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The Students Spatial Critical Thinking Skill by Using Map and Remote Sensing Imagery on Geography Lesson

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Abstract——Spatial thinking is main feature of learning geography at school. A map and remote sensing imagery could be integrated to whole materials in spatial thinking skill test. This research aims to analyze spatial thinking skill of students by using map and and remote sensing imagery in Public SMA Negeri 1 Bae Kudus. This research uses quantitative approach. The sampling technique is *random sampling* from X, XI, and XII grades. The technique of collecting data uses test. The used test in this research is average accomplishment test which is then described. The findings showed average accomplishment of the students' spatial thinking skills were not optimal. The average score found by using map was higher than remote sensing imagery. The low level of the students' spatial thinking skills could be used as initial reference to compose learning material and learning evaluation in improving spatial thinking skill of the students by using map and remote sensing imagery.

Keywords: geography learning, spatial thinking, map, remote sensing imagery

I. INTRODUCTION

Spatial thinking is a cognitive set consisting of *space, tool,* and *reasoning process* (National Research Council, 2006). Spatial thinking is a mental skill in fostering and manipulating of visualized objects in analyzing matters or objects concerning with three dimensional perspective (Putra, 2015).

Spatial thinking becomes the main feature in practical and theoretical process dealing with geography learning activities (Huynh & Sharpe, 2009). Geography is a lesson dealing with earth surface in which, visually, could be described as spreading and grouping spots (Maharani et al, 2015; Hardati, 2010). Spatial thinking concept does not only exist in geography but also other disciplines which use spaces as main factor to provide explanation about certain feature and function of an object symptom, such as chemical, physics, engineering, history, art, and many more (Marsh, Goledge & Batterby, 2007).

The main purpose of learning geography is to habituate students to think spatially as attached in core competence of geography materials (Permendikbud No 20 Year 2003). The implementation of supportive curriculum toward spatial skill is effective in improving students' achievements at schools (Bodzin, 2011). Such skill will be useful for students in determining or creating decision toward simple and complex matters dealing with space or location (Setiawan, 2015). Ideas about space are centered on various science domains, such as ideas about forms and object arrangement in space or about spatial process (Marunic & Glazar, 2014).

Geography learning had not been fully based on philosophy and essence of geography as spatial science. It had not been directly involved in creating learning products and there had not been any concrete media and tended to be verbal which could develop cognitive and psychomotor aspects (Maharani, 2014). Learning source availability, especially those with project based which was needed by students, was still limited (Cintang, N., Setyowati, D. L., & Handayani, S. S. D, 2017). Learning method applied in the classroom would influence students' learning achievements (Natakusuma, A., Suroso, S., & Hardati, P. (2017). Learners were still doubt and not optimal in achieving spatial skills. To solve the problem, there would be a need of appropriate combinations of ideas, behaviors,

and reasoning products (Trisnawati et al, 2018). One of alternatives in solving geography problems to motivate students developing spatial thinking skill is by using map and remote sensing imagery (Shin EK, 2006). A map and remote sensing imagery is representation of *spatial thinking* as potential medium to train and improve skills and spatial thinking skill (Cheung et al, 2011; Badan Informasi Geospasial, 2015). Multiple representative skills of students are key of success in solving problems (Hwang et al, 2007).

Spatial thinking concept development is adjusted to period of education (age) in thinking spatially by using map and geospatial technology (Mohan & L. Mohan, 2013). Senior High School students of social study major has age interval between 11 - 18 year old (formal operational stages). They got geography lesson and they should be able to think abstractly and logically, included cartography literacy skill (National Research Council, 2006; Campbell et al, 2012). The application of spatial thinking skill test is worth to use for SHS level students through spatial thinking skill test (Oktavianto, 2017). Spatial thinking test focused on map and imagery has not existed and it has not taken geographical aspect into account (Lee, Jongwoon & Bednarz, 2009).

In Kudus, one of schools which apply the curriculum into geography learning is SMA Negeri 1 Bae Kudus. The school has potency to implement spatial thinking on learning geography. The students could optimize their skills in delivering and connecting ideas and their spatial information. Spatial thinking test needs to be developed in measuring relationship between cognition and psychomotor which are integrated by using map and remote sensing imagery to learn geography. Composing the questions which were from map and remote sensing imagery was expected to be solution in improving and measuring the students' spatial thinking skills. Geography is expected to focus on spatial thinking which is strongly correlated to map and image to analyze spatial aspect.

II. METHODS

This quantitative approached typed research used *one shoot test design.* The subjects were taken from all graders of X - XII grades of social study major SMA Negeri 1 Bae Kudus, since: 1) it had geography lesson, 2) map and image were implemented into the material, and 3) the students obtained materials based on same curriculum. The sample was taken by error level table 5%, resulting into 62 participants from X, XI, and XII grades. The data collecting techniques were done by spatial thinking skill test and comparison test in using map and remote sensing imagery (Setyowati DL, 2007). The used test in this research is average accomplishment test with minimum passing grade 70 which was then described.

III. RESULTS AND DISCUSSION

A. Spatial Thinking Skill by Using Map

The used indicator in analyzing spatial thinking skill by using map covers *comparison*, aura, *region*, hierarchy, *transition*, *analogy*, *pattern*, and *association (Association of American Geographers 2008).* The used map in spatial thinking skill consists of province, tectonic plate distribution, Borneo area deforestation, topography, population density, and wind movement maps. Here is the table of spatial thinking knowledge results of the students by using maps based on the class levels.

Table 1. The Students' Spatial Thinking Skills by Using Map

Clas	t-coun	Averag Score	Accomplishme Criteria	Accomplish Students
X	-3.1	67	Not passed	33
XI	-2.2	68	Not passed	36
XII	1.04	71	Passed	42

The accomplishment average score of spatial thinking skill by using map on each levels shows differences. On Table 1, XII graders have average score 71, the highest one. The amount of t-count is 1.04. It means spatial thinking skill of the students by using map had met the accomplishment criterion with 42 participants of XII. X and XI graders had not passed criterion of accomplishment. The average of X graders was the lowest one (67) with 33 students accomplishing the test. It shows that there was heterogeneity of the students' spatial thinking skill in using map on geography lesson.

The difference of accomplishment average score of each class occurred since on X graders, the spatial analysis of material object and geography formal by using map was still limited. Although in the core competence, there is basic knowledge of map which could be used as guidance in solving each question. The XI grade material was mostly explaining natural resource potency and Indonesia civilization dynamics. The XI graders were still difficult to remember and re-implement the obtained materials from X grade even the questions had attached materials by integrating map usages. On XII graders, in this core competence, there was analysis of material implementation in the form of map interpretation on various fields. The materials

obtained by XII graders were prepared for final learning evaluation activity so students could be better understanding and implementing each question number.

B. Spatial Thinking Skill by Using Remote Sensing Imagery

Spatial thinking skill by using remote sensing imagery consists of color, form, size, shade, texture, patter, cite, and association (Kusumawidagdo et al, 2009:30). The result is indicator addition of the test result done by the students as presented in Table 2.

Table 2. The Students' Spatial Thinking Skills by Using Remote Sensing Imagery

Clas	t-coun	Averag Score	Accomplishme Criteria	Accomplish Students
X	-4.8	64	Not passed	29
XI	-2.1	67	Not passed	33
XII	-0.7	69	Not passed	37

Based on the table 2, all average scores of X, XI, and XII were categorized complete or accomplished. However, the accomplishment score is different. The XII graders had the highest accomplishment (37) compared to the others. The average accomplishment of X graders was the lowest one with 29 participants.

On remote sensing material which was obtained differently to each other and was given only for X and XII graders. The interview result obtained that remote sensing material was still difficult to understand. Such condition became focus on geography learning activity in improving remote sensing skill, especially imagery interpretation which could be integrated to all lessons' materials. Students would finally habituate in delivering their spatial ideas by using remote sensing imagery.

C. Profiles of Spatial Thinking Skill by Using Map and Remote Sensing Imagery

The profile of spatial thinking could be shown based on accomplishment result comparisons. The data process results toward the students spatial thinking skills by using map and imagery were based on accomplishment results as shown on Table 3.

Dealing with spatial thinking skill in geography as shown on Table 3, it was found that it was still out of expectation since basically students were expected to active in delivering ideas and spatial information in using map and imagery although the XII graders were considered to have completed it. The students had not paid attention on accomplishment achievement.

Table 3. Spatial Thinking Skill Comparisons

Class	Average Score	
	Map	Imagery
X	67	64
XI	68	67
XII	71	69

On the table, there is average score of spatial thinking skill accomplishment. The average of each class by using map was higher than imagery. The use of map was considered easier and could be understood conceptually and characteristically which was integrated into the material. The finding is in line with Maryani & Maharani (2015), stating that a map used in learning provides positive and joyful respond in improving spatial thinking skill. Remote sensing imagery medium was categorized low for each class. This low average accomplishment was due to imagery was something new for them to understand. The students still had difficulty in solving each question so it influenced their spatial thinking skill results. Spatial skill questions are considered as new things for educational units (Fachrurozi, 2011).

Other factors which may cause discrepancies of the accomplishment scores were due to zonation program in screening new student recruits. It influenced input student quality which influenced their spatial thinking skills in using map and imagery into geography learning activity.

Learning geography is not only merely explaining similarity and difference of geosphere phenomena but also to use environmental and regional perspectives with spatial context. Spatial thinking is a main indicator in learning geography. The use of map and imagery in this learning and evaluation, which were integrated into the learning material, is expected to be knowledge and skill provisions to have better spatial skill.

IV. CONCLUSION

Spatial thinking skill of the students by using map and remote sensing imagery in geography learning at school was still below the standard accomplishment. The differences of the obtained materials and remembering capability of students influenced their spatial thinking skills. The average of each class by

using map was higher than imagery. The use of map was considered easier and could be understood conceptually and characteristically. This low average accomplishment was due to imagery was something new for them to understand. Map and remote sensing imagery were seldom to be integrated in learning evaluation so the students had difficulties in delivering their spatial ideas and information.

Based on the findings, to improve spatial thinking skill could be done by test in which each question number should be integrated by the use of map and remote sensing imagery. The findings are also expected to be solutions in improving spatial thinking skill of the students by integrating the use of map and remote sensing imagery into geography learning evaluation of X, XI, and XII grades.

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