Geo-Literacy between School Environment and Students Spatial Intelligence

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Abstract. School environment has an important role in the success of learning geography for the school environment has an influence on the increase in spatial learners. The effect of the school environment on spatial intelligence moderated by geo-literacy. Geo-literacy strong connection with spatial intelligence, because the element of geographical has a role in increasing individual spatial intelligence. This study aims at (1) analyze the influence of the school environment on spatial intelligence (2) to analyze geo-literacy as a moderating variable in the school environment influences the spatial intelligence. The method of this study is survey method with 264 respondents. Data were analyzed using regression analysis with a moderating variable. Results of this study are (1) the school environment have a significant effect on students’ spatial intelligence. It is based on regression weight = 0.364 and p value = 0.004; (2) the geo-literacy does not significantly influence as a moderating variable. This argue based from X1X2 significance value greater than 0.05 is 0.633. However, as independent variable geo-literacy has regression weight = 0.350 and p value = 0.0017. This study concluded that the school environment significantly influences spatial intelligence and geo-literacy is not as significant as a moderating variable but independent variables that affect spatial intelligence.

1. Introduction

The school environment is the venue for learning and teaching and knowledge transfer so the potential of students can develop. The condition of the students learn must be designed as good as possible in order to students can optimized the learning process. “The learning environment should be designed in such a way as to allow students to attain scientific knowledge and gain a more positive attitude toward science” [1]. The development of the school environment should consider the development potential of learners, both on the physical environmental or psychosocial environment. The school environment is a part of the learning environment students. This shows that the school environment is one factor affecting the success of student learning. To understand the position of the school environment to the learning environment, can be seen in figure 1.

Environment effect on human life through many phenomena received by human senses. Even Abiola, and Dhindsa mentioned that, “Neuroscience research has highlighted the effect of the environment on the growing brain as well as the role of protein synthesis in memory formation during learning” [2]. Sutomo explains that "The perception and the human reaction to the events and symptoms in the geographic around it will be recorded in his mind into a structured knowledge-
systematic” [3]. Throughout the development of life, people cannot be separated from the environment.

Human activities are thinking in their efforts to adapt to the environmental conditions. In every aspect of life, human life and interaction with the environment. Environment may affect humans, but on the other hand people can also affect the environment. Likewise, in the learning process, learning environment is a source of a lot of effect on the learning process that goes on in it. “When students learn new things through discovery, they can reconstruct their knowledge” [1]. “The environment is also one of the many factors that affect learning and impact on the achievement of student learning” [4]. Environmental conditions affecting learners in a variety of ways. Schwartz mentioned that “Small schools have better interpersonal relationships than large schools [5]. Small schools appear to nurture better student and teacher relationships and foster an environment where students are better known and develop strong feelings of belonging to their school.”

Besides interpersonal relationships with the school community students, the school environment plays affect the perception of students. Intelligence is one part of the students affected by environmental conditions. Basically, human intelligence is divided into two, namely the fluid intelligence and crystallized intelligence [6]. Fluid intelligence is the intelligence obtained from genetic factor. While crystallized intelligence is the intelligence gained from the experience and knowledge that is dependent on environmental conditions. Environment provides a lot of information on individuals. The information if it is used continuously repeatedly will settle in the brain so it turns the potential that exists within the individual. “Without downplaying the role and importance of the teacher as the carrier of knowledge and culture, it is necessary to mention the importance of adequate informational educational systems and environments in education” [7].

![Diagram of School Environment]

**Figure 1.** School environment as part of the learning environment of students.

“The brain learns faster in challenging, creative, accommodating, and healthy environments. To provide for the growing, learning brains of our children, we must not forget that the environments we design have a major influence in building smarter brains” [2]. One type of intelligence that humans are spatial intelligence. Spatial intelligence is intelligence in recognizing space as well as sensitive to the shape and color. Spatial intelligence has an important position for the survival of individuals, especially with the level of one's creativity. Spatial intelligence becomes potential support human activities in space, that is mobilization. Human behavior in space is determined by spatial intelligence. The earth's surface is the space occupied by humans to interact and adapt to environmental conditions. Therefore, spatial intelligence has a close relationship with geographical conditions.

The environment is not just affect humans, especially cognitive characteristics. Environment needs to be interpreted more so that students able to understand the environment as a learning resource that builds on their knowledge. “Complex concepts cannot be directly taught to students - they must have experiences that allow them to make and to construct, much more sophisticated cognitive connections” [8]. The ability of person to make representations environment is determined by the spatial abilities.
"As cognitive, they are presumed to differ from ‘true’ maps of the environment" [9]. Students receive the influence from the environment as a stimulus to develop their spatial intelligence. Students receive intentional influence from the educators. This is caused by educators interact with learners with conscious effort. “From a systems perspective, the classroom social climate is shaped by teacher-student relationships and classroom order” [10], not only educators that have an impact on purpose, but also from the other factors. "The intentionally effect accepted by learners is not only done by educators, but also done by parents who intentionally affect positively, politic leaders also affect students as his citizens" [4].

Human sensitivity to the geographical conditions from the space they occupy is determined by geo-literacy. Geo-literacy is a term that is closely related to Geography. Geography is involved in the process of improving spatial students because geography is a science that combines physical aspects and social aspects in the earth's surface spatially. We can argue that geography, in the way it brings together the human and the natural—physical, the social and the environmental, people and place, equips the 21CG with the power of integrative thinking that will allow them to navigate the ethical dilemmas our era of supercomplexity presents" [11].

Geo-literacy is an individual's understanding of any phenomenon or symptoms that occur in the surrounding environment based on the Geographical perception. Geography perception is characterized by the introduction of the three aspects, namely interconnection, interaction, and implication. Geo-literacy is a concept initiated by the National Geographic Society in 2009. This concept describes the literacy of a person to see a variety of events and symptoms in the earth's surface with the Geographical approach. Geo-literacy will be useful as a new approach in taking decisions more appropriate and effective for this concept with various components of the natural and social in the Earth's surface.

Based on these descriptions, it can be concluded that the hypothesis is environment has an influence on spatial intelligence. Then, geo-literacy has a role in improving the environmental influences on spatial intelligence. To prove this hypothesis, we need a proper research. “For educational neuroscience, the effects in brain connectivity and behavior in response to educational intervention is guiding learning assessment as demonstrated by recent findings” [12]. Therefore, in this study required a set of measuring instruments are capable of measuring the environmental conditions of the school, literacy and geo-spatial of students.

The purpose of this study (1) analyze the influence of the school environment on spatial intelligence (2) to analyze geo-literacy as a moderating variable in the school environment influences the spatial intelligence. The research subject chosen for this study are students at State High School of Bandung City and Bandung Regency. High school in the Cities and Regencies Bandung is an ideal research subjects to answer this question. High School conditions here are also quite varied, ranging from the top schools to schools that are in the lower class. Moreover, the condition of the area in Bandung City and Bandung Regency is quite heterogeneous because it has a rural village areas and also areas of the city. It describes that the state high school in Bandung City and Bandung Regency has the right characteristics to be used as research subjects. Research will be conducted intend to emphasize that the school environment is important in the learning process, so it is necessary to get the attention to be designed and developed according to the needs. Then, this research will provide a destination for schools to design a school environment that can enhance spatial intelligence students in state high school of Bandung City and Bandung Regency.

2. Methods
This study will examine the relationship of the school environment variable regression (X1) to the spatial intelligence (Y). The variable regression relationship is moderated by geo-literacy variable (X2). Moderating variables are variables that affect the regression relationship between two variables but did not have an influence on the independent variables and the dependent variable. The composition of the research variables can be seen in figure 2.
This study used survey method. Determination of survey research methods based on objective research intends to explore the influence of the school environment to spatial of students. This research was conducted by collecting data from a population by selecting a sample. The results of data collection of the sample will be generalized to the entire population. Technically, this study used questionnaires and other instruments to measure the research variables to the respondents. The survey research was conducted at the state senior high school in Bandung City and Bandung Regency with a total sample of 264 respondents.

The sampling technique used in this study consisted from the two techniques, which is stratified random sampling and accidental sampling. Stratified random sampling is a sampling technique by dividing the study population based on specific categories, and each category is determined randomly sampled. This technique is used to take samples of high school land located in the City and County of Bandung. Accidental sampling is a sampling technique by chance are selected based on field conditions at the time of the study. This technique is used to take a sample student in each sampled school. The research instrument used as much as two types, which is (1) the observation instrument (school environment), (2) the test instrument (geo-literacy and spatial intelligence). Each measurement data was analyzed by linear regression analysis with moderating variables to know the influence of each independent variable on the dependent variable in accordance with a model that has been determined. After conducting regression analysis, this research will result in two equations to test the hypothesis. Each equation has two hypotheses need to be tested for truth, which is $H_0$ (initial hypothesis) and $H_a$ (alternative hypothesis) using the t test.

3. Results and Discussion
School environment variable is comprised of indicators related to spatial intelligence of students. School environment indicators in this study were (1) infrastructure, (2) the use of instructional media, (3) the rules of the school, (4) behavior of the school community. Each indicator is described in the table observation that must be completed in accordance with the actual situation in schools. The results from the observation table filling the score will be calculated so as to produce a measurable value. Those values will be a comparison between the school environment are observed. The higher the value the higher quality environment to support the development of students’ spatial intelligence.

Geo-literacy indicator variable in this study is an introduction to the three aspects, namely interconnection, interaction, and implication. Geo-literacy instrument consists of 15 questions to be answered by each respondent. Respondents who answer correctly will receive a value of 1 and respondents who answered incorrectly will have a value of 0. Respondents with the most correct answer will receive the highest value and so on.

Spatial intelligence raised in this study is the intelligence associated with a person’s ability to determine the direction and mobilize on the earth's surface as part of the room. The ability is measured to determine the students’ spatial intelligence is a cognitive map, collage and spatial cognitive mental. The third ability becomes the main reference in the development of students’ spatial intelligence test instrument that has been filled by the respondents. Students’ spatial intelligence test instrument contains 20 items that test these capabilities. The respondents have filled this instrument and give the answer they think is most appropriate. The resulting data were used to measure respondents' level of students’ spatial intelligence. School environment variable data, geo-literacy and spatial intelligence obtained from the study were statistically processed using regression analysis with moderating variable. The results of data processing can be seen in Table 1 and Table 2.
Table 1. Summary of equation modeling analysis of moderation.

| Model | R    | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|------|----------|-------------------|----------------------------|
| 1     | 0.529a | 0.280    | 0.272             | 2.538                      |

a. Predictors: (Constant), School Environment *Geo-literacy, School Environment, Geo-literacy

Based on Table 1, it can be information that models the variables have the value of adjusted R² equal to 0.272. This shows that the model can explain the conditions of a population of about 27.2%. In other words, the school environment and geo-literacy variables to students’ spatial intelligence affects only 27.2%. The figure also shows that there are other variables that affect students’ spatial intelligence but not involved in the study, which amounted to 72.8%.

Table 2. Regression weights of research variable.

| Model            | Unstandardized Coefficients | Standardized Coefficients | t    | Sig. |
|------------------|-----------------------------|---------------------------|------|------|
| (Constant)       | 6.358                       | 0.706                     | 9.009| 0.000|
| School Environment (X₁) | 0.428                      | 0.147                     | 0.364| 2.916| 0.004|
| Geo-literacy (X₂)  | 0.303                       | 0.126                     | 0.350| 2.413| 0.017|
| School Environment *Geo-literacy (X₁X₂) | -0.010                     | 0.021                     | -0.103| -0.477| 0.633|

Dependent variable: Spatial Intelligence (Y)

Based on table 2 it can be concluded that the school environment and geo-literacy have a significant effect on students’ spatial intelligence. It is based on the significant value of each variable, which is 0.004 and 0.017. Then, each variable has a value of regression weight of 0.364 and 0.350. Geo-literacy does not significantly influence as a moderating variable. It means geo-literacy did not improve the school environment influences the students’ spatial intelligence, but can be seen as an independent variable. This argue based from X₁X₂ significance value greater than 0.05 is 0.633. The results from the model analysis using SPSS may be presented in the form of a chart that can be seen in figure 3.

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Figure 3. Moderation equation model of SPSS processing results (Standardized).

Yearwood and Stranieri mentioned that “There are two main approaches that people use to organize and make sense of their experiences: logical thinking and narrative thinking” [13]. In other words, man's way of interpreting the environment. The school environment is any object, condition, and the aspects to be around students within the scope of the school. This study limits the school environment to a variety of objects, conditions and aspects related to students’ spatial intelligence of students. Everything related to students’ spatial intelligence, such as images or media visual learning, identified in this study.

Then the identification result is converted into the form of numbers that can be compared with each other. Researchers suspect that the school environment in accordance with these criteria is a school environment that has a lot of visual objects at around it, either in the form of a floor plan of the school, the class label, paintings, photographs, wall magazines and so on. All of these criteria is inserted into the instrument of observation and filled in accordance with the conditions of each school that the research sample. Geo-literacy is an awareness of the earth as a system that affect one's actions, especially in decision-making. National Geographic Society adopted this term to describe an
individual's understanding in response to various phenomena and symptoms that occur at the Earth's surface. People who do not have geo-literacy would not think broadly to various phenomena and symptoms that he encounters. Geo-literacy helps people to understand it more comprehensively so that they can decide better action.

Geo-literacy is not an act, but the capabilities of a person to act better. In simple terms, it can be said that people with high geo-literacy will take the right decisions at the right conditions. This will improve the quality of their actions. Researcher suspect that if a person has a high affordance then geo-literacy they will be high. If geo-literacy was high, the quality of decisions and their actions will be high. Geo-literacy to discuss how to understand a phenomenon and events based on three aspects, namely interconnection, interaction, and implication. Surely, three things are closely related to Geography concepts and environment conditions. If someone can think by geo-literacy approach, then that person will analyze the various considerations that gave birth decisions and appropriate action.

The geo-literacy concepts provide the ability for a person to think deeply and consider the various factors to make the right decision. Often geo-literacy is linked to the phenomenon analysis capabilities using tools such as a map. The pictures on the walls of the school present the results of students who are thinking deeply that they know the appropriate action to address various issues related to environmental issues. Thus, the regression relationship between the school environment variables and variable geo-literacy can be explained by the presence of visual objects in the school environment are related to problems that occur on Earth.

Besides visual objects, the influence of the school environment can also be explained through the media that is used by teachers in the classroom, especially the instructional media used in geography subjects. Geography is the only subjects that are closely related to environmental issues. Learners can tell a lot about the issue through Geography learning. Especially if the Geography teacher always uses visual learning media that stimulate the right brain of students. The right brain is capable of storing the information received in a longer time than the left hemisphere. Moreover, visual learning media can stimulate spatial thinking abilities students so that learners can use to interpret the subject matter better.

However, between several types of visual media need to do further studies to compare the effectiveness of each media to the increased geo-literacy of students. The conclusion that can be drawn from this discussion is the school environment has a positive influence on the geo-literacy students through the presence of visual objects in the school environment and the use of instructional media (especially geography subjects). Visual media can stimulate the development of students’ spatial intelligence through a learning process that is done by translating the drawings. The more visual objects related to environmental issues and the higher the intensity of the use of visual media, the geo-literacy students will be higher.

Spatial students measured through three capabilities, namely cognitive maps, cognitive collage, and spatial mental. Cognitive map is the ability of learners to remember the location of an object, event, or place and placing the other locations are known. Map of mental or cognitive map is a basic ability in students’ spatial intelligence. Mental map can be regarded as a capital importance for human survival in the running of daily spatial behavior. Learners can move from the one place to another well as cognitive ability of this folder.

Spatial intelligence also makes it easy for students to choose the right location to meet their needs. Of course, it is supported by the amount of information it holds. For example, a student wants to find books to complement the paper, then he will look for the library. In his mind, he will map out the location of the library and compares with its location at the time. Once he knows the location relative to the library, students will look for the shortest route to reach the place he wants to go. Even that students can analyze multiple routes to find the best route to his journey.

The second capability from the students’ spatial intelligence is a cognitive collage. This ability indicates that spatial intelligence is not only present information static, but also dynamic. Map cognitive ability will not work optimally if not accompanied with information that is dynamic.
Cognitive collage is a capability that represents the location of the actual and dynamic, so the ability is used to supplement the first capability, the cognitive map.

When students have already mapped the locations, he wants to go in his mind, then cognitive collage gives a visual representation of these locations. A visual representation is derived from the experience gained in the past. Spatial thinking skills must be supported by much of the information obtained from the exploration of the surrounding environment. Any information received will help learners to analyze spatial phenomena. Students who have exploration experience that many will have the cognitive ability collage higher than students who experience low exploration.

Last ability from the students’ spatial intelligence is the spatial mental. Spatial mental is the highest ability in students’ spatial intelligence. Spatial mental indicated by the mind's ability to represent processes that occur in the environment in mind. The function from this ability is to explain the causes from a phenomenon and predicts the effects from a phenomenon. The higher a person's ability spatial mental aspect of this, the higher the person's ability in predicting the phenomena in space.

Spatial mental acts like a radar for individuals to improve the effectiveness of mobility in space. Mental spatial ability can be exemplified by the case of car drivers on the road who want to change direction of vehicle speed. A car driver was passing a road with two-way system. Then he was about to turn to the right by cutting the opposite lane next to it. At the same time, there are other drivers who move from the opposite direction and move straight. Illustration from this case can be seen in figure 4.

![Figure 4](image)

**Figure 4.** Illustration of the use of spatial mental abilities. (1) Car A was about to turn right. While the car and was speeding in the opposite direction on front of the car A. (2) Just shortly after the car B pass through a T-junction, a car immediately turn to the right without looking in the rearview mirror.

A car driver saw the car B moving in the opposite direction in front of him so that he thought that on front of the car and cannot be a vehicle to follow. This condition causes the driver A car can turn right with a very sure, although not see directly what is behind it. Car B has helped A car driver to "see" the conditions behind it. Environmental conditions around the car driver A has simulated perfectly in his mind. Even in his mind have emerged two possibilities. The first possibility is no vehicle following from behind as the car was passing and right behind it. The second possibility is a vehicle about to overtake from behind. But if that happens then the vehicle will hit the first car B and car A can still drove safely.

Geo-literacy is an awareness of the geography of the individual to the environment from the Geography standpoint. Geo-literacy makes people collect and processes geographic information to solve problems in everyday life. No one's intelligence will play a part in solving the problem if the person has little information about the problem to be solved. Spatial information and skills that learners can be improved through Geography learning in the classroom. Therefore, student’s spatial intelligence belonging to the crystallized intelligence can be improved by increasing the knowledge and skills of a person.
The results from this study indicate that the arrangement of the school environment can be planned to develop students’ spatial intelligence students through increased geo-literacy. Each object such as posters, bulletin boards, school floor plans to the directions has its own role in enhancing these variables. The school environment is an important stimulus to direct the behavior of spatial learners become more effective and efficient. Geo-literacy as independent variables that have an influence on students’ spatial intelligence must be addressed by using the environment as a means to address issues concerning the disaster and terrestrial. The move is predicted to increase students’ spatial intelligence students, because these issues will stimulate students to think laterally. Geo-literacy support students’ spatial intelligence aspects of geographic knowledge. Geographic knowledge can be transferred from the school environment for learners through the use of appropriate media. If you want to get optimal results, the media used must of course be audio-visual media such as LCD TV with good quality speakers. But if the school environment has limitations to provide this, the media used may be the print media or media models. It should be the main focus not the sophistication of the media, but the completeness of the information conveyed by the media. Even if the media being used only print media, but if the information it conveys a complete and easy to understand students, slowly the media will affect the mindset of students.

School environment as a stimulus affecting the perception and spatial knowledge has been proven statistically impact on students’ spatial intelligence. The concept of students’ spatial intelligence in Geography learning does not have the same orientation to the concept students’ spatial intelligence was initiated by Howard Gardner. Gardner students’ spatial intelligence position as the potential of individuals to imagine a variety of shapes (either two-dimensional or three-dimensional), and determine the best design for an object. But in Geography learning, students’ spatial intelligence is destined to form the spatial behavior students. The ideal spatial behavior from the standpoint of Geography learning is a behavior that is based on careful consideration of various spatial information owned.

Of course, this is a complex thing, but it does not mean that cannot be developed. The progress of time requires people to think more complex and thorough. The mindset of a linear (one-way) will not be able to overcome the problems that occur in modern times. While mindset lateral (forked) will support solving contemporary problems. Mindset lateral one of which can be done through spatial mindset based on the students’ spatial intelligence. So, do not be surprised if the National Geographic Society says that the spatial mindset is the mindset of modern society that has many complex problems that must be faced. Spatial intelligence will underlie spatial thinking skills that will eventually manifest in spatial behavior. This can be exemplified by a tourist from the Indonesia to be traveled to Japan in December.

The traveler will think about the ongoing season on Japan. Then he will determine what items he will bring to the tour. In December, Japan is experiencing winter, the tourists will bring warm clothes and other items that are able to anticipate the cold. There are many examples of the application of spatial behavior that are useful in everyday life in modern society. Therefore, the concept of students’ spatial intelligence in Geography learning should be developed in order to give birth to the concept of a valid and raw. This meant that every Geography teacher on Indonesia have the same perception to develop students’ spatial intelligence on their respective schools. “The geography as a field of study has been rethought it is still rethought and it will be further rethought and redesigned, in order to provide new tools and perspectives in insurance the quality learning in schools” [14].

4. Conclusions

After doing research and reviewing the data obtained, it can be obtained two conclusions. First, school environment and geo-literacy have a significant effect on students’ spatial intelligence. It is based on the significant value of each variable, which is 0.004 and 0.017. Then, each variable has a value of regression weight of 0.364 and 0.350. Second, geo-literacy does not significantly influence as a moderating variable. It means geo-literacy did not improve the school environment influences the
students’ spatial intelligence, but can be seen as an independent variable. It can be seen from the significant value X1X2 that 0.633 (greater than 0.05).

This article has provided an overview of the relationship between the school environment, geo-literacy, and students spatial intelligence. Therefore, there are three things recommended by researchers related to this article. First, efforts to improve the students’ spatial intelligence learners can made through posters or photographs relating to the geosphere phenomenon today as environmental issues or disaster. Magazine walls can be filled with pictures nurturing sympathy students to environmental problems. As well as other additional objects need to be designed to make the students more aware of its role to preserve the environment. Second, development of students’ spatial intelligence instruments in Geography learning should be developed. Spatial intelligence on Geography aspects is the ability to move in space. The ability to move in this space based on two capabilities of onboarding and representation. Orientation is the human ability to determine the direction. While representation is the ability of humans to create a replica of the space around it in the mind. The concept of students’ spatial intelligence used in this study. However, it should be examined more deeply so that the concept of this students’ spatial intelligence can really clearly defined and can be measured precisely. Last, Efforts to improve students’ spatial intelligence can be done through increasing geo-literacy of students. This can be done in various ways, e.g. describes an example of actual environmental issues and analyze them from the Geography standpoint. Certainly, the analytical techniques used must be principled on aspects of geo-literacy that interconnection, interaction, and implication.

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