Practicing creative thinking skills: Inquiry base activity sheets development in protists learning material

By Rossanita Truelovin Hadi Putri

WORD COUNT 4046
TIME SUBMITTED 19-NOV-2020 02:09PM
PAPER ID 65327416

Practicing creative thinking skills: Inquiry base activity sheets development in protists learning material

Rossanita Truelovin Hadi Putri [1*], Raharjo [2], Fida Racmadiarti [3]

[1]Science Education, University State of Surabaya, Jl. Rektorat Unesa, Surabaya (60213), JATIM, Indonesia, rossanita.18018@mhs.unesa.ac.id*

Article Info

Article History:
Received
Revised
Accepted
Published

Keywords:
LKPD
Inquiry
Creative thinking
Protists

ABSTRACT

Protist learning materials have been developed by many researchers, but no one has developed learning tools by training students' creative thinking skills. This study aims to produce LKPD based on protist material inquiry and to train creative thinking skills, by describing the validity and effectiveness of LKPD on protist material. The LKPD developed refers to the 4D model which consists of the stages of define, design, develop, and disseminate. The research design used was the One-Group Pretest-Posttest Design. LKPD was tried out on 12 students of class XI MIPA SMA. After using LKPD, the validity and effectiveness data were analyzed descriptively quantitatively. The validity of the LKPD is measured based on the assessment of the education expert lecturers and materials. The effectiveness of protist LKPD is measured based on the learning outcomes of students and students' responses. The results showed the validity of the LKPD was 99.4% with the very valid category. The effectiveness based on the learning outcomes of students was 92% with the category very effective and the response of students was 99%. Based on the results of this assessment, it can be concluded that LKPD based on inquiry on protist material to train creative thinking skills is declared valid and effective.

Citation:

INTRODUCTION

Education has an important role for the advancement of human resources. Humans need the ability to think in order to improve their quality. In today's development, students are required to have the ability to have high order thinking (HOT), literacy, PPK (Strengthening Character Education), and 4C (critical thinking, communication, collaboration and creativity) (Kemendikbud, 2017). One of the abilities in the 4C that has been mentioned is creativity or creativity. Students are said to have thought creatively if they meet the elements of creative thinking criteria. There are four criteria for creative thinking according to Cohean and Swerdlik (2010), namely, fluency (fluency), flexibility (flexibility), originality (authenticity), and elaboration (detail). Suhartini, et al. (2016) creative thinking can prepare students to think in various scientific disciplines, towards fulfilling intellectual needs and developing individual potential. The development of creative thinking in our educational and learning practices is less of a learning objective. In the field of research, protist material has been developed with various models and learning tools that have been made, but to train creative thinking skills it has not been developed. Astuti (2017) examines creative thinking skills in environmental pollution material.

Nurfaizah and Indana (2019) examined the effectiveness of LKPD to train creative thinking skills. Examples from some of these studies have examined creative thinking skills on several devices, but in protist material there is still no development that trains creative thinking skills by conducting breeding and observation activities.

Kingdom Protista is a biological material that requires an observation activity (Bode et al, 2014). Pradianti, et al. (2015) the inquiry learning model is a thought process that begins with observation. Inquiry is a thought process that students take to find a concept through the steps of problem formulation, submitting hypotheses, planning hypothesis testing, conducting hypothesis testing through experiments and demonstrations, recording experimental data, processing data, analyzing data and making conclusions. Some of these inkuri activities can be used to practice creative thinking skills. In inquiry activities, formulating problems can practice creative thinking skills, fluency and flexibility. When students make designs in research, students are able to think creatively, originality and elaboration.

Based on observations of one of the schools in Mojokerto City, many students have difficulty when learning is not taught through direct observation (Wahyuningtyas and Isnawati, 2019). Another research was also conducted by Nurmalasari (2016), learning protist material using the PjBL (Project Based Learning) model and data collection through questionnaires. The study obtained a percentage value of 71% in either category with the information that students became active in working on project tasks. However, in working on project assignments students are more focused on working on project assignments so that students have difficulty accepting the concept the teacher wants to convey. At SMA Negeri 1 Mojokerto the student activity sheets given are still informative, containing material summaries and practice questions. The device used is monotonous and still trains the cognitive abilities of students only (Saputra and Kuntjoro, 2019). Thinking skills should have been trained in students considering that the era of globalization is now entering the 21st century. The challenges of the 21st century, students are required to have the ability to have high order thinking (HOT), literacy, PPK (Strengthening Character Education), and 4C (critical thinking, communication, creativity, and collaboration).

Based on this description, an inquiry based LKPD was developed on protist material to train creative thinking skills. Before using the LKPD, the validity of the expert lecturers was tested as a validator, while the effectiveness test was carried out when data collection at school was using Protista inquiry-based learning tools.

RESEARCH METHODS

Research Design

This development uses the 4D Models method. The 4D models method has stages of define (define), design (planning), develop (development), and disseminate (deployment). The method was adapted from 4D Thiagarajan and Semmel (1974) into defining, planning, developing and outreach. In developing this learning tool, it uses three stages, namely, defining, planning and developing. While the dissension stage is carried out on a small scale in schools which are the research subjects. The research design used was the One-Group Pretest-Posttest Design (Sugiyono, 2016).

Population and Samples

The subjects of this study were MIPA class students from SMA Negeri 3 Mojokerto City. The development of this learning tool was tested on 12 students who were selected heterogeneously. Heterogeneous students consist of female and male students. These students are used as a reference to determine the feasibility and effectiveness of developing learning devices.

Instruments

The research instruments used in the development of this LKPD were the validation sheet and the effectiveness sheet. The LKPD validation sheet is assessed objectively by a designated education expert lecturer and material expert. The effectiveness sheet in the form of a creative thinking skill test

was obtained from the students' scores. The test for creative thinking skills is measured based on four indicators of creative thinking, namely, fluency, flexibility, originality, and elaboration. The problem of creative thinking skills tested on students is in the form of an essay which consists of three questions. Meanwhile, students' responses were obtained through student response sheets in the form of questionnaires distributed to students.

Procedures

The procedure in this LKPD development research can be described as follows: (1) defining stages, which are defined in the form of curriculum analysis, student analysis, and concept analysis. Curriculum analysis begins with the current curriculum, the revised 2013 Curriculum. The basic competencies developed refer to KD 3.6 and KD 4.6. The analysis of students as subjects of this study was tested on 12 students of class X MIPA at SMA Negeri 3 Kota Mojokerto, who were selected heterogeneously. The concept analysis developed in this study divides the protist material into three sub-chapters, namely the first sub-chapter discusses the habitat of protists in life, the second sub-chapter discusses the classification of protists based on observations, the third sub-chapter is about the use of protist organisms in everyday life. (2) planning stage, designing the development of inquiry based Protista material LKPD to train creative thinking skills. The planning stage is designing the LKPD by reviewing various provisions such as determining the title of each sub-chapter of the material, writing of the LKPD, the structure of the LKPD, and determining the design of the LKPD. (3) the development stage is the validation and revision of the LKPD and the trial stage is limited to students. The LKPD that has been developed by the researcher is then validated by expert lecturers, and the results of the validation will be revised to review the suggestions and input of expert lecturers. Then the LKPD was tried out on 12 students to find out the results of the effectiveness of the LKPD. (4) the extension stage is to provide LKPD on a small scale at SMA Negeri 3 which is the research site.

Data Analysis

The data analysis technique used in the development of this learning device is descriptive analysis as follows.

a) Analysis of Validation Results

The feasibility of the learning tools developed is determined from the results of the validation assessment by one education expert and one material expert to assess the correctness of the concepts in the LKPD. The score obtained from the validation results is then calculated the percentage of eligibility using the following equation.

$$\text{Validation results} = \frac{\text{Obtained score}}{\text{Maximal score}} \text{ X } 100\ \%$$

The results of the validation were then analyzed using descriptive analysis methods based on the provisions in Table 1 below.

Table 1. Criteria for Interpretation of Validation Results

Score Percentage (%)	Category
0 - 24	Not valid
25 – 49	Less valid
50 – 74	Valid
75 - 100	Very valid

(Adapted from Arikunto, 2010)

b) Analysis of Creative Thinking Skills Test

The analysis of the completeness of the results of students' creative thinking skills is measured based on the achievement of indicators and cognitive learning objectives in terms of the answers

of students while working on the given pretest and posttest. Students are said to have thought creatively if they are able to complete the result> 75%. The mastery analysis is calculated using the following formula.

$$\text{Compliteness (\%)} = \frac{\text{The number of students who completed}}{\text{The total number of students}} \text{ X 100 \%}$$

The categories of student learning outcomes based on the percentage obtained are presented in Table 2.

Table 2. Criteria for Interpretation of Learning Outcomes Scores

Score Percentage (%)	Category
0 - 24	Not good
25 – 49	Less good
50 – 74	Good
75 - 100	Vert good

(Adapted from Arikunto, 2010)

In addition to completeness of learning outcomes, the increase in student learning outcomes after using inquiry-based learning tools for learning protist material is determined by the N gain value. The formula for determining N-gain is as follows.

$$G = \frac{\textit{posttest score} - \textit{pretest score}}{\text{maximal score} - \textit{pretest score}}$$

The criteria for the N-gain level are shown in Table 3. as follows.

Table 3. Classification of N-Gain values

Score	Criteria
$G \geq 0{,}7$	High
$0{,}3 \leq G < 0{,}7$	Average
$G < 0{,}3$	Low

c) Student Response Analysis

Analysis of student responses in terms of the results of filling out questionnaire sheets that were distributed to students at the end of learning activities using LKPD.

Analysis of students' responses is known to use the Guttman scale. The completed questionnaires are calculated based on the criteria in Table 4.

Table 4. Guttman Scale Criteria

Score	Student answer
1	Yes
0	No

(Adapted from Sugiyono, 2016)

Students' responses to learning using developed learning tools can be calculated by the following formula.

$$\text{Student responses (\%)} = \frac{\text{Obtained score}}{\text{Maximum score}} \text{ X 100}$$

RESULTS

Inquiry-based student worksheet development research on protist material to train creative thinking skills is obtained from the lack of knowledge of students about protist material because the

learning method being taught is not suitable. Based on observations of one of the schools in Mojokerto City, many students experience difficulties when learning is not taught through direct observation (Wahyuningtyas and Isnawati, 2019). According to Abdias et al. (2019) many students are taught protist material only by looking at pictures through books or internet media, but not through direct observation. In the development of the LKPD that was developed, it has facilitated students to be able to observe protists directly through observation with a microscope.

Starting from the LKPD validation stage on education expert lecturers and material expert lecturers who have the ability in their respective fields to provide an objective assessment in assessing LKPD. The lecturer provides an assessment through a validation sheet that has been previously developed by the researcher. The validation sheet consists of several points of assessment aspects. The aspects that are assessed on the LKPD learning tools are content criteria, presentation criteria, and language criteria. The validation results of the LKPD that were validated got an average score of 3.85 with the very valid category (Table 5).

Table 5. LKPD Validation Results

No	Rated aspect	Scoring scale			Category
		VI	V2	Average	
I	**Content Criteria**				
	a. The correctness of the LKPD	4	4	4	Very valid
	b. Cmpleteness of the LKPD structure	4	4	4	Very valid
	c. The suitability of LKPD with inquiry learning	3	4	3.5	Valid
	d. LKPD trains creative thinking skills	3	4	3.5	Valid
2	**Serving Criteria**				
	a. The suitability of the LKPD cover with the protist material being taught	4	4	4	Very valid
	b. The layout and design of the LKPD are attractive	4	4	4	Very valid
	c. Inclusion of LKPD objectives	4	4	4	Very valid
	d. Inclusion of tools and materials	4	4	4	Very valid
	e. Inclusion of activity steps	4	4	4	Very valid
3	**Language Criteria**				
	Writing in Indonesian according to the correct EYD spelling	3	4	3.5	Valid
Average LKPD validation results				3.85	Very valid
Conclusion: The developed LKPD is suitable for use by teachers in implementing learning.					

The effectiveness of the developed LKPD can be demonstrated through test results. The test results of students' creative thinking abilities were obtained from the pretest and posttest. Overall the pretest scores get an average score of <50 and the category obtained is less creative or KK. While the

posttest score of students got an average of 87.1% in the very creative category or SK. The average N-gain result obtained from inquiry-based learning on this protist material is 0.79 with the high category (Tabel 6).

Table 6. Student Pretest and Posttest Results

Student Name	Pretest (%)	Category	Posttest (%)	Category	N-Gain	Criteria
S1	30.2	KK	89.5	SK	0.8	High
S2	30.2	KK	92.7	SK	0.89	High
S3	36.5	KK	83.3	SK	0.7	Sedang
S4	29	KK	86.5	SK	0.80	High
S5	33.3	KK	87.5	SK	0.81	High
S6	36.5	KK	79.2	K	0.7	Average
S7	33.3	KK	90.6	SK	0.85	High
S8	30.2	KK	86.5	SK	0.80	High
S9	32	KK	84.4	SK	0.77	High
S10	30.2	KK	87.5	SK	0.82	High
S11	30.2	KK	93.7	SK	0.90	High
S12	35.4	KK	83.3	SK	0.74	High
Amount	387		1044.7		9.53	
Average	32.3	KK	87.1	SK	0.79	High

Information:
KK : Less creative
K : creative
SK : very creat

Assessment of students' creative thinking skills is measured through four criteria, namely fluency, flexibility, originality, and elaboration. The overall mean score of the pretest for each aspect was <40%, while the posttest score resulted in> 80%. The comparison of the overall pretest and posttest scores can be seen in Figure 1.

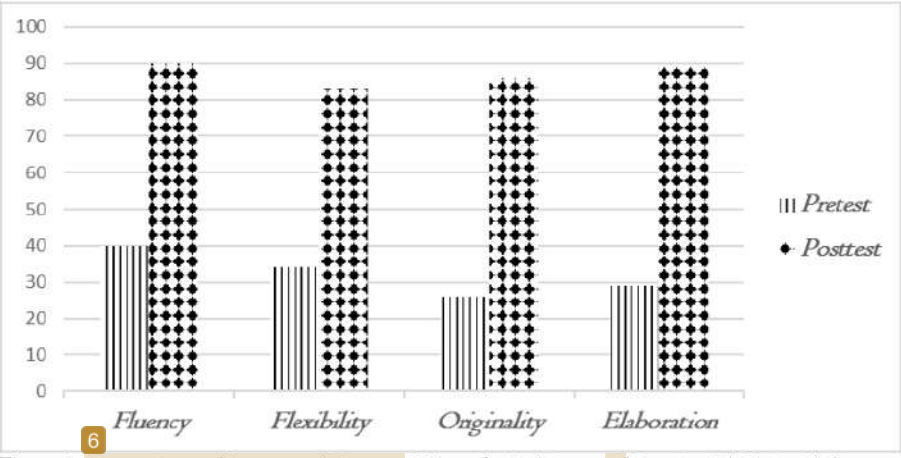

Figure 1. Comparison of Pretest and Posttest Values for Indicators of Creative Thinking Skills

The results of the response were obtained from 12 students who had used LKPD based on Protista material inquiry to practice creative thinking skills. The results of students' responses were assessed from several aspects, namely, material aspects, appearance, readability, language, and learning activities. The results of all aspects through the assessment of students' responses have results> 85% in the very

good category (Table 7). Thus it can be determined that the development of inquiry-based LKPD on protist material to train creative thinking skills has a very good response to the developed device and has a positive response from students.

Table 7. Results of Student Responses

No	Aspect	Percentage (%)	
		Yes	No
1	Material	97.2	2.8
2	Display	97.2	2.8
3	Legibility	94.4	5.6
4	Language	100	0
5	Learning Activities	85.4	14.6
Average		94.84	5.16

DISCUSSION

The development of LKPD based on protist material inquiry to train students' creative thinking skills needs an assessment of the feasibility of the device. Assessment of the appropriateness of this tool is needed so that the quality of the tools developed in the form of this LKPD is suitable for use in learning in schools (Ibrahim et al, 2020). The development of LKPD is expected to be able to complement the deficiencies in learning that has been taught in schools, especially in protist material. Protist matter is abstract matter, because protist organisms cannot be seen directly by manual observation. Kingdom Protista is a eukaryotic group, but most of these organisms consist of only one complex cell (Plattner, 2014). Based on the size of the protist organism, observing the protist organism must use a microscope. Protist material LKPD was developed as one of the teaching materials that made it easier for students to understand the material through the observation process. LKPD was also developed based on the inquiry learning model to train creative thinking skills. Before the LKPD is used by students, first the LKPD is validated by a validator so that it is suitable for use in learning.

LKPD validation was assessed by two validators from expert lecturers in the field of material and education. Validation by material and education experts is carried out to assess the suitability of the material with the formulation of competencies, the accuracy of the material and the depth of the learning material (Batubara and Sormin, 2018). The LKPD developed consists of three sections, namely the first about the habitat of protists, the second about the observation of protist organisms with a microscope and the last is about the use of protist organisms in everyday life. The aspects that are assessed on the LKPD learning tools are content criteria, presentation criteria, and language criteria.

In the content criteria, there are four points in the validated aspect column, there are two points that have a valid category value. The truth aspect of the concept has a very valid category, this aspect has an important role in learning. If the concepts taught by the teacher experience errors, then students have a high chance of experiencing a misconception of Kingdom Protista material. Setiyawan et al. (2016) in their research stated that the content of a learning device must be easily understood by students in order to be able to minimize misconceptions in protist learning which is abstract material. The suitability aspect of LKPD with inquiry-based learning has a valid category value. Inquiry learning is a process where students find or make hypotheses in a problem and students can find solutions to solve a problem (Pedaste et al., 2012). Inquiry is a thought process that students take to find a concept through the steps of problem formulation, submitting hypotheses, planning hypothesis testing, conducting hypothesis testing through experiments and demonstrations, recording experimental data, processing data, analyzing data and making conclusions.

Aspects of LKPD content criteria to train creative thinking skills have a valid category value. Creative thinking is one of the skills bills in 21st century learning. Creative thinking skills can be shown when students are able to solve a problem with high-order thinking (HOT) (Sa'idah and

Isnawati, 2020). When someone thinks creatively, they automatically think critically because they sort out all the knowledge and abilities they have, criticize before applying it to solving problems (Prayitno, 2016).

The presentation criteria for the overall assessment results obtained from the validator have a very valid category. In the presentation criteria, there are several points, all of which mention the structure and design of the LKPD. LKPD learning tools must have an attractive value which when read can make people interested when reading them. LKPD display aspects including very valid category, seen from the appearance of LKPD which is not excessive. Selection of images and using color variations properly and including new things can attract the attention of students to learn. LKPD is able to be an alternative source of learning and teaching materials that have been adapted to the needs, characteristics and environment of students and refers to the basic competencies that must be achieved by students so that students are actively involved in learning activities (Prastowo, 2016).

The last criterion is the language criterion, the linguistic aspect of the LKPD must use good and correct Indonesian writing according to the EYD, and the language used is in accordance with the thinking abilities of students. The first aspect of the language criterion point is that writing language that is easily understood by students gets a very valid category. The writing of the language used in LKPD is in accordance with the age limit of students from 15 years to adulthood. The second aspect is the use of standard words accordingly, the two validators give different assessments. One of the validators gave an assessment not on this aspect, by providing information that there was one word that was deemed less standard. Standard words can be interpreted as words that are correct in terms of Indonesian spelling rules and rules. A valid source for references to various kinds of standard languages is through the Big Indonesian Dictionary (KBBI). The last aspect of the language criteria is to use communicative sentences, this aspect gets a very valid category. Sentences can be said to be communicative if they meet several requirements, namely, in accordance with the rules of the Indonesian language, in accordance with reason, and in accordance with the message that is intended by the speaker.

After being validated by the validator and declared fit for use in learning, then LKPD is tested for coabakan on students. LKPD is used by students in order to practice thinking skills in students. Students' thinking skills were assessed through pretest and posttest tests. The assessment aims to determine the effectiveness of LKPD in learning Protista material. The pretest results obtained before students used LKPD based on protist material inquiry to practice creative thinking skills resulted in an average of 32.3 with the less creative category. The posttest score of students after using LKPD has an average of 87.1 with a very creative category. This shows that learning using inquiry-based LKPD on protist material to train creative thinking skills has been effective. Arikunto (2010) states that the learning device developed is declared effective if the completeness value of learning outcomes towards learning objectives is $\geq$ 75%. LKPD is used as an exercise for students to develop creative thinking skills. LKPD as one of the learning tools that has steps to make an observation by observation (Sugiarto, 2020).

According to Cohean & Swerdlik (2010) creative thinking has four dimensions, namely, fluency, flexibility, originality, and elaboration. This dimension is to determine the achievement of the ability to think creatively. When comparing the four dimensions of creative thinking skills in the pretest and posttest questions, one can find out the effectiveness of LKPD in training creative thinking skills. Figure 1 compares the results of the pretest and posttest which have a value range of two or more times. This shows that students are able to train creative thinking skills very well. The significant increase at the pretest and posttest was in the originality creative thinking skills compared to the other three thinking skills. Originality thinking skills are trained when students repeatedly get practice to make an experimental design. This can make students think of making an experiment based on their thoughts from previous experiences and producing new things in the form of ideas in the form of a design.

The response of students who were given also produced excellent results, the results of the response of students who answered "yes" were 94.84%, while students who answered "no" were

5.16%. These results can prove that students also feel motivated in this learning. Andriyani (2016) motivation has a significant role in one's success in learning so that the learning outcomes achieved can be maximized.

CONCLUSION

Based on this data analysis, it can be concluded that the validity of inquiry-based LKPD on protist material to practice creative thinking skills is 99.4% with a very valid category, the practicality of LKPD is 98% with the very practical category, the effectiveness of student learning outcomes is 92% and the response of students was 99% with the category very effective. So LKPD based on inquiry on protist material to train creative thinking skills is valid, practical, and effective so that it is feasible to be applied in learning.

ACKNOWLEDGMENT

Thanks to SMA Negeri 3 Kota Mojokerto for allowing researchers to research at the school. Thanks also to the supervisor who has guided patiently so that researchers are able to complete this research.

REFERENCES

Practicing creative thinking skills: Inquiry base activity sheets development in protists learning material

ORIGINALITY REPORT

6%

SIMILARITY INDEX

PRIMARY SOURCES

1	Anida Luthfiana, Alben Ambarita, Suwarjo Suwarjo. "Developing Worksheet Based on Multiple Intelligences to Optimize the Creative Thinking Students", JIPM (Jurnal Ilmiah Pendidikan Matematika), 2018 Crossref	49 words — 1%
2	Nuril Hidayati, Farizha Irmawati, Trio Ageng Prayitno. "Peningkatan Keterampilan Berpikir Kritis Mahasiswa Biologi Melalui Multimedia STEM Education", JPBIO (Jurnal Pendidikan Biologi), 2019 Crossref	48 words — 1%
3	A F Syadzili, Soetjipto, Tukiran. "Guided Inquiry with Cognitive Conflict Strategy: Drilling Indonesian High School Students' Creative Thinking Skills", Journal of Physics: Conference Series, 2018 Crossref	41 words — 1%
4	R Herpiana, U Rosidin, Abdurrahman. "Development of Instruments to Train Critical and Creative Thinking Skills in Physics Assessment for High School Students' Learning", Journal of Physics: Conference Series, 2019 Crossref	25 words — 1%
5	Ucik Fitri Handayani, Cholis Sa'dijah, Sisworo, Mukhtamilatus Sa'diyah, Lathiful Anwar. "Mathematical creative thinking skill of middle-ability students in solving contextual problems", AIP Publishing, 2020 Crossref	20 words — < 1%
6	Ade Putri, Kartini Kartini, Putri Yuanita. "The Effectiveness of Learning Tools Based on	13 words — < 1%

Discovery Learning That Integrates 21st Century Skills to Mathematical Critical Thinking Ability in Trigonometric Materials in High School", Journal of Physics: Conference Series, 2020
Crossref

7	R Adawiyah, A Harjono, G Gunawan, H Hermansyah. "Interactive e-book of physics to increase students' creative thinking skills on rotational dynamics concept", Journal of Physics: Conference Series, 2019 Crossref	13 words —	< 1%
8	id.123dok.com Internet	12 words —	< 1%
9	eprints.walisongo.ac.id Internet	11 words —	< 1%
10	ejournal.unsub.ac.id Internet	10 words —	< 1%
11	www.iiste.org Internet	8 words —	< 1%
12	D Fitri, R Johar, A Ahmad. "The validity test of the lesson plan to reduce students' misconceptions using the cognitive conflict strategy", Journal of Physics: Conference Series, 2018 Crossref	8 words —	< 1%
13	Ismail, Fitriani, Takdir, P Sudirman, Umar. "Blog-based mathematics learning devices", Journal of Physics: Conference Series, 2020 Crossref	8 words —	< 1%
14	Sri Wahyu Purnomo Nugroho, Riyadi, Triyanto. "Analysis of Students' Creative Thinking Skill in Solving Algebra Problem", Journal of Physics: Conference Series, 2020 Crossref	8 words —	< 1%

EXCLUDE QUOTES	OFF	EXCLUDE MATCHES	OFF
EXCLUDE BIBLIOGRAPHY	OFF		