

Relation Between Spatial Ability and Critical Thinking in Geography Education: A Survey on Student of Senior High School

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Abstract

The study aims to find out the relationship between the spatial ability and critical thinking ability of the students of the XI SMA Lab School UPI on geography subjects. The study used the ex-post-facto method to find out causal relationships that were not manipulated or were not given treatment by researchers. The subject in this study was a student of XI IPS 3 class at SMA Lab School UPI Bandung. The instrument used is a matter of double choice of spatial ability and a question of multiple choice of critical thinking ability. Based on the results of data analysis concluded that: (1) The average percentage of the student's spatial ability amounted to 71.9% with high criteria; (2) The average percentage of the student's critical thinking ability is 70.17% with high criteria; (3) There is a positive relationship between the spatial ability and the critical thinking ability of learners with a significance value of 0.000 and a Pearson correlation 0.760 value at a strong relationship degree level.

INTRODUCTION

Advances in technology and information encourage the availability of reliable human resources that have the skills needed. Lubinski (2013) and NRC (2006) suggest that spatial ability is a very important and fundamental capability to work well in departments of Science, Technology, engineering, mathematics, and geography. Spatial ability becomes one of the very important capabilities because by using spatial capabilities, students can, 1) depict in their minds the shape of objects in the space or images on paper, 2) see three-dimensional images, and 3) Describe an area, sketch, street or building on their minds. In this regard, it is emphasized that spatial ability is essential to be able to express space in different ways, understand and express the elements that exist in the environment, create images related to space and interpret Pictures (MNE, 2005).

Spatial ability is generally defined as the ability to form well-constructed visual forms, remember them, and organize and modify them (Lohman, 1996). Maier (in Imamuddin & Isnaniah, 2018, p. 32) divides the spatial ability elements into five important parts i.e. spatial perception (perceptual perception), spatial visualization, mental rotation, spatial Relation), and the spatial orientation (for the Harmony).

Spatial ability involves understanding and understanding the concepts and relationships of the space, how we represent those concepts and relationships in different ways, as well as how we can be reasoned with information Spatial (NRC, 2006). Spatial ability is an important component in one's intellect because it must be able to develop static and dynamic thinking skills. Spatial ability is a cognitive aspect that allows the child to relate the abstract concept of objects in their minds to other aspects related to the object. The spatial ability of a child develops as the child grows, starting when the child is at the level of the motor sensor thinking up to the formal operating level.

Spatial ability correlates positively with success in mathematics and science (Battersby, Golledge, & Marsh, 2006). Spatial ability is an important variable that guides students' academic achievements (Battista, Wheatley, & Talsma, 1982; Lubinski, 2010; Maeda & Yoon, 2013; Yurt, 2014). Studies conducted in this case have revealed that spatial capabilities are correlated with high-level skills such as problem-solving (Kragten, Admiraal, & Rijlaarsdam, 2015). In addition, it has been understood that we are using our spatial capabilities effectively in everyday life, for example, when using maps, exercising and in order to set our goods (Peng & Sollervall, 2014; Pietsch & Jansen, 2012). Referring to the importance of spatial capabilities as stated above, it should be the spatial ability to be trained and taught in classroom learning.

Essentially a person has a spatial ability, but they don't realize it as an ability that helps them to solve problems in life. The concept of geography is presented by looking at the surrounding environment making a child become interested in learning it. Be aware of the importance of spatial ability in the geographic subjects that have actually learned it contextually in their own right, but most people do not realize that they have geographic ability geography.

Each individual has a spatial ability, such as mathematical fields using cubes in geometric materials, physics, medicine, architects and others. All have the spatial ability in their respective fields as well as geography. The spatial ability research on geography studies has not done much to do with the broad geographical concept of studying the Earth and its content appeals to researchers to conduct research by looking at the spatial ability of students seen from Geographic viewpoint based on the supporting indicators.

The Partnership for 21st Century Skills is said that the capabilities of the 21st century include (a) critical thinking and problem-solving or critical thinking and solving problems, (b) communication and collaboration or communicating and collaborating, (c) Creativity and Innovation or creativity. This prowess must have someone in order to compete in the life of the modern 21st century. One of the essential abilities students must have is the ability to think critically. Ennis (1996) says that the ability of critical thinking is a thought process aimed at making rational decisions that are geared towards deciding whether to believe or to do something. The ability of critical thinking is an active process of thinking things deeper and not just passively accepting. The ability of critical thinking becomes one of the basic capital so that students are able to face the problems it encounters in life. This is in line with the opinion of Cabera (in Fachrurazi, 2011, p. 2) that mastery of critical thinking is not enough to be used as an educational purpose, but also as a fundamental process that allows students to overcome various Future issues in the environment. Referring to the above description, researchers are interested in conducting survey research to find out the link between the spatial ability and critical thinking skills of learners on geography in class XI SMA Lab School UPI. As for the formulation of problems in this study as follows.

1. How does the spatial ability of class XI SMA Lab School UPI on the subject of Geography curriculum 2013?
2. What is the ability of critical thinking as well as the class XI SMA Lab School UPI on the subjects of Geography Curriculum 2013?
3. Whether there is an influence of the spatial ability of the learners' critical thinking skills in the subjects of geography class XI SMA Lab School UPI

RESEARCH METHODOLOGY

Research uses survey research methods to examine the relationship between the spatial ability and critical thinking skills of learners. Research was conducted at SMA Lab School UPI Bandung,

on the odd semester of the 2019-2020 school year. The research subject is a student of XI-IPS 3 class which amounted to 27 people, where this class is a class of XI-IPS program in SMA Lab School UPI. Sampling on the research is done using the random technique and Accidental sampling is the accidental sampling technique chosen based on the field conditions at the time of the study. This technique is used to take student

Here are the average geographic values of the odd semester of the 2019/2020 school year presented in table 1.

Table 1. Average geographic value Semester odd school year 2019/2020

School Name	Class	Number of learners	Average geography values
SMA Lab School UPI Bandung	XI IPS 3	27	72,07

Spatial ability is a learner’s ability to answer critical thinking questions based on the indicator Prasetyono (2012) which has been modification covering aspects; 1) reading the map, 2) has a comfortable living place, 3) prediction of social process occurrence, 4) Image Object visualization, and 5) space view. Test instruments used to measure the Spatial ability of learners in the form of a multiple-choice question as many as 25 questions representing the five aspects of the spatial ability.

The ability of critical thinking is an understanding of aspects of critical thinking ability. Aspects of the critical thinking skills that are trained are 1) identifying the reasons and conclusions, 2) Understanding the reasoning, 3) acceptability reason, 4) evaluating inference, 5) reasoning concerning a causal explanation, 6) decision making (Fisher, 2009). A test instrument used to measure students ‘ critical thinking skills in the form of a multiple-choice question of 25 questions representing six aspects of critical thinking ability. The scoring of the spatial ability Test and the critical thinking ability of the correct answer were given a score of 1, and the answer was incorrectly given a score of 0 as presented in table 2.

Table 2. Answer instrument problem

Instrumen	Soal	
	Correct	Incorrect
Spatial Ability	1	0
Critical Thinking ability	1	0

The category of spatial ability percentage and learners ‘ critical thinking ability can be seen in table 3.

Table 3. Percentage of descriptive analysis criteria

No.	Percentage	Criteria
1	81%-100%	Very high
2	61%-80%	High
3	41%-60%	Enough
4	21%-40%	Low
5	≤20%	Very low

Hypotheses on this study are:

H_0 : There is no significant connection to the spatial ability and critical thinking ability of learners.

H_1 : There is a significant connection to the spatial ability and critical thinking skills of learners.

The hypothesis test uses the Pearson Correlation test on the SPSS program with the test criteria: if the probability value (Sig.) $\geq \alpha$ ($\alpha = 0.05$), then the H_0 is received, if the probability value (Sig.) $\leq \alpha$ ($\alpha = 0.05$), then H_0 is rejected. Next, the coefficient value to determine the relationship level (Pearson Correlation) can be interpreted in table 4.

Table 4. Pearson's Koefisian-based relationship level

Coefficient Interval	Relationship level
0,80-1,000	Very strong
0,60-0,799	High
0,40-0,599	Enough
0,20-0,399	Low
0,00-0,199	Very low

RESULTS AND DISCUSSION

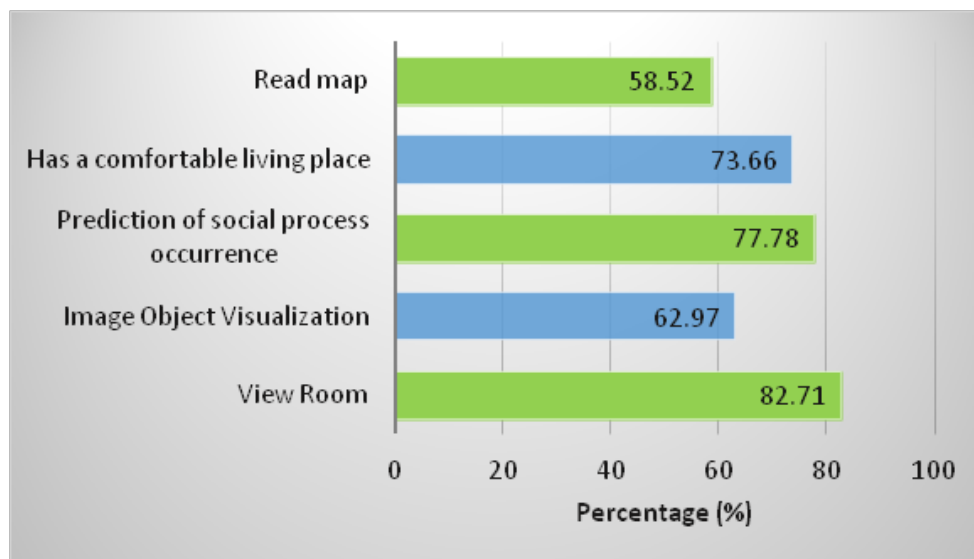
Result of Spatial Ability

The spatial ability instrument developed was given to 27 students at SMA Lab School UPI. The following data of the learners' spatial ability percentage are presented in table 5.

Table 5. Data results Analysis Percentage score Spatial Ability Learners

Class	Maximum Score	Percentage (%)	Criteria
XI	27	71,9	High

The descriptive analysis results in Table 4.1 showed that the average percentage of class XI IPS 3 was 71.9% with high criteria. The modified spatial ability aspect of Prasetyono (2012) covers aspects; 1) reading the map, 2) has a comfortable living place, 3) prediction of social process occurrence, 4) Image Object visualization, and 5) space view. Here's the average percentage of critical thinking abilities on every aspect presented in Figure 1.



Aspek Figure 1. Average percentage of high school-student Spatial Ability in every aspect

Based on Figure 1 above, the spatial ability of learners SMA Lab School UPI has a higher average percentage score on the space view aspect of 82.71% compared to other aspects. While the aspect of reading the map has a lower percentage compared to other aspects of 62.97%. The reading aspect of the map earns a 58.52% value. This is influenced by the level of use of map media poorly understood by students because it is not familiar with the map media used in the classroom. In addition, the ability to read maps is also influenced by the cognitive development of learners. Piaget (2006) reveals that the cognitive development of learners relies on one's interactions with its environment. These cognitive developments support the spatial ability of one of them reading a map.

On the aspect of having a comfortable living place gained an average percentage of 73.66% with high criteria that includes sub facets determining the location of the business, identifying potential landslides, identifying the potential groundwater, knowing the natural phenomena in the highlands and lowland, identifying flood potential, recognizing the exposed environment of pollution. This is because learners are familiar with it so that the resulting value meets the criteria. In line with Apino and Retnawati (2017) who said that the effort to be done to improve students' ability is to engage students in learning activities and facilitate students to develop the skills needed. In this case, the teacher has implicitly applied this aspect to the geography of the subjects so that the results are high.

Furthermore, on the aspect of the social process, the average percentage of 77.78% with high criteria is achieved. This aspect includes the sub aspect of traffic congestion prediction, the prediction of transmission of disease outbreak, prediction of difficulties in remote areas. The cause of the high acquisition is due to students of most students already familiar with the predicted symbols. Arya et al., (2011) also reveals that the familiarity of vocabulary has a direct relationship with the reader's knowledge of topics that can pose a huge impact on understanding.

The image object visualization aspect obtains a value of 62.97% with sufficient criteria. This is due to the students' less understanding of the problems of the image object that exists in geography subjects, especially at identifying the temperature of a region, identifying its natural potential in the region.

The latter aspect is the view of the space with the sub-aspect identifying the location icons of the region, identifying the moment of the event in a region and reading the time based on the natural circumstances that obtained an average value of 82.71% with very high criteria. Mayer (2008) stated that students could not develop the skills needed well if not trained. The view aspect of this space is estimated to have already been well-trained in the classroom so that it gets very high results.

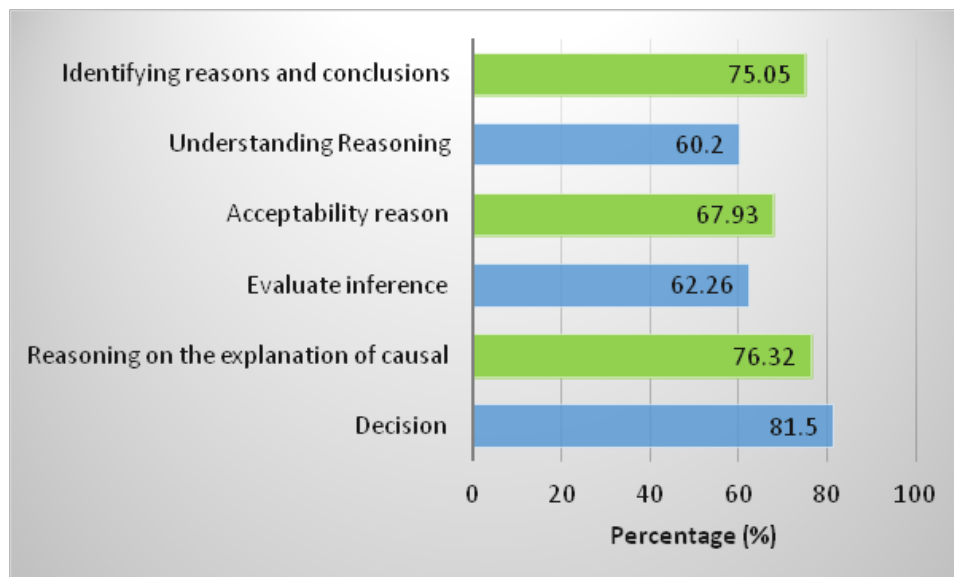
RESULTS OF CRITICAL THINKING ABILITY

The instrument of critical thinking is being developed is given to 27 students at the UPI SMA Lab School. The following data percentage of learners' critical thinking ability is presented in table 6.

Table 6. Average percentage result Data critical thinking ability

Class	Maximum Score	Average percentage (%)	Criteria
XI	27	70,52	High

The descriptive analysis results in Table 4.1 showed that the average percentage of class XI IPS 3 was 70.52% with high criteria. The ability of critical thinking according to Fisher (2009) consists of five aspects, 1) identifying the reasons and conclusions, 2) understanding reasoning, 3) acceptability reasons, 4) evaluating inference, 5) reasoning regarding a causal explanation, 6) uptake Decision. Here's the average percentage of critical thinking abilities on every aspect presented in Figure 2.



Picture 2. Average percentage of learners' critical thinking ability in every aspect

Based on Figure 2 above, the critical thinking ability of students of class XI IPS 3 SMA Lab School UPI has a higher average percentage score on the decision-making aspect of 81.5% compared to other aspects. While the aspect of understanding reasoning has a lower average percentage compared to other aspects of 60.2%.

In the first aspect of identifying the reasons and conclusions get an average percentage of 75.03% with high criteria. In this aspect, most students have successfully identified the problem in the actions taken. In line with Khine (2013) that reveals that well-organized learning has contributions to help students understand and solve problems related to the material in their daily lives. The second aspect is understanding the reasoning of obtaining an average percentage of 60.20% with sufficient criteria. This is because students are still struggling to implement their reasoning to understand a problem. Furthermore, the third aspect of acceptability reason is obtaining an average percentage of 67.93% with sufficient criteria. This is because some students are still not able to analyze the reason for the problem. In the fourth aspect of evaluating inferences received an average percentage of 62.26% with sufficient criteria. This is because some students have not been able to evaluate the inference of a phenomenon.

The fifth aspect of reasoning is that the cause of the result is to achieve an average percentage of 76.32% with high criteria. Most students have been able to analyze the consequences that will occur from a particular cause. The sixth aspect of decision making to achieve an average percentage of 81.5% with very high criteria. Most students are able to outline decisions taken based on specific cases.

HYPOTHESIS TEST

The hypothesis test was conducted to determine the relationship between spatial ability and the students' critical thinking ability by using the SPSS 16 program, the Pearson correlation test. The following results are test correlation of spatial ability and students' critical thinking abilities are presented in table 7.

Table 7. Result test correlation between the spatial ability and the student's critical thinking ability

Data Source	N	Pearson Correlation	Sig.	Decision
Data percentage of spatial ability and critical thinking ability of students	27	0,760	0,000	There is a relationship between Spatial ability and critical thinking ability

Based on table 7, hypothetical test result data performed on spatial ability percentage data and students' critical thinking ability has a significance value of 0.000 which is smaller than 0.05 so that H₀ is rejected. Next the value of the relationship degrees (Pearson correlation) between the spatial ability and the critical thinking ability of 0.760, so that it can be concluded that there is a connection between spatial ability and critical thinking ability with a degree of relationship strong.

CONCLUSION

Based on the results of data analysis concluded that: (1) The average percentage of the student's spatial ability amounted to 71.9% with high criteria; (2) The average percentage of the student's critical thinking ability is 70.17% with high criteria; (3) There is a positive relationship between the spatial ability and the critical thinking ability of learners with a significance value of 0.000 and a Pearson value of correlation 0.760 on strong criteria.

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