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Application of Project Based Learning (PjBL) Assisted by *Google My Maps* on Students' Spatial Thinking Ability in Geography Learning Material Distribution of Natural Resources

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ABSTRACT

This study aims to determine the effect of the application of Project Based Learning (PjBL) learning model assisted by Google My Maps digital media on students' spatial thinking skills in learning geography on natural resource distribution material. The method used was quasi-experiment with post-test only control group design, involving two XI classes at SMAN 1 Jeruklegi, namely experimental class (using PjBL and Google My Maps) and control class (using conventional learning). Data were collected through multiple choice and essay tests that have been adjusted to the indicators of spatial thinking ability. The results showed that the average post-test score of the experimental group was higher (81.38) than the control group (73.33), with the majority of students in the experimental group in the "good" and "very good" categories (88.9%). This shows that the application of the PjBL model assisted by Google My Maps is effective in improving students' spatial thinking skills. The implications of this study recommend the use of project-based learning and digital technology as innovative teaching strategies in geography education.

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1. INTRODUCTION

21st century education requires students to have critical, creative, collaborative and communicative thinking skills. One important aspect in the development of these abilities is spatial thinking, which is the ability to understand, interpret, and analyze information related to the space and position of an object. This ability is especially important in subjects such as geography, math, and science. Geography is a field of study that helps humans understand their surroundings. This science continuously studies the earth and its contents, including physical and social aspects and the relationship between the two in the context of the environment[1].

This statement emphasizes that the core of Geography studies is the relationship between spaces (*spatial relations*). This view is supported by Sporck and Tulipe in Sumaatmadja (1981) who call Geography as a science that studies phenomena with a spatial approach. Geography subjects play a role in shaping the way students think about the relationship between the geosphere and social aspects in a particular region[2]. Thus, one of the learning objectives of Geography is to develop students' spatial thinking skills. This ability is important so that students can understand the concept of space which is the basis of Geography studies (Metoyer & Bednarz, 2017).

[1] (Oktavianto, 2017)
[2] (Sholeh, 2007)

Spatial thinking is the skill to analyze space relationships on the earth's surface[3] . This skill allows students to observe, analyze, explain, and make decisions related to matters related to location, direction, distance, and estimated travel time (Charcharos, Kokla, & Tomai, 2016). Therefore, spatial thinking skills are very important for students in living their daily lives. To support the ability to have spatial thinking skills, there needs to be student involvement and activity in learning activities. Learning activities according to Dimyati and Mudjiono in[4] is the activeness of students in learning activities to construct their own knowledge.

Learners are active in building an understanding of the problems and everything they face in the learning process. Every individual must learn to actively develop their potential, without learning activities the learning process is not interesting, students are required to always process and process the learning gains obtained by students. To bring up an interesting learning process, students must interact well in the learning process. One way to generate student learning activities and improve students' spatial thinking skills is by using learning models that can increase motivation and conducive learning activities and utilizing digital innovations as learning media.

Some learning models based on the synthetic approach are learning models that can increase student motivation to learn actively and be able to think critically. According to[5] there are three learning models that can increase student motivation and activeness in learning, namely; *Project Based Learning* Model, *Problem Based Learning* Model, *Discovery Learning* Model. According to[6] in his research with the title: "*The Effect of Project Based Learning on* Student Learning Activities in Geography Class XI IPS 1 SMA Bina Karya South Halmahera Regency" explains that the application of the Project Based Learning learning model can increase student learning activeness.

This can be seen from the comparison between cycle I and cycle II. In cycle I the percent value was 36.96 with fairly good criteria in cycle II the percent value was 65.00 with good criteria. While teacher activity in cycle I amounted to 80.00% with good criteria and in cycle II amounted to 98.00% with very good criteria. *Project Based Learning* Model, is a learning model that characterizes the implementation of the independent curriculum. The Merdeka Curriculum bases its approach on a more contextual, inclusive, and learner-centered educational paradigm (Agustina, 2018)[7] .

This approach emphasizes learning that accommodates students' individual needs and potential, and provides space for students' creativity and active participation in the learning process. In the active learning approach, students are invited to be directly involved in the learning process, both individually and in groups, with various activities that encourage understanding of concepts and application in real contexts. The project-based learning approach provides opportunities for students to learn and apply concepts and skills in the context of projects that are relevant to daily life.

Meanwhile, the learner-centered approach emphasizes the active role of students in constructing knowledge and building understanding through direct experience, reflection, and dialogue (Syah, 2019). *Project Based Learning* (PjBL) is a learning process that produces a project directly involving students. This learning model develops skills to solve a project that can produce something. In its implementation, this model provides ample opportunities for students to make decisions in choosing topics, conducting research, and completing a specific project[8] . The students work in a real way, as if they are in the real world that can produce real products.

Project-based learning (PjBL) is a learning model that requires students to solve a problem together in a particular group. The problems presented are usually authentic, in accordance with the curriculum and sometimes consist of various fields of study. In PjBL, students are required to follow certain steps in learning, known as syntax, to solve a given problem in detail. The stages in PjBL include (1) observation and questioning stage, (2) testing stage, (3) associating stage, (4) simplifying stage and (5) reconstruction stage. In addition to choosing the appropriate learning model, media utilization is also an important innovation in supporting the success of the learning process in the classroom.

Learning media plays a role in increasing students' learning motivation, stimulating creativity, and encouraging higher-level thinking skills (Muniadi, 2012). One of the geospatial technology innovations that can be utilized in learning is *Google My Maps*, a digital platform that focuses on mapping and map making (Kumala, 2020). *Google My Maps* allows users to add, change and store information in the form of location markers, lines, shapes, text, images and videos on the Google Maps base map with various elevation scales. Collaborative features are also available, allowing users to share and work together on map creation (Elliot, 2009).

It functions similarly to a Geographic Information System (GIS), helping students learn to create maps using geospatial data, but with simpler features. *Google My Maps* is also easily accessible by anyone who has a

[3] (Oktavianto, 2017)
[4] (Purbayanti et al., 2022)
[5] (Rinasari & Sriyanto, 2022)
[6] (Abu et al., 2023)
[7] (Tuerah & Tuerah, 2023)
[8] (Rusmiyati & Sriyanto, 2023)

link to the map project. By using this media, students are expected to be able to analyze and describe the condition of their area based on the material and learning objectives. Research that raises topics related to digital innovation media in relation to spatial thinking skills explains that the use of *Google Earth-based* learning media has a significant effect on students' spatial thinking skills.

This is proven by the results of the T-Test test which shows (.sig) <0.05, namely 0.000, supported by the results of the Gain test which shows the experimental class has a higher increase than the control class, which is 0.7 and 0, 43, so it can be said that the experimental class has an increase in spatial thinking ability which is classified as high[9]. Based on observations of conditions in the field related to the spatial thinking ability of geography students in learning Geography is still low. This condition can be known by researchers when observing students at SMAN 1 Jeruklegi, researchers saw several things that made students' skills low, namely, students were unable to show the location when the teacher provided a map of Indonesia.

For example, when the teacher asked learners to point to the name of the islands in Indonesia, most learners could not point correctly on the map. Learners have difficulty in describing the characteristics of a location on the map. third, learners cannot connect the effect of location on the characteristics of the region. for example, when the teacher explains the geographical, astronomical, and geological location of Indonesia, learners have not been able to explain the positive and negative impacts of Indonesia's location. Based on the background of the problem, we are interested in conducting experimental research on the application of the *Project Base Learning* model assisted by *Google My Maps* to students' thinking skills in learning geography material on natural resources.

2. LITERATURE REVIEW

2.1 Spatial Thinking Ability

Spatial thinking ability stems from the concept of "spatial intelligence" which was first introduced by Gardner in 1983. This intelligence is closely related to an individual's ability to think spatially. In general, spatial thinking refers to skills in understanding the meaning of the position or movement of objects, size, direction, shape, and phenomena or processes in space, including the relative position between objects or phenomena (Oktavianto, 2017). This ability includes understanding spatial relationships, such as recognizing spatial patterns and distributions, connecting geographically dispersed locations and phenomena, using the concept of spatial hierarchy, regionalizing, and skills in reading and creating maps based on verbal descriptions, including sketching, comparing maps, and overlaying and dissolving maps (Golledge & Stimson in Lee & Bednarz, 2009).

According to the NRC in Metoyer and Bednarz (2017), spatial thinking ability is a combination of cognitive skills arranged systematically, which includes understanding the concept of space, using representation tools, and applying reasoning processes. The concept of space is the basis of spatial knowledge (Metoyer, Bednarz, & Bednarz, 2015). Individuals with a good understanding of spatial concepts are able to solve spatial problems, find solutions, and provide appropriate answers. In this process, representation tools such as maps, diagrams, graphs, sketches, flowcharts, and models play an important role in identifying, describing, explaining, and conveying information related to spatial objects and relationships (Metoyer & Bednarz, 2017). Representation tools will be effective if users are able to apply the reasoning process.

In the Big Indonesian Dictionary, reasoning is defined as the ability to use logic and think rationally (Kalamu, 2018). Reasoning is the skill to think and understand logically, which is important in the learning process, especially when accepting, changing, or defending a belief or practice (Metoyer et al., 2015). These components contribute to measuring the level of students' spatial thinking ability. In Jo and Bednarz's (2009) modified taxonomy of spatial thinking skills, these skills are divided into three main components: spatial concepts, representation tools, and reasoning processes. The concept of space component consists of four subcategories, namely spatial primitives, simple-spatial, complex-spatial, and non-spatial. Representation tools include two subcategories, namely use and non-use.

Meanwhile, the reasoning process is described into three cognitive levels: input level, processing level, and output level. The three components form a unity that can be used to measure and identify the level of spatial thinking ability.

Table 1. Spatial thinking indicators

Indicator	Sub-indicator
Concept of Space *Tool representation Reasoning* process	*Region* *Spatial* Association *Map (Map)* Causal Relationship (*Stating Casualty*) *Invent*
	-

[9] (Santoso, 2022).

2.2 Project Based Learning (PjBL)

Project Based Learning (PjBL) is a learning process that produces a project directly involving students. This learning model develops skills to solve a project that can produce something. In its implementation, this model provides ample opportunities for students to make decisions in choosing topics, conducting research, and completing a specific project. The students work in a real way, as if they are in the real world that can produce real products. Project-based learning (PjBL) is a learning model that requires students to solve a problem together in a particular group.

The problems presented are usually authentic, in accordance with the curriculum and sometimes consist of various fields of study. In PjBL, students are required to follow certain steps in learning, known as syntax, to solve a given problem in detail. The stages in PjBL include (1) observation and questioning stage, (2) trial stage, (3) associating stage, (4) simplifying stage and (5) reconstruction stage. (Solomon B G 2003) in[10]. According to Suryaman in[11]

The syntax of the Project Based Learning learning model has six stages, namely; 1) determining fundamental questions (*start with essential questions)*, 2) designing project implementation (*design a plan for the project*), 3) preparing a schedule (*create a schedule*), 4) monitoring students and *the progress of the* project (*monitor the students and the progress of the project*), 5) testing the results (*assess the outcome*), and 6) evaluating *the* experience (*evaluate the experience*).

Simpler PjBL steps can also be summarized into the stages of gathering information from various sources, analyzing and synthesizing concepts based on the previous two steps. This shows that PjBL is a learning process that is pursued through a series of experiences. Therefore, this learning model can prepare students to construct their own knowledge through learning.

3. RESEARCH METHODS

This research used experimental method with quasi experimental model with *posttest only control group design.* The subjects of this research were students of class XI SMAN 1 Jeruklegi totaling 72 students consisting of 36 students in class XI F-1 as the experimental class and 36 students in class XI F-2 as the control class.

Table 2. Research Design

Subject	Treatment	Test
Experimental class	x	O_1
Control Class	-	O_2

Description:

$O_{(1}$ = Experimental class post-test results

$O_{(2}$ = Control class post-test result

X = Treatment of *Project Base learning* model *assisted by Google My*

\- = Control class treatment with generative learning model

Data collection techniques in this study used tests. Instruments in data collection in this study were obtained through summative questions in the form of multiple choice and essay for geography spatial thinking ability test. The data analysis technique used in this research is quantitative descriptive analysis by comparing the nature and distribution of data from the control group and the experimental group.

4. RESULTS AND DISCUSSIONS

4.1 Research Results

The research was conducted at SMAN 1 Jerulegi in the academic year 2024/2025 even semester in class XI with a package of geography elective subjects using the *Project Based Learning* model assisted by *Google My Maps* media in the experimental class, while the control class used conventional models and media. Both sample classes come from a population that is based on the daily test scores of the previous material, the results are homogeneous, so it can be ascertained that both have the same ability. The treatment given refers to the ability to think spatially on the material "Distribution of natural resources" which then measures the results through the final test.

The post-test of geography literacy skills was presented in the form of 20 multiple choice questions and 5 essay questions. All questions have been adapted to the indicators of spatial thinking skills, namely understanding the Region, Spatial Relationships, Causal Relationships and Finding. Experimental group learning

[10] (Rusmiyati & Sriyanto, 2023)

[11] (Soleh, 2021)

activities were carried out with a *project-based* learning model with the help of *google may maps.* The learning objectives that are expected to be achieved by students are, Students are able to make a map of the distribution of natural resources and are able to analyze the factors and potential of natural resources in the territory of Indonesia.

The *google may maps* platform in learning activities is used to help students make a digital natural resource distribution map. The implementation of the Project Based Learning model assisted by google may maps is carried out in the learning syntax as follows.

Table 3.

Syntax	Learner Activity
Start with essential questions	The teacher asks questions or problems relevant to the topic to be learned, which can motivate students to get involved. Learners respond by identifying questions related to natural resources.
design a plan for the project	Students together with the teacher design the **Cilacap Regency Natural Resources Distribution Map** project to be carried out, including objectives, methods, resources, and schedule.
create a schedule	Students create a project schedule, including deadlines and stages of work.
monitor the students and the progress of the project	Students work on the project according to the plan and schedule that has been made, starting with collecting data on the distribution of natural resources and supporting literature, followed by making maps on the *Google My Maps* platform and integrating data on the distribution of natural resources in the digita map.
assess the outcome	Students present the project results to the teacher and friends, and test the project results.
evaluate the experience	Students and teacher evaluate the process and results of the project, including reflection on the learning gained.

Based on the results of the post-test of spatial thinking ability, a description of the number of scores, average, highest and lowest scores is presented in Table 3.

Table 4. Post-test scores of spatial thinking ability

Post test score	Total	Average	Highest Score	Lowest Score
Experiment Group XI F-1	2930	81,38	98	54
Control Group XI F-2	2820	73,33	96	49

The difference in test results based on the number of scores, average scores, highest and lowest scores shows that the experimental class has better abilities than the control class. The difference in results is related to the difference in treatment given, especially in the experimental class using the Project Based Learning model assisted by *Google My Maps* media so that it can invite students to be more active, interested in learning the material, and train spatial thinking skills. In contrast to the control class that uses conventional models and media, students tend to be less active and feel bored in the learning process. The difference in students' spatial thinking ability between the experimental group and the control group is presented in more detail in the following table.

Table 5. Frequency Distribution of Posttest Values of Experimental Class

Value	Qualification	Post test	
		Frequency	Percentage (%)
85 - 100	Very good	15	41,7
70 - 84	Good	17	47,2
55 - 69	Simply	3	8,3
40 - 54	Less	1	2,8
< 39	Very Less	0	0,0

Table 4 presents the experimental class post-test scores showing students with very poor spatial thinking ability qualifications of 0%, totaling 0 students. Students with less qualifications amounted to 2.8%, totaling 1 student. Students with sufficient qualifications amounted to 8.3%, totaling 3 students. Students with good qualifications of 47.2% amounted to 17 students. Students with very good qualifications of 41.7% amounted to 15 students. This indicates that the spatial thinking ability of the experimental class is in good and very good qualifications, while there are no students with very poor spatial thinking ability qualifications.

Table 5. Frequency Distribution of Control Class Post-test Score

Value	Qualification	Post test	
		Frequency	Percentage (%)
85 - 100	Very good	13	36,1
70 - 84	Good	16	44,4
55 - 69	Simply	5	13,9
40 - 54	Less	2	5,6
< 39	Very Less	0	0

Table 5 displays the post-test scores of the control class showing students with very poor spatial thinking ability qualifications of 0% totaling 0 students. The percentage of students with less qualifications is 5.6% with a total of 2 students. The percentage of students with sufficient qualifications amounted to 13% with a total of 5 students. Students with good qualifications amounted to 44.4% totaling 16 students. Students with excellent qualifications amounted to 36.1% totaling 13 students. Based on this, it can be seen that the qualification of the spatial thinking ability of the control class is in the sufficient qualification, while there are no students who have very poor spatial thinking ability.

4.2 Discussion

Based on the post-test results of spatial thinking ability, there is a significant difference between the experimental group and the control group. The experimental group using the *Project Based Learning* (PjBL) learning model assisted by *Google My Maps* media obtained higher results than the control group using conventional learning. The average post-test score in the experimental group was 81.38 with the highest score of 98 and the lowest score of 54, while the control group obtained an average of 73.33 with the highest score of 96 and the lowest score of 49. This difference shows that the use of a project-based learning model supported by interactive media such as *Google My Maps* can increase student engagement and encourage the development of spatial thinking skills more effectively.

The frequency distribution of the scores also reinforces this finding. In the experimental group, the majority of students (88.9%) were in the "good" and "very good" categories, while in the control group the percentage was slightly lower (80.5%). In addition, the percentage of students in the "fair" and "poor" categories in the experimental group was much lower than the control group. No students in both groups were in the "very poor" category, but the percentage of students in the "poor" and "fair" categories was higher in the control group.

These results reflect that the technology-based PjBL model is able to create a more interesting and challenging learning atmosphere, and provides greater opportunities for students to develop higher order thinking skills, including spatial thinking. Meanwhile, conventional learning tends to be less able to generate students' interest in learning optimally, which has an impact on the low achievement of their spatial thinking skills. The results of this study are in accordance with Nurwahida Abu's research[12] which explains that the application of the Project Based Learning (PjBL) learning model can increase student learning activeness.

In line with this research[13] in his research entitled "Application of the Project-Based Learning Model to Improve the Learning Outcomes of Grade III Elementary School Students' Time Units" also explains that 1). The application of the Project Based Learning (PjBL) model can improve student learning outcomes and improve the learning implementation process. 2) Changes in behavior shown by students during the learning implementation process increased because they were able to solve problems, have collaboration skills, actively participate in class, have an attitude of cooperation, discipline, and responsibility.

The use of *Google May Maps* digital media can help students to better understand information related to the concepts of space, *region*, phenomena in space and relationships between regions. This is shown from the average post-test score on the experimental group shows that the spatial thinking ability of 41% students in the criteria Very good and 47% in good criteria. This is in line with other research on the use of digital media with the title "The Effect of *Google Earth* Learning Media on the Spatial Thinking Ability of High School Students" conducted by[14] , explaining that the use of *Google Earth-based* learning media has a significant effect on students' spatial thinking ability.

Thus, the application of innovative project-based learning models with the help of digital media such as *Google My Maps* is proven to have a positive impact on student learning outcomes, especially in developing

[12] (Abu et al., 2023)
[13] (Ramadhanti et al., 2023)
[14] (Santoso, 2022)

spatial thinking skills. The implication of this result can be a consideration for educators in designing learning strategies that are more contextual and interesting for students.

5. CONCLUSIONS

The Project Based Learning (PjBL) learning model assisted by *Google My Maps* media effectively improves students' spatial thinking skills. This is evidenced by the average post-test score of the experimental group (81.38) which is higher than the control group (73.33). The distribution of spatial thinking ability in the experimental group was more dominant in the "good" and "very good" categories (88.9%), while in the control group the percentage was lower (80.5%) and more students were in the "fair" and "less" categories. *Google My Maps* digital media is able to provide a more contextual and interactive learning experience, thus motivating students to be more active, understand the concept of space and territory, and increase participation in learning.

Future research can expand the scope of subjects and variables such as learning motivation, collaboration ability, and problem solving to examine more deeply the impact of project-based learning assisted by digital media. The application of digital learning media should be adjusted to the characteristics of students and learning materials, so that the benefits are more optimal and can improve various 21st century skills such as creativity, communication, collaboration, and critical thinking.

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