Jurnal Pendidikan Geografi:
Kajian, Teori, dan Praktik dalam Bidang Pendidikan dan Ilmu Geografi, 28(1), 2023, 75-83
ISSN: 0853-9251 (Print): 2527-628X (Online)
DOI: 10.17977/um017v28i12023p75-83

Effects of webGIS-based spatial intelligence training on Geography teacher's spatial skills

Lili Somantri[1], Siti Hamidah

Universitas Pendidikan Indonesia, Dr. Setiabudhi Street No. 229, Bandung, West Java, 40154, Indonesia
[1]Corresponding author, Email: lilisomantri@upi.edu

Paper received: 02-03-2022; revised: 30-03-2022; accepted: 18-08-2022

Abstract

The inadequate spatial intelligence of teachers culminates in students' minimum spatial intelligence. As teachers carry the role of learning facilitators and instruments, spatial intelligence training is highly substantial for geographic teachers. This study aims to identify the effects of spatial intelligence training based on webGIS on the geographic teachers' spatial intelligence. This study used a quantitative method with a pre-experimental design and a one-group pretest-postest with paired sample T-test data analysis. Our analysis results using T-test showed Sig. (2-tailed) 0.00 less than 0.05, indicating the influence of spatial intelligence training based on webGIS on geography teachers' spatial intelligence. Besides, the increase in teachers' spatial intelligence is also shown by their increasing average test scores by 28.24 percent.

Keywords: training; spatial intelligence; geospatial

1. Introduction

Spatial intelligence is the central asset for studying an area. Aliman et al. (2018) described spatial intelligence as the individual potential to combine space with its inside components. This combination of a space and its components is carried out through a process of perception involving translation, selection, and management of the received, presented, or observed spatial information (Amaluddin et al., 2019). With excellent spatial intelligence, someone is capable of illustrating an area in their thought, along with its location, position, relative distance, and correlation with other areas, so spatial intelligence is highly correlated with an area (Marlyono & Urfan, 2020).

In addition, this spatial intelligence is also crucial for society, especially for students, since spatial intelligence can be used to understand the territorial signs in Indonesia (Silviarza et al., 2020; Urfan, 2017). Accordingly, geography teacher carries a relatively essential role in students' spatial intelligence development. As reported in previous studies, geography teachers are expected to participate substantially in students' spatial and geographical intelligence progression, primarily for students with excellent career potential in the related field, which requires spatial intelligence (Yani et al., 2018).

Therefore, spatial intelligence is highly crucial for geography teachers, particularly during the knowledge transfer to the students. Eminent spatial intelligence is one of the professional competencies of geography teachers in spatial material learning. This competence is frequently used as one of the competencies in measuring geography teachers' professionality in facilitating students learning to identify and understand interconnection, relationship, and

interdependence between geography materials. Students' spatial skills will only enhance if the geography teachers present great spatial knowledge. Besides, geography teachers with high spatial intelligence have accurate analysis skills in geography materials (Susilawati & Sunarhadi, 2017).

However, in reality, many geography teachers are reported to have inadequate spatial intelligence (Astawa et al., 2019). Simultaneously, these teachers are expected to facilitate students in improving their spatial intelligence. The teachers' primary roles as facilitator and providing an instrument for students during learning has placed their insufficient spatial intelligence as a crucial issue (Lee & Bednarz, 2012; Susilawati & Sunarhadi, 2017). Therefore, geography teachers with low spatial intelligence encounter difficulties in aiding students to increase their spatial intelligence through identifying Indonesian areas and their potential, specifically.

Additionally, the rapid progression of technology and information has increased the challenges for geography teachers. In this 21st century or digital era, teachers and students are living in a society that heavily relies on digital devices (Yana et al., 2021). Linearly, digital technology must be used to support geography education (Wijayanto et al., 2020). Therefore, geography teachers are also expected to master the geographical material and the most recent technologies to realize successful learning for students. One of the essential technologies for geography teachers is webGIS. WebGIS is a digital map based on a website that visualizes spatial data using interactive means precisely (Febrianto et al., 2021). It is one of the effective media to identify, analyze, and evaluate an area through interactive and specific means, so it can be used as learning and training media to enhance spatial intelligence. Thus, webGIS-based training can be an alternative to improve geography teachers' spatial intelligence.

The aforementioned description has highlighted the need and urgency for improving the spatial intelligence of geography teachers. Meanwhile, the students carry the primary potential to realize a spatial society that understands the Indonesian phenomenon as fundamental for future development, potential management, and policy formulation. Many studies have investigated different strategies to increase spatial intelligence. However, those studies focus on enhancing the spatial intelligence of kindergarten (Giasi, 2020; Sansiana et al., 2017), elementary school (Wahdah et al., 2020), junior high school (Hutagalung & Harahap, 2018), and senior high school students (Asiyah et al., 2020; Febrianto et al., 2021; Mahmudati & Alawiyah, 2018; Rahayu et al., 2022; Tantular, 2019). The study investigating geography teachers' spatial intelligence has rarely been carried out. Meanwhile, research carried out by Astawa et al. (2019), and Susilawati and Sunarhadi (2017) reported geography teachers' low spatial intelligence. Therefore, the Department of Geographic Information Science of Universitas Pendidikan Indonesia conducted spatial intelligence training using webGIS for geography teachers from all around Indonesia. The training aims to accelerate geography teachers' spatial intelligence. Meanwhile, this study aims to identify the effects of webGIS-based spatial skills training on geography teachers' spatial intelligence.

2. Method

This study used a quantitative research method with a pre-experiment one-group pretest-posttest design. In the one-group pretest-posttest design, the collected data were in the form of pretest and post-test scores completed before and after the treatment. For the procedures, this study adopted the procedures from Devecioglu-Kaymakci (2016). Thus, this

research analyzed the obtained pretest and post-test scores concerning Indonesian regions and their potential.

The pretest and post-test used elementary spatial intelligence competency as the indicator. The basic spatial intelligence level covers someone's skills in recognizing an area (Oktavianto et al., 2017) and reading a map (Nofirman, 2019). Additionally, webGIS was used to aid the enhancement of geography teachers' spatial intelligence, starting from the introduction and use of digital map which requires teachers to understand the potentials from each Indinesia area by implementing the concept of location based on blind map, an area's potential or natural resources, their landmark or icon, and their potential tourism and human resources (Nofirman, 2019; Somantri, 2022). Meanwhile, for the score range used in interpreting the participants' spatial skills, we adopted the spatial skill criteria from Astawa et al. (2019), in which: (1) 0—44 scores indicated very insufficient ability, (2) 45—54 scores showed insufficient ability, (3) 55—69 scores showed moderate skills, (4) 70—84 scores signified excellent skills, and (5) 85—100 showed excellent skills.

The pretest and post-test data were gathered to identify the effects of webGIS spatial intelligence training on the participants' spatial thinking skills. The quantitative data in the form of pretest and post-test scores were analyzed using the normality test and paired samples t-test through the SPSS. The webGIS-based spatial intelligence training was carried out by the Geographic Information Science Study Program of Universitas Pendidikan Indonesia, in cooperation with Esri Indonesia, and supported by the WGS84 Community. The training was conducted for nine days, from 10 to 18 July 2021. This research population was 29 participants. Thus, this research used purposive sampling to select the research respondents, using two criteria, namely: 1) full attendance and 2) following all the activities in nine days, starting from the pretest, and material discussion, guided training, until the post-test. The respondents came from 11 provinces of Indonesia, as illustrated in Figure 1.

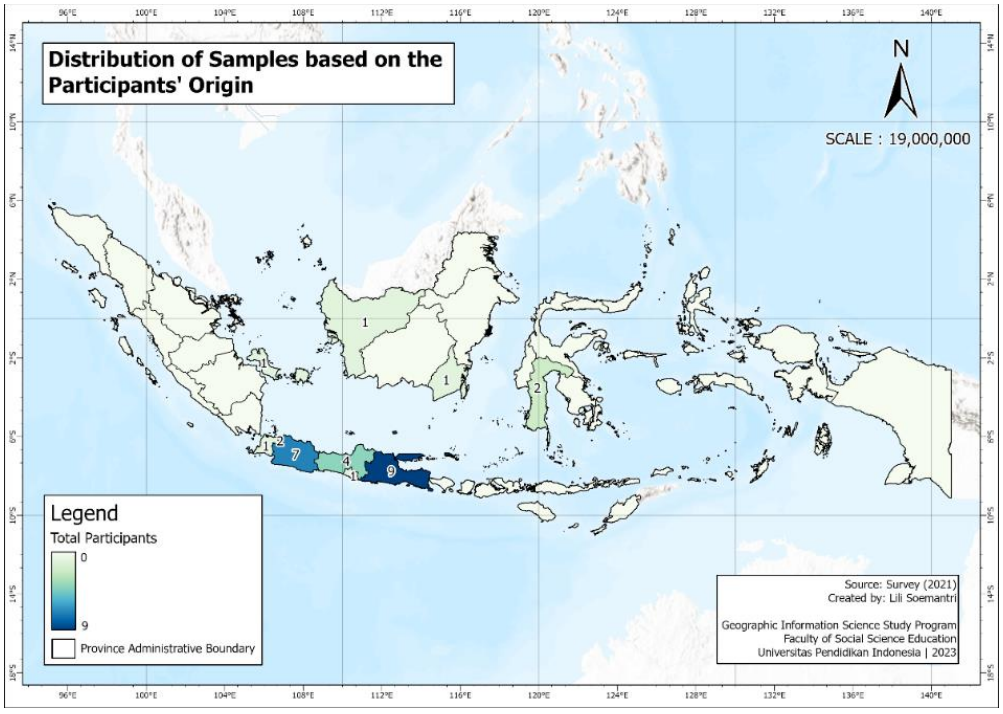

Figure 1. Distribution of Samples based on the Participants' Origin

3. Results and Discussion

The investigation was carried out during the webGIS-based spatial intelligence training conducted by the Geographic Information Science Study Program of Universitas Pendidikan Indonesia in collaboration with Esri Indonesia and supported by the WGS84 Community. WebGIS was selected due to the need for interactive media and stimulants to attract the learners' or participants' interest (Asiyah et al., 2020). WebGIS is an interactive and stimulating media that is capable of enhancing spatial intelligence. Febrianto et al. (2021) reported that webGIS can effectively improve spatial intelligence. Besides, Fadly, Purwanto, Masruroh, and Sumarmi (2022) also discovered that webGIS effectively increases students' Geography learning outcomes.

In this study, we used the Indonesia Spatial Intelligence webGIS along with Indonesia Spatial Intelligence Module. The Indonesia Spatial Intelligence webGIS contains the spatial variables related to Indonesia's regional potentials, such as observation of a city or region, along with their attributes, such as their area, cultural diversity, natural resources, and living environment, landmarks, and the other spatial attributes (Nofirman, 2019). This media was designed to optimize the participants' spatial intelligence, as it had been customized to the training purposes. The dashboard display of Indonesia Spatial Intelligence webGIS used in training is illustrated in Figure 2.

Figure 2. Dashboard of Spatial Intelligence WebGIS

Before the webGIS training, the participants were given a pretest to estimate their initial spatial thinking skills. Then, the post-test was provided at the end of the training process. Those two tests were carried out as we adopted the pre-experiment one-group pretest-posttest design (Amaluddin et al., 2019; Devecioglu-Kaymakci, 2016; Sansiana et al., 2017). The results of the quantitative data analysis are presented in Table 1. The highest pretest score was 84, while the highest post-test score was 86, from the maximum score of 100. Meanwhile, the average pretest and post-test scores were 53.24 and 68.27, respectively. As presented in Table 1, the participants' spatial intelligence increased after they attended the webGIS spatial training.

Table 1. Participants' Pretest and Post-test Scores

	Pretest	Posttest
N	29	29
Mean	53.24	68.27
Median	58	70
Std. Deviation	15.642	13.32
Range	66	52
Minimum	18	34
Maximum	84	86

Following the skills criteria category introduced by Astawa et al. (2019), in the pretest, most of the participants (48%) attained moderate criteria with a score ranging from 55 to 69. Meanwhile, in the post-test, most participants (45%) were in the good criteria. The classification of participants' scores is shown in Table 2.

Table 2. Participants' Spatial Skills Criteria

Score Range	Criteria	Pretest		Post-test	
		N	%	N	%
0—44	Poor	8	28	1	3
45—54	Low	5	17	4	14
55—69	Moderate	14	48	9	31
70—84	Great	2	7	13	45
85—100	Excellent	0	0	2	7
Total		29	100	29	100
Average Score		53.24 (Low)		68. 27 (Moderate)	

The results of our normality test suggested that our pretest and post-test data were normally distributed. For the normality test, this research used the Shapiro-Wilk test, showing a significant value >0.05, as shown in Table 3. The significance of the pretest and post-test variables was 0.128 and 0.073, respectively. This significant score indicated that the pretest and post-test results have a normal distribution since both the pretest (12.8%) and post-test (7.3%) variables were more significant than a 5% of significance level.

Table 3. Results of Normality Test on the Pretest and Post-test Data

	Pretest	Post-test
Significance Score	0.128	0.073

To identify the effects of webGIS-based spatial intelligence training on the participants' spatial skills, this research carried out the paired sample t-test. The results of paired sample t-test showed a 0.00 (0%) significant score <0.05% (0<5%), as shown in Table 4.

Table 4. Results of Paired Sample t-test

	df	Sig. (2-tailed)
Pair 1 Pretest-Posttest	28	0,000

The results of the t-test suggested the effects of webGIS-based spatial intelligence training on the participants' spatial thinking ability. The use of webGIS as the primary media in the training process enhances the participants' accessibility and usage of visual geographic information (Fadly et al., 2022). The web-based Geography Information System is proven to be reliable in facilitating learning related to spatial aspects (Setiawan, 2016). Therefore, webGIS was selected as the main media for spatial intelligence training.

The benefits of webGIS are confirmed through the significant difference between the pretest and post-test results, shown by the obtained 0.00 (0%) of significance from the paired t-test results. Further, the lowered than 0.05 t-test significance showed that H_0 was rejected and H_1 was accepted, as described by Amaluddin et al. (2019) and Febrianto et al. (2021). Therefore, our data analysis results suggested the increasing spatial intelligence of the training participants. Besides, the same result was observed from the higher average post-test score (34.1 or 68.7, categorized as moderate) than the average pretest score (26.6 or 53.24,

categorized as low). Thus, the participants' spatial intelligence increased by 28.24%, obtained from the estimation using the formula 1.

$$X = \frac{Y - Z}{Z} \; x \; 100\% \qquad (1)$$

Description:
X = The average posttest score
Y = The average posttest score
Z = The average pretest score

Our analysis results reinforced webGIS' capacity as a reliable medium for enhancing spatial thinking skills. Setiawan (2016) explained that Geographic Information System (GIS) facilitates the improvement of spatial thinking skills. The indicators of Geography spatial intelligence competence are shown in Table 5.

Table 5. Indicators of Geography Spatial Intelligence Competence

Indicators	Average Score	
	Pretest	Post-test
Showing a location in the blind map	36	42
Identifying a location based on the regional potentials or natural resources	37	47
Identifying a location based on the icons or landmarks	38	47
Identifying a location based on tourism or human resources potential	41	49

Source : Nofirman (2019), Somantri (2022)

As presented in Table 5, the highest increase is found in the ability to identify a location based on the regional potential or natural source. The increase was 28%, from a 38 average pretest score to a 47 average post-test score. Meanwhile, in the indicators of identifying a location based on the icons or landmarks, identifying a location based on the tourism or human resources potential, and identifying a location in a blind map, the obtained scores increased by 24, 19, and 18%, respectively. As a training media, webGIS has explicitly enhanced the participant's ability to identify regional potential. The use of webGIS as the interactive map and the fundamental data presents a better learning experience for the training participants, primarily in data visualization (Fadly et al., 2022). Besides, webGIS also allows the participants to adjust the scale, enabling them to attain more detailed information (Febrianto et al., 2021). The increasing spatial intelligence scores of the webGIS-based training participant are illustrated in Figure 3.

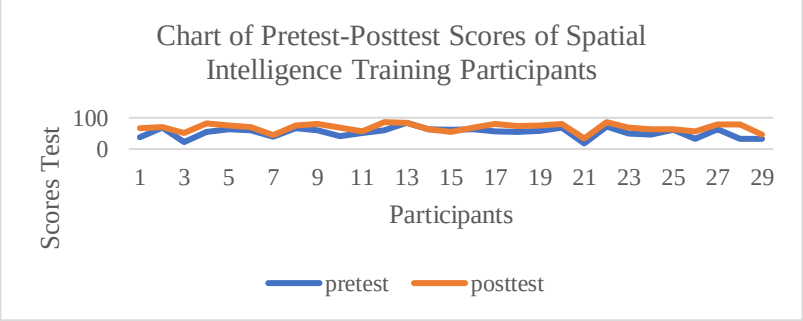

Figure 3. Pretest and Post-test Score of Participants in Spatial Intelligence Training

As illustrated in Figure 3, webGIS-based spatial intelligence training on the potentials of Indonesian regions can be an alternative intervention to enhance the participants' spatial intelligence. The acceleration of people's spatial intelligence can be a fundamental capital to establish a geospatial society. Yani et al. (2018) described that spatial intelligence is correlated with the ways an individual views and analyzes their surroundings. Thus, spatial intelligence aids an individual in making decisions related to the regional and environmental situation. Further, someone with excellent spatial intelligence can easily adapt to an environment, as individuals constantly relocate from one location to another location (Marlyono & Urfan, 2020). Consequently, if a group of people is dominated by those with great spatial intelligence, then they form a geospatial society. Aliman et al. (2018) added that national integrity is influenced by spatial intelligence as it affects individuals' environmental knowledge and attitudes. In contrast, individuals with poor geographical awareness will present low concern for their environment. In the long term, people with excellent geospatial knowledge are expected to provide a significant contribution to future national growth. Thus, spatial intelligence is vital for Indonesia's national expansion. Meanwhile, Geography teachers are the central pioneer in the education process leading toward a geospatial society. They actively and directly participate in improving students' geographical and spatial skills (Yani et al., 2018). Accordingly, the progression toward geospatial society can be effectively completed if Geography teachers constantly enhance their spatial intelligence.

4. Conclusion

The webGIS-based spatial intelligence training positively influences the Geography teachers' spatial intelligence, as indicated by the obtained 0.00<0.05 Sig (2-tailed) from the paired sample t-test analysis. The analysis results suggested increasing spatial intelligence in the participants by 28.24%. The increase was also identified from the higher average post-test score (68.27), which was categorized as moderate than the average pretest score (53.24) and was classified as low. This study was a preliminary step in establishing a geospatial society. Geospatial society development requires a sustainable research and development process. Thus, this initial study was expected to be followed by further developments, such as in the types of intervention, variations on the learning and training media, as well as different research respondents representing different levels of Indonesian society. Further, these studies were expected to ensure the adoption of geospatial intelligence as the underlying capital for Indonesia's archipelagic nation development that follows its regional characteristics.

References

Aliman, M., Mutia, T., & Yustesia, A. (2018). Integritas kebangsaan dalam tes berpikir spasial. *Prosiding Seminar Nasional Pendidikan Geografi FKIP UMP*, 82–89.

Amaluddin, L. O., Rahmat, R., Surdin, S., Ramadhan, M. İ., Hidayat, D. N., Sejati, A. E., Purwana, İ. G., & Fayanto, S. (2019). The effectiveness of outdoor learning in improving spatial intelligence. *Journal for the Education of Gifted Young Scientists*, *7*(3), 717–730.

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), 12–15.

Astawa, I. B. M., Sarmita, I. M., & Nugraha, A. S. A. (2019). Pengembangan spatial thinking skills guru Geografi di Provinsi Bali. *Widya Laksana*, *8*(2), 181–189.

Devecioglu-Kaymakci, Y. (2016). Embedding analogical reasoning into 5E learning model: A study of the solar system. *EURASIA Journal of Mathematics, Science and Technology Education*, *12*(4), 881–911.

Fadly, A. A., Purwanto, P., Masruroh, H., & Sumarmi, S. (2022). Pengaruh penggunaan webGIS (web based Geographic Information System) terhadap hasil belajar Geografi dan keterampilan Geografi secara berkelanjutan. *Jurnal Integrasi dan Harmoni Inovatif Ilmu-Ilmu Sosial (JIHI3S)*, *2*(2), 128–142.

Febrianto, A. D., Purwanto, P., & Irawan, L. Y. (2021). Pengaruh penggunaan media WebGIS Inarisk terhadap kemampuan berpikir spasial siswa pada materi mitigasi dan adaptasi bencana. *Jurnal Pendidikan Geografi: Kajian, Teori, dan Praktek dalam Bidang Pendidikan dan Ilmu Geografi*, *26*(2), 73–84. https://doi.org/10.17977/um017v26i22021p073

Giasi, N. (2020). Peningkatan kecerdasan visual-spasial melalui permainan balok pada Kelompok B di TK Anggrek Mekar Haya-Haya Kecamatan Limboto Barat Kabupaten Gorontalo. *Early Childhood Islamic Education Journal*, *1*(1), 56–72.

Hutagalung, A., & Harahap, M. S. (2018). Peningkatan kemampuan spasial siswa melalui penggunaan Model Auditory Intellectually Repetition (AIR) di SMP Negeri 1 Pinangsori. *Jurnal MathEdu (Mathematic Education Journal)*, *1*(1), 15–23.

Lee, J., & Bednarz, R. (2012). Components of spatial thinking: Evidence from a spatial thinking ability test. *Journal of Geography*, *111*(1), 15–26.

Mahmudati, R., & Alawiyah, L. (2018). Sebaran peningkatan kemampuan visual-spasial siswa dengan butir soal HOTS (High Order Thinking Skill). *Jurnal Penelitian dan Pengabdian Kepada Masyarakat UNSIQ*, *5*(3), 333–337.

Marlyono, S. G., & Urfan, F. (2020). Optimalisasi kecerdasan spasial untuk meningkatkan kesiapsiagaan bencana. *Seminar Nasional Peningkatan Mutu Pendidikan*, *1*(1), 440–448.

Nofirman, N. (2019). Studi kemampuan spasial Geografi siswa kelas XII SMA Negeri 6 Kota Bengkulu. *Jurnal Georafflesia: Artikel Ilmiah Pendidikan Geografi*, *3*(2), 11–24.

Oktavianto, D. A., Sumarmi, S., & Handoyo, B. (2017). Pengaruh pembelajaran berbasis proyek berbantuan google earth terhadap keterampilan berpikir spasial. *Jurnal Teknodik*, *21*(1), 59–69.

Rahayu, S. T., Handoyo, B., & Rosyida, F. (2022). Peningkatan kemampuan berpikir spasial siswa melalui penerapan Project Based Learning dengan menggunakan platform google classroom. *Jurnal Integrasi dan Harmoni Inovatif Ilmu-Ilmu Sosial (JIHI3S)*, *2*(1), 68–80.

Sansiana, S., Indarto, W., & Febrialismanto, F. (2017). Pengaruh media pop up book terhadap kecerdasan visual spasial anak usia 5-6 tahun di TK Al-latif Kecamatan Tambang Kabupaten Kampar. *Jurnal Online Mahasiswa (JOM) Bidang Keguruan Dan Ilmu Pendidikan*, *4*(2), 1–12.

Setiawan, I. (2016). Peran Sistem Informasi Geografis (SIG) dalam meningkatkan kemampuan berpikir spasial (spatial thinking). *Jurnal Geografi Gea*, *15*(1), 83–89.

Silviarza, W., Sumarmi, 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.

Somantri, L. (2022). Indonesian spatial intelligence for geography teachers. *JPPI (Jurnal Penelitian Pendidikan Indonesia)*, *8*(2), 267–274.

Susilawati, S. A., & Sunarhadi, M. A. (2017). Implementasi model peta (pembelajaran kompetensi spasial) dalam mata pelajaran Geografi bagi guru SMA di Kabupaten Sukoharjo Jawa Tengah. *Warta LPM*, *20*(2), 128–137.

Tantular, B. A. (2019). *Pengaruh media permainan simcity terhadap kecerdasan spasial peserta didik: Studi kuasi eksperimen pada pembelajaran Geografi, pokok bahasan mitigasi bencana, kelas XI MIPA di SMA Angkasa Lanud Husein Sastranegara Bandung*. Universitas Pendidikan Indonesia.

Urfan, F. (2017). Pengaruh lingkungan sekolah terhadap kecerdasan spasial peserta didik melalui affordance dan geo-literacy menggunakan analisis jalur (studi kasus SMA Negeri di Kota Bandung dan Kabupaten Bandung). *Jurnal Geografi Gea*, *16*(2), 105–115.

Wahdah, N., Sukirwan, S., & Pamungkas, A. S. (2020). Pengembangan kemampuan spasial siswa sekolah dasar melalui penggkonstruksian volume bangun ruang. *Jurnal Elementary: Kajian Teori dan Hasil Penelitian Pendidikan Sekolah Dasar*, *3*(2), 76–81.

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

Yana, Y., Handoyo, B., & Putra, A. K. (2021). Pengembangan buku ajar digital Geografi SMA berplatform aplikasi 3D Page Flip dengan pendekatan STEAM (Science, Technology, Engineering, Art, Mathematic) materi keragaman budaya di Indonesia. *Jurnal Pendidikan Geografi: Kajian, Teori, dan Praktek dalam Bidang Pendidikan dan Ilmu Geografi*, *26*(2), 92–98. https://doi.org/10.17977/um017v26i22021p092

Yani, A., Mulyadi, A., & Ruhimat, M. (2018). Contextualization of spatial intelligence: Correlation between spatial intelligence, spatial ability, and Geography skills. *Journal of Baltic Science Education*, *17*(4), 564–575.