

Geographic Skills Measurement for Geography Education Students

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Abstract: Geographic skill is ability to process spatial information to solve problems. In the concept of geography skills there are other supporting concepts that are spatial abilities and geo-literacy. Spatial ability is individual's ability to determine orientation and representation of space. Geo-literacy is individual's understanding of every phenomenon that occurs in the environment around the aspects of interconnection, interaction, and implication. This study aimed to develop a model of geographic skills measurement instrument. Subjects were 70 students. The instrument model was developed in the form of multiple choice test with 30 items of questions giving 5 options. Spatial ability components include cognitive map, cognitive collage, and spatial mental themes; while geo-literacy includes themes of interactions and interconnections. The test result has reliability value of 0.51 and the correlation between the score of item of questions and total score is generally not significant. So it can be concluded that the instrument model has the potential to be applied although at this level it still has several lackness. It is recommended to test it to more samples and improving other aspects of content validity and construct validity.

1 INTRODUCTION

Geographic skill is one of the sub subjects that should be developed by teachers for their students on Geography Subject on High School level (class X). Geographic skills are spatial information processing skills to make decisions in everyday life. National Geographic's official website describes the benefits of geography skills as follow: *“Geographic skills are used in making decisions important to everyday life—where to buy or rent a home; where to get a job; how to get to work or to a friend's house; and where to shop, vacation, or go to school. All of these decisions involve the ability to acquire, arrange, and use geographic information. Daily decisions and community activities are linked to thinking systematically and spatially about environmental and societal issues”*. (National Geographic Society, 2009).

Geographic skills are not innate but derived from learning, therefore they are necessary and can be developed. The development of geographic skills is formally done through geography learning, but it can also grow informally from adults living around childrens' environment along with the maturity of their psychology. Geography develops geographic skills through various lessons such as reading maps,

aerial photography, reading graphs, field observations, and critical thinking on space.

At school, geography teachers are required to develop geographical skills for their students. To be able to develop students' geographic skills, prospective geography teachers should train themselves since they were in college. Therefore, research on geographic skills measurements for geography college students is needed, so that their geographic skills can be confirmed before they teach their students in the future. This research aimed to develop geographic skill measurement instrument model for geography college student with participant from Universitas Pendidikan Indonesia.

2 LITERATURE REVIEW

Nowadays Geographic Information System (GIS) technology has been supporting geographic skills development. GIS is a computerized system that helps in maintaining data about geographic space (By, 2001). As a computer system, GIS has the ability to build, store, manage and display geo-referenced information. With GIS technology, organizing, analyzing, and presenting geographic information is easier and faster to make quick decisions as well.

In a broader sense, geographic skills are not only technical in processing and analyzing spatial data. In everyday life, geographic skills are inherent with spatial abilities, geo-literacy, and global view. Therefore, geographic skills also involve the ability to "think critically" or generic thinking processes, such as knowing, summarizing, analyzing, judging, hypothesizing, generalizing, predicting, problem solving, and decision making after seeing spatial data in the form of maps, pictures, living environment, even seeing phenomenon from graphic data and tables. For example, when we look at graphs of air temperature rise in an urban area, people with geographical skills will conclude that there has been an increase in air pollution and or reduced vegetation and reduced urban park area.

Spatial ability is a collective term for a wide range of acquired skills, all of which make use of basic memory for shape and position (May and Smith, 1998). All spatial skills make use of basic memory for shape and position; there is now considerable research evidence that the potential to acquire various spatial skills (sometimes termed spatial aptitude) deepens upon the strength of a person's basic spatial memory (Lohman, 1988).

Practically, spatial abilities help people to position themselves in space. People represent the space they will occupy in their mind. They make a clone of space in their mind so that they can imagine the space in detail. Space structures depicted in the memory can be transformed into various forms of information, both in the form of numbers and sentence descriptions.

Spatial ability can be used in various parameters to determine direction in space, determining position of the rising sun, the shadow direction, the flow of traffic and various examples of other parameters used by people to determine their own direction and position in space. Therefore, it can be concluded that spatial ability is part of generic geographic skills because it fast and mechanical.

Geo-literacy is a term refers to understanding of how the earth works in the context of modern society. "Geo-literacy is the ability to reason about earth systems and interconnections to make far-reaching decisions. Whether we are making decisions about where to live or what precautions to take for natural hazards, we all make decisions that require geo-literacy throughout our lives." (National Geography Society, 2009)

Geo-literacy is an individual understanding of every phenomenon occurs in his or her surrounding environment based on geographic perception. The geographic perception is characterized by three

aspects that are interconnection, interaction, and implication. The combination of spatial ability and geo-literacy will give students the ability to understand and to process spatial information received from a geographical point of view. Based on these arguments, it can be concluded that geographic skills can be built by two capabilities, spatial ability and geo-literacy. Efforts to measure the college students' geographic skills can be done by identifying the indicators of the two capabilities.

In addition to the above two parameters, geography skills can also be measured from indicators of global view. Global view is a person's ability to view the world more broadly and comprehensively. Those with global view insight will be more careful and care about the circumstances around them. Although they believe that they live in a remote place, but because of their actions can affect life globally then they will avoid such actions. For example, if someone is staying in a closed room, he or she will not spray perfume or aerosols containing excessive CFC (Chlorofluorocarbons) or freon gas, because he knows it will damage the ozone layer in the atmosphere.

If geographic skills are peeled procedurally, the sequence is more systematic. Geographic skill is identical to the process skill which is the stage of making conclusion after going through the scientific process. Adapt the Guidelines for Geographic Education: Elementary and Secondary Schools, prepared by the Joint Committee on Geographic Education by the Association of American Geographers and the National Council for Geographic Education; there are five geographic skills that have sequential steps (National Geographic Society, 2009):

- Asking Geographic Questions;
- Acquiring Geographic Information;
- Organizing Geographic Information;
- Analyzing Geographic Information;
- Answering Geographic Questions.

In this study, the measurement of geographical skills has not covered the above five steps but refers to the themes of spatial abilities, geo-literacy, and global view. The main reason is that the measurement of geographic skills not only measures the five steps above but focuses more on the real results of the thinking process. The assumption is that someone who is able to answer questions about spatial abilities, geo literacy, and global view, means that their mentality has been through the process of geographic skills in his or her memory.

3 METHODS

This study employed a descriptive method to describe the geographic skills measurement instrument model specifically tested in geography education students. Respondents are prospective teachers totalling of 70 students. The number of question items that were developed were 30 questions. Time to do was 60 minutes. Test results were processed with ANATES version 4.0.2 developed by Karno to and Yudi Wibisono. This program has been published and can be downloaded for free.

This research was done through a relatively easy process, began with needs identification as the basis for establishing the objectives of measuring geographic skills. Deciding several themes as reference in the development of the question items, developing item of questions as the research instrument, testing validation of the instrument, and improving the instrument. After the geographic skills measuring was done, the final stage was to analyze the strength and weakness of the instrument and the geographic skill level of the students.

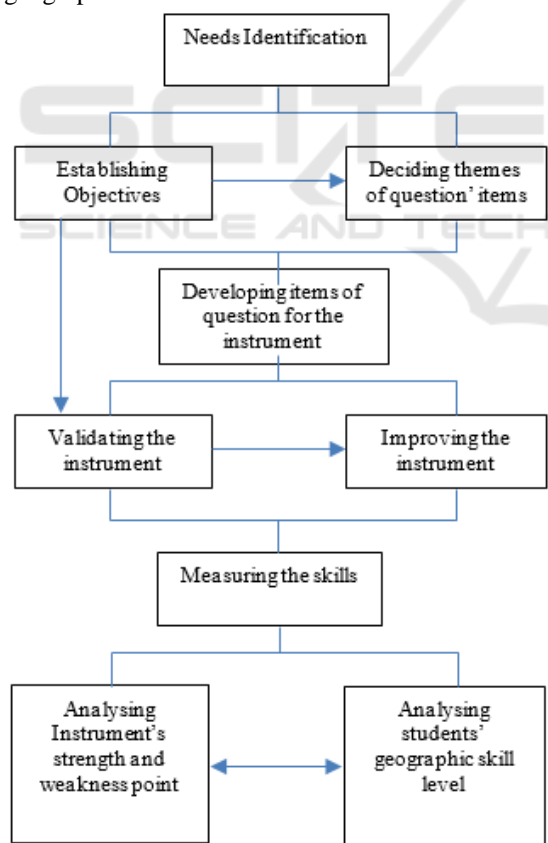


Figure 1: Research Process.

4 FINDINGS AND DISCUSSIONS

4.1 Developing Instrument to Measure Geographic Skills

Geography students are prospective geography high school teachers who are required to have geography skills. The demands are quite rational because they will develop geographic skills of their students.

The first step to measuring geography skills is to develop standard instruments that start from the identification of needs, goal setting, question's themes development, question items development, instrument validation, instrument improvement, measurement implementation, and measurement analysis.

Questionnaire to measure geographic skills is in multiple choice form by selecting three subjects that are related to spatial abilities, geo-literacy, and global view. Spatial ability components are developed including themes of cognitive maps, cognitive collage, and spatial mental, while geo-literacy components include interactions and interconnections. For the global view components consist of the effects of globalization in the field of socio-cultural, understanding climate change, global disaster, and competitiveness of Human Resources. Here are the themes for the questions:

Cognitive Map

- Define routes to known locations;
- Specify routes to unknown locations;
- Determine the shortest route between two locations;
- Determine the shortest route between more than two locations.

Cognitive Collage

- Matches the image to the appropriate location;
- Convert verbal information into images and vice versa.

Spatial mental

- Simulate object changes in space;
- Predict the movement of the object;
- Determine the relationship between one object with another object in space.

Interactions

- Determine the location / object / event that affect each other based on certain characteristics;
- Find evidence of locations, objects, or events that affect each other based on certain characteristics.

Interconnections

- Determine the relationship between locations, objects, events based on certain characteristics;
- Describe relationships between locations, objects, events based on location patterns.

Implications

- Predict the impact of interaction and interconnection between locations, objects, events based on existing data;
- Formulate effective measures to reduce the risk of negative impacts of interaction and interconnection;
- Formulate effective steps to achieve a positive impact of interaction and interconnection.

Global view

- Effect of globalization in the socio-cultural field;
- Understanding climate change;
- Global disaster;
- The competitiveness of Human Resources.

Here is an example of question to measure geographic skill:

4.1.1 Example of Cognitive Map Question

Look at the boarding pass below!



Figure 2: Example of Cognitive Map Question.

If the North has azimuth map 0°, then the airplane boarded by the owner of this boarding pass move in the direction of azimuth

- A. 0°
- B. 45°
- C. 90°
- D. 225°
- E. 315°

The above questions are example of mental map measurement., it is necessary to know about the location of the plane take off (Bangkok) and the plane will be landing (Taipei – Taiwan) to answer the above question. The key answer to the above question is B.

The students who do not know the location of Bangkok and Taipei will certainly fail to answer the

above question. In addition, knowledge of the orientation of maps is also required, i.e. knowledge of azimuth concept maps.

4.1.2 An Example of Cognitive Collage Question

Look at the picture below!

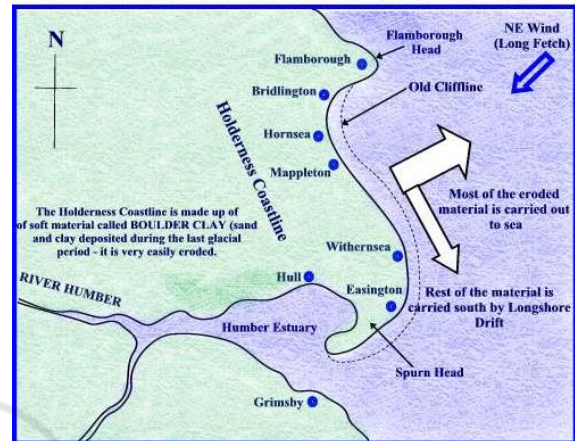


Figure 3: An example of cognitive collage question.

If the above map shows the river estuary and spit, then it can be expected that ...

- A. Sea sedimentation is higher than abrasion
- B. Potential delta formation at the mouth of the river
- C. The formation of bay, cape and keo
- D. The rainfall is longer than drought
- E. Flood can extend to 20 meters

The above question has a goal to measure the ability of students in turning image information into verbal information. In geographic term it is called the ability of map interpretation which is one of the geography skills.

4.1.3 Example of Spatial Mental

The spatial mental question is a question for measuring the ability to understand and apply the knowledge of the map to a particular context. Here is one example of a spatial mental question

Which map symbol is generally far apart from other symbol on a map?

- A. Symbol of grave and school
- B. Symbol of mosque and market
- C. Symbol of settlement and postal service
- D. Symbol of the hospital and historic place
- E. Symbol of the head of villagers office and historic place

The above question has degree of C4 (application) that is applying location theory in reading or interpretation of land use map. This capability is universal because land use patterns follow a common pattern of land benefits. In the case above, the location of the school must meet the requirement that it should not be adjacent to the crowds of markets, terminals, and or the burial site. Thus, the location of schools and cemetery sites are generally far apart so that the symbol of the map between the burial site will be far from the school location.

4.1.4 Example of Interaction and Interconnection Question

Another example is to measure students' predictive ability from the impact of interaction and interconnection between locations, objects, events based on data:

Look at to the below Garuda Indonesia Airlines service routes!



Figure 4: Example of interaction and interconnection question.

In development context, this map can be used to view phenomenon of...

- A. Flight activity
- B. Intensity of population mobility
- C. Center of regional growth
- D. Garuda Indonesia Airlines promotion
- E. Flight information for passengers

The above question has the advantage to measure the ability of the students' association skill to associate the intensity of interaction with the growth of the region.

4.1.5 Example of Implication Question

In the upper river there has been forest destruction. Below is the case that will appear at the end...

- A. Erosion and flash flood
- B. Landslides and river silting
- C. Springs and forests destruction
- D. Agricultural production decreasing
- E. Urbanization and unemployment

This question has the advantage of measuring the ability to predict a geographical condition in the future.

To answer the above questions logical thinking range is existing (Yani, 2016). The answers are all correct, but the spatial phenomenon arise at the end due to forest destruction are urbanization and unemployment. The logical thinking range is "distance" between two concepts connected by the unseen concepts when the two concepts are connected. As in the example above, the nearest distance between the forest destruction in the upper river is erosion and flash flood. After the flood disaster, the next impact is springs and forests destruction. It will be followed by a decline in agricultural production that causes poverty in the village. Furthermore, the poverty will encourage people to urbanize because of the many are unemployed. To explain the relationship between the forest destruction with urbanization need several logical reasons. Thus comes the term of logical thinking range.

4.1.6 Example of Global View Question

Each living environment has an ecological carrying capacity limit. The situation in the urban environment that has exceeded the carrying capacity is:

- A. Often experience water shortages and flooding
- B. Hit by a devastating earthquake and tsunami
- C. The atmosphere is stuffy, densely populated, and often jammed
- D. Lots of garbage and river water are polluted
- E. Is often plagued by infectious diseases

The above question can measure students' insights about the symptoms of environmental threats caused by common human behavior in any place that is subjected to population pressure.

The above examples are way of how researchers develop questions of the instrument to measure geographic skills.

4.2 Developing Instrument to Measure Geographic Skills

The questions form for measuring geographic skills is multiple choice, distributed in 30 items of questions with the following divisions:

- Spatial ability = 11 items;
- Geo-literacy = 12 items;
- Global view = 7 items.

The subjects of the study were college students of Department of Geography Education, FPIPS

Universitas Pendidikan Indonesia with the number of participants of 70 students. Here are the results:

- Highest score = 21;
- Lowest score = 7;
- Mean = 13,44 (44,8%);
- Median = 3,10;
- XYCorrelation = 0,34;
- Reliability = 0,51;
- Distinguishing power = 25,26.

Difficulty Level:

- Very difficult = 1 piece;
- Difficult = 7 piece;
- Medium = 19 piece;
- Easy = 3 piece.

Significance of Question item score to total score:

- Very significant = 1 piece;
- Significant = 2 piece;
- Not significant = 27 piece.

Based on the above data, the average score obtained by the research subjects was 13.44 or 44.8% which means below 50% (expected average). In fact, if considering the difficulty level there are 19 (63.3%) questions are easy. The distinguishing power of 25.26 is relatively moderate. This data indicates that the developed instrument is suspected problematic.

Tuckman cited by Purwanto (2011) explain that a measuring instrument must qualify as a good measure, at least have adequate validity and reliability. A valid instrument is capable of measuring object to be measured precisely. "Validity of a test has been defined as the extent to which the test measures what it was designed to measure" (Aiken, 1994: 103). While reliability is the consistency of measurements required to obtain valid results. However, there are times when instruments are questioned about its invalid reliability, because validity is related to the feasibility of the interpretation of the test results, while the reliability is related to the consistency of test results.

Referring to the results above, the competence of research subjects who only get a score of 13.44 (44.8%) can be said have low competence. Other facts also indicate that the problem presented actually has good distinguishing power with a relatively easy level of difficulty.

However, it should also be recognized that the developed questions appear to be invalid because 27 of the 30 items are stated to have questions item to total score correlation is insignificant. To ensure the validity of the questions, it appears that it should enlarge the number of research subjects (Sugiyono, 2010) and need to select subjects randomly to ensure the election of representative sample.

5 CONCLUSIONS

The result of the test instruments development for measuring geographic skills in this research seems less satisfactory. Although the reliability of the questions is good (0,51) but it does not have high score of validity. Question items are not able to measure the object to be measured, therefore additional research subjects to determine the level of validity are required. However, to increase the number of research subjects, it should also look for more diverse sample candidates and randomly selected. In this research it is admitted that the research samples are not random because they are only from one community which are the Geography Education Students class of 2016. For the benefit of further research, it is recommended to choose other more senior students, or even graduate students either master or doctoral degrees. Although the validity of this prediction is not satisfactory, but researchers hope that the content validity and construct validity can be rationally accountable and likely to continue to be developed. The development of geography skills measurement instrument will change much of the perception of geography. The former geography subjects are only considered as general knowledge taught in school and are less meaningful, after which research will enrich the society's insight that geography subjects can be beneficial to the lives of learners in the future. Thus, this research is very useful to establish geography subjects in the Curriculum 2013 in Indonesia.

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