



## SPATIAL INTELLIGENCE AND GEOGRAPHIC SKILLS: REACT MODEL ON REGIONAL DEVELOPMENT AND GROWTH MATERIALS

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**Abstract:** The REACT model is constructive contextual learning that emphasizes the meaning of learning and the knowledge built in students' minds. This study aims to determine the effect of the REACT model on students' Spatial Intelligence and Geographic Skills. This research uses Quasy Experimental with Posttest Only Control Group Design. The subjects used in the study were students of class XII Social Sciences 2 as an experimental class and XII Social Sciences 3 as a control class at Senior High School 10 Malang in the academic year 2022/2023. Determination of the sample using purposive sampling technique with the consideration of having a middle school final exam score that is almost the same. The research instrument uses an essay test referring to geographic skills and spatial intelligence indicators. Data analysis used the Independent-Sample T Test and the Mann-Whitney U Test with a significance level of 0.05. The significance value of the Independent-Sample T-Test for spatial intelligence shows an effect of the REACT learning model on students' spatial intelligence with a value of 0.004 < 0.05, with the spatial concept indicator having the highest influence. In contrast, the reasoning process indicator has the most effect low. The significance value of the Mann-Whitney U test geographical skill test shows an impact of the REACT learning model on students' spatial intelligence with a value of 0.004 < 0.05, with the indicator answering geographical questions having the highest impact, while the indicator asking geographic questions has the highest influence the lowest

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## Introduction

Learning Geography studies all human and natural activities and their interactions through a spatial perspective. Human interaction with nature is complex and dynamic, which is interesting to study (Putra, 2022). Learning Geography emphasizes a unique way to research geosphere phenomena with various auxiliary sciences from a Geography perspective (Putra, 2022). Geography has a broad field of study with complex concepts (Putra et al., 2021). Geography as an intricate knowledge aims for students to understand spatial, environmental, and regional patterns and master essential skills in obtaining data and information, which are then communicated and applied in Geography knowledge (Schultz & DeMers, 2020). Studying Geography provides opportunities for students to develop their skills in facing global competition (Putra et

al., 2021). Thus, learning Geography requires spatial intelligence that can assist students in studying complex geosphere phenomena.

Geography learning contributes to developing spatial intelligence. The study of geographical phenomena, which includes comparisons, similarities, and differences, requires spatial intelligence to analyze environmental conditions between one space and another (Duarte et al., 2022). Spatial intelligence has three main components: concepts of space, tools of representation, and processes of reasoning (Ridha et al., 2020). With this ability, students will increase their perception and perspective in seeing geographic phenomena and recognize the potential and vulnerability of an environment in everyday life (Puttick & Cullinane, 2022). Learning activities such as problem-solving, analyzing locations, and looking for causal relationships, can help students improve spatial intelligence (Velázquez & Méndez, 2021). Spatial intelligence can construct knowledge about various environmental problems, so students must develop it (Putra et al., 2022). Spatial intelligence will grow faster if students master geographic knowledge of geosphere phenomena.

Students need geographical skills to understand the geosphere phenomenon with an environmental and regional approach from a spatial point of view. Through geographical skills, students understand the interrelationship of human life with the geosphere conditions and changes in space that continue to change from time to time (Yong Liu & Pásztor, 2022). Mastering geographic skills will improve the ability to ask geographic questions, search for geographic information, organize geographic data, analyze geographic information, answer geographic questions, and develop thinking skills to understand the earth and all human activities (Handoyo et al., 2017). Improving geographic skills requires appropriate learning models, which emphasize activities to find the linkage of geosphere phenomena; then, together, students will analyze a phenomenon that occurs. These learning activities are suitable to be applied so that students can observe patterns, associations, and regional spatial planning and make it easier for students to understand Geography learning.

Geography learning activities emphasize that students memorize what the teacher gives so that learning feels monotonous and focused on the teacher (Teacher Centered). Teacher-centered education makes students passive and results in students who get bored quickly in the Geography learning process (Florentina & Leonard, 2017; S. Rizal et al., 2022). Students who already feel bored need help to follow the lesson well, resulting in difficulty understanding the material (Hidayah et al., 2021). Students who need help understanding what has been learned lead to low academic results because students need the opportunity to develop thinking skills in learning Geography. Studying geography requires an appropriate and constructive learning model. One of the constructive learning models is the Relating, Experiencing, Applying, Cooperating, and Transferring (REACT) learning model. The five stages will indirectly improve students' science process skills.

The stages of the REACT model guide students in finding the concept of learning Geography. According to Crawford (2001), the five stages are (1) Relating, which is learning in the context of students' real-life experiences associated with the context of Geography material, (2) Experiencing, which is a strategy by learning through exploration, discovery, and problem-solving activities, (3) Applying, namely students learn by putting concepts to use, by providing realistic and relevant exercises, (4) Cooperating, guiding students to learn in the context of sharing, responding, and communicating with other learners, (5) Transferring, This is the last stage that guides students to apply the knowledge they have learned into new contexts or situations.

The REACT learning model has the advantage that this model has a gradual understanding strategy, from the basic understanding that appears at the Applying stage to in-depth understanding at the Transferring stage. This gradual understanding will help students improve their thinking skills (Aliman et al., 2019). They are learning geography by the REACT Model in its application. The REACT model is a generative learning model that emphasizes the meaning of learning and knowledge built in students' minds (Cahyaningrum & Febriana, 2019). The application of the REACT learning model guides students to find material concepts related to life around students, collaborates in problem-solving, and encourages students to learn using new knowledge (Aliman et al., 2019). Students will be motivated and able to develop geography thinking ability if in learning the teacher can create meaningful learning and encourage student understanding.

One geography subject matter that fits the REACT model is the material for regional development and growth. The development material contains human efforts to utilize the environment to meet the needs of life, which will gradually improve human welfare. The material for regional development and growth leads to understanding the spatial conditions of the surrounding area's growth. Studying the material for regional development and growth cannot be separated from the students' spatial intelligence and geographic skills. Therefore, studying the region's development and growth requires a constructive learning model based on the characteristics of the subject's geography.

Researchers solved two research questions in this study: RQ1: Does the REACT learning model affect spatial intelligence on regional development and growth materials?; RQ2: Does the REACT learning model affect geographic skills on regional development and growth materials? The following are the hypotheses of this study: RQ1: H0: The REACT learning model does not affect spatial intelligence on regional development and growth materials; H1: The REACT learning model affects spatial intelligence on regional development and growth materials. RQ2: H0: The REACT learning model does not affect geographic skills on regional development and growth materials; H1: The REACT learning model affect geographic skills on regional development and growth materials.

## Method

### *Research Design*

This research is quasi-experimental with a posttest-only control group design. This study used a control group and an experimental group. The experimental class received the REACT learning model treatment, while the control class received the conventional learning treatment. The control group here compares to the experimental group, which has been treated during the learning activities. The effect of the model on spatial intelligence and geography skills can be seen from the posttest scores

**Table 1. Research Design**

Group	Treatment	Posttest
Control	X	O
Experiment	-	O

Description:

X : SOLE Learning

- : Conventional Learning

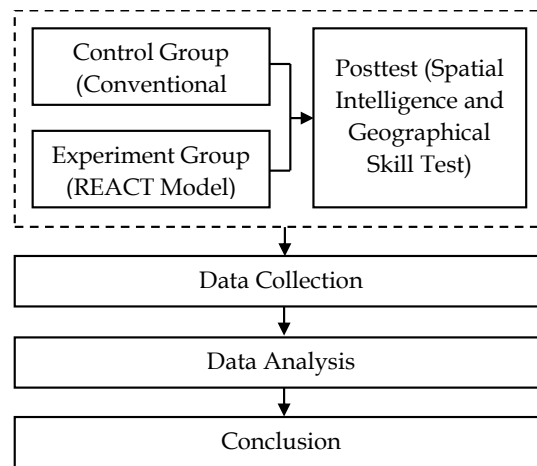
O. : Measurement of creative thinking skills and science

### *Research Subject*

The subjects were class XII Social Sciences Senior High School 10 Malang students in the academic year 2022/2023. Determination of the sample using purposive sampling technique with consideration of the average value of the Final School Examination, which is almost the same. The sample used is Class XII Social Sciences 2, with as many as 35 students with an average UAS score of 59.09 used as the experimental class, and XII Social Sciences 3, as many as 33 students with an average UAS score of 59.15 as the control class. The two classes have almost the same Final exam average score and have a minor difference.

### *Data Collection Procedure*

The data collection technique used in this study was an essay test to measure spatial intelligence and geographic skills. The research instrument uses written test questions by indicators of spatial intelligence and geographic skills. After the two classes had received treatment, the researcher gave a post-test to the students. Before the test, the researcher tested the validity and reliability of the instrument. The results of the validity of the instrument using the Pearson product-moment correlation test yield a significance score of  $0.00 < 0.05$  which means that the instrument is valid, while the results of the reliability of the instrument using the Cronbach's Alpha test produce a score of  $0.70 > 0.60$  which means that the instrument is reliable.



Picture 1. Research Flow

### Data Analysis Techniques

Data analysis used the Independent-Sample T-Test assisted by SPSS with a significance level of 0.05, which aims to determine the effect of the REACT model on geographic skills and spatial intelligence. Before testing the hypothesis. The prerequisite test of this analysis is using the normality and homogeneity tests. The results of the normality test using Kolmogorov-Smirnov on the spatial intelligence variable resulted in a score of  $0.054 > 0.050$  which means that the data distribution is normal while the geographical skill variable produces a score of  $0.02 < 0.05$  which means that the data distribution is not normal. The results of the homogeneity test using Levene's Test on the spatial intelligence variable resulted in a score of  $0.654 > 0.050$  which means that the data is homogeneous, while the geographic skills variable produces a score of  $0.479 < 0.05$  which means that the data is homogeneous. The spatial intelligence variable uses the Independent Sample T-Test because it fulfills the prerequisite test. In contrast, the geographical skills variable uses the Mann-Whitney U Test to substitute for the Independent-Sample T-Test because it has an abnormal data distribution.

### Result

The data presented are the research results conducted in the odd semester in August 2022 in the experimental and control classes. The researcher applies REACT four offline meetings. The experimental class is class XII Social Sciences 2, treated with the REACT model. At the same time, the control class is class XII Social Sciences 3, which uses conventional learning models through discussions, lectures, and assignments.

The data shows a comparison of spatial intelligence scores based on indicators, where the experimental group scored higher than the control group. All indicators in the experimental group have a high category, while the control group has a moderate and high category. The representation tool indicator has the highest value in the control and experimental groups, with 76.67 in control and 85.56 in the experimental groups.

**Table 2.** Results of Analysis of the Value of Spatial Intelligence Indicators

Spatial Intelligence Indicator	Control		Experiment	
	Mean	Category	Mean	Category
Concepts of Space	70,56	Enough	74,44	high
Tools of Representation	76,67	high	85,56	high
Processes of Reasoning	69,44	Enough	79,44	high
Average	72,22	Enough	79,81	high

Source: Research Data, 2022

**Table 3.** Results of Analysis of Geographic Skills Indicator Values

Geographic Skills Indicator	Control		Experiment	
	Mean	Category	Mean	Category
Asking Geographical Questions	68.89	Enough	72.22	Enough
Obtaining Geographic Information	71.11	Enough	82.22	high
Organizing Geographic Information	81.11	high	88.89	very high
Analyzing Geographic Information	78.89	high	91.11	very high
Answering Geographical Questions	73.33	high	84.44	high
Average	74.67	high	83.78	high

Source: Research Data, 2022

The results showed a comparison of geographic skill scores based on indicators, where the experimental group had a higher score than the control group. Indicators in the experimental group are dominated by high and very high categories, while moderate and high categories dominate the control group. The indicator governing geographic information is the indicator with the highest score in the control group, with a score of 78.89 Analyzing geographic information is the indicator with the highest score in the experimental group, with a value of 91.11.

**Table 4.** Independent-Sample T-Test Spatial Intelligence

Spatial Intelligence	<i>t-test for Equality of Means</i>
	Sig. (2-tailed)
<i>Equal variances assumed</i>	0,004
<i>Equal variances not assumed</i>	0,004

Source: Research Data, 2022

The significance value of the Independent-Sample T-Test of spatial intelligence shows an effect of the REACT learning model on students' spatial intelligence with a value of 0.004. It is said to be influential because it has a significance value of <0.05.

**Table 5.** Independent-Sample T-Test Spatial Intelligence Based on Indicator

Indicator	Mean		Sig. 2 tailed
	Control	Experiment	
Concepts of Space	70,56	74,44	0,019
Tools of Representation	76,67	85,56	0,052
Processes of Reasoning	69,44	79,44	0,104

Source: Research Data, 2022

The results showed the significant value of the Independent-Sample T-Test of spatial intelligence based on indicators. The concept of space has a strong influence with a significance value of  $0.019 < 0.05$ , while the reasoning process indicator has a low influence with a significance value of  $0.104 > 0.05$ .

**Table 6.** Mann-Whitney U Test Geographic Skills Test

	Geographic Skills
<i>Mann-Whitney U</i>	260,500
Sig. (2-tailed)	0,004

Source: Research Data, 2022

The data in the Table 5 shows the significant value of the Mann-Whitney U Test of geographic skills of 0.004, which indicates an effect of the REACT learning model on students' geographic skills because it has a significance value of  $<0.05$ .

**Table 7.** Mann-Whitney U Test Geographic Skills Test Based on Indicator

Indicator	Mean		Sig. 2 tailed
	Control	Experiment	
Asking Geographical Questions	68,89	72,22	0,614
Obtaining Geographic Information	71,11	82,22	0,039
Organizing Geographic Information	81,11	88,89	0,091
Analyzing Geographic Information	78,89	91,11	0,023
Answering Geographical Questions	73,33	84,44	0,014

Source: Research Data, 2022

The results of the significant value of the Mann-Whitney U Test of geographic skills showed that the indicator of answering geographic questions had a strong influence with a significance value of  $0.014 < 0.05$ , while the indicator of asking geographic questions had a low influence with a significance value of  $0.614 > 0.05$ .

## Discussion

The Relating, Experiencing, Applying, Cooperating, and Transferring (REACT) learning model is a contextual-based learning development that aims to improve students' understanding. The REACT learning model helps teachers to instill concepts in students (Putri et al., 2019). This model applies the concept of generative learning that connects experience and knowledge and makes it easier for students to learn complex geography material (Putra et al., 2022). This model has the advantage of building a gradual understanding starting from relating. At this stage, expect a basic understanding to have emerged; students can build concepts related to the material and in-depth understanding up to the transfer stage (Cahyaningrum & Febriana, 2019).

The REACT learning step in the first stage is Relating. Learning activities at the Relating stage, where the teacher connects concepts with students' prior knowledge (Nurhasanah & Luritawaty, 2021). The teacher at the Relating stage provides explanations and questions about the relationship between the material to be studied and the daily experiences of students (Cahyaningrum & Febriana, 2019). The linking stage will give students an understanding of concepts so that their initial knowledge will make it easier for them to obtain new information (Widada et al., 2019).

Learning activities at the Experiencing stage are students learning through discovery and problem-solving activities (Widada et al., 2019). Students need problem-solving skills to produce significant knowledge (Wirahayu et al., 2018). The Experiencing stage provides knowledge when students explore through the internet and Google Earth the area around them, especially the Sawojajar area. Students will look for land use changes in the Sawojajar area over the last ten years resulting from regional development and growth. Using Google Earth as an internet technology can make learning easier for students (Putra et al., 2022). Experiencing learning activities increase students' understanding of the causal relationship of a phenomenon, making students look for solutions to the problems that occur so that students can integrate the results into information that can be a reference in solving a problem (Aslan, 2021). The Experiencing stage attracts students' interest and is by the learning style of the current digital generation (Prasetyo et al., 2021).

The next REACT learning activity is Applying. The application of Applying stage is when students learn by applying the concepts learned by providing relevant exercises (Asfar et al., 2018). After explaining the material, the teacher presented several problems related to regional development and growth in Surabaya, Malang, and Batu. The teacher instructs students to search for literature via the internet regarding the causes and consequences of a problem, then look for solutions to the problems that occur. This learning activity will combine knowledge with its usefulness, thus encouraging students to understand a concept that shows benefits (utility) in life (Puttick & Cullinane, 2022).

The fourth stage in REACT learning is Cooperating. This activity begins with the formation of six study groups, and the teacher provides student worksheets to facilitate



students in the learning process. Students in the Cooperating stage learn in group interactions to share knowledge, provide feedback, and describe regional growth factors (Hidayanti et al., 2019). This stage encourages students' curiosity by asking questions and learning practically (Putra 2022). Learning in the context of sharing, responding, and communicating helps students understand the concept of regional development and growth (Lefrida, 2014). Students enter the discussion results into PowerPoint Text as material for further learning activities.

Finally, the stage in REACT learning is Transferring. This stage continues the previous learning activities, where students learn by applying their knowledge in a new context (Budiman et al., 2020). This stage helps students increase their self-confidence and guides students to gain a learning experience (Nisyah et al., 2022). At the transferring stage, students in groups can present the discussion results in front of the class. The other group will give rebuttals, suggestions, and questions to the presenting group. At the end of the learning session, the teacher gives an evaluation, and students reflect on the learning activities. This activity represents the knowledge gained during the learning process (Putra et al., 2021).

### *The Effect of REACT Learning Model on Spatial Intelligence*

Geography learning activities using the REACT model affect students' spatial intelligence. Learning Geography by applying the REACT model has a positive impact on increasing students' spatial intelligence. The experimental group's spatial intelligence average was 79.81, which was higher than the control group's average value of 72.22, which proves that the experimental group with the REACT learning model has a higher average value of spatial intelligence than the control group using the conventional model in their learning activities. Therefore, learning geography recommends the REACT learning model to improve students' spatial intelligence.

The series of learning activities in the REACT model affect students' spatial intelligence. The activities in the Relating step train students to understand the causal relationship of a phenomenon. The teacher requires students to answer questions about regional development and growth materials. The concept of space is the indicator with the most decisive influence on spatial intelligence with a significant Independent-Sample T-Test of 0.019, which means this activity can grow indicators of the concept of space in spatial intelligence. With Related learning activities, students can identify the location of urban areas so that students can find relationships, both city problems and the benefits of the city to the surrounding area. Looking for a link between a phenomenon will foster students' spatial understanding of the location and the relationship between a phenomenon that occurs (Urfan, 2017). Kusumaningsih (2019) states that the Relating stage can help students build new knowledge and grow student's perspectives on the spatial dimensions of the region.

Experiencing and Applying learning activities can train students' spatial intelligence in understanding the spatial conditions of the area around them. In learning

activities, students look for geographic information about an area and represent the exploration results. This activity helps students gain a clear understanding of regional growth. After students get geographic information, they present it in tabular form, making it easier to understand. The ability of representation helps the process of perfecting students' understanding of spatial conditions in an area (Yang Liu et al., 2022). Fitri (2017) states that exploration and representation activities are essential as communication tools and thinking tools. Thus, using a representation tool, students better understand learning related to regional growth and make it easier to reflect on learning.

The Cooperating process in REACT learning can effectively develop spatial intelligence regarding students' reasoning concepts. By working together in group discussions, students will learn and exchange opinions in studying regional growth factors in terms of physical, social, and economic conditions or supporting facilities in supporting regional growth. Working together will improve students' reasoning processes in explaining the factors that influence growth and provide solutions to problems. Yusuf and Andariana (2022) opinion states that the working process will allow students to explore and share knowledge. Students will help each other in explaining and finding solutions to a problem. However, the reasoning process indicator has the lowest result from other indicators, with a significance value of 0.104. Only some students are active in discussions, students need to have a high curiosity which causes students to carry out open discussions without arguments, and students' passiveness to seek and find themselves causes students who are less active in the discussion process to have difficulty understanding the material for regional growth.

### *The Effect of REACT Learning Model on Geographic Skills*

Geography learning activities using the REACT model affect students' geographic skills. Learning Geography by applying the REACT model has a positive impact on improving students' geographic skills. The average value of geographical skills in the experimental group was 83.78, higher than the control group, with an average value of 74.67, proving that the experimental group with the REACT learning model has a higher average skill score than the control group using the conventional model in learning activities. Therefore, the learning activity of the REACT learning model in geography learning can develop students' geography skills.

The series of learning activities in the REACT model affect students' geographic skills. Activities in the Relating step train students to ask and answer questions related to learning materials. In the connecting activity, the teacher asks students to write down questions about the growth of the area around them, then the students and the teacher together answer the questions written by the students. Asking is needed by students as a way of gathering information to grow students' understanding of regional growth material. Kayseroglu and Samur (2018) stated that to have a positive effect on growing students' understanding, Asking questions will form curiosity into new knowledge that

stimulates cognitive processes and becomes the basis for solving regional growth problems. Asking students is required to collect student information in regional growth materials. Therefore, asking and answering questions is an inseparable part of the Geography learning process (Lewis & Fan, 2019). However, the indicator asking questions has the lowest result from other indicators, with a significance value of 0.614, because students need help understanding information related to geography, thus preventing students from asking geographical questions.

Problem-solving activities with exploration through the internet in REACT learning can affect indicators of obtaining and managing geographic information. In the learning process, the teacher provides several regional growth problems; Then, students look for the cause and effect of a problem. Furthermore, from the information obtained, students will process the information to solve problems. This learning activity will improve students' skills in finding and managing geographic information in an area. Looking for geographic information by utilizing the internet will deliver information to students' mindsets in understanding causal relationships with regional growth problems (Lavasani & Khandan, 2020). Utilizing the internet as a learning resource technology can make it easier for students to analyze regional development planning materials (Syah Rizal & Syaibana, 2022). Therefore, by searching and processing information, students can build a causal relationship with a phenomenon by manipulating the virtual environment as a contextual learning environment (Putra et al., 2022), trying to come up with a solution by predicting possible consequences (Yiğit Özüdoğru & Demiralp, 2021).

The collaborative learning process and presentation on the REACT model can effectively develop students' ability to analyze and answer geographical questions. By working together in group discussions, students will learn to analyze problems by exchanging opinions as an active learning strategy, which will indirectly grow students' ability to analyze information on regional growth factors (Golightly, 2021). In the next activity, students present in groups to convey the discussion results. Other students will provide responses, suggestions, and questions to the group that makes the presentation. This activity will train students to answer geography questions (Putra et al., 2021). Indicators answering questions on geographic skills are the most significant indicators of geographic skills. The results show a significance value of 0.014 because students already understand the concepts related to regional growth factors, making it easier to answer the questions asked.

## Conclusion

The REACT learning model influences students' spatial intelligence and geographical skills in the development and growth of the region. The significance value of the Independent-Sample T-Test for spatial intelligence shows an effect of the REACT learning model on students' spatial intelligence with a value of 0.004 < 0.05 with spatial

concept indicators having a strong influence with a significance value of  $0.019 < 0.05$  whereas, the indicator of the reasoning process has a low effect with a significance value of  $0.104 > 0.05$ . The significance value of the Mann-Whitney U test in geographical skill test shows an influence of the REACT learning model on students' spatial intelligence with a value of  $0.004 < 0.05$ , with indicators answering geographical questions having a strong effect with a significance value of  $0.014 < 0.05$ . In contrast, indicators asking geographical questions have a low influence, with a significance value of  $0.614 > 0.05$ . The researcher recommends the REACT learning model as a variation of the model in geography learning, especially in the development and regional growth material. However, in its application, the REACT learning model requires a long time to carry out all stages fully. All stages starting from Relating to Transferring must be carried out sequentially so that students can build an understanding of development materials and regional growth.

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