed that as many as 83% of respondents agreed that this test instrument was categorized as good for use. Overall, the results of the study indicate that the developed test instrument meets the requirements of a good test instrument including validity, response test, and item analysis. Thus, the test instrument is appropriate to be used to train and measure students' creative thinking abilities.

REFERENCES

Anwar, MN, & Aness, M. (2012). An examination of the relationship between creative thinking and academic achievements of secondary school students. *International Interdisciplinary Journal of Education* , 1(219), 1-4.

Argarini, D., F. Budiyono. Sujadi, I. (2014). Characteristics of Creative Thinking of Class VII Students of SMP N 1 Kragan in Solving and Proposing Mathematical Problems Comparative Materials in terms of Cognitive Style. *JMEE Journal,* 4(2):1-12.

Arikunto, S. (2009). *Basics of Educational Evaluation (Revised Edition).* Jakarta: Earth Script.

Asriadi, M., & Istiyono, E. (2020). Exploration of creative thinking skills of students in physics learning. *Journal of Educational Science and Technology (EST)*, *6* (2), 151-158.

Batlolona, JR, Diantoro, M., & Latifah, E. (2019). Creative Thinking Skills Students in Physics on Solid Material Elasticity. *Journal of Turkish Science Education* , *16* (1), 48-61.

Borg, WR; & Gall, MD (1983). *Educational Research: An Introduction, Fifth Edition.* New York: Longman.

Coon, D. & Mitterer, JO (2014). *Psychology: A Journey. Fifth Edition* . California: Wadsworth, Cengage Learning.

Hadisan, N., Susanti, R., & Robiyanto. (2017). Validity and Reliability Test of the Indonesian Version of B-IPQ in Patients with Chronic Kidney Failure at Soedarso Hospital, Pontianak. *Journal of Pharmaceutical Management and Services* , 1(1), 1-8.

Herpiana, R., & Rosidin, U. (2018). Development of instruments for assessing students' critical and creative thinking abilities. In *Journal of Physics: Conference Series* (Vol. 948, No. 1, p. 012054). IOP Publishing.

Hinton, PR, Brownlow, C., Memurray, I., & Cozens, B. (2004). *SPSS Explained, East Sussex* . England: Routledge Inc.

Islami, FN, Putri, GD, & Nurdwiandari, P. (2018). Fluency, Flexibility, Originality, and Self-Confidence Ability of Junior High School Students. *JPMI (Journal of Innovative Mathematics Learning)* , 1(3), 249-258.

Istiyono, E., Dwandaru, WB, & Rahayu, F. (2018). The developing of creative thinking skills test based on modern test theory in physics of senior high schools. *Journal of Educational Horizons* , 37(2).

Kartini, KS, & Putra, INTA (2020). Student Responses to the Development of Android-Based Interactive Learning Media. *Indonesian Journal of Chemistry Education* , 4(1), 12-19.

Lawshe, CH (1975). A quantitative approach to content validity. *Personnel psychology* , *28* (4), 563-575.

Lichtenberger, A., Wagner, C., Hofer, SI, Stern, E., & Vaterlaus, A. (2017). Validation and Structural Analysis of the Kinematics Concept Test. *Physical Review Physics Education Research* , 13(1), 010115.

Benefits, B., & Nurhairiyah, S. (2013). Development of Test Instruments to Measure Statistical Reasoning Ability of Mathematics Tadris Students. *Journal of Tadris Mathematics Department* , 2(02).

Mardhiyana, D., & Sejati, EOW (2016, February). Develop creative thinking skills and curiosity through problem-based learning models. In PRISMA, Proceedings of the National Mathematics Seminar (pp. 672-688).

McGregor, D. (2007). *Developing thinking; developing learning* . McGraw-Hill Education (UK).

Merta Dhewa, K., Rosidin, U., Abdurrahman, A., & Suyatna, A. (2017). The development of Higher Order Thinking Skill (Hots) instrument assessment in physics study. *IOSR Journal of Research & Method in Education (IOSR-JRME)* , *7* (1), 26-32.

Munandar, U. (2012). *Gifted Children's Creativity Development.* Jakarta: Depdikbud and Rineka Cipta.

Mursidik, EM, Samsiyah, N., & Rudyanto, HE (2015). Creative Thinking Ability in Solving Open-Ended Mathematical Problems Viewed From the Level of Mathematics Ability of Elementary School Students. pedagogy. *Journal of Education* , 4(1), 23.

Muttaqin, MZ, & Kusaeri, K. (2017). Development of Written Test Assessment Instruments in the Form of Descriptions for Pie Learning Based on Fiqh Material Problems. *Tatsqif Journal* , 15(1), 1-23.

Nasution, IRY (2021). Development of Creative Thinking Skills Test Instruments on Direct Current Electricity in SMA (Doctoral dissertation, UNIMED).

Nugroho, RA (2018). *HOTS Higher Order Thinking Skills: Concepts, Learning, Assessment, and Problems* . Jakarta: Gramedia.

Pratama, NS, & Istiyono, E. (2015). The Study on the Implementation of Higher Order Thinking-Based Physics Learning (HOTS) in Class X at SMA Negeri Yogyakarta City. In *PROCEDURE: National Seminar on Physics and Physics Education* . 6(2).

Purwanto, J. & Winarti. (2016). Profile of Physics Learning and Critical Thinking Ability of Madrasah Aliyah students in Yogyakarta. *Journal of Learning Physics Research.* 7:8-18.

Purwanto, MN (2009). *Teaching Evaluation Principles and Techniques.* Bandung: Rosdakarya Youth.

Rahmawati, R., Rustaman, NY, Hamidah, I., & Rusdiana, D. (2018). The Development and Validation of Conceptual Knowledge Test to Evaluate Conceptual Knowledge of Physics Prospective Teachers on Electricity and Magnetism Topic. *Indonesian Journal of Science Education* , 7(4), 283-490.

Ramos, JLS, Dolipas, BB, & Villamor, BB (2013). Higher Order Thinking Skills and Academic Performance in Physics of College Students: A Regression Analysis. *International Journal of Innovative Interdisciplinary Research* , 4(1), 48-60.

Sani, RA (2019). *HOTS (Higher Order Thinking Skills) Based Learning.* Tangerang: Tira Smart.

Shadiq , B. (2011). *Secrets of Creative Teaching, Inspirational and Smart* . Jakarta: Galileo's logic.

Sudjana, N. (2009). *Assessment of Teaching and Learning Outcomes* . Bandung: Rosdakarya.

Tanjung, YI, & Bakar, A. (2019). Development of Physical Test Instruments Based on the Conceptual Knowledge Dimension of the Revision Bloom Taxonomy. *Journal of Physical Education* , 8(2), 141-148.

Tanjung, YI, & Dwiana, YA (2019). Development of Critical Thinking Skill-Based Test Instruments on Straight Motion Material. *INPAFI (Innovation Learning Physics)* , 7(4).

Torrance, EP (1990). *Torrance Tests of Creative Thinking* . Beaconville: Scholastic Testing Services.

Wulandari, RR, Yamtinah, S., & Saputro, S. (2015). Two Tier Test Instruments for Knowledge Aspects to Measure Science Process Skills (KPS) in Chemistry Learning for Class XI SMA/MA Students. *Journal of Chemistry Education (JPK)* , 4(4), 147-155