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APPLICATION OF SPATIAL BASED LEARNING MODEL TO IMPROVE GEOGRAPHIC SKILLS AND DISASTER LITERACY IN HIGH SCHOOL STUDENTS

Annisa Rahmawati Ayuningtyas[1], Listyo Yudha Irawan[2]
[1,2] Geography Departement, Universitas Negeri Malang, Indonesia

Abstract

The importance of geographical skills and disaster literacy for high school students can be addressed through the application of a spatial-based learning model to support quality education. This study aims to enhance the geographical skills and disaster literacy of high school students by implementing the spatial-based learning model. The research employed a classroom action research method with 36 students from Grade XI IPS 1 as subjects. Data were collected through pretests and posttests to measure improvements in students' abilities. The findings showed a significant increase in the average scores, from 62.25 in the pre-cycle to 68.61 in Cycle I and 78.89 in Cycle II. The increase was also shown by the number of students who met the KKM score of 78% or more than half of the total students in the class. The study concludes that the spatial-based learning model is effective in improving geographical skills and disaster literacy and can serve as an interactive and contextually relevant alternative for geography learning, contributing to the overall enhancement of educational quality.

Keywords: *Spatial based learning, Geographic skills, Disaster Literacy*

* Correspondence Address:	annisa.rahmawati.2107216@students.um.ac.id

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INTRODUCTION | مقدمة

Geography is a science that studies the surface of the earth and all the phenomena that occur on it. Understanding geography involves knowledge of space and time on earth (Alvia, 2024). A good understanding of geography is very important for students in understanding the surrounding environment and social phenomena that occur in society (Marissa et al., 2024). In the era of globalization, understanding geography is a crucial factor in preparing young people who are ready to face global challenges, such as resource management, sustainable development planning, and understanding of disasters (Ekowati et al., 2022). It is important for students to know the basic concepts of geography in developing geographical thinking skills (Hidayanti et al., 2019).

Geographical skills are one of the essential abilities for students to have as a provision in understanding the natural conditions around them. Geographic skills can be defined as the ability to use and analyze spatial information to understand the world around us (Asiyah et al., 2020). Geographical skills have an important role in equipping students with the ability to analyze, interpret, and respond to spatial patterns and processes that are happening in the surrounding environment (Irawan et al., 2021). These skills include various competencies, such as reading and interpreting maps to understanding complex environmental systems and human interactions

with the environment (Rahmah, 2023). The indicators of geographical skills, according to the Geography Education National Implementation Project (GENIP, 2012), include: (1) Formulating geographical questions; (2) Acquiring geographical information; (3) Organizing geographical information; (4) Analyzing geographical information; and (5) Communicating information. By enhancing geographical skills, students can better navigate and address pressing global issues in the 21st century (Pamuk, 2023).

Disaster literacy is an ability that must be possessed by every individual in facing the risks and threats of natural disasters. This ability is important amidst the increasing frequency and intensity of disasters that are prone to occur due to climate change and environmental exploitation (Çalışkan & Üner, 2021). The importance of understanding disasters should start early, especially in the school environment as an awareness effort in dealing with disasters that can occur at unpredictable times (Yildiz et al., 2024). There are 3 indicators of disaster literacy in education according to Chung & Yen (2016), namely: (1) Knowledge; (2) Attitude; and (3) Behavior. (Hamid et al., 2021). In this case, students need to understand disaster risks by developing effective ways to mitigate and respond to disasters (Nikmah et al., 2020). Disaster literacy not only focuses on knowledge related to types of disasters, but the importance of understanding preventive measures, evacuation procedures and post-disaster recovery (Ariani, 2021). Therefore, it is hoped that students can become agents of change in creating a society that is more responsive and ready to face future disaster challenges.

Spatial based learning is a learning model that directs students to have the ability to think about geographic phenomena that occur on the earth's surface. This learning model invites students to understand the relationship between objects, locations, and phenomena on the earth's surface through the use of maps, images and other geospatial technologies (Alhidayah, 2022). Spatial-based learning is an approach that emphasizes understanding and analyzing the concept of space in the learning process so that it can develop spatial critical thinking skills (Manek et al., 2019). In addition, spatial based learning not only improves students' ability to interpret geographic data, but also helps in dealing with the impact of environmental change on human life through spatial understanding (Manek, 2023). By applying spatial based learning model in learning, students can more effectively link theory with real context so that they are able to apply geography knowledge in various situations in daily life and be wiser in making decisions related to environmental issues.

The implementation of Spatial based learning model in an effort to improve geography skills and disaster literacy can be applied during classroom learning. Spatial thinking skills and disaster literacy have an important role in understanding geography and facing environmental challenges (Asep & Novio, 2024). However, not all learning approaches integrate these two aspects effectively so that the spatial based learning model can be an alternative in learning. With this approach, students are trained to understand and analyze geographical phenomena and spatial patterns related to the risks and impacts of disasters that can occur (Setyowati et al., 2020). The spatial based learning model allows students to develop spatial thinking skills that are linked to the ability to identify disaster-prone areas and develop appropriate mitigation actions (Hidayah & Wagistina, 2023). The linkage of geographical skills and disaster literacy with the spatial based learning model can improve geographical understanding in preparing students who are more responsive and ready to face various types of disasters through an understanding of the relationship between location, environment and human activities.

Education in schools plays a crucial role in developing students' spatial abilities through the implementation of relevant learning models. However, school approaches often rely on

conventional methods that tend to overlook spatial thinking skills, such as map interpretation, geospatial data analysis, and understanding spatial relationships (McLaughlin & Bailey, 2023). This situation is exacerbated by limited resources, including a lack of practice-based learning materials that support students' spatial abilities, particularly in identifying and analyzing disaster-prone areas (Wahyuningtyas et al., 2020). These limitations negatively impact students' understanding of spatial concepts and geographic patterns, leaving them less prepared to respond to disaster situations that require mastery of spatial concepts (Kasmiati et al., 2023).

This study provides a novel approach to classroom learning by linking the variables of geographical skills and disaster literacy through the implementation of a spatial-based learning model. Unlike the previous research conducted by Ridha et al. (2019), which utilized the geographical skills variable without applying the spatial-based learning model or including the disaster literacy variable, this study places a stronger emphasis on spatial thinking skills. Furthermore, the research conducted by Kamil et al. (2020) focused solely on the disaster literacy variable as a competency students should possess. Similarly, the study by Pambudi & Masruroh (2023) employed a spatial-based learning model but concentrated on student learning outcomes, differing from this research, which focuses on the variables of geographical skills and disaster literacy. These prior studies highlight the need for further research to develop innovative learning approaches that can provide diverse solutions to classroom challenges.

The limited implementation of teaching methods that support geographical skills and the low level of students' disaster literacy are reflected in their poor understanding of geographical concepts and lack of awareness about disaster risks. Many schools have yet to utilize geospatial tools such as digital maps, satellite imagery, and disaster simulations that help students connect theoretical knowledge with real-world situations (Sebillo et al., 2020). Consequently, students are often unprepared to face disaster situations, further exacerbated by the lack of integration of disaster-related material into the curriculum and insufficient supporting facilities (Wang et al., 2023). Therefore, there is a need for innovative, more interactive teaching methods based on spatial realities to enable students to better understand disaster risk phenomena through concrete spatial comprehension (Deng & Li, 2020).

This study was conducted in response to the real challenges faced by Grade XI Social Science students at SMA Negeri 1 Lawang, where limitations in learning methods have resulted in low geographical skills and disaster literacy. To address this issue, the spatial-based learning model was implemented to improve these competencies. Based on the observed conditions of the students in Grade XI Social Science at SMA Negeri 1 Lawang, the objective of this research was formulated: to enhance students' geographical skills and disaster literacy through the application of the spatial-based learning model. It is hoped that the findings of this study will demonstrate improvements in student learning outcomes, paving the way for more effective teaching strategies in the future.

METHOD | منهج

Research Design

This research is a type of classroom action research with two cycles. This type of classroom action research is conducted by teachers or educators with the aim of improving or enhancing the learning process in the classroom (Azizah, 2021). Classroom action research aims to solve problems that arise in learning through certain actions which then evaluate its success (Haerullah & Hasan, 2021). This method allows teachers to become researchers in their own classrooms to better understand learning and make decisions based on the data obtained (Sukardi, 2022).

Data were collected through pretest and posttest assessments. The research instrument consisted of essay questions, comprising eight items—five questions designed to measure geographical skills and three questions to assess students' disaster literacy. The development of these questions was aligned with the indicators measured in this study. The instrument underwent reliability and validity testing, ensuring that the questions were appropriate for use with students. The test was conducted with Grade XI IPS 2, as they had completed the material on Natural Disaster Mitigation, making them suitable for the instrument feasibility test.

The data analysis technique used is descriptive analysis which aims to describe the results of pretest-posttest data in more detail. The data collected from each cycle is analyzed to see the improvement of students' abilities and the effectiveness of the actions that have been implemented. The results of the analysis can be used as a reflection to determine the actions to be taken in the next cycle. This research process is repeated until the expected improvement in learning quality is achieved, especially in improving students' geographical skills and disaster literacy.

This research was conducted at SMA Negeri 1 Lawang, which is located at Jalan Madukoro, Lawang District, Malang Regency, East Java. The selection of this research location was based on the results of observations during the Teaching Assistance (AM) program which was carried out during February-June. The subjects in this study were XI IPS 1 class consisting of 36 students.

In this research, Kurt Lewin's approach is applied to explore the potential of Spatial-based Learning (SBL) in improving geographical skills and disaster literacy in high school students. Kurt Lewin's research method is known as action research with a systematic approach to improving the quality of learning in the classroom (Saraswati, 2021). The following are the stages in the Kurt Lewin method.

1. Planning

   At this stage, the teacher plans the actions that will be applied to overcome problems or improve the quality of learning. The planning includes evaluating previous learning outcomes, preparing research instruments, and preparing materials to be applied. This stage is organized based on the syntax of the spatial based learning model (Handoyo & Purwanto, 2016). The 8 syntaxes of spatial based learning include: (1) Spatial orientation and mapping; (2) Identification and formulation of spatial problems; (3) Collection of spatial data; (4) Organization of spatial data; (5) Analysis of spatial data; (6) Conclusion; (7) Communication; and (8) Reflection.

2. Action

   This stage is used as the implementation of previously planned actions. Teachers or researchers implement actions that are expected to overcome problems or improve learning.

3. Observation

   The teacher or researcher observes the impact of the actions that have been implemented. Observation is used to monitor student activity and learning effectiveness.

4. Reflection

   This stage is the last stage in one research cycle. Teachers or researchers reflect on the results obtained from the planning process until the observation is completed. This cycle can be repeated until it reaches the expected target with a minimum number of 2 cycles for each study.

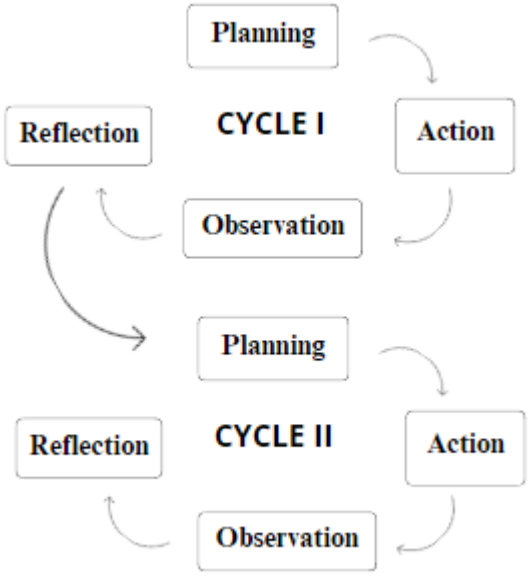

Figure 1. Kurt Lewin Model Classroom Action Research Cycle

The diagram above illustrates the flow of classroom action research based on the Kurt Lewin model. This cycle is repeated until the learning objectives are achieved as expected by the teacher or researcher. The results of classroom action research not only have a positive impact on the quality of learning, but also provide new insights into student needs and effective teaching methods (Hidayati et al., 2023).

RESULT | نتائج

This research was conducted at SMA Negeri 1 Lawang for about 2 weeks or in the period from April 23 to May 7 (4 meetings). The subject of this research is class XI IPS 1 which consists of 36 students with 22 female students and 14 male students. The class was chosen based on observations that have been made during teaching at SMA Negeri 1 Lawang. Data in this study were taken through pretest-posttest assessments that have been designed with questions that have been prepared according to indicators of geography skills and disaster literacy. The following is the average score of XI IPS 1 class after going through all the planned actions.

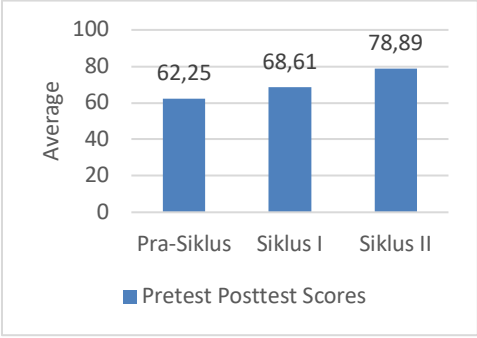

Figure 2. Average Score of Geographical Skills and Disaster Literacy

The graph above shows an increase from each cycle applied. In the pre-cycle, the average score was 62.25. While in cycle I showed an increase in the average value of 68.61. Then, in cycle II there was an increase of 78.89. This shows that the treatment or action given is appropriate so that there is an increase in each cycle. In addition, these results also support researchers to suffice research in cycle II because the average value has increased and is in accordance with the

Minimum Completeness Criteria (KKM) at SMA Negeri 1 Lawang. The increase in the average score of students experienced a percentage increase which is shown in the following table.

Table 1. Improved Geographic Skills and Disaster Literacy

Stages	Average Score	Improved	Percentage Increase
Pre-Cycle	62,25	-	-
Cycle I	68,61	6,36	10,21%
Cycle II	78,89	10,28	14,98%

Based on table 1, it can be observed that there is an increase in each stage or cycle. At the pre-cycle stage towards cycle I there was an increase in scores of 6.36 or 10.21%. Then, cycle I to cycle II there was an increase in value of 10.28 or 14.98%. The increase occurred because the completeness of student scores increased as in the following table.

Table 2. Improved Geographic Skills and Disaster Literacy

Minimum Completion Criteria (75)	Class Completeness		Individual Completeness	
	Class Average	Criteria	Completed Students	Students who Did Not Complete
Cycle I	68,61	KKM	3	33
Cycle II	78,89	KKM	28	8

Table 2 shows the increase in student completeness scores, both from class completeness scores and individual student completeness. In cycle I, the class average score was 68.61 with 3 students who were complete and 33 students who were not complete. Then, cycle II showed a class average of 78.89 with 28 students and 8 students who were complete. These results are in accordance with the research objectives that have been prepared by researchers. The number of students who meet the KKM is more than the number of students who do not meet 78% or more than half of the students in the class.

DISCUSSION | مناقشة

The results of this study show that the application of spatial based learning model can significantly improve students' geographical skills and disaster literacy. This is due to the more contextual and spatial-based learning approach, which allows students to understand the material in the context of real life (Lee et al., 2022). This model encourages students to be more active in identifying, analyzing, and solving geographical problems that will be faced in the future (Silviarza et al., 2020). Thus, students not only develop academic skills but also preparedness in dealing with disaster situations in their environment.

The successful implementation of spatial based learning model is inseparable from the preparation of research instruments that are in accordance with the needs of students. In the pre-cycle planning stage, a thorough class observation was carried out through observation during class learning. In this situation, students are given learning as usual using learning methods and approaches that have been designed in accordance with the rules of learning activities, through the preparation of lesson plans and learning outcomes evaluation assessments (Parwati et al., 2023). Then, observation is carried out in accordance with the learning conditions in the classroom and learning reflection is carried out (Fitria et al., 2019).

Geographical skills and disaster literacy have basically been possessed by students and embedded since early childhood. However, these two aspects are not developed in more depth so that their abilities are not sharp (Kamil et al., 2020). We have more or less heard of ways to observe and deal with the surrounding environment where we live. The advancement of digital technology also influences the importance of geographical skills and disaster literacy to be improved (Richardson & Bissell, 2019). These skills are important not only in the scope of geography education, but also in mastering environmental education (Hidayah, 2023).

Disaster analysis through disaster literacy and geographic skills combines an understanding of disaster risk and geographic knowledge to strengthen students' preparedness and response. Disaster literacy increases individual and group awareness of disasters, while geographical skills support the mapping of vulnerable areas and identification of local resources for disaster mitigation (Fitriana, 2021). It is important to integrate disaster literacy into the education curriculum, so that students can recognize potential hazards and mitigation measures (Irawan et al., 2024). In addition, geographical skills provide knowledge for students to map disaster-prone areas and analyze data spatially (Sahrina, 2022). This approach not only increases students' awareness of disaster issues but also encourages them to play an active role in disaster risk reduction efforts within the student sphere (L. Y. Irawan, 2022).

The spatial-based approach is designed as an effort to enhance the quality of learning by addressing the variables of geographical skills and disaster literacy. This approach emphasizes the use of spatial concepts, location, and interregional relationships as a framework for understanding geographical phenomena (Handoyo, 2022). By employing learning strategies that involve map analysis, geospatial data interpretation, and exploration of the surrounding environment, students are encouraged to develop critical and analytical thinking skills (Ririn, 2024). Furthermore, this approach helps students understand disaster risk patterns, enabling them to better identify and respond to potential threats (Nisa & Hidayatulloh, 2024). Integrating the spatial-based approach into learning is expected to create relevant and practical learning experiences for students (Silviariza & Handoyo, 2020).

Teachers can adopt a spatial-based learning approach even with limited resources by utilizing the surrounding environment as the primary learning source. For example, teachers can engage students in direct observations around the school to identify geographical patterns such as land use, types of vegetation, or local disaster risks (Morote et al., 2021). The use of simple maps, such as printed maps or hand-drawn sketches, can also be an effective tool for teaching spatial concepts and interregional relationships (Al-Bukhori & Purwanto, 2024). Additionally, teachers can incorporate group discussions, simulations, or problem-based case studies relevant to local conditions to help students develop critical and analytical thinking skills (Wijayanto et al., 2020). This approach enables spatial-based learning to be implemented without requiring advanced technology while providing contextual and practical learning experiences for students.

Challenges in implementing the Spatial-Based Learning model are often related to the limited facilities and learning resources available to support the development of students' spatial abilities. The availability of thematic maps, local geospatial data, and spatially oriented learning media remains a significant issue in many schools (Subroto et al., 2023). Additionally, variations in students' backgrounds, such as differing initial abilities in spatial interpretation and analytical skills, can affect the effectiveness of this model's application (Oktavian et al., 2023). Other factors, such as limited instructional time and lack of access to learning environments conducive to spatial activities, can also hinder the optimal implementation of this model (Alfharizi et al., 2024). Therefore, efforts are needed to address these challenges through more flexible and

contextually adapted teaching strategies tailored to local conditions.

The reality that occurred during the learning process when the pretest was given was that students did not know in detail the skills that would be improved. This is because initially students are not interested in understanding maps and evacuation routes because for them it is difficult to understand the material. Students only know through the knowledge or information they have before. Then, the posttest results showed an increase in the graph because students understood better after getting more interactive and less monotonous material.

The increase in posttest results shows that students are not only able to understand the concept theoretically but also apply it when done in real practice. More engaging learning leads them to further explore digital technology so that they have new insights (Ambarita et al., 2023). The more students understand spatial data can increase confidence and interest in further exploring spatial abilities (Abidin et al., 2021).

The application of spatial based learning model also successfully overcomes some of the weaknesses of the conventional learning approach that tends to be boring for students because it does not involve the active role of students. This model provides a clear spatial context, making it easier for students to understand geography concepts so that these concepts can be applied in disaster mitigation (Wahyuni, 2023). In addition, spatial-based learning directs students to explore various spatial data and maps that can help to analyze and solve geographical problems (Virgiawan et al., 2023). Thus, this spatial based learning model is able to provide the right solution to improve the quality of learning in the classroom by linking geographical skills and disaster literacy effectively.

CONCLUSSION | خاتمة

The Spatial-Based Learning model has proven effective in enhancing students' geographical skills and disaster literacy through a contextual and spatial approach. Beyond fostering a deep understanding of geographical concepts, this model also equips students to apply their knowledge in real-life situations, such as responding to disaster risks. The study's success is evidenced by the increase in average scores, from 62.25 in the pre-cycle to 68.61 in Cycle I, and reaching 78.89 in Cycle II. The increase was also shown by the number of students who met the KKM score of 78% or more than half of the total students in the class. Practically, this model is recommended for implementation in geography education by utilizing the surrounding environment as a learning resource to enhance student engagement and relevance. Theoretically, these findings contribute to the development of innovative teaching strategies that support the integration of spatial and disaster literacy into formal education, laying the groundwork for further research on spatial-based learning in diverse contexts.

BIBLIOGRAPHY | مراجع

Abidin, Y., Mulyati, T., & Yunansah, H. (2021). *Pembelajaran literasi: Strategi meningkatkan kemampuan literasi matematika, sains, membaca, dan menulis*. Bumi Aksara.

Al-Bukhori, L. A., & Purwanto, P. (2024). Impact Of ArcGIS Story Maps On Geography Learning And Remote Sensing Skills In MAN 1 Malang Students. *Abjadia: International Journal of Education*, *9*(1), 122-134.

Alfharizi, M. F., Anwar, S., & Susetyo, B. B. (2024). Persepsi Peserta Didik terhadap Aplikasi Teknologi Geospasial Pada Pembelajaran Geografi Kelas X Fase E MAN 1 Bukittinggi. *Edu*

Geography, *12*(1), 121-136.

Alhidayah, Y. (2022). *Pengaruh Model Spatial Based Learning (SBL) Terhadap Kemampuan Berpikir Spasial Siswa SMA/MA*.

Alvia, R. (2024). *Analisis Pengetahuan Berpikir Spasial Siswa Kelas X dan XI IPS pada Pelajaran Geografi di SMA Pertiwi 2 Padang*. Universitas Negeri Padang.

Ambarita, J., SIMANULLANG, M. P. K. P. S., & Adab, P. (2023). *Implementasi Pembelajaran Berdiferensiasi*. Penerbit Adab.

Ariani, F. (2021). Penerapan satuan pendidikan aman bencana (SPAB) di SMA Negeri 8 Mataram. *Indonesian Journal of Educational Development (IJED)*, *2*(1), 108–117.

Asep, A., & Novio, R. (2024). Analisis Sadar Bencana Melalui Pembelajaran Geografi: Studi Literatur. *Jurnal Geografi, Lingkungan Dan Kesehatan*, *2*(1), 40–46.

Asiyah, S., Putri, M. K., Heldayani, E., Oktavia, M., Chairunisa, E. D., & Aryaningrum, K. (2020). Pemanfaatan seni kartografi untuk meningkatkan kemampuan spasial siswa SMA Negeri 1 Pemulutan. *Jurnal Pengabdian Kepada Masyarakat*, *26*(1), 12.

Azizah, A. (2021). Pentingnya penelitian tindakan kelas bagi guru dalam pembelajaran. *Auladuna: Jurnal Prodi Pendidikan Guru Madrasah Ibtidaiyah*, *3*(1), 15–22.

Çalışkan, C., & Üner, S. (2021). Disaster literacy and public health: a systematic review and integration of definitions and models. *Disaster Medicine and Public Health Preparedness*, *15*(4), 518–527.

Chung, S. C., & Yen, C. J. (2016). Disaster prevention literacy among school administrators and teachers: a study on the plan for disaster prevention and campus network deployment and experiment in Taiwan. *Journal of Life Sciences*, *10*.

Deng, S., & Li, W. (2020). Spatial case revision in case-based reasoning for risk assessment of geological disasters. *Geomatics, Natural Hazards and Risk*, *11*(1), 1052–1074.

Ekowati, N. D., Margareta, D., Kurniawati, D. W., Riyati, A., Hariyani, L., Suryaningsih, E., Chumairoh, F., & Lasteningtias, C. W. (2022). *Resonansi Pemikiran ke-20:"Pelangi Pemikiran Berbagai Bidang Untuk Peningkatan Pembelajaran Geografi" Kumpulan Artikel dan Opini di Media Massa Januari–Februari Tahun 2022*. Muhammadiyah University Press.

Fitria, H., Kristiawan, M., & Rahmat, N. (2019). Upaya meningkatkan kompetensi guru melalui pelatihan penelitian tindakan kelas. *Abdimas Unwahas*, *4*(1).

Fitriana, E. (2021). Pendidikan Siaga Bencana: Pendekatan Dalam Pembelajaran Geografi. *Meretas: Jurnal Ilmu Pendidikan*, *8*(1), 72–87.

Geography for life:National Geography Standards 2012, (2nd ed.). Washington, DC: National Council For Geographic Education.

Haerullah, A., & Hasan, S. (2021). *PTK & Inovasi Guru*. uwais inspirasi indonesia.

Handoyo, B., Amirudin, A., & Soekamto, H. (2016). Analyzing The Geographical Skills Across The World Secondary Schools Curriculum Based on The Scientific Approach. 1st International Conference on Geography and Education (ICGE 2016), 376-382.

Handoyo, B. (2022). *Pengantar Geografi: Penguatan Berpikir Spasial*. Bayfa Cendekia Indonesia.

Hidayah, N., & Wagistina, S. (2023). The Effect of Gersmehl's Spatial Learning on Students'

Disaster Spatial Literacy. *International Journal of Educational Methodology*, *9*(2), 345–354.

Hidayah, R. (2023). *Peran Geografi dalam Pembentukan Karakter Generasi Emas*. Penerbit P4I.

Hidayanti, I. H., Sumarmi, S., & Utomo, D. H. (2019). *Pengaruh model relating, experiencing, applying, cooperating, transferring terhadap kemampuan berpikir spasial siswa sma*. State University of Malang.

Hidayati, D., Unandar, A., Setiawan, A. R., Ramadhan, G., & Nuryadin, D. (2023). Upaya memecahkan problem pembelajaran melalui penelitian tindakan kelas. *Jurnal Kreativitas Mahasiswa*, *1*(2), 154–165.

Irawan, L. Y., Fauzan, S., Farihah, S. N., Sofiana, E. I., & Nugroho, L. D. (2024, October). Design Thinking of Smart School Emergency Tents Modular Based as Post-Disaster Recovery. In *IOP Conference Series: Earth and Environmental Science* (Vol. 1406, No. 1, p. 012021). IOP Publishing.

Irawan, L. Y., Sumarmi, S., Febrianto, A. D., Sholeha, A. W., Dirgantara, S. D., Nadhifah, M. R., Wahono, F., & Panoto, D. (2022). Local material in improving students' knowledge and comprehension of natural hazards. In *Exploring New Horizons and Challenges for Social Studies in a New Normal* (pp. 88–93). Routledge.

Irawan, R. A., Maryani, E., & Ruhimat, M. (2021). Geographical inquiry skills on implementation of participants at geography in high school at bandung city. *IOP Conference Series: Earth and Environmental Science*, *683*(1), 12035.

Kamil, P. A., Utaya, S., & Utomo, D. H. (2020). Improving disaster knowledge within high school students through geographic literacy. *International Journal of Disaster Risk Reduction*, *43*, 101411.

Kasmiati, S., Andrias, A., Saudi, F., & Garusu, E. H. (2023). PELATIHAN PEMBELAJARAN GEOGRAFI BERBASIS GEOSPASIAL BAGI GURU SMA DI KOTA KENDARI. *Community Development Journal: Jurnal Pengabdian Masyarakat*, *4*(2), 3883–3891.

Lee, J. H., Yao, Y., Özdemir, O., Li, M., Weber, C., Liu, Z., & Wermter, S. (2022). Spatial relation learning in complementary scenarios with deep neural networks. *Frontiers in Neurorobotics*, *16*, 844753.

Manek, A. H. (2023). Pengaruh Model Spasial Based Learning (SBL) Terhadap Kemampuan Berpikir Spasial Mahasiswa Pada Mata Kuliah Praktek Kerja Lapangan Geografi (PKLG). *Geoedusains: Jurnal Pendidikan Geografi*, *4*(1), 1–17.

Manek, A. H., Utomo, D. H., & Handoyo, B. (2019). *Pengaruh model spasial based learning terhadap kemampuan berpikir kritis siswa*. State University of Malang.

Marissa, N., Juwita, D. R., Iratutisisilia, I., Kasanang, K., & Pujono, P. (2024). Persepsi Siswa Tentang Pentingnya Geografi dalam Kehidupan Sehari-hari. Jurnal Sociopolitico, *6*(2), 185–189.

McLaughlin, J. A., & Bailey, J. M. (2023). Students need more practice with spatial thinking in geoscience education: a systematic review of the literature. *Studies in Science Education*, *59*(2), 147–204.

Morote, Á. F., Hernández, M., & Olcina, J. (2021). Are future school teachers qualified to teach flood risk? An approach from the geography discipline in the context of climate change. *Sustainability*, *13*(15), 8560.

Nikmah, S. M., Banowati, E., & Suharini, E. (2020). School's Strategy on Flood Disaster Mitigation Endeavor to Students of SMA Negeri 1 Welahan. *International Conference on Science and Education and Technology (ISET 2019)*, 245–249.

Nisa, L. F., & Hidayatulloh, M. F. (2024). Potensi dan Tantangan Dari Analisis Kewilayahan dalam Merancang Strategi Mitigasi Bencana.*Triwikrama: Jurnal Ilmu Sosial*, *3*(7), 122-132.

Oktavian, R. A., Utomo, D. H., Putra, A. K., Wirahayu, Y. A., & Rizal, S. (2023). Spatial Intelligence and Geographic Skills: React Model on Regional Development and Growth Materials. *Abjadia: International Journal of Education*, *8*(1), 29-44.

Pambudi, M. R., & Masruroh, M. (2023). Efektifitas Model Pembelajaran Berbasis Spasial Terhadap Hasil Belajar Siswa. *Paedagoria: Jurnal Kajian, Penelitian Dan Pengembangan Kependidikan*, *14*(2), 161-165.

Pamuk, M. (2023). *Teaching Geographical Thinking With GIS-Based Projects: Learning From Experienced Teachers' Perspectives*. The Florida State University.

Parwati, N. N., Suryawan, I. P. P., & Apsari, R. A. (2023). *Belajar dan pembelajaran*. PT. RajaGrafindo Persada-Rajawali Pers.

Rahmah, I. R. N. U. R. (2023). *Pengaruh Geography For Kids (Lokasi, Jarak dan Keterjangkauan) sebagai Sumber Belajar dalam Meningkatkan Keterampilan Geografis Peserta Didik Sekolah Dasar (Studi Kasus di Kelas V SDN 2 Bangunsari Kecamatan Pamarican Kabupaten Ciamis)*. Universitas Siliwangi.

Richardson, L., & Bissell, D. (2019). Geographies of digital skill. *Geoforum*, *99*, 278–286.

Ridha, S., Utaya, S., Bachri, S., & Handoyo, B. (2019). Students' geographic skills in Indonesia: Evaluating learning material questions about GIS using taxonomy of spatial thinking. *Journal of Social Studies Education Research*, *10*(4), 266-287.

Ririn, P. (2024). *Analisis Kemampuan Siswa dalam Menginterpretasi Citra Pola Keruangan Sosial Budaya Dengan Menggunakan Aplikasi Google Maps* (Doctoral dissertation, Universitas Lampung).

Sahrina, A., Aksa, F. I., Labib, M. A., & Irawan, L. Y. (2022, December). *Landscape as a Nature Laboratory in Geography Learning in South Malang, Indonesia. In 2nd International Conference on Social Knowledge Sciences and Education (ICSKSE 2022) (pp. 111-127). Atlantis Press.*

Saraswati, S. (2021). TAHAPAN PTK. *Penelitian Tindakan Kelas*, *49*.

Sebillo, M., Vitiello, G., & Di Gregorio, M. (2020). Maps4Learning: enacting geo-education to enhance student achievement. *IEEE Access*, *8*, 87633–87646.

Setyowati, D. L., Adhi, M. A., Sidiq, W. A. B. N., Pratiwi, E. S., & Trihatmoko, E. (2020). Spatial Information Learning to Improve Consciousness and Attitude Towards Disasters. *Geomate Journal*, *18*(67), 162–167.

Silviarza, W., Sumarmı, S., & Handoyo, B. (2020). Using of Spatial Problem Based Learning (SPBL) model in geography education for developing critical thinking skills. *Journal for the Education of Gifted Young Scientists*, *8*(3), 1045–1060.

Silviariza, W. Y., & Handoyo, B. (2020). Spatial-Problem Based Learning (SPBL) development (preliminary studies for geography learning). *Jurnal Pendidikan Geografi*, *25*(1), 69-79.

Subroto, D. E., Supriandi, S., Wirawan, R., & Rukmana, A. Y. (2023). Implementasi Teknologi dalam Pembelajaran di Era Digital: Tantangan dan Peluang bagi Dunia Pendidikan di Indonesia. *Jurnal Pendidikan West Science*, *1*(07), 473-480.

Sukardi, H. M. (2022). *Metode penelitian pendidikan tindakan kelas: implementasi dan pengembangannya*. Bumi Aksara.

Virgiawan, D. B., Murtini, S., & Rahmah, R. R. (2023). Meningkatkan Kemampuan Berpikir Spasial dengan Model Discovery Learning pada Pembelajaran Geografi. *ASANKA: Journal of Social Science and Education*, *4*(2).

Wahyuni, F. (2023). *Pengaruh Spatial Thinking Skill dan Pemahaman Siswa Tentang Materi Mitigasi Bencana Terhadap Kesiapsiagaan Bila Terjadi Gempa Bumi Di SMAN 1 Liwa.*

Wahyuningtyas, N., Febrianti, L., & Andini, F. (2020). The carrying capacity of GIS application for spatial thinking growth in disaster material. *IOP Conference Series: Earth and Environmental Science*, *485*(1), 12018.

Wang, Z., Han, Z., & Li, Y. (2023). The Interplay between School Preparedness and Student's Individual Protective Actions: The Mediating Role of Disaster Education. *Sustainability*, *15*(20), 14888.

Wijayanto, B., Sutriani, W., & Luthfi, F. (2020). Kemampuan berfikir spasial dalam pembelajaran Abad 21. *Jurnal Samudra Geografi*, *3*(2), 42-50.

Yildiz, A., Dickinson, J., Priego-Hernández, J., Teeuw, R., & Shaw, R. (2024). Effects of disaster education on children's risk perception and preparedness: A quasi-experimental longitudinal study. *The Geographical Journal*, *190*(2), e12556.