The Influence of Students' Attributes on Thematic Map Reading Ability

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Abstract. A thematic map is a media in conveying specific spatial information on the surface of the earth. One form of spatial information is disaster vulnerability area. Through maps, students can improve their competence in understanding spatial disaster information. The better the ability to read the information on the map, the better the decision-making in a disaster. This study aims to analyze (1) The ability of the students to read an earthquake vulnerability map and (2) the influence of students' attributes such as gender, age, and disaster experience on the ability to read an earthquake vulnerability map. This was quantitative research with a correlational research design. The sample was 179 students in SMP Negeri 2 Bayat in Klaten Regency, Central Java, Indonesia. The data were collected using tests, documentation, and observation. The data were analyzed using Pearson product-moment correlation. The map scale was 1:200.000. The result showed that students' attributes have no significant influence on students' ability to read an earthquake vulnerability map. The ability to find information through earthquake vulnerability maps is still low regardless of gender, age, and disaster experience.

Keywords: Map, Thematic Map, Earthquake, Junior High School Student, Map Reading.

1 Introduction

Klaten Regency, which is located in the southern region of Central Java Province, is extremely vulnerable to natural disasters. This is a result of the position, which is connected to endogenous movements that create the Bayat Hills and the Mount Merapi landform. Klaten Regency is one of the regions that are vulnerable to earthquakes because of its position. The earthquake that hit the Regency in 2006 was one of the tragic occurrences. This earthquake's epicenter was located in the South of the Special Region of Yogyakarta Province. The quake caused extensive property damage and thousands of fatalities. The education sector in the Klaten Regency is one of the steps the government has taken to reduce the danger of earthquake disasters. One of these involves creating disaster-safe schools in the educational sector, though still, not all schools are eligible to participate in this initiative. The Districts of Gantiwarno, Bayat, and Cawas

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are among those in Klaten Regency that is very vulnerable to earthquakes. The areas most impacted by the earthquake in 2006 were these three regions. As a result, these areas have a higher priority for disaster risk reduction than other areas.

Disasters happen as a result of the interaction of hazards, risk factors, and vulnerability [1]. Therefore, reducing these three characteristics of the disaster can contribute to reducing the risk of earthquake tragedies. The provision of adequate disaster education can maximize efforts to mitigate disaster risk in schools since students are one of the characteristics that are vulnerable to disasters because they are considered to be young. If disaster vulnerability information can be effectively disseminated to students, disaster risk reduction efforts will be more successful. Thematic maps of disaster vulnerability are one way in which information about disaster vulnerability can be presented. Maps are able to present information on earthquake hazards spatially so as to increase spatial awareness among students.

A map of the seismic risk is one method of conveying information. A map is a flat, scaled representation of the surface of the earth. Maps geographically display a variety of information about the earth's surface. The phenomena that take place on the surface of the earth can be better described using maps. The use of internet-based and digital maps has increased along with the rapid advances in technology, but traditional paper maps still have a number of benefits, such as being simpler to read and offering more information [2]. The ability to read maps is a skill that is relevant to many different fields [3], however, the utilization of information on maps needs to be done through an effective process of reading and interpreting maps [4].

Students' ability to interpret maps is undoubtedly impacted by variations in the curriculum that teaches this skill. According to Rahayu (2011), elementary school children come into the low group for map reading skills in the scale measuring portion. The reading proficiency of high school pupils is likewise low, according to [5], despite the fact that this proficiency influences students' comprehension of spatial relationships. Accordingly, [6] discovered that high school pupils' map-reading skills were also generally poor. According to [7], students' map-reading skills are also generally inadequate. Based on these claims, it was determined that students' ability to read maps was poor starting in elementary school and continuing through higher education, although no one had examined junior high school students. All educational levels offer classes on earthquake mitigation, however, in junior high school social studies geography classes are when new maps are first introduced, as opposed to primary school, when atlases and plans are used to present spatial information.

A number of studies have emerged around the topic of map reading abilities in line with the rapid development of science and technology, including [8] research, which looked at primary school teachers' map reading proficiency. [9], who examined gender variations in student map reading abilities, [10] evaluated students' map reading skills based on gender, memory, and geographic information systems, whereas [11] investigated the development of reliable map-reading ability instruments. [12] examined how well students could interpret maps dependent on their gender. [2] examined students' map reading ability based on gender, while [13] compared the most effective learning

strategies to enhance students' map reading proficiency. In earlier studies, reading topographic maps was examined; in the current research, reading thematic maps—specifically, earthquake hazard maps—is examined.

Students in the disaster-prone area must be able to read a map, so the information on the map is crucial. Students can learn about earthquake disasters spatially through maps. It's feasible that careful map reading can help decision-makers take disasters into consideration when making choices. This study aims to (1) analyze the ability of students in junior high school 3 Bayat to read earthquake hazard maps and (2) analyze the impact of student characteristics (gender, age, experience with disaster events) on the ability of students in junior high school 3 Bayat to read earthquake disaster vulnerability maps.

2 Method

This research is quantitative research with a correlational research design. This research was conducted in junior high school 3 bayat, Klaten district. The population in this study were all students in grades 7, 8, and 9 with a sample of 179 students. The sample is calculated using the slovin formula while the sampling is carried out using the stratified random sampling method. The variables in this study are independent variables, namely gender, age, and experience of disasters while the dependent variable is the student's ability to read maps. Data collection was carried out by testing and documentation methods. The questions used in the map reading test consisted of 13 questions with map reading ability indicators obtained from [8] including the ability to determine directions based on latitude and longitude, describing locations on a map using standard symbols, the ability to determine locations on a map using directions, as well as distances and directions, ability to compare distances, use of travel routes, and ability to read the information on maps. The map used in this study is an earthquake hazard map in Klaten Regency on A4-size paper and a 1: 200,000 scale. in working on this problem each student will receive a set of worksheets consisting of maps and questions.

The data analysis technique uses the product-moment correlation parametric test with analysis prerequisite tests, namely the normality test, homogeneity test, and linearity test. If the prerequisite test is not met then the data will be analyzed using the non-parametric test. the non-parametric data analysis technique of the Mann-Whitney and Kruskall-Wallis tests. Attributes used in this study are gender, age, and experience with disaster events. The genders are male and female. The score for gender is "1" for females and "2" for males. Age was classified into three levels, namely 11–12, 13–14, and 15–16 years old, with scores 1, 2, and 3. Whereas disaster experience was divided into "yes" and "no," with a score of 1 and 0. This study's hypothesis is that students' attributes have no influence on their ability to read maps.

3 Result and Discussion

Students were given questions and maps to complete as part of the data collection technique in this research. Gradually, from first to third grades, data were collected. Time spent working on questions can affect performance when reading maps, so the time

allotted is adjusted to the degree of attention to detail required for each item [14]. The questions were delivered, and students had 45 minutes to work on them. Following collection, the data is coded and subjected to descriptive statistics and correlation tests for analysis. The following are the findings of the research in Table 1.

3.1 Students' Ability to Read Earthquake Hazard Maps

Table 1. Mean and standard deviation of students' reading map ability

Attributes	Attributes Classification	*N*	*M*	SD	Min	Max
Gender	Male	96	5,3	0,9	3,3	7,3
	Female	83	5,1	0,9	3,3	7,3
Age	11-12 years old	65	5,2	0,9	3,3	7,3
	13-14 years old	103	5,3	0,9	3,3	7,3
	15-16 years old	11	5,2	0,6	4,0	6,0
Disaster experience	Have	84	5,2	0,9	3,3	7,3
	Do not have	95	5,3	0,9	3,3	7,3

Three categories—high, moderate, and low—were used to categorize the student's proficiency with maps. The Sturgess method was used to determine the group numbers for the classification. According to Table 1, both male and female students had the same minimum score (3.3) and the highest score for their ability to interpret maps (7.3). As well as attributes for age and prior earthquake experience. The minimal score for the 15–16-year-old attribute is lower than the other age range and other student attributes, yet it is higher than the minimum score in the age range (4.0). The test's maximum score of maps reading ability was 10, however, data analysis revealed that the typical student score was only 5.2. This shows that only 52% of the questions given to students can be answered correctly. The standard deviation is a measure of how widely distributed the data are within a sample and how closely related they are to the mean value. The mean is 5.2 and the standard deviation is 0.9, indicating that the data is less varied because the standard deviation is lower than the mean. This implies that the student's responses on the test evaluating their ability to read maps tended to be similar (Fig 1).

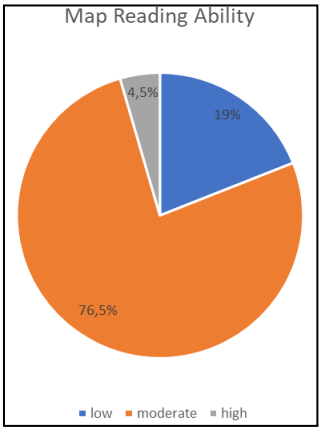

Fig. 1. Student's Map Reading Ability

3.2 The Influence of Gender

Table 1 depicts the distribution of scores for male teachers (N=96, M=5,3, SD=0,9) and female teachers (N=83, M=5.1, SD=0,9). There are nearly equal numbers of students of both genders. However, it is clear that male students scored on average higher than female students. The Mann-Whitney test was used to determine how gender influences students' ability to read maps. According to Table 2, the p value of 0.836 indicates that the difference in student gender categories was greater than 0.05. It can be inferred that the hypothesis was correct and that gender has no influence on a student's ability to read maps.

Table 2. The Mann-Whitney U test's significance of the gender classification difference between students.

Gender Classification	*N*	Sum of Rank	Mean Rank	*U*	*Z*	*P*
Male	96	8661.5	90.22			
Female	83	7269.5	88.65	3866	-.207	0.836

3.3 The Influence of Age

The number of students in the age groups of 11–12 (N=65, M=5,2, SD=0,9), 13-14 (N=103, M=5,3, SD=0,9), and 15-16 (N=11, M=5,2, SD=0,6) is shown in Table 1. It demonstrates that the distribution of ages was uneven. The age group with the highest percentage of students was 13–14 (57,5%), then 11–12 (36,3%), and 15–16 (6,2%). However, the mean score reveals that the age group did not necessarily correlate with the mean score. Kruskal-Wallis was used to examine the impact of students' age on map reading ability. Table 3 shows that there was no significant difference in the age group categories, with a p value of 0.991 > 0.05. It may be argued that the students' map reading ability was not much impacted by age.

Table 3. The impact of the age categorization of students using Kruskal-Wallis.

Age Classification	*N*	Mean Rank	*P*
11-12	65	89.32	
13-14	103	90.39	
15-16	11	90.41	0.991

3.4 The Influence of Disaster Experience

The students were questioned regarding their experience with earthquakes. Students with earthquake experience are shown in table 1 (N= 84, M= 5,2, SD 3,3), while students without experience are shown in table 1 (N= 95, M= 5,3, SD 3,3). It was discovered that more students (53,1%) had no prior earthquake experience than (46,9%) had

prior earthquake experience. Regardless of whether someone had experienced an earthquake or not, the mean value was essentially the same. The Kruskal-Wallis p value analysis revealed the significant influence; the value of 0.416 > 0.05 indicates there was no significant difference in earthquake experience, leading to the conclusion that earthquake experience had no significant impact on the student's ability to read maps (Table 4).

Table 4. The significance of the difference in students' earthquake experiences using Kruskal-Wallis.

Disaster Training Experience	*N*	Mean Rank	*P*
Have	84	86,71	
Do not have	95	92,91	0.416

3.5 Discussion

The ability to read maps is helpful in numerous aspects of life [3] including disaster mitigation. Maps have become more popular than ever before as a result of recent technological advancements; therefore, it is critical that young people have sufficient knowledge and skills to process the content of cartographic products [2]. The result showed that the majority of pupils (76.5%) have a moderate understanding of how to read maps. With a total score of 168, the majority of students correctly responded to the indicator of comprehending the location on the map. This is achievable because students, who are locals, already know where the location is on the map without having to read the maps. This is along with [11] assertion that people can instinctively assess a location well in daily life. The majority of students also accurately identified the symbols on a map (93,3%) and could determine the direction (93,9%). This is reasonable considering that the map's legend makes it simple to identify the symbol's name. This is consistent with [15] argument that map symbols are an important component because they provide the reader with accurate map information. If the location is right at the point where latitude and longitude meet, students can also locate the area using these coordinates (72,6%). Students at this level have not been able to determine the location by calculating the distance based on latitude and longitude. These aptitudes are not the major abilities for reading information on maps; rather, they are fundamental aptitudes for reading maps.

On the other hand, a large number of students provided inaccurate responses for the main ability to read disaster maps. The capacity of students to compare vulnerability information on disaster maps produced the most incorrect replies (3,9%). The color-coded symbols on the map did not enable students to determine which regions are more vulnerable to earthquakes (5,6%). Additionally, students have also struggled to recognize how the distances on the map compare (7,8%). Students also struggle to comprehend disaster management priorities based on the map's level of vulnerability. Therefore, to improve students' ability to read maps, appropriate learning strategies are required, one of which is cooperative-based learning [13].

Based on the results, it is known that students at this level are only able to read broad information on maps and can only read maps at a minimal level. The overall information being discussed is that which is described in the legend and other map data. Students, however, are not proficient at interpreting the data on the disaster map. This indicates that students' reading comprehension of the information on this disaster-themed map needs to be improved. Since the map allows students to locate earthquake information spatially, the information displayed on this disaster thematic map is a significant source of disaster information. The proper decisions in earthquake mitigation can be based on the knowledge of students who can read map information well. This skill contributes to the student's capacity to reduce the risk of earthquakes. The map used is paper-based, but this has no effect on students' ability to read maps and is mainly affected by students' learning styles [16].

Data analysis shows that gender (male or female) has no influence on one's ability to read maps. This is consistent with the findings of [10], who stated that gender has no effect on map reading ability. Despite the fact that males score higher than females on average, both genders' averages and test scores are nearly identical. However, the variation is insufficiently noteworthy. Therefore, there is no certainty that men or women will read disaster maps more effectively.

The capacity of students to read disaster maps is unaffected by age. The analysis's findings indicate that the low-age category has a lower average value than the medium-age category. The high-age group, however, does not perform any better than the middle age group. i.e., there is no steady improvement—for instance, map reading skills improve with age. The second explanation is that low ages are better at reading maps than medium and high ages due to other factors including the curriculum's design, which includes content on maps in the early years of schooling. This is along with [17] state that one effort that can be made to develop students' ability to read maps is through curriculum integration across material on subjects such as geography.

One of the districts of Klaten Regency with a high level of earthquake vulnerability is Bayat Subdistrict. The Bayat Subdistrict was among those that suffered significant damage during the occurrence of an earthquake in the year of 2006. It's probable that students in this area have been affected by the earthquake due to the region's characteristics. Students' exposure to disaster events may be the basis for developing their capacity for disaster risk reduction. The study's findings, however, indicate that disaster experience has little impact on students' ability to interpret disaster maps. This is understandable considering how infrequently map media, particularly themed maps, are used in classroom instruction. Thematic map media are still incredibly scarce in classrooms. Thematic maps are only shown in a limited way in the textbooks that students and teachers utilize. Students lack familiarity with this thematic map as a result. As a consequence, the availability of thematic maps and curriculum support is consistent with student's ability to interpret maps in schools. According to [18], attempts to enhance map reading skills should be integrated into the curriculum starting in elementary school.

4 Conclusion

Map reading proficiency among students comes into the medium range. Students can interpret basic types of thematic maps, such as symbols, directions, and locations. The ability to understand the information on the map, however, is still relatively limited. in order to get the conclusion that students' capacity to understand disaster information on maps is severely insufficient. According to statistical analyses, attributes such as gender, age, and prior earthquake experience did not significantly influence students' ability to understand themed disaster maps.

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