

PAPER NAME

2019, Tiara, W Suana, dll. IOP.pdf

AUTHOR

Tiara Damai

WORD COUNT

3118 Words

CHARACTER COUNT

16530 Characters

PAGE COUNT

6 Pages

FILE SIZE

829.7KB

SUBMISSION DATE

May 27, 2022 1:14 PM GMT+7

REPORT DATE

May 27, 2022 1:15 PM GMT+7

● 18% Overall Similarity

The combined total of all matches, including overlapping sources, for each database.

- 11% Internet database
- 12% Publications database
- Crossref database
- Crossref Posted Content database
- 13% Submitted Works database

● Excluded from Similarity Report

- Bibliographic material
- Manually excluded sources
- Manually excluded text blocks

PAPER • OPEN ACCESS

Development of critical thinking instrument of electricity for senior high school students

4

To cite this article: T D Yanti *et al* 2019 *J. Phys.: Conf. Ser.* **1157** 032007

View the [article online](#) for updates and enhancements.



IOP | ebooks™

Bringing you innovative digital publishing with leading voices to create your essential collection of books in STEM research.

Start exploring the collection - download the first chapter of every title for free.

Development of critical thinking instrument of electricity for senior high school students

T D Yanti, W Suana*, N Maharta, K Herlina and I W Distrik

Program Studi Pendidikan Fisika, Fakultas Keguruan dan Ilmu Pendidikan,
Universitas Lampung, Jl. S. Brojonegoro No. 1, Bandar Lampung, 35145, Indonesia

*wsuane@gmail.com

Abstract. Teaching and learning in 21st Century is recommended to achieve higher order thinking skills (HOTS), such as critical thinking skills. However, the availability of instruments of critical thinking skills at senior high school level is very limited. This paper discusses the development of a critical thinking skills instrument on the topic of electricity, dynamic electricity and static electricity for senior high school students. The development procedure consisted of seven stages. The subjects in present study consisted of three experts for content, construct, and language assessment, three students for readability test, and 70 high school students for validity and reliability tests. From the results of Pearson correlation coefficient and Cronbach alpha value, there were 4 indicators (out of 6 indicators) with 32 items were valid and reliable. Thus, the critical thinking instrument of electricity topic may be used to measure students' critical thinking skills at senior high school level.

1. Introduction

In the teaching and learning of 21st century, training higher order thinking skills (HOTS) to students is very crucial. Educators have to encourage their students to gain the skills, one of which is the critical thinking skills [1,2]. It is believed that critical thinking skills play an important role in logical thinking, making decisions, and solving problems [3]. This skills are essential for academic and career success [4] and have a significant role in all aspects of life [5], along with the progress of science and technology that change the structure of society [6].

Teachers often assume that critical thinking skills are necessarily taught to learners, but most of them have difficulty how to teach it effectively [7]. Generally, they teach critical thinking skills to their students only through asking questions about phenomena but never measure their students' critical thinking skills in physics subject [8]. As a consequence, the learning process that takes place today tends to get stuck at a lower order thinking skills. It can be seen from the results of PISA test, Indonesia is ranked 64 out of 65 countries [9].

One of the subjects that are considered difficult for students of senior high school is physics, in particular, electricity topics. Many research on students' learning difficulties were about electricity topics [10,11]. In addition, from the results of a preliminary study conducted at several senior high schools in Bandar Lampung showed that there were many students who had difficulties to understand electricity, dynamic electricity and static electricity topics. Although recent physics education curriculum has been focused on development and improvement of critical thinking skills, the assessment instruments to measure students' critical thinking skills are still very limited [12]. The



Efforts to foster the success of educators in teaching critical thinking skills must be supported by its measuring instrument. In fact, the assessment instruments of physics at senior high schools measured only the low level of thinking abilities of students [8].

Availability of test instruments to be used as a guide in determining the level of students' critical thinking skills, especially in physics is still very limited, while the tests are needed to develop critical thinking skills in all topics of physics [13]. Thinking skills must be taught to students so that its implementation needs to be evaluated using the appropriate instrument [14] and this development of critical thinking instruments may provide an alternative instrument to the existing problems. This research, therefore, was conducted to develop a valid and reliable critical thinking instrument in dynamic and static electricity topics for senior high school.

2. Method

This study was a research and development study. The design of research and development employed in this study was based on [1]. Along with developing the instrument, there were seven stages that had been done, namely: 1) define the construct and formulate goals, 2) determine the format of items, 3) determine the construction items, 4) define guidelines for the assessment, 5) expert testing and readability test, 6) field testing, and 7) revision of the item. In the expert assessment, the critical thinking instrument had been examined by three experts to assess the validity of content, construct and language aspect of the instrument. Content aspect was related to the suitability of the content in the instrument, construct was related to the suitability of the indicator, the answer choices, and the level of student cognition. The language aspect, on the other hand, dealt with the accuracy, relevance, and clarity of the language used. Furthermore, readability test was conducted by three students to get prior insight to the clarity of each item from students' point of view.

The development of critical thinking instrument initially consisted of 40 multiple choice questions with five possible answers referred to Ennis [15]. They were 1) focus on the question, 2) analyze arguments, 3) consider whether the source is reliable or not, 4) induces and consider the results of induction, 5) identify assumptions, and 6) take actions. Before compiling and testing the instrument, a review of relevant research and preliminary study to collect data regarding the instruments used in schools, infrastructure, educational system, the potential to allow for the development of test instruments critical thinking had been done firstly. Thus, developing critical thinking test instrument can address the potential problems in the field. The field test was conducted at one of senior high schools in Bandar Lampung with a sample of 70 third-grade students who had studied dynamic and static electricity topics in their previous semester. The validity of instrument was analyzed by Pearson correlation product moment. The reliability, on the other hand, was analyzed with *Cronbach alpha*. Level of difficulty and discrimination power of all of the item of the instrument were also tested as well.

3. Result and discussion

3.1. Expert and readability test

The critical thinking instrument that had been designed was then given to three experts in the field of physics education and physics learning evaluation to assess the content, construct, and language aspects of the instrument. Expert tests were performed to check the suitability between the questions and the purpose of the test [16]. Based on the assessment of experts, the instrument was declared worthy of use. The result of the assessment on the language aspect was 77% in the valid category with minor revisions, the construct aspect of 80% in the valid category with minor revisions, and the content aspect of 87.5% with high valid. In general, the revision of the item lies in the grammar, the suitability of the indicator with the items, the cognitive domain of the content, the conformity of the image and graph. Overall, the validity of the instrument were at 81.5% and could be further tested to three students for readability test and a small number of samples for validity and reliability test.

Meanwhile, the readability test of the instrument was guided by a questionnaire which aimed to reveal the students' understanding of the questions related to the clarity of language, letters, numbers, images, symbols, and graphs. All of three students stated that the languages of instrument test were clear, understandable and did not lead to multiple interpretations. The letters, numbers, images, symbols, and graphs contained in each item could also be seen clearly. Therefore, the critical thinking instruments could then be tested to a small number of samples.

3.2. Validity, reliability, level of difficulty, and discrimination power

The test was conducted in one of senior high schools in Bandar Lampung with the sample of 70 students. Data analysis of critical thinking test instrument was processed by using SPSS 21.0 data obtained were then processed and analyzed to obtain the validity for each item. The results of the Pearson correlation demonstrated that all item of the instrument were valid. Meanwhile, reliability, level of difficulty, discrimination power, and level of students' critical thinking skills can be seen in Table 1, Table 2, Table 3, and Table 4.

Table 1. Cronbach's alpha value of instrument per each indicator.

| Indicators of critical thinking | Cronbach's alpha | Number of items |
|---|------------------|-----------------|
| Focusing question | 0.738 | 8 |
| Analyzing arguments | 0.668 | 8 |
| Considering reliability of information sources | 0.218 | 4 |
| Inducing and considering the results of the induction | 0.663 | 8 |
| Identifying assumptions | 0.265 | 4 |
| Determining an action | 0.674 | 8 |

The value of *Cronbach alpha* for overall 40 items amounted to 0.907 indicates that the test instrument has high reliability. However, the values of *Cronbach alpha* for each indicator were lower than the overall value. The reliability value for each indicator of critical thinking instrument can be seen in Table 1. Indicators of “considering reliability of information sources” and “identifying assumptions” had very low values of Cronbach alpha, they were only 0.213 and 0.265, respectively. The indicators then were considered not reliable. Therefore, in this study, there were only four valid and reliable indicators consisting of 32 items. However, the overall reliability value for 32 items was only 0.893 which was lower than initial value of 40 items.

Table 2. Distribution of difficulty level.

| Category of difficulty level | Number of items |
|------------------------------|-----------------|
| High (0.00 to 0.29) | 4 |
| Moderate (0.30 to 0.69) | 24 |
| Low (0.70 to 1.00) | 4 |

Table 2 shows the level of difficulty which was ranging from 0.23 to 0.74. From the all of the 32 items, 4 items were at low difficulty level, 24 items were at moderate difficulty level, and 4 items were at the high level of difficulty.

Table 3. Distribution of discrimination power.

| Category of discrimination power | Number of items |
|----------------------------------|-----------------|
| Lack (0.00 to 0.19) | - |
| Sufficient (0.20 to 0.39) | 8 |
| Good (0.40 to 0.69) | 18 |
| Very Good (0.70 to 1.00) | 6 |

Table 3 is the distribution of discrimination power of all items and the results has a range of 0.277 to 0.845. Results of the analysis showed that discrimination power of 8 items with sufficient category, 18 items have good category, 6 items with very good category.

Table 4. Students' distribution of critical thinking skills.

| Category | Value | Number of students |
|-----------|------------|--------------------|
| Very high | 80.1-100 | - |
| High | 60.1 to 80 | 9 |
| Average | 40.1 to 60 | 38 |
| Low | 20.1 to 40 | 13 |
| Very Low | 0.0-20 | 10 |

Table 4 showed the result of students' level of critical thinking skills that ranged from 5.0 to 87.5 out of 100. It is found that there were no students with very high level of critical thinking skills, nine students with high critical thinking skills, 38 students had medium level of critical thinking skills, 13 students with low critical thinking skills, and 10 students who had very low critical thinking skills. From the data analysis, the average value of critical thinking for 70 samples was 62.41, a high critical thinking ability.

Based on the validity, reliability, level of difficulty, and discrimination power analysis, it was revealed that this present instrument has good criterion as the standard instrument for measuring students' critical thinking. As shown in Table 1, reliability gained 0.893 value which indicates that the test instrument has high reliability, and test also obtained items range from 0.23 to 0.74 of level difficulty which means that the items have good distribution. Moreover, discrimination power index showed that there are 6 items with the very good category, 18 items have good category, and 8 items sufficient discrimination power. Therefore, it can be concluded that this instrument is can be used as a tool to assess critical thinking skill of electricity topics at senior high school level.

The result of the present study is in line with previous study [17] which was about the evaluation techniques at high-level thinking skills of students. It showed that by using both multiple choice test or essay types of HOTS assessment can enhance students' thinking skills. Another study [18] on the development of assessment instruments physics HOTS also obtained the same results that by using HOTS assessments of multiple choice test or essay format can enhance students' thinking skills. The other relevant research [19] was also found the similar result with this study. They investigated the use of the assessment tool in the learning required to develop students' thinking skills. Moreover, Klenowski had showed that assessment for learning is proven to help develop students' thinking skills [20]. Thus, the development of critical thinking test instruments in electrical materials can be used as an alternative instrument to train and develop students' critical thinking skills in teaching and learning of electricity materials.

4. Conclusion

It has been developed an instrument to measure students' critical thinking skills in electricity topics (dynamic and static electricity) for senior high school level. The instrument initially consisted of 40 multiple choice questions with five possible answers. All of 40 items were valid based on the test to 70 students. However, from six indicators of critical thinking initially developed, it appeared that the *Cronbach alpha* of two indicators, i.e. "considering reliability of information sources" and "identifying assumptions", were very low. As a result, there were only four reliable indicators with 32 items in total. Results of the Pearson correlation coefficient indicates that all of 32 items were valid. Meanwhile, the value of Cronbach alpha of 0.893 for overall items indicates that the instrument has high reliability. Therefore, this instrument can be used as an alternative instrument to measure students' critical thinking skills of dynamic and static electricity topics. Further tests for the instrument need to conduct in a broader scale to test the consistency.

Acknowledgments

The authors highly appreciate the Directorate of Research and Community Service, Ministry of Research, Technology, and Higher Education for the financial aid through the Grant of National Strategic Research-Institution 2017-2018.

References

- [1] Tiruneh D T, De Cock M, Weldeslassie A G, Elen J and Janssen R 2017 Measuring Critical Thinking in Physics: Development and Validation of a Critical Thinking Test in Electricity and Magnetism *Int. J. Sci. Math. Educ.* **15** 4 p. 663–682
- [2] Ikuenobe P 2001 Teaching and Assessing Critical Thinking Abilities as Outcomes in an Informal Logic Course *Teach. High. Educ.* **6** 1 p. 19–32
- [3] Butler H A 2012 Critical Thinking Assessment predicts real-world outcomes of critical thinking. *Applied Cognitive Psychology* **25** 5 p. 721–729
- [4] Liu O L, Frankel L and Roohr K C 2014 Assessing Critical Thinking in Higher Education: Current State and Directions for Next-Generation Assessment *ETS Res. Rep. Ser.* 2014, 1 p. 1–23
- [5] Gumus S S, Gelen I and Keskin A 2013 Value acquisition, critical thinking skills and the performance of 6th grade students *Educ. 3-13* **41** 3 p. 254–264
- [6] Abed S, Davoudi A H M D and Hoseinzadeh D 2015 The effect of synectics pattern on increasing the level of problem solving and critical thinking skills in students of Alborz province *WALIA J.* **31** 1 p. 110–118
- [7] Choy S C and Pou S O 2012 Reflective Thinking And Teaching Practices: A Precursor For Incorporating Critical Thinking Into The Classroom?. *International Journal of Instruction* **5** 1 p. 167-182
- [8] Sugiarti T, Kaniawati I and Aviyanti L 2017 Development of Assessment Instrument of Critical Thinking in Physics at Senior High School *Journal of Physics: Conf. Series* 812 012018
- [9] OECD 2012 *PISA 2011 Science competencies for tomorrow world volume 1: Analysis* (Rosewood. Drive: OECD)
- [10] Obafemi D T A and Onwioduokit F A 2013 Identification of Difficult Concepts in Senior Secondary School Two (SS2) Physics Curriculum in Rivers State, Nigeria *Asian Journal of Education and e-Learning (ISSN: 2321 – 2454)* **1** 5
- [11] Kiptum M G 2015 Difficulty physics topics in Kenyan secondary schools: A case study of Uasin Gishu County *Sch. J. Educ.* **4** 4 p. 72–81
- [12] Benjamin R, Klein S, Steedle J, Zahner D, Elliot S and Patterson J 2013 *The Case for Critical-Thinking Skills and Performance Assessment* p. 1–26
- [13] Mabruroh F and Suhandi A 2017 Construction Of Critical Thinking Skills Test Instrument Related The Concept On Sound Wave *Journal of Physics: Conf. Series* 812 012056
- [14] Bahr N 2010 Thinking Critically about Critical Thinking in Higher Education *Int. J. Scholarsh. Teach. Learn.* **4** 2
- [15] Ennis R H and Weir E 1985 *The Ennis Weir Critical Thinking Essay Test* (Pacific Grove, CA: Midwest Publication, D)
- [16] Gelerstein D, Río R del, Nussbaum M, Chiuminatto P and López X, 2016 Designing and implementing a test for measuring critical thinking in primary school *Think. Ski. Creat.* 20 p. 40–49
- [17] Abosalem Y 2016 Assessment Techniques and Students Higher-Order Thinking Skills *International Journal of Secondary Education* **4** 1 p. 1-11
- [18] Kusuma M D, Rosidin U, Abdurrahman A and Suyatna A 2017 The Development of Higher Order Thinking Skill (Hots) Instrument Assessment In Physics Study *IOSR J. Res. Method Educ.* **7** 1 p. 26–32
- [19] Treagust D F R, Jacobowitz J L, Gallagher and Parker 2001 Using Assesment as a Guide in Teaching for Understanding: A Case Study of a Middle School Science Class Learning about Sound *Science Education* **85** 2 p. 137-157
- [20] Klenowski V 2009 Assesment for Learning revisited: an Asia-Pacific perspective *Assesment in Education: Principles, Policy, Practice* **16** 3 p. 263-268

● 18% Overall Similarity

Top sources found in the following databases:

- 11% Internet database
- 12% Publications database
- Crossref database
- Crossref Posted Content database
- 13% Submitted Works database

TOP SOURCES

The sources with the highest number of matches within the submission. Overlapping sources will not be displayed.

| | | |
|---|---|-----|
| 1 | Herni Yuniarti Suhendi, Diah Mulhayatiah, Rizki Zakwandi. "The Effectiv... | 2% |
| | Crossref | |
| 2 | jurnal.fkip.unila.ac.id | 1% |
| | Internet | |
| 3 | Universitas Pendidikan Indonesia on 2017-01-26 | 1% |
| | Submitted works | |
| 4 | S Karimah, N Hidayah, U Utami. " Developing mathematics module of c... | 1% |
| | Crossref | |
| 5 | Universitas Negeri Surabaya The State University of Surabaya on 2020-... | 1% |
| | Submitted works | |
| 6 | jurnalmahasiswa.unesa.ac.id | <1% |
| | Internet | |
| 7 | ro.ecu.edu.au | <1% |
| | Internet | |
| 8 | worldwidescience.org | <1% |
| | Internet | |

| | | | |
|----|--|-----------------|-----|
| 9 | ojs.umrah.ac.id | Internet | <1% |
| 10 | Putri Mahanani, Sutarno, Muchtar. "Big Book Based on SAS Method U... | Crossref | <1% |
| 11 | Jenit Anggiani Lutfianis, Agus Fany Chandra Wijaya, Purwanto Purwant... | Crossref | <1% |
| 12 | ejmste.com | Internet | <1% |
| 13 | Canisius College on 2011-04-19 | Submitted works | <1% |
| 14 | Hobri, R Oktavianingtyas, D Trapsilasiwi, R P Murtikusuma, Q A'yun. "A... | Crossref | <1% |
| 15 | TechKnowledge on 2020-11-30 | Submitted works | <1% |
| 16 | London School of Science & Technology on 2022-05-24 | Submitted works | <1% |
| 17 | Universitas Pendidikan Indonesia on 2018-11-01 | Submitted works | <1% |
| 18 | ejournal.undiksha.ac.id | Internet | <1% |
| 19 | eprints.soton.ac.uk | Internet | <1% |
| 20 | f1000research.com | Internet | <1% |

- 21 Stanley S. Jacobs. "Technical characteristics and some correlates of t... <1%
Crossref
-
- 22 Universitas Pendidikan Indonesia on 2018-12-27 <1%
Submitted works
-
- 23 ejournal.radenintan.ac.id <1%
Internet
-
- 24 mierjs.in <1%
Internet
-
- 25 science.gov <1%
Internet
-
- 26 "The Effect of Thinking Actively in a Social Context and Creative Proble... <1%
Crossref
-
- 27 "The Palgrave Handbook of Critical Thinking in Higher Education", Spri... <1%
Crossref
-
- 28 Dafid Slamet, Riawan Yudi, Sugiman Sugiman. "The Application of Mat... <1%
Crossref
-
- 29 McAdam, Jennifer. "An Investigation of the Relationship Between Stud... <1%
Publication
-
- 30 Pian Suci Sopiani, Iskhak Said, Ratnawati .. "Investigating Students' Hi... <1%
Crossref
-
- 31 Ardi Dwi Susandi, Cholis Sa'dijah, Abdur Rahman As'ari, Susiswo Susis... <1%
Crossref
-
- 32 Daud Dakabesi, Isana Supiah Yosephine Luoise. "The effectiveness of ... <1%
Crossref

- 33 Liu, Ou Lydia, Lois Frankel, and Katrina Crotts Roohr. "Assessing Critic... <1%
Crossref
-
- 34 Universitas Pendidikan Indonesia on 2017-01-31 <1%
Submitted works
-
- 35 Wartono Wartono, Muhammad Nur Hudha, John Rafafy Batlolona. "Ho... <1%
Crossref

● Excluded from Similarity Report

- Bibliographic material
- Manually excluded text blocks
- Manually excluded sources

EXCLUDED SOURCES

| | |
|--|------------|
| T D Yanti, W Suana, N Maharta, K Herlina, I W Distrik. "Development of critical ... | 94% |
| Crossref | |
| repository.lppm.unila.ac.id | 12% |
| Internet | |
| scribd.com | 12% |
| Internet | |
| iopscience.iop.org | 12% |
| Internet | |
| digilib.unila.ac.id | 8% |
| Internet | |
| Tigas Tri Kurniawan, Santoso, Sri Utaminingsih. "Analysis of 4C-Based HOTS ... | 5% |
| Crossref | |
| De La Salle University on 2021-09-21 | 5% |
| Submitted works | |
| Universitas Pendidikan Indonesia on 2020-11-15 | 4% |
| Submitted works | |
| Universitas Pendidikan Indonesia on 2020-11-15 | 4% |
| Submitted works | |
| A Silvianty, A Suhandi, W Setiawan. "Video supported critical thinking test in t... | 4% |
| Crossref | |

| | |
|--|-----------|
| A A Abdullah, W N Shanti, D A Sholihah. "Critical thinking ability through exper... | 4% |
| Crossref | |
| W K Sari, A Supriatna, S Hendayana. "Analysis of students difficulties based o... | 4% |
| Crossref | |
| Agustini, R U Rery, L Anwar. "The Development and Validity of CPS-Based Ass... | 4% |
| Crossref | |
| Universitas Pendidikan Indonesia on 2020-11-15 | 4% |
| Submitted works | |
| Universitas Pendidikan Indonesia on 2020-11-15 | 4% |
| Submitted works | |
| Universitas Pendidikan Indonesia on 2020-11-15 | 4% |
| Submitted works | |
| Universitas Pendidikan Indonesia on 2020-11-15 | 4% |
| Submitted works | |
| Universitas Pendidikan Indonesia on 2019-08-01 | 4% |
| Submitted works | |
| S Sutarno, A Setiawan, A Suhandi, I Kaniawati, A Malik. "The development and... | 4% |
| Crossref | |
| repository.unpak.ac.id | 4% |
| Internet | |
| Universitas Islam Bandung on 2021-04-15 | 4% |
| Submitted works | |
| Universitas Pendidikan Indonesia on 2020-10-28 | 3% |
| Submitted works | |

| | |
|---|-----------|
| Universitas Pendidikan Indonesia on 2019-11-27 | 3% |
| Submitted works | |
| Universitas Negeri Jakarta on 2019-03-26 | 3% |
| Submitted works | |
| oa.las.ac.cn | 3% |
| Internet | |
| S Hartini, S Liliyasi, P Sinaga, A G Abdullah. "An investigation of critical thinki... | 3% |
| Crossref | |
| Universitas Pendidikan Indonesia on 2019-05-22 | 3% |
| Submitted works | |
| ecampus.imds.ac.id | 3% |
| Internet | |
| repository.uin-malang.ac.id | 3% |
| Internet | |
| eprints.ukmc.ac.id | 3% |
| Internet | |
| D Susanti, A Permanasari, H Hernani. "Preliminary study on students' chemica... | 3% |
| Crossref | |
| D Nurdiyanti, A Permanasari, S Mulyani, H Hernani. "Perceptions of prospectiv... | 3% |
| Crossref | |
| D C Kusuma, A Mudzakir, T Widhiyanti. "Pre-service chemistry teachers' VNO... | 3% |
| Crossref | |
| E Nursaadah, L Liliyasi, A Mudzakir. "Model of educational reconstruction of ... | 3% |
| Crossref | |

| | |
|---|----|
| repository.ubharajaya.ac.id | 3% |
| Internet | |
| pics.unipma.ac.id | 3% |
| Internet | |
| L H Sa'diyah, P Siahaan, A Samsudin, E Suhendi, V R Riani, W O Fatima. "Prom... | 3% |
| Crossref | |
| Syiah Kuala University on 2021-03-04 | 3% |
| Submitted works | |
| repository.syekhnurjati.ac.id | 3% |
| Internet | |
| R Haryadi, R Situmorang, Khaerudin. "Effectiveness of use direct learning mo... | 3% |
| Crossref | |
| E Rahmawati, F Nur Ismiyasari, L Etika Rahmawati, Z Abidin. "The different go... | 3% |
| Crossref | |
| A H Aminudin, D Rusdiana, A Samsudin, L Hasanah, J Maknun. "Measuring cri... | 3% |
| Crossref | |
| A C Saputri, Sajidan, Y Rinanto. "Critical thinking skills profile of senior high s... | 3% |
| Crossref | |
| Susilawati, S Ardhyani, Masturi, Wijayanto, N Khoiri. "Project Based Learning ... | 3% |
| Crossref | |
| A A Waluyo, Hartono, Sulhadi. "Critical thinking skills assessment instrument... | 3% |
| Crossref | |
| R Andriani, A Hidayat, E Supriana, R Anantanukulwong. "Examining the relatio... | 3% |
| Crossref | |

| | |
|---|-----------|
| Parno, S Zulaikah, F U N Rosyidah, M Ali. "Faraday flashlight project-based ST... | 3% |
| Crossref | |
| lib.unnes.ac.id | 3% |
| Internet | |
| S Sutarno, A Setiawan, I Kaniawati, A Suhandi. "Pre-Service Physics Teachers'... | 3% |
| Crossref | |
| P Utami, H Bharata. "Analysis of Mathematical Critical Thinking Skill of Junior... | 3% |
| Crossref | |
| R Herpiana, U Rosidin, Abdurrahman. "Development of Instruments to Train C... | 3% |
| Crossref | |
| F Mabruroh, A Suhandi. "Construction Of Critical Thinking Skills Test Instrume... | 3% |
| Crossref | |
| R Lusiana, T Andari. "Brain based learning to improve students' higher order t... | 3% |
| Crossref | |
| R Herpiana, U Rosidin. "Development of instrument for assessing students' cri... | 2% |
| Crossref | |
| S Suryanti, Y Arifani, D Sutaji. "Augmented Reality for Integer Learning: Investi... | 2% |
| Crossref | |
| semantic scholar.org | 2% |
| Internet | |
| docplayer.net | 2% |
| Internet | |
| Universitas Pendidikan Indonesia on 2020-01-23 | 2% |
| Submitted works | |

| | |
|--|----|
| Clayton College & State University on 2021-07-20 | 2% |
| Submitted works | |
| download.atlantis-press.com | 2% |
| Internet | |
| W Suana, W S A Ningsih, N Maharta, N M A A Putri. "The effect of blended lear... | 2% |
| Crossref | |
| Rienzi, Vito Arcangelo Mussuto. "Diseno De Un Instrumento Para Evaluar El P... | 2% |
| Publication | |
| Syofnidah Ifrianti, Ayu Nur Shawmi, Nur Asiah, Ardian Asyhari, Livia Putri, Hap... | 2% |
| Crossref | |
| mafiadoc.com | 2% |
| Internet | |
| David F. Treagust, Roberta Jacobowitz, James L. Gallagher, Joyce Parker. "Us... | 2% |
| Crossref | |
| onlinelibrary.wiley.com | 2% |
| Internet | |
| Jan Sermeus, M. De Cock, J. Elen. "Critical thinking in electricity and magnetis... | 2% |
| Crossref | |
| centaur.reading.ac.uk | 1% |
| Internet | |
| Wahyuni, R Johar, M Duskri. "Teachers' activities during designing Higher-Ord... | 1% |
| Crossref | |
| staffnew.uny.ac.id | 1% |
| Internet | |

| | |
|--------------------------------------|----|
| hdl.handle.net | 1% |
| Internet | |
| eprints.unsri.ac.id | 1% |
| Internet | |
| publications.aston.ac.uk | 1% |
| Internet | |
| eprints.uthm.edu.my | 1% |
| Internet | |
| eprints.umpo.ac.id | 1% |
| Internet | |
| doi.org | 1% |
| Internet | |
| mech.unn.ru | 1% |
| Internet | |
| research.aalto.fi | 1% |
| Internet | |
| livrepository.liverpool.ac.uk | 1% |
| Internet | |
| eprints.whiterose.ac.uk | 1% |
| Internet | |
| eprints.unm.ac.id | 1% |
| Internet | |
| eprints.umm.ac.id | 1% |
| Internet | |

| | |
|--|-----|
| Repository.Unej.Ac.Id | 1% |
| Internet | |
| Staffnew.Uny.Ac.Id | 1% |
| Internet | |
| Aston University on 2018-02-14 | <1% |
| Submitted works | |
| backend.orbit.dtu.dk | <1% |
| Internet | |
| University College London on 2022-04-26 | <1% |
| Submitted works | |
| University of Greenwich on 2020-04-13 | <1% |
| Submitted works | |
| readkong.com | <1% |
| Internet | |
| repo.uni-hannover.de | <1% |
| Internet | |
| repository.petra.ac.id | <1% |
| Internet | |
| repository.tudelft.nl | <1% |
| Internet | |
| kyutech.repo.nii.ac.jp | <1% |
| Internet | |
| doc-pak.undip.ac.id | <1% |
| Internet | |

| | |
|--|-----|
| umpir.ump.edu.my | <1% |
| Internet | |
| repository.unp.ac.id | <1% |
| Internet | |
| elar.urfu.ru | <1% |
| Internet | |
| University of Greenwich on 2020-04-23 | <1% |
| Submitted works | |
| repository.futminna.edu.ng:8080 | <1% |
| Internet | |
| pure.rug.nl | <1% |
| Internet | |
| pubman.mpdl.mpg.de | <1% |
| Internet | |
| kclpure.kcl.ac.uk | <1% |
| Internet | |

EXCLUDED TEXT BLOCKS

Journal of Physics: Conference Series PAPER • OPEN ACCESS

Hobri, R Oktavianingtyas, D Trapsilasiwi, R P Murtikusuma, Q A'yun. "Analysis of students' critical thinking sk...

Content from this work may be used under the terms of the Creative Commons Att...

Hobri, R Oktavianingtyas, D Trapsilasiwi, R P Murtikusuma, Q A'yun. "Analysis of students' critical thinking sk...

2018)IOP PublishingIOP Conf. Series: Journal of Physics: Conf. Series

nectar.northampton.ac.uk

2018)IOP PublishingIOP Conf. Series: Journal of Physics: Conf. Series

nectar.northampton.ac.uk