

ISSN: 1742-6596

# Journal of Physics

## Conference Series

**The 7th International Conference on Mathematics,  
Science, and Education 2020 (ICMSE 2020) 6 October  
2020, Semarang, Indonesia**

1918

Volume 1918

Accepted papers received: 7 May 2021

Published online: 14 June 2021

Editor:  
Martin L

The open access *Journal of conference proceedings*  
[iopscience.iop.org/jpcs](http://iopscience.iop.org/jpcs)

# Table of contents

Volume 1918

2021

◀ Previous issue    Next issue ▶

**The 7th International Conference on Mathematics, Science, and Education 2020 (ICMSE 2020) 6 October 2020, Semarang, Indonesia**

Accepted papers received: 07 May 2021

Published online: 14 June 2021

Open all abstracts

## Preface

OPEN ACCESS

011001

Preface

— Close abstract



View article



PDF

The 7<sup>th</sup> International Conference on Mathematics, Science and Education 2020 (ICMSE2020) is the international conference organized by Faculty of Mathematics and Natural Sciences Universitas Negeri Semarang (Indonesia) under the theme of *Accelerating Innovative Research from Laboratory to Industry*. This conference aims to discuss the innovation of the laboratory research as well as to downstream those innovative products.

Since the world has faced the global Covid-19 pandemic, it would be too risky to hold international conference through direct plenary meeting. Therefore, the conference that was originally conducted in Semarang, Indonesia, on 6 October 2020 but then it was converted into virtual conference to protect participants from Corona Virus transmission. In addition, travel restrictions also prevented participants from attending the conference onsite, then the virtual conference setting was decided as the best option to keep the conference ran on schedule.

The keynote and invited speakers from five countries consisting of Asst. Prof. Dr. Chalongrat Daengngam (Thailand), Assoc. Prof. Stephane Bressan (Singapore), Asst. Prof. Aditya P. Adiredja, Ph.D (USA), Assoc. Prof. Ch.M Dr. Roswanira Abdul Wahab (Malaysia), and Prof. Dr. Ir. Amin Retnoningsih, M.Si (Indonesia) delivered their talk through video conference, and the technology support to deliver the conference was "Zoom Video Conferencing" software. All keynote speakers shared the material from their countries as well as the participants.

This site uses cookies. By continuing to use this site you agree to our use of cookies. To find out more, see our Privacy and Cookies policy.



There were three sessions which involved opening, invited speaker presentation and authors' parallel presentation. Opening session consisting of keynote speech and opening remark lasted 20 minutes, followed by each invited speaker presentation for 20 minutes and each author presentation took 10 minutes. The breakout rooms were provided to facilitate authors in presenting their research result. Every parallel session was guided by one moderator to lead the discussion. Participants still could involve themselves in the intellectual discussion in invited speakers and parallel sessions although the conference was conducted virtually as they could write the question through chat box or directly deliver their question.

Finally, the committees via review stage selected the papers-presented in this forum to be published in Journal of Physics: Conference Series (Institute of Physics Publisher) indexed in some databases, including the Conference citation index, Scopus, Chemical Abstracts Service, and Astrophysics Data System. We hope that this program will expand the mutual understanding and respect in stimulating research in Mathematics, Science, and Education; share research interest and information, and create a form of collaboration and build a trust relationship. We are delighted to be able to show the world what recent developments in the field of Mathematics, Natural Science, and Science Education through this fruitful program.

As conclusion, we would like to acknowledge to all of supporting teams, especially the organizing committee members and reviewers, for their great contribution in conference organization. We hope that this program will further encourage research publication in Mathematics, Natural Science, and Science Education and build trust relationship. We feel honoured and privileged to serve the best recent developments in the field of Mathematics, Natural Science, and Science Education to you through this exciting program.

Chairperson

Prof. Dr. Dyah Rini Indriyanti, M.P.

List of Committees, Images are available in this pdf.


<https://doi.org/10.1088/1742-6596/1918/1/011001>

OPEN ACCESS

011002

Peer review declaration

— Close abstract  View article  PDF

All papers published in this volume of Journal of Physics: Conference Series have been peer reviewed through processes administered by the Editors. Reviews were conducted by expert referees to the professional and scientific standards expected of a proceedings journal published by IOP 

This site uses cookies. By continuing to use this site you agree to our use of cookies. To find out more, see our Privacy and Cookies policy.

- **Type of peer review: Single-blind/Double-blind/Triple-blind/Open/Other (please describe)**
- **Conference submission management system:** www.icmseunnes.com
- **Number of submissions received:** 513
- **Number of submissions sent for review:** 393
- **Number of submissions accepted:** 327
- **Acceptance Rate (Number of Submissions Accepted/Number of Submissions Received X 100):**  $327/513 \times 100 = 63.74$
- **Average number of reviews per paper:** 3-4 reviews per paper
- **Total number of reviewers involved:** 43
- **Any additional info on review process:**

The review process of abstract was done before conference day to inform to the authors to present their works in the conference and submit their full manuscript. Having been full manuscripts submitted, they were reviewed by our reviewers. The review process of full manuscript has been done for six months, since October 10, 2020 until March 31, 2021. The manuscript must comply these requirements to be proceeded to publication stage,

- 1) The topic of manuscript should be relevant to conference scopes,
- 2) The manuscript must be written in appropriate English,
- 3) The manuscript must be written using IOP template,
- 4) The manuscript should cite totally at least 15 references with at least 80% are international journal articles. It is suggested the references are published at the last seven years,
- 5) Citation style is numbering with the first cited the first appears,
- 6) The section sequence generally is: Introduction, Methods, Result and Discussion, Conclusion, Acknowledgement (optional), References. There is no section number for the two last sections,
- 7) The references must be cited predominantly in Introduction dan Results and Discussion sections. There is no citation in Abstract nor in Conclusion.

This site uses cookies. By continuing to use this site you agree to our use of cookies. To find out more,

see our [Privacy and Cookies policy](#).  
 • **Contact person for queries: Dr. Masturi (email: [tourfis@gmail.com](mailto:tourfis@gmail.com))**



## JOURNAL LINKS

---

[Journal home](#)

---

[Journal Scope](#)

---

[Information for organizers](#)

---

[Information for authors](#)

---

[Contact us](#)

---

[Reprint services from Curran Associates](#)



This site uses cookies. By continuing to use this site you agree to our use of cookies. To find out more, see our [Privacy and Cookies policy](#).





## Table of contents

Volume 1918

2021

◀ Previous issue    Next issue ▶

**Mathematics and Its Application**

Accepted papers received: 07 May 2021

Published online: 14 June 2021

Open all abstracts

**Mathematics and Its Application****OPEN ACCESS** 042001

Automatic geotagging using GPS EXIF metadata of smartphone digital photos in tree planting location mapping

B Prasetyo, Alamsyah, M A Muslim, Subhan and N Baroroh

+ Open abstract     View article     PDF**OPEN ACCESS** 042002

Evaluation performance recall and F2 score of credit card fraud detection unbalanced dataset using SMOTE oversampling technique

B Prasetyo, Alamsyah, M A Muslim and N Baroroh

+ Open abstract     View article     PDF**OPEN ACCESS** 042003

Web-based expert system to determine digital forensics tool using rule-based reasoning approach

E Ramadhani, H R Pratama and E G Wahyuni

+ Open abstract     View article     PDF**OPEN ACCESS** 042004

Autocorrelation analysis of COVID-19 based on hijri calendar

G Darmawan, D Rosadi, BN Ruchjana and Hermansah

+ Open abstract     View article     PDF**OPEN ACCESS** 042005

Inventory control and distribution of medicine stocks by using a just in time method

This site uses cookies. By continuing to use this site you agree to our use of cookies. To find out more, see our Privacy and Cookies policy.



D A Efrilianda, K Umam and A F Aulia

[+ Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

042006

User requirement and prototype design of radio streaming using mind map model for "Forum Diskusi Radio Ponorogo" association

N A S Asy'ari and D Muriyatmoko

[+ Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

042007

GIS-based spatial autocorrelation analysis and use of aerial photos metrics for land price per plot: a case study of Tembalang sub-district

S Subiyanto, F J Amarrohman and NDU Giardi

[+ Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

042008

Changing user needs and motivation to visit a website through ad experience: a case study of a university website

K Budiman and I Akhliis

[+ Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

042009

Combining caesar cipher and hill cipher in the generating encryption key on the vigenere cipher algorithm

Z Qowi and N Hudallah

[+ Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

042010

Development of a tracer study system for graduates of the Integrated Science Department, Universitas Negeri Semarang

N R Dewi, P Listiaji, M Taufiq, E N Savitri, A Yanitama and A P Herianti

[+ Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

042011

Development of automatic spam detection application based on modular programming

S Subhan, R Arifudin, D A Efrilianda and B Prasetyo

[+ Open abstract](#)[View article](#)[PDF](#)**OPEN ACCESS**

042012


Machine-learning algorithm for demand forecasting problem

DT Wiyanti, I Kharisudin, AB Setiawan and AK Nugroho

This site uses cookies. By continuing to use this site you agree to our use of cookies. To find out more,

[see our Privacy and Cookies policy](#)

[PDF](#)

- 
- OPEN ACCESS** 042013  
Mobile learning development using augmented reality as a biology learning media  
A Susilo, W Hardyanto, N K T Martuti and A Purwinarko  
[+](#) Open abstract [View article](#) [PDF](#)
- 
- OPEN ACCESS** 042014  
Analysis of image watermarking with a discrete wavelet transform for digital data security  
MA Muslim, Y Dasril, M Khusniati and S Subhan  
[+](#) Open abstract [View article](#) [PDF](#)
- 
- OPEN ACCESS** 042015  
A review of using data mining and machine learning for predicting drug loading modeling in solid lipid nanoparticles containing curcumin  
R Widyati, A Ashari and Afiahayati  
[+](#) Open abstract [View article](#) [PDF](#)
- 
- OPEN ACCESS** 042016  
Convolutional neural Network-XGBoost for accuracy enhancement of breast cancer detection  
E Sugiharti, R Arifudin, D T Wiyanti and A B Susilo  
[+](#) Open abstract [View article](#) [PDF](#)
- 
- OPEN ACCESS** 042017  
Design and development of a web GIS for management and performance evaluation of agricultural farms of sahar food industries company (SFIC)  
S Oliazadeh, M R Khoram and M Abbasi  
[+](#) Open abstract [View article](#) [PDF](#)
- 
- OPEN ACCESS** 042018  
Low-cost educational robotics for promoting STEM education  
Z Abidin, R Arifudin, W Hardyanto, I Akhlis, R Umer and N Kurniawan  
[+](#) Open abstract [View article](#) [PDF](#)
- 
- OPEN ACCESS** 042019  
Development of postgraduate school's digital library as a repository of digital collections  
Z Abidin, I Zulaikha, D W Wicaksono, K Umam and A F Aulia  
[+](#) Open abstract [View article](#) [PDF](#)
- 
- OPEN ACCESS** 042020  
This site uses cookies. By continuing to use this site you agree to our use of cookies. To find out more, see our Privacy and Cookies policy. [A comparative forecasting model of COVID-19 case in Indonesia](#) 



Development of STEM-nuanced textbook to improve students' mathematical communication skill

M Asikin, M F Nurhidayat and A S Ardiansyah

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

042065

CB-BL model (challenge based on blended learning) for mathematical creativity

A S Ardiansyah, Mulyono, Mashuri, R A Fiyanti and F S Hamidah

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

042066

Mathematical concepts using *Kain Cepuk* Nusa Penida

N M Dwijayani

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

042067

Mathematical reasoning ability of junior high school viewed from logical mathematical intelligence

V Y A Prastika, Riyadi and Siswanto

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

042068

The development of the spatial visual-oriented geometry test to measure the creative thinking skills of elementary students

H T Wijaya, Sunardi, E Yudianto, E Cahyanita and N R Aini

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

042069

Exploring the elementary school's teacher's perception of students' mathematical thinking in mathematics teaching

A W Kurniasih, I Hidayah and M Asikin

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

042070

The effect of mathematical matriculation as the basis for calculus lectures: a case study of electrical engineering, UNISNU Jepara - Indonesia

L Sulistyono and I Junaedi

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

042071

Students' Creative Thinking Process in Solving Ill-Structured Problem at Eight Grade Students with High Ability.

Students with High Ability.

This site uses cookies. By continuing to use this site you agree to our use of cookies. To find out more, see our Privacy and Cookies policy.

Y N Firpausi, J Sunardi and F Nurhasanah



PAPER • OPEN ACCESS

## The development of the spatial visual-oriented geometry test to measure the creative thinking skills of elementary students

To cite this article: H T Wijaya *et al* 2021 *J. Phys.: Conf. Ser.* **1918** 042068

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



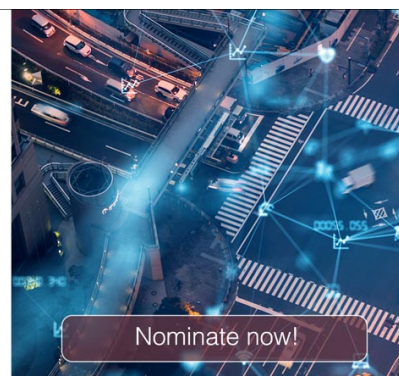
**The Electrochemical Society**

Advancing solid state & electrochemical science & technology

The ECS is seeking candidates to serve as the  
**Founding Editor-in-Chief (EIC) of ECS Sensors Plus,**  
a journal in the process of being launched in 2021

The goal of ECS Sensors Plus, as a one-stop shop journal for sensors, is to advance the fundamental science and understanding of sensors and detection technologies for efficient monitoring and control of industrial processes and the environment, and improving quality of life and human health.

*Nomination submission begins: May 18, 2021*



# The development of the spatial visual-oriented geometry test to measure the creative thinking skills of elementary students

H T Wijaya\*, Sunardi, E Yudianto, E Cahyanita, and N R Aini

Department of Mathematics dan Science, Faculty of Teacher Training and Education, Universitas Jember, Indonesia

\*Corresponding author: hendratanu64@gmail.com

**Abstract.** This research is a qualitative descriptive research by using 4D development consisting of the Define, Design, Develop, and Disseminate stages. The research was carried out to develop a spatial visual-oriented geometric test to measure elementary students' creative thinking skills. The creative thinking level of each student has different categories based on the fluency, flexibility, and novelty. The subjects of this research consisted of 5 students from 30 fifth grade students from elementary school which were selected based on the van Hiele's level ability category of each student. Operationally, the steps of this research included the preliminary step of research, data collection, and data analysis. The data of this research was obtained by using tests, observation, and interview. The data of the students was obtained by conducting a learning outcome test. The results has showed that 5 students who met the category of students' creative thinking had a variation on the percentage of the creative thinking level by using a spatial test, namely 40%, 20%, 20%, 20%, 20%, which were respectively categorized as very creative (level 4), creative (level 3), quite creative (level 2), less creative (level 1). There were 2 of 5 students who were at the same level, namely as very creative (level 4) but had differences in answering.

## 1. Introduction

Mathematics is closely related to daily life. Unconsciously, every activity in daily life indirectly requires mathematics. Mathematics is learned from an early age without age restrictions, such as can be learned in the school. Students find difficulty in learning mathematics because they only rely on memorizing existing formulas without understanding mathematical concepts well. The purpose of learning mathematics in school is to help students to be able to solve their problems including the ability to understand problems, design a mathematical model, solve problems, and interpret the solutions obtained [1].

Geometri learning has effect students's understanding to explain solid geometri oriented visual spatial [2]. Geometry is includes training materials for visual, logical, systematic thinking as well as the animating process of critical thinking, creativity, and innovative abilities development.

According to Pratiwi [3], Indonesia ranked 65 out of 69 countries participating in PISA. The results of the TIMSS assessment showed that more than 95% of Indonesian students are only able to reach the intermediate level. Level 0 (Visualization) is the basic level in the van Hiele stage, which is a requirement to be able to master the higher level well. The development of the spatial-visual test will also affect students' creative thinking abilities, because students are expected to be enthusiastic with this question test so that there will be mathematical geometry concept of students which will be measured



by the concepts of students' creative thinking abilities, namely flexibility, fluency, and novelty. Creative thinking ability is a thought process that creates a new idea broadly and diversely [4].

Creative thinking is an organized process of reasoning, while creative thinking is exploring possible problems. Creativity is a person's ability to find several alternative answers to a problem, which is emphasized on the usefulness and the diversity of answers. The process of individual creative thinking is a process of transformation between an individual and his environment [5]. The analysis of students' creative thinking level includes different levels based on fluency which refers to the ability of students to produce diverse and correct answers, flexibility which refers to the ability of various ways to solve problems, and novelty which refers to the ability to answer problems with different answers from the previous.

Spatial ability can be interpreted as the ability to understand, manipulate, rearrange, and mentally interpret visual relationships [6]. Spatial reasoning abilities involve visualizing and manipulating two dimensions or three dimensions of shapes or patterns. Students with spatial abilities can recognize, manage, and create three images, shapes, and spaces dimensions [7]. Build a space in mathematics that has a volume of content, and has 3 constituent components in the form of sides, edges, and vertices. Geometry is discussing the field area, which is a combination of a simple closed curve with its inner area, as well as the space objects. The space area is a combination of a simple closed surface and its interior [8].

Spatial-visual intelligence is very helpful for students in studying geometry which always applies the abstract concept of geometric objects [9]. The level of education at school greatly affects the passing rates of elementary school students' geometric thinking based on van Hiele [10]. Therefore, in this research, the researchers wanted to examine the results of the application of the spatial test on students' visual abilities to increase the level of students' creative abilities based on the van Hiele theory. The level of students' thinking ability affects the number of skills and spatial ability [11].

The development of spatial skills and how to measure them will be the focus of learning mathematics learning. One of the measures the spatial ability according to the van Hiele test. Creative thinking is a very important especially for solid geometry learning [12]. In finishing the assignments on these instruments, students will use abstraction and visual abilities which are strongly influenced by students' creative thinking. The indicators that must be fulfilled by students to be regarded as creative, including fluency, flexibility, and novelty which refers to the student's ability in producing various and correct answers. The individual creative thinking process is a process of transformation between an individual and his environment. Accordingly, the researcher wanted to develop a geometry test using spatial test ability. This research aimed to describe the process of developing a spatial visual-based geometry test package to measure students' creative thinking ability.

## 2. Research Methods

This research is a descriptive study using a qualitative approach. Researchers used 4D development is Define, Design, Develop, and Disseminate [13]. The product developed in this study was a spatial-visual test that was used to measure the level of elementary school students' creative thinking. Operationally, the steps of this qualitative research consisted of the preliminary step of study, data collection, and data analysis. The data obtained by using documentation and interviews. The research was conducted on 5 students. Furthermore, product development is processed with the 4-D stage [14] The following is a diagram of the 4-D development model in Figure 1.

The preliminary step of the research was carried out by using several preparations, including determining the research subject and research locations, preparing research instruments, and applying the spatial test. The researchers determined the location according to the data needed in which the school had students' data which fulfilled the requirement of this research namely consisted of 5 subjects. Furthermore, the researchers prepared a spatial test that was used, according to the content, material, and previously validated formats. Furthermore, the research instrument consisted of spatial questions which had been validated by three validators.



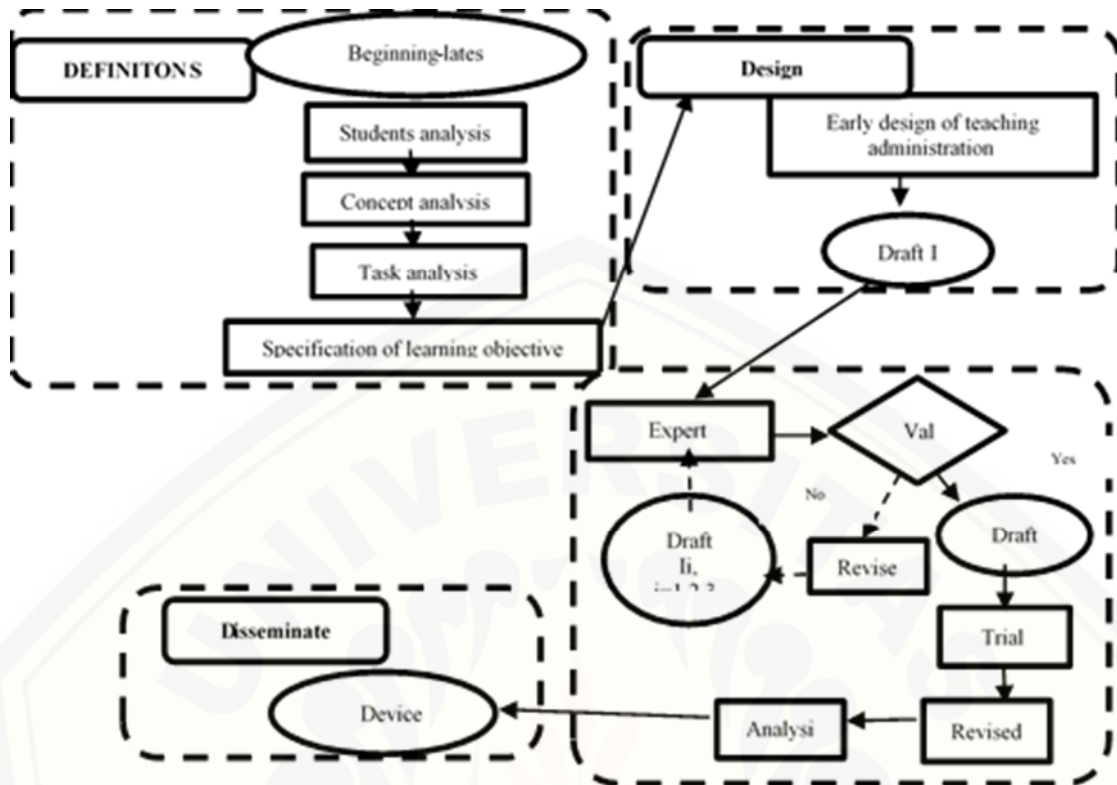


Figure 1. Diagram of the 4-D development model

Data collection was carried out in two meetings in which the activity of doing the spatial visual test was in the first meeting and the activity of completing the test with open-ended questions with geometry material was at the second meeting. After students took the learning outcome test, the researchers make observations and classify the student's test results. Furthermore, the researchers interviewed with selected students according to their creative thinking levels. If the data obtained contradicted the theory, the researchers had to retrieve the data again with the same stages as the initial steps taken in the research. Data analysis was carried out after the data was obtained from the data collection process, then the data was processed and observed according to the classification of students' creative thinking levels based on fluency, flexibility, and novelty. While the indicators of students' creative thinking ability in solving the spatial test are as follows.

Table 1. The indicator of creative thinking (modified from Siswono)

Indicators	The Ability Criteria
Fluency	Students can solve problems with various (more than one) correct answers to the problems
Flexibility	Students can solve problems in a variety of different ways
Novelty	Students can make a new solution that had never been done by other individuals

The criteria of each level can be seen in Table 2 [12]



**Table 2** The classification of creative thinking ability levels

TKBK Level	Description
Level 4 (Very Creative)	Students can demonstrate their fluency, flexibility, and novelty or their novelty and flexibility in solving or posing problems
Level 3 (Creative)	Students can show their fluency and novelty or their novelty and fluency in solving or posing problems
Level 2 (Quite Creative)	Students can show their flexibility in solving and posing problems
Level 1 (Less Creative)	Students can show their fluency in solving and posing problems
Level 0 (Not Creative)	Students are not able to show three indicators of creative thinking aspects

**Table 3.** The guideline of creative thinking ability levels

Scores	Levels
$80 < NP \leq 100$	Level 4 (Very Creative)
$60 < NP \leq 80$	Level 3 (Creative)
$40 < NP \leq 60$	Level 2 (Quite Creative)
$20 < NP \leq 40$	Level 1 (Less Creative)
$0 < NP \leq 20$	Level 0 (Not Creative)

Note:  $NP$  = Percentage Value

### 3. Result and Discussion

The research was started by determining the research instrument, namely using document studies where the researchers identified a theory that examines the students' spatial-visual levels. The research was conducted by observing schools that met the requirements to obtain the data needed by researchers. The school chosen was an elementary school that met the student data required according to the research criteria.

The development process in this research was carried out through several stages, namely data collection was carried out after the instrument was designed and validated by experts. The experts referred to are those who were experts in their fields and could provide input, suggestions from other experts. In the material and format aspects of the test, the questions obtained 92% validity, which was a very high category of interpretation and had fulfilled the validity. The response and observation questionnaires showed a percentage of 92% indicating that the test that had been developed was categorized as very good, so the question test was practical. The question test that had been developed and students' learning outcomes produced 94% class completeness, so the test could be considered as effective in measuring the level of students' creative thinking abilities.

The data collection of this research was started by the presentation of instructions for working on a spatial visualization test package to 5 students from the fifth-grade of an elementary school. Furthermore, each student as the research subject was given the spatial test package to be done systematically. The students' answers were emphasized on other alternative answers along with the reasons for each problem in the spatial test package. The creative thinking process that occurred in students in the mathematical process produced creative mathematical ideas as a mathematical model in the geometry material. The mathematical model was the first step to solve mathematical problems with the aim of finding mathematical solutions and other alternative answers that were suitable with the instruction. Creative thinking is a thinking ability that allows students to apply their imagination and remain flexible in creating new ideas, alternatives, or possibilities and seeing new relationships between existing definitions that might be needed in solving problems and challenges [15]. In accordance with the concept of creativity, the answers or solutions which were given by students varied. In the second meeting, the students were asked to complete an achievement test consisting of six questions, then the researcher identified and classified the test results.

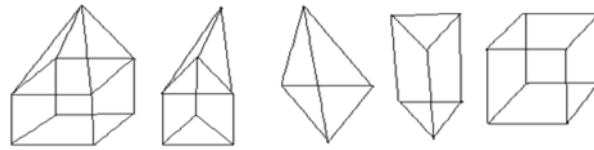


Figure 2. The example of a spatial-visual test

Based on the results of the test and interview data analysis, there were subjects related to creative thinking problems, the following test and interview results were obtained according to van Hiele's thinking level.

The 4<sup>th</sup> student, with the 2<sup>nd</sup> van Hiele level (informal deduction)

Researcher: "What do you think about that? Was it difficult or easy?"

Student: "I think it was easy, but I got a few difficulties to understand how if the shape was rotated, and image and manipulate the shape of the space"

Researcher: "Had you put your imagination into pictures?"

Student: "Yes, but I could mention some pictures that fit my imagination."

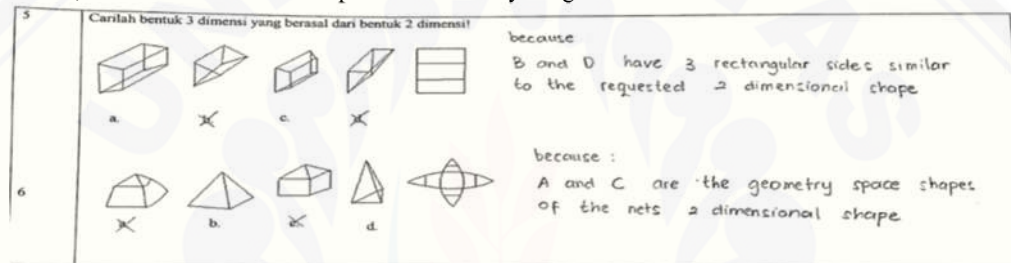
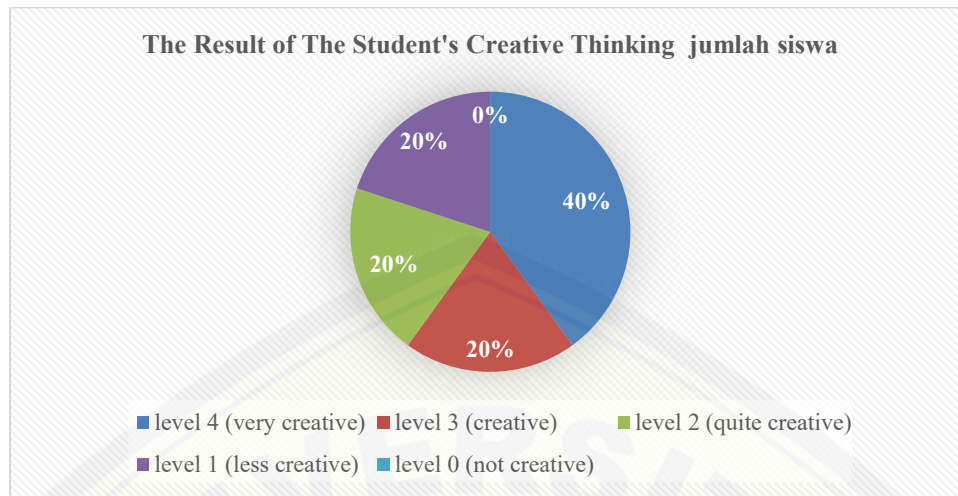


Figure 3. Student's answer

The data that had been collected showed that from 5 students at the creative thinking level that can be identified, 2 students were categorized as level 4, which was very creative, 1 student was categorized as level 3, which was creative, 1 student was categorized as level 2, which was quite creative, and 1 student was declared as level 1, which was less creative. The percentage of the 5 students' level of creative thinking consisted of 40% as level 4 (very creative), 20% as level 3 (creative), 20% as level 2 (quite creative), and 20% as level 1 (less creative). These results indicated that students who thought creatively in learning by using a spatial-visual-oriented mathematics test tended to have creativity in answering the given test questions. The grouping was in accordance with the flow of student completion, not from the scores obtained by students from answering questions with the correct value. Wijaya, said that the higher van Hiele's level can be achieved by the student, the more characteristic of visual spatial intelligence the student meet [9]. There were 2 students of 5 students who got a score of 100 and 3 students who got a score fewer than 100, but all of the students who answered correctly had differences in the process of solving the problems given.



**Figure 4.** The result of the student's creative thinking

Both students at the 2<sup>nd</sup> van Hiele level (informal deduction) with the 4<sup>th</sup> level category, which was very creative, could show fluency in which they were able to produce various and correct answers, flexibility in which they were able to solve and explain problems in various ways; and novelty in which students answered the problems with a different answer with the previous. There were 2 students who had the same 1<sup>st</sup> van Hiele level (analysis) but had differences in the creative thinking skill levels, namely level 3 and level 2. At level 3, which was creative, it could be described that these students were able to solve problems in fluency and novelty by themselves. They were only able to solve problems correctly with their understanding so they are new, but do not show flexibility in solving problems. Students who were categorized at level 2 were quite creative. They showed that there were differences in answering the provided questions and solved them correctly so that it could be seen that there was fulfilled fluency and flexibility. A student answered systematically by explaining each step of the solution, but the results obtained were not quite right. There was 1 student who had 0 van Hiele level (visual) with 1<sup>st</sup> level category which meant less creative, it could be described that students were able to show fluency in solving or posing problems but there was no visible flexibility which was unable to solve problems in various ways and novelty namely being unable to make a new solution that has never been done by other students.

Based on the study about on students' creative thinking skills in geometrical spaces, it can be concluded that students had different creative skills according to their levels [12]. In a further research on spatial visualization skills, the van Hiele level at each level of spatial thinking was different [9] It was related to my research on the development of a test package for measuring students creative thinking ability, which showed that higher the student's van Hiele level, the higher the level of his creative thinking, based on the test package of spatial skills.

#### 4. Conclusion

The test was developed by fulfilling the valid, practical, and effective criteria after it had been tried out, therefore the test could be used to measure the students' creative thinking ability. The test development with spatial-visual oriented used to measure the students' creative thinking level showed that 2 students had the 2<sup>nd</sup> van Hiele level ability (informal deduction) on the 4<sup>th</sup> level (very creative), 1 student who had 1<sup>st</sup> van Hiele level ability (analysis) with the 3<sup>rd</sup> level (creative), 1 student who had 1<sup>st</sup> van Hiele level ability (analysis) was on the level 2 (quite creative), 1 student who had 0 van Hiele level was on the 1<sup>st</sup> level (less creative). These results showed that students tended to think on the 3<sup>rd</sup> level which was creative, students could show fluency in solving the problems correctly and novelty in solving the problems by using their ways. The given test had not fully influenced students' creative thinking. The main factor in students' thinking was the level of students' knowledge. If the students didn't want to read or pay attention, it would be difficult to think creatively. The test used was good because students could

think creatively in solving math problems. In further research, it is suggested to use easier material for students to understand in interpreting problems related to one's visualization.

### Acknowledgement

We give our best gratitude to all parties who supported this research and Departement of Magister Mathematics Education, Faculty of Teacher Training and Education University of Jember and Elementary School Luqman Al Hakim Jember.

### References

- [1] Aini A N, Mukhlis M, Annizar A M, Jakaria M H D, and Septiadi D D 2020 *J. Phys. Conf. Ser.* **1465** 1
- [2] Schoevers E M, Leseman P P M, and Kroesbergen E H 2020 *Int. J. Sci. Math. Educ.* **18**(8) 1613
- [3] Pratiwi I 2019 *J. Pendidik. dan Kebud.* **4**(1) 51
- [4] Jankowska D M, Gajda A, and Karwowski M 2019 *Int. J. Sci. Educ.* **41**(8) 1096
- [5] Sitorus J and Masrayati, 2016 *Think. Ski. Creat.* **22** 111
- [6] Winarti D W 2018 *J. Phys. Conf. Ser.* **1088**
- [7] Jelatu S Sariyasa and Made Ardana I 2018 *Int. J. Instr.* **11**(4) 325
- [8] Sagita N 2015 *J. Pelangi* **8** 1
- [9] Wijaya Y Y, Sunardi, Slamim, Margaretha P M and Wijayanti N P A A 2019 *IOP Conf. Ser. Earth Environ. Sci.* **243** 1
- [10] Ma H L, Lee D C, Lin S H, and Wu D B 2015 *Eurasia J. Math. Sci. Technol. Educ.* **11**(5) 1181
- [11] Chan H S, Chu H Y, and Chen M F 2019 *Horttechnology* **29** 5 670
- [12] Utami S, Usodo B, and Pramudya I 2019 *J. Phys. Conf. Ser.* **1227** 1
- [13] Muhajir S N, Utari S, and Suwarma I R, 2019 *J. Phys. Conf. Ser.* **1157** 3
- [14] Permana A H, Mulyati D, Bakri F, Dewi B P, and Ambarwulan D 2019 *J. Phys. Conf. Ser.* **1157** 3
- [15] Ritter S M and Mostert N 2017 *J. Cogn. Enhanc.* **1**(3) 243