Edueksos: Jurnal Pendidikan Sosial dan Ekonomi

p-ISSN: 2252-9942 e-ISSN: 2548-5008
https://syekhnurjati.ac.id/jurnal/index.php/edueksos

Volume XII, Number 02,
December, 2023

GEOGRAPHICAL INQUIRY WITH GEOSPATIAL VIRTUAL PANORAMIC: CAN IMPROVE THE SPATIAL SKILLS OF GEOGRAPHY STUDENTS?

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Article History
Received:
19-06-2023
Revised:
19-08-2023
Accepted:
19-09-2023
Available online:
30-12-2023

ABSTRACT

Thinking spatial is essential for students to develop in geography learning. This is useful for students to analyze geosphere phenomena from a spatial perspective. The selection of a learning model is critical to develop students' abilities. However, the ability to think spatially in class XII IPS 2 MAN Kota Blitar is still low. A students' spatial thinking skills in the pre-cycle, namely 43.77. One of the reasons for this lack of spatial thinking skills is that teachers lack innovation in using instructional media and often use the lecture method. This research aims to improve learning and students' spatial thinking skills by applying the geographic inquiry model with the help of a virtual panoramic geospatial. The type of research used is Classroom Action Research (CAR), which is divided into two cycles with descriptive quantitative analysis. The results show that after applying the geographical inquiry model with the help of a panoramic virtual geospatial, the spatial thinking ability test score for cycle 1 was 64.76, and cycle 2 was 77.56. This indicates that students' spatial thinking skills always increase every cycle. Implementing the geographic inquiry model, assisted by a virtual panoramic geospatial, can help students better interpret a geographical phenomenon from a spatial perspective.

Keywords: Spatial thinking skills; Geographical Inquiry; Geospatial virtual panoramic.

ABSTRAK

Kemampuan berpikir spasial penting untuk dikembangkan siswa di dalam pembelajaran geografi. Hal tersebut berguna bagi siswa dalam menganalisis fenomena geosfer dari segi keruangan. Pemilihan suatu model pembelajaran sangat penting untuk mengembangkan kemampuan siswa. Namun nyatanya kemampuan berpikir spasial siswa kelas XII IPS 2 MAN Kota Blitar masih rendah. Hal tersebut diperkuat dengan nilai kemampuan berpikir spasial siswa pada pra siklus yakni 43,77. Kurangnya kemampuan berpikir spasial tersebut salah satunya disebabkan oleh guru kurang berinovasi dalam menggunakan media pembelajaran dan sering menggunakan metode ceramah. Tujuan dilaksanakan penelitian ini adalah memperbaiki pembelajaran dan meningkatkan kemampuan *berpikir spasial siswa dengan menerapkan model geographical inquiry berbantuan geospasial virtual panoramic. Adapun jenis penelitian ini yang digunakan yakni Penelitian Tindakan Kelas yang terbagi menjadi 2 siklus dengan analisis kuantitatif deskriptif. Hasil menunjukkan setelah diterapkannya model geographical inquiry berbantuan geospasial virtual panoramic, diperoleh nilai tes kemampuan berpikir spasial siklus 1 adalah 64,76 dan siklus 2 adalah 77,56. Hal tersebut mengindikasikan bahwa kemampuan berpikir spasial siswa setiap siklus selalu meningkat. Dengan diterapkannya model geographical inquiry berbantuan geospasial virtual panoramic dapat membantu siswa dalam meningkatkan kemampuan dalam menginterpretasikan sebuah fenomena geografis dari segi keruangan.*

Kata kunci: *Kemampuan Berpikir Spasial, Geographical Inquiry, Geospasial Virtual Panoramic*

A. INTRODUCTION

Geography learning has the characteristic that learning activities must be student-centered. Students should be able to develop geographic knowledge, attitudes, and skills. The learning atmosphere should be collaborative, interactive, and fun. Students develop analytical skills through assignments combined with the study of complex problems. Learning activities should utilize ICT and rich learning resources (Nofrion & Suasti, 2015). 1st-century geography learning is focused on identifying geosphere problems and asking geographic questions, obtaining information based on spatial data, and analyzing spatial data to solve spatial problems (Diansyah, 2018).

The ability to think spatially is one of the abilities students must have. The ability to think spatially is helpful for students in drawing conclusions and planning decisions from something simple to complex in terms of space and location (Setiawan, 2016). The ability to think spatial consists of three contexts, namely, life space (cognition in space), physical space (cognizes about space), and intellectual space (Cognition with space) (Lee & Bednarz, 2012). The knowledge that must be present in learning geography includes analyzing location and spatial distribution and explaining hierarchy and agglomeration (Béneker & Palings, 2017).

The ability to think spatially is closely related to geography learning. It is related to students' ability to study geographical objects in terms of spatiality. The ability to think spatially is finding a meaning of a shape, size, orientation, direction of location, process, or phenomenon (Oktavianto & Handoyo, 2017). The ability to think spatially refers to intellectual processes in geographical observation as a reference for social analysis (Claval, 2015). The ability to think spatially can be helpful to students in making decisions related to space (Rahayu, Handoyo, & Rosyida, 2022)

From the results of observations made in class XII social studies and interviews with geography teachers and students of grade XII social studies 2, a problem was the low ability of students to think spatially. The causes of the low ability of students' spatial thinking are as follows: (1) teachers in learning do not direct students to use high-level abilities; (2) teachers do not utilize geospatial technology in learning; and (3) Low student motivation because learning is not meaningful. Lack of motivation causes boredom it affects student competence (Putra, Islam, Sasmito, & Yusrotin, 2021). The ability of geography teachers is uneven in master geospatial technology, so they only rely on textbooks as the leading learning resource (Kurniawan, Eva, Dafip, & Sriyanto, 2011). To prove the description of the problem, the researcher tested the students' spatial thinking skills and obtained an average score of 43.77.

Based on these causes, several alternative solutions exist to overcome students' low spatial thinking skills. Because students are still not accustomed to using higher-order thinking skills in learning, it is necessary to apply learning models that actively develop spatial thinking skills. One appropriate model is the Geographical Inquiry Model. Geographical Inquiry is a project-based learning model for students to review and take appropriate action on the problem under study (Oberle, 2020). Geographical Inquiry allows students to study the characteristics and functions of the earth and the problems in it (Kidman, 2012). Geographical inquiry learning is a 21st-century Geography Education Road Map that focuses on practicing geographical thinking (Bednarz, Heffron, & Huynh, 2013). Geographical Inquiry is relevant for student learning because it can develop knowledge, skills, and motivation in geographical investigation (Favier & Schee, 2012).

Because the lack of use of geospatial technology is one of the causes of the lack of spatial thinking skills, it is necessary to use geospatial technology as a learning medium. Some of the right geospatial technologies for teaching are Google Maps and Open Data Blitar Regency. The reason for the selection is because the use of google maps and open data of Blitar Regency is easy to access by students. Geospatial virtual panoramic is helpful as a source of information in carrying out geographical inquiry learning steps. Using Google Maps can make it easier for students to observe the natural appearance of remote sensing results through students' smartphones during classroom learning. Using the open data website of Blitar district can also make it easier for students to find geospatial information, including morphology, land cover, altitude, and land capability. With the use of Geopatial Technology can make it easier to analyze geospatial information in the form of maps, charts or graphs and provide direct experience to explore the world (Baker et al., 2014)

Using technology in the classroom can improve the quality of the learning process. The learning paradigm shifted due to the development of science and technology in the 21st century (Putra, Sumarmi, Deffinika, & Islam, 2021). Using technology in learning makes transferring knowledge to students more accessible, practical, and interactive (Raja & Nagasubramani, 2018). Geography learning with geographic information system technology and smartphones has an effective and efficient impact. (Pollard & Hesslewood, 2015). Using Geographic Information Systems in inquiry-based learning appropriately combines discussion and geographical investigation (Favier & Schee, 2012).

The material in geography learning that emphasizes using spatial thinking skills is using maps, remote sensing, and GIS. In this material, students must be able to use maps, remote sensing, and GIS to analyze patterns, characteristics, and potential natural features. Applying a geographical inquiry model assisted by geospatial virtual panoramic will make it easier for students to develop spatial thinking skills on the material.

From the description above, researchers chose Classroom Action Research (CAR) which aims to improve and improve students' spatial thinking skills by applying a panoramic virtual geospatial assisted geographical inquiry model. In addition, the application can be used as a teacher again in developing an active, collaborative, and fun learning model.

B. RESEARCH METHOD

The research instrument consisted of group discussion sheets, observation sheets, field notes, and essay tests on spatial thinking skills. Quantitative data were obtained from tests of spatial thinking skills at the end of the learning cycle. Qualitative data in the form of observations during implementation and field notes. Spatial thinking ability test questions in the form of 7 essay questions made based on indicators of spatial thinking skills according to (Jo & Bednarz, 2011):

Table 1. Indicator of Spatial Thinking Skills

Indicator	Sub-Indicator	Questions Item
Concept of Space	Determine the location (*Location*)	1
	Identify the characteristics of the region (*Region*)	2
	Identify the pattern of a region (*Pattern*)	3
Representation	Visualize data in Maps (*Maps*)	4
Cognitive Process	Identify geographic phenomena (*Identify*)	5
	Analyze geographic phenomena (*Analyze*)	6
	Plan an idea (*Plan*)	7

The spatial thinking ability test instrument was tested for validity and reliability (≥ 0.60 and reliable). The validity test was carried out according to Pearson Moment Product Correlation (valid, sig 2-tailed) < 0.05).

The class action research design applies the geographical inquiry model with virtual panoramic geospatial media using a descriptive quantitative approach to data analysis. According to Kemmis and McTaggart, classroom action research consists of; (1) planning, implementing actions, (2) observing, (3) and reflecting in a spiral. Classroom action research aims to solve problems in learning that require concrete action as a process of capacity building and problem solving (Susilo, Chotimah, & Sari, 2011). The focus of the problem in this research is the low ability of students' spatial thinking in geography subject. Here are the instructional details:

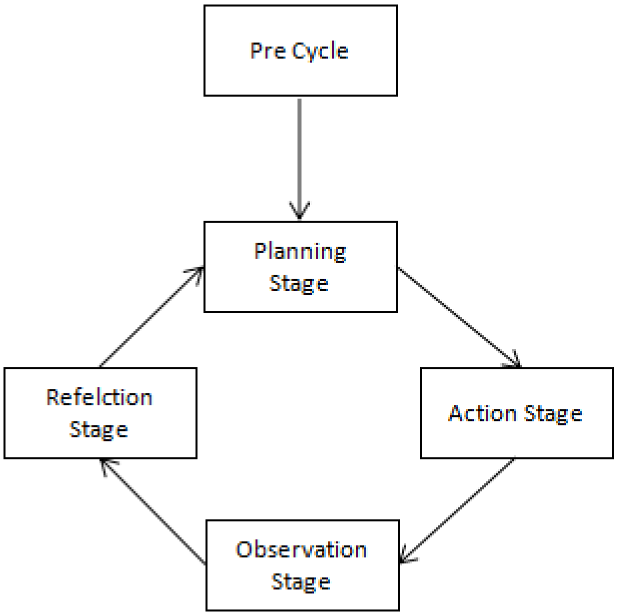

Figure 1. Classroom Action Research Pipeline

Pre-Cycle Stage

The pre-cycle stage aims to identify problems by conducting interviews with geography teachers and social science class-2 students. In addition, the researcher participated in observing the ongoing learning activities. At the pre-cycle stage, the researcher also gave pretest questions about students' spatial thinking skills to reinforce deficiencies in learning geography.

Planning Stage

This stage involves preparing a lesson plan, group worksheets, observation sheets, and field notes. The learning implementation plan is prepared based on the geography curriculum applied in the research location, and a learning implementation plan is prepared each cycle. Group worksheets are arranged based on geographical inquiry model steps with a geospatial virtual panoramic.

Action Stage

The enforcement stage refers to the instructional learning model of geographical Inquiry assisted by virtual panoramic geospatial. Students apply geographic inquiry learning steps according to (ESRI, 2003) with the help of group worksheets. Learning steps include asking geographic questions, acquiring geographic resources, exploring geographic data, analyzing geographic information, and acting on Geographical Knowledge.

Observation Stage

The observation stage includes recording all learning conditions on observation sheets and field notes and giving post-test questions on spatial thinking skills. Researchers and observers carry out observation activities for recording on observation sheets and field notes carried out by observers. Post-test questions are given at the end of each cycle which is intended to measure students' spatial thinking skills after applying the panoramic virtual geospatial assisted geographical inquiry model.

Reflection Stage

The reflection stage is carried out by researchers and geography teachers as observers by evaluating learning activities. Evaluation in the form of discussion of the advantages of the disadvantages of applying geospatial inquiry models assisted by geospatial virtual panoramic and learning improvements. In addition, at this stage, a decision is made to continue learning in the next cycle or stop the cycle based on the post-test value of spatial thinking skills at the end of learning.

Data analysis comparing the value of spatial thinking skills in pre-cycle cycle 1 with cycle 2. In addition, to see the increase in the value of spatial thinking ability is calculated by the formula:

$$\frac{Average\ Score\ \ Cycle\ 2 - Average\ Score\ Cycle\ 1}{Average\ Score\ Cycle\ 1} X\ 100\%$$

C. RESULTS AND DISCUSSION

RESULTS

Pre-Cycle Spatial Thinking Skills Test

The results of pre-cycle observations showed that students' spatial thinking skills were still low, and the average initial score of students' spatial thinking skills was only 43.77, significantly less than the KKM geography subject, which was 75. The following is the average score of students based on indicators of spatial thinking skills:

Table 2. Average of Pre-Cycle Spatial Thinking Skills Indicator Score

Indicator	Sub Indicator	Average Score of Pre-Cycle
Concept of Space	Location	5,11
	Region	4,00
	Pattern	3,94
Representation	Maps	8,50
Cognitive Process	Identify	7,56
	Analyze	6,72
	Plan	7,94

In the Location sub-indicator, an average is 5.11. The Region sub-indicator is 4.00. The Pattern sub-indicator is 3.94. The Maps sub-indicator is 8.50. Sub Indicator Identify is 7.56. Sub Indicator Analyze is 6.72. Plan Sub Indicator of 7.94

Post-Cycle Spatial Thinking Ability Test

The spatial thinking ability test after actions in cycles 1 and 2. The following is an explanation of the value of students' spatial thinking skills:

Table 3. Average Score Based on Spatial Thinking Ability Indicators of Cycle 1 and Cycle 2

Indicator	Sub Indicator	Cycle 1	Cycle 2
Concept of Space	Location	8,20	10,44
	Region	7,20	8
	Pattern	5,20	9,04
Representation	Maps	10,60	12,07
Cognitive Process	Identity	10,76	11,56
	Analyze	10,12	12,19
	Plan	12,68	14,26

Based on the table, there was an increase in values from cycle 1 to cycle 2 on all indicators of spatial thinking ability.

Table 4. Class and Individual Completeness Cycles 1 and 2

	Class Completeness	Individual Completeness	
	Class Average	Completed	Not Completed
Cycle 1	64,76	2	23
Cycle 2	77,56	19	8

Based on the table, improvements also occurred in aspects of individual completeness of spatial thinking skills. In cycle 1, there are only 2 students who complete. Then it increased to 19 students who completed in cycle 2.

Table 5. Enhancement of Students' Spatial Thinking Skills

Observation	Average of Spatial Thinking Skills	Enhancement	
		Score	%
Pre-Cycle	43,77	-	-

Cycle 1	64,76	20,99	32,41%
Cycle 2	77,56	12,80	19,77%

Based on the table, the average increase in the value of spatial thinking skills from precycle to cycle 1 was 20.99 or 32.41%. Furthermore, there was also an increase in cycle 2 of 12.80 or 19.77%.

Table 6. Enhancement Score of Spatial Thinking Skills by Indicator

Indicator	Sub-Indicator	Pre-Cycle To Cycle 1	Percentage (%)	Cycle 1 To Cycle 2	Percentage (%)
Concept of Space	Location	3,09	38	2,24	27
	Region	3,2	44	0,8	11
	Pattern	1,26	24	3,84	74
Representation	Maps	2,1	20	1,47	14
Cognitive Process	Identify	3,2	30	0,8	7
	Analyze	3,4	34	2,07	20
	Plan	4,74	37	1,58	12

Based on data analysis results, applying the Geographical Inquiry model assisted by Geospatial Virtual Panoramic can improve the spatial thinking skills of students 12 IPS MAN Kota Blitar.

DISCUSSION

The study began with observing and taking the initial value of students' spatial thinking skills. The observation was done by observing learning activities in class XII IPS 2 and conducting student and teacher interviews to get information. This is done to find out the actual conditions in the classroom. In addition, these activities are used to identify problems contained in learning. Based on observations, learning activities tend to be passive, and students pay less attention to learning. When teachers ask students to interpret images, students still cannot interpret the image of a natural feature. Based on interviews with several students, the usual lecture method often involves learning activities. The teacher has never directed students to develop students spatial thinking skills.

The average value of spatial thinking skills is still in the low category and has not met the Minimum Completeness Criteria. When viewed from each indicator of spatial thinking ability, the average score is also still low. Some factor that causes students' low spatial thinking skills is that students are not used to using spatial thinking skills in geography learning. In addition, the learning process is only fixed with the lecture method and is not directed to conduct scientific learning.

The geographical inquiry learning model is different from other inquiry models. This difference lies in the object of the study investigated, the conceptual framework underlying the investigation, and the type of questions asked (Harte & Reitano, 2016). The Geographical inquiry learning model emphasizes aspects of geography at each learning step. Geographical Inquiry can grow students' knowledge of geographical literacy by asking geographical questions, interpreting the information obtained, and drawing conclusions from the investigations (Özüdoğru & Demiralp, 2021).

The application of Geographical Inquiry can be combined with Geospatial virtual panoramic as a data source in the investigation process. Inquiry learning combined with Information and Communication Technology improves students' ability to conduct scientific research and collaboration skills (Kuisma, 2017). Using geospatial technology can develop students' spatial thinking skills through collecting, manipulating, analyzing, and displaying spatial information from locations in the real world (Harte, 2017).

Several factors influence the increase in scores that occur in cycle 1, (1) Students have begun to develop spatial thinking skills by applying each learning step, especially in the Acquire Geographic Resources and Explore Geographic Data steps which direct students to observe spatial data sources. (2) Students begin to get used to actively expressing thoughts and opinions in group discussions. This happens during the Analyze Geographic Information stage. Geographic analysis models integrated with Geographic Information Systems can develop knowledge in decision-making (Lü et al., 2019).

The increase in score on the spatial concept indicator occurred in the location, region, and pattern sub-indicators; cycles 1 and 2 increased. The increase is due to the time of learning. Students formulate geographical questions developed from the essential concepts of geography. Formulating geographical questions can help students study the position, distribution, object environment, facts and geographical perspectives (Özüdoğru & Demiralp, 2021). After that, students observe a panoramic virtual geospatial data source to answer questions developed from these geographically essential concepts. Students to properly and correctly understand spatial concepts such as location, region, and pattern.

Furthermore, improvements also occur in indicators using the representation tool (Maps). This is inseparable from using geospatial data sources google maps and open data Blitar Regency. To answer the formulation of questions that have been developed, students observe and investigate with the help of both data sources. This activity can train students to pull information from spatial data sources through images and maps. This follows research (Bodzin, 2011), which explains that using spatial information technology can improve students' understanding of land use change and spatial thinking skills related to remote sensing interpretation.

In the reasoning process indicator, there was an increase in three sub-indicators: Identity, Analyze, and Plan. The increase occurred because students carried out Explore

Geographic Data, Analyze Geographic Information, and Act Upon Geographic Knowledge in geographical Inquiry learning. Students explore data sources and identify and discuss groups to answer geographic questions. After that, students analyze the information obtained and come up with a conclusion from the entire investigation process. The conclusions that have been put forward result from students' geographical thinking during the Geographical inquiry activity. This is supported by the statement (Harte & Reitano, 2016) that the geographical inquiry process requires students' ability to identify, analyze and make conclusions.

Based on the data findings, the most significant increase occurred in the increase from Pre-cycle to cycle 1. This is also the case with each indicator. The significant increase is because the average score of students is meager in the pre-cycle or before the action. Moreover, in cycle 1, actions have been implemented. The subsequent data finding is that the indicator that has increased most significantly is the indicator of understanding the concept of space in the pattern sub-indicator. This is because students observe directly and identify spatial patterns of an area using Google Maps imagery.

Based on the findings of the first cycle of observations, students are still confused and often ask about how to carry out the steps of geographical Inquiry assisted by panoramic virtual geospatial. This is because students have never applied the learning model. However, after applying the second cycle, students can carry out the learning steps independently. This indicates that habituating the way of learning repeatedly makes students more independent in implementing learning. This aligns with the behavioristic theory proposed by Gabe and Berliner regarding changes in student behavior due to learning experiences (Rusli & Kholik, 2013).

When viewed from the increase in value, there is a significant increase from pre-cycle to cycle 1. However, most students' scores have not met the Minimum Completeness Criteria (KKM). The criteria have not been met because students are carrying out geographical inquiry learning activities assisted by virtual panoramic geospatial for the first time. This is the basis for improvement and application in cycle 2. It was found that after the implementation of cycle 2, most of the students' spatial thinking ability scores met the Minimum Completeness Criteria. This follows Classroom Action Research (Kamil, Utaya, & Utomo, 2019) that the low completeness in cycle one is caused by new students receiving treatment, so treatment must be carried out in cycle 2.

Overall the learning process in cycle 2 is more conducive and directed. This is because students already understand the learning steps when the first cycle is carried out. The student's experience in completing each step of the geographical inquiry model in cycle 1 makes students able to compete again in cycle two independently. This fact is in line with the constructivism theory in learning, which reveals that students' knowledge is not found but built by the individual himself, which is the result of experience (Sugrah, 2020). In addition, students look more fluent in working on group worksheets. Students are also more active in expressing opinions during group discussion activities.

The last stage of research is the reflection stage. The reflection stage is essential in Classroom Action Research because as a means for all parties to convey evaluations, criticisms, and suggestions regarding the actions taken (Kunlasomboon, Wongwanich, & Suwanmonkha, 2015). Based on the results of reflection with observers, learning activities by applying Geographical Inquiry assisted by geospatial virtual panoramic make students more active and independent and can develop students' spatial thinking skills. This follows research (Fitri, Rosyida, Putra, Wirahayu, & Selviana, 2022) that Geographical Inquiry is a new learning model developed to build geographic thinking skills.

Based on the reflection results with students, learning activities are more exciting and interactive because students can make observation activities through google maps and open data of Blitar Regency, and students can express opinions during learning activities. These results align with research (Tüzün, Hakan, 2009) explaining that geography learning that utilizes ICT can build student learning motivation. (Utami, Jihan Putri. Utaya, Sugeng. Wagistina, 2021) explained that learning using geographical Inquiry makes students more active and communicative and raises motivation in learning because learning is more interesting.

D. CONCLUSION

Based on the presentation of the results and discussion, the researcher concluded that applying the geographical inquiry model assisted by geospatial virtual panoramic can improve students' spatial thinking skills. This is evidenced by the increasing value of students' spatial thinking skills. By applying this learning model, students are more active and interactive in expressing opinions during group discussions. Students can recognize and interpret natural features in remote sensing images after trapping the Geographical Inquiry model assisted by Geospatial Virtual Panoramic.

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