Geography teachers perception toward spatial thinking teaching and learning

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Abstract. Spatial thinking can be thought through geography however to teach spatial thinking, geography teachers need appropriate knowledge and perception. The aim of this research was to know geography teacher perception about teaching spatial thinking through geography that viewed by gender. The geography teacher was a senior high school teacher with the consideration that spatial thinking has a deep connection with Geographic Information System (GIS) where GIS is given as geography subject materials to senior high school students. The data collection use a questionnaire to find out geography teachers perception about spatial thinking. The filled questionnaire then scored and analyzed using descriptive quantitative. The result showed that there was no significant correlation between gender and disposition to spatial thinking teaching and learning.

1. Introduction

Spatial thinking is one of five aspects included in geocapabilities it is found in Walkinton et al (2017) geocapabilities consist of use of the geography imagination, ethical subject-hood with the consideration to the effects of process in geography, unifying thinking about the relationships between society and environment, spatial thinking, and systematical exploration of places [1]. Furthermore, Spatial thinking has a very strong connection with science, for example, some of the geosciences depend on spatial representation such as maps, spatial relationships such as a nearest neighbor, spatial pattern and so on, it is also explain that spatial thinking is important in most people activities [2]. Geography is one of the geosciences that has a correlation with spatial thinking it can be seen by its connection to maps and other spatial representation and phenomena. It was stated that spatial thinking is not a new term in geography education, however, the uses of this term is new and widely use recently, spatial thinking means the use of spatial concepts such as direction, distance, and region, the presentation tools such as maps and graphs [3]. In addition, Geography education gives not only skill, geographical knowledge, and special attributes but also promotes complete specific capabilities in disciplines area, that responsible for student’s learning and experiences in the future [1].

It is possible to learn spatial thinking, thus spatial thinking can and should be given in the educational system at all levels, furthermore it is essential to provide a systematic educational program in order to promote spatial literacy by strengthening spatial thinking levels in K-12 students [4]. However, the prerequisite for the teacher to support spatial thinking for students is that teachers own the appropriate skills, dispositions, and knowledge [5]. Furthermore, it was stated that general agreement about what form essential to the concepts of spatial thinking and how spatial thinking could apply to teach geography is an important move for cross over the connection of geography curriculum and basic scientific research [6]. Educators who want to enhance and provide practice in their class or courses with spatial thinking may benefit from developing their vocabulary about spatial thinking [7].
One of the subject matter that can improve and has a deep correlation to spatial thinking is Geographic Information System (GIS) [8][9], this subject is given to students in senior high school. As for example based on their research found that implemented webGIS to students improved their ability to think spatially [10].

2. Method

The respondents were all geography teachers in Surakarta Central Java Indonesia. These geography teachers were high school teachers who become a member of the association of geography teacher called Musyawarah Guru Mata Pelajaran (MGMP) Geography in Surakarta. The questionnaire was used to collect the data engaged teaching spatial thinking though geography disposition inventory [11]. The questionnaire consisted of 40 items under five categories, the categories were teaching thinking skills (consist of seven items), teaching spatial thinking (consist of seven items), spatial thinking in geography (consist of 6 items), the explicit teaching of spatial concepts (consist of eleven items), and the last was adopting spatial representations and geospatial technologies (consist of nine items). Scoring method guidance used was Jo and Bednarz (2014), the scoring was one for strongly agree, two for disagree, three for neutral or don’t know, and five for strongly agree) [11]. The data was viewed by gender (male and female) and analyzed using a descriptive quantitative method using statistics such as mean, standard deviation, and normality. Analyzed technique to know the effect of gender on geography teachers perception using t-test if the data was normal and mann whitney if the data was not normal.

3. Result

The collecting data processes were done in the weekly meeting session of MGMP Geography Surakarta that attended by all geography teachers in Surakarta. The questionnaire was given by the researcher and filled out by the teachers, the researcher here gave instructions and helped if needed. The questionnaire that used was copied (not computerized). The average of times used to fill out the questionnaire was 20 to 30 minutes.

There was 40 questions in the questionnaire and classified into 5 categories, the first categories were teaching thinking skill. In this categories the result showed that geography teachers generally agree that teaching thinking skill is an important thing, it was shown by the mean score for each item in subcategories 1 was 4,2 both in male and female. The highest score for male teachers was the idea.
that the teachers believed thinking skill can be taught. In this case, geography teachers believe that thinking skills can be taught in senior high schools classes, and teachers believe also that thinking skills should be taught, however other result showed that priority goal to teach this skills was the lowest scores, it was indicated that even though teachers believed that teaching thinking skills were an essential part however its not the highest priority goal of the teachers. On the other hand, female teachers had agreed that enhancing students’ thinking skill will be their main priority goal. The differences between male and female were striking in this item, however in the other items, both male and female had a similar disposition.

![Graph showing differences between male and female teachers on various teaching goals](image)

**Figure 2.** Subcategories 2 Teaching Spatial Thinking

The second categories were teaching spatial thinking, in these categories, the questions were straight to spatial thinking. Both male and female teachers knew what spatial thinking was and teachers believed also that spatial thinking was not an innate skill. Female teachers believed that spatial thinking is powerful, the male teacher believed that too however the mean scores were lower than female teachers. Other items revealed that female teachers believed spatial thinking can be learned across disciplines rather than the male teacher. Other items specify the similarity between male and female teacher, for example, they believed that spatial thinking is integral in students everyday life and workplace, they agree that spatial thinking can and should be taught in schools, especially in senior high schools classes.

| No. | Item                                                                 | Male M | SD | Female M | SD |
|-----|----------------------------------------------------------------------|--------|----|----------|----|
| 15  | I believe that spatial thinking should be taught in schools          | 4      |    | 4,1      | 1  |
| 16  | I believe that geography is best learned by rote memorization of facts | 3,8    | 1,1| 3,4      | 1,1|
| 17  | I believe that asking questions and solving problems is important in geography | 4,5    | 0,5| 4,2      | 0,5|
| 18  | I believe that geography is the study of spatial aspects of human existence | 4,3    | 0,6| 4,2      | 0,4|
| 19  | I believe that understanding spatial pattern and processes is essential in learning geography | 4,3    | 0,5| 4,2      | 0,4|
| 20  | I believe that spatial thinking is an essential part in learning geography | 4,2    | 0,6| 4,3      | 0,5|

**Table 1.** Sub Categories 3 Spatial Thinking in Geography
The third category was spatial thinking in geography, male teachers strongly believed that asking question and problems solving is important in geography (mean scores: 4,5), the table also indicates that the highest scores for female teachers were that they believed that spatial thinking is an important part of the learning process (mean scores: 4,3). Both male and female teachers highly believe that geography study about spatial aspects of human existence and think that in geography it was important to realize about spatial pattern and processes. On the other hand, the lowest score for both teachers was the idea that geography was best learned by rote memorization of facts ( male: 3,8., female: 3,4)

![Bar chart showing mean scores for male and female teachers for spatial thinking in geography.](image)

**Figure 3.** Sub Categories 4 Explicit Teaching of Spatial Concepts

The average of means score in the fourth categories was 4,2 for male and 4,3 for female. These result showed that male and female teachers have a similar disposition toward the teaching of spatial concepts explicitly such as the concepts of location, scale, overlay, map projection and so on. It was because teachers strongly believe that it was essential to recognize spatial concepts as part of learning geography.

**Table 2.** Sub Categories 5 Adopting Spatial Representations and Geospatial Technologies

| No. | Item                                                                 | Male   | Female  |
|-----|----------------------------------------------------------------------|--------|---------|
|     |                                                                     | M      | SD      | M      | SD      |
| 32  | I believe that using and creating spatial representations, such as maps, diagrams, and graphs, are essential for spatial thinking | 4.1    | 0.9     | 4.4    | 0.7     |
| 33  | I believe that using and creating spatial representations are essential for learning geography | 4.1    | 0.8     | 4.2    | 0.6     |
| 34  | I believe that students can readily interpret spatial representations without a guided practice | 3.8    | 0.9     | 3.6    | 1.2     |
| 35  | I will demonstrate to students to create their own spatial representation | 3.8    | 0.7     | 4.2    | 0.5     |
| 36  | I will frequently ask students to create their own spatial representation | 3.8    | 0.7     | 4.2    | 0.5     |
| 37  | I believe that geospatial technologies, such as geographic information system (GIS) and global positioning system (GPS), are powerful tools for spatial thinking | 3.9    | 0.8     | 4.2    | 0.5     |
| 38  | I believe that geospatial technologies are a powerful tool for learning geography | 3.8    | 0.7     | 4.2    | 0.5     |
| 39  | I am familiar with the educational uses of spatial technologies | 3.6    | 1       | 3.4    | 0.9     |
| 40  | I will demonstrate to students how geospatial technologies can be used to solve problems and make decision | 3.9    | 0.6     | 3.9    | 0.5     |
In this fifth categories, male teachers have lower scores compared to female teachers except in believing that use and create spatial representations are important in geography and familiarity of using spatial technologies male have a higher score than female. The highest scores for both male and female is that they believed use and create spatial representation is important for spatial thinking. both teachers have lower scores at believing that students especially senior high school students without a guided practice can make interpretation of spatial representation. Female teachers will demonstrate and ask their students to make their own representation however male teacher have a lower score at this statement. Female teachers strongly believe that geospatial technologies are essential for spatial thinking and learning geography by 4,2, on the other hand, the male teacher did not think so by 3,8. The similarity was found that teachers will demonstrate can help problems solving and decision making easier by 3,9.

4. Discussion
Overall geography teachers perception for the first category teaching thinking skill was high average mean score for these categories was 4,2. It is indicated that geography teachers believe that thinking skill is essential furthermore it can and should be taught, teachers agree also of some strategies that can develop students ability to think as argued that students should do research rather than receiving information about the answers passively [12]. In the second category teaching spatial thinking, both teacher also believe that spatial thinking can and should be given to students, they also have to understand what spatial thinking is and they agree spatial thinking is powerful as stated that spatial thinking skill is important to accomplishment in many subdisciplines of the geosciences [13][14][15]. In the third category spatial thinking in Geography teachers strongly believe that problem solving and studying aspect in the spatial thinking is important in geography it and teachers believed that studying spatial thinking is also part of learning geography additionally the high school students high-liter in geography was found in student who has a high spatial intelligence scare [16]. In the fourth category explicit teaching of spatial concepts teacher were generally agree to teach spatial concept explicitly such as location, scale, overlay and so on. In the fifth category adopting spatial representations and geospatial technologies, there were no differences between male and female teachers, male teachers have low mean scores to demonstrate and ask their students to create their own spatial representation and less believe that geospatial technologies are important to spatial thinking and learning geography contrary to female teachers as stated that there were no particular differences found by gender [5]. However, all in all, the result of data analyzed showed that there was no significant correlation between gender and perception toward spatial thinking teaching and learning.

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