http://dx.doi.org/10.18623/rvd.v23.n2.4188

POSITIVE SYNERGY BETWEEN GEOGRAPHIC LITERACY AND SKILLS: INSIGHTS FROM PROSPECTIVE TEACHERS

SINERGIA POSITIVA ENTRE A LETRACIA GEOGRÁFICA E AS COMPETÊNCIAS: PERCEPÇÕES DE FUTUROS PROFESSORES DE GEOGRAFIA

Article received on: 8/29/2025
Article accepted on: 11/28/2025

Wiwik Sri Utami*
*Department of Geography Education, State University of Surabaya, Indonesia
Orcid: https://orcid.org/0000-0002-2085-6733
wiwikutami@unesa.ac.id

Bambang Sigit Widodo*
*Department of Geography Education, State University of Surabaya, Indonesia
Orcid:https://orcid.org/0000-0002-6780-1158
bambangsigit@unesa.ac.id

Indah Prabawati*
*Department of Public Administration, State University of Surabaya, Indonesia
Orcid:https://orcid.org/0000-0003-0613-5259
indahprabawati@unesa.ac.id

Ita Mardiani Zain*
*Department of Geography Education, State University of Surabaya, Indonesia
Orcid:https://orcid.org/0000-0002-4811-802X
itamardiani@unesa.ac.id

Hendri Prastiyono*
*Department of Geography Education, State University of Surabaya, Indonesia
Orcid:https://orcid.org/0000-0002-8833-2821
hendriprastiyono@unesa.ac.id

The authors declare that there is no conflict of interest

Abstract
Geographic literacy and skills are essential competencies for prospective Geography teachers to effectively perform their roles as educators in the 21st-century education era. This study analyzes the relationship between learning styles, geographic literacy, and geographic skills among prospective Geography teachers. A quantitative survey design was employed, using questionnaires and tests to measure learning styles, geographic literacy, and geographic skills. The approach used is quantitative, using a survey method, problem-based investigation, and data analysis using Structural Equation Modeling (SEM). The study population consists of all active students in Geography Education programs at public and private universities in Indonesia. The sample size amounting to 249 students from 19 public and private universities. Using two types of instruments geographical literacy test: multiple-choice questions-based case study and learning style questionnaire:

Resumo
A letracia geográfica e as habilidades geográficas são competências essenciais para futuros professores de Geografia desempenharem seu papel de forma eficaz na era da educação do século XXI. Este estudo analisa a relação entre estilos de aprendizagem, letracia geográfica e habilidades geográficas entre futuros professores de Geografia. Foi adotado um delineamento de pesquisa quantitativa do tipo survey, utilizando questionários e testes para medir estilos de aprendizagem, letracia geográfica e habilidades geográficas. An abordagem utilizada é quantitativa, empregando o método survey, investigação baseada em problemas e análise de dados por meio de Modelagem de Equações Estruturais (SEM). A população do estudo é composta por todos os estudantes ativos dos cursos de Licenciatura em Geografia em universidades públicas e privadas na Indonésia. A amostra incluiu 249 estudantes provenientes de 19 universidades públicas e

adapted from the Felder-Silverman. Focus Group Discussions (FGDs) to gain deeper insights and data analysis using SMART PLS software. These results underscore the importance of fostering geographic literacy as a foundation for enhancing geographic skills. The influence of visual, auditory, and kinesthetic learning styles on geography skills (KG) and geographic literacy skills (KLG) have different effects. The implications of this study highlight the need for instructional strategies that support visual learning styles and promote the development of geographic literacy among prospective teachers, preparing them to become professional educators capable of addressing global challenges. The findings reveal that student with a visual learning style exhibit higher geographic literacy than those with auditory and kinesthetic learning styles.

Keywords: Learning Styles. Geographic Literacy. Prospective Geography Teachers. Geographic Skills**.**

privadas. Foram utilizados dois tipos de instrumentos: um teste de letracia geográfica com questões de múltipla escolha baseadas em estudos de caso e um questionário de estilos de aprendizagem adaptado do modelo Felder-Silverman. Também foram realizados Grupos Focais (FGDs) para aprofundar a compreensão dos dados, e a análise estatística foi conduzida com o software SMART PLS. Os resultados reforçam an importância de promover a letracia geográfica como base para o desenvolvimento das habilidades geográficas. An influência dos estilos de aprendizagem visual, auditivo e cinestésico sobre as habilidades geográficas (KG) e sobre as habilidades de letracia geográfica (KLG) apresenta efeitos distintos. As implicações deste estudo destacam a necessidade de estratégias de ensino que favoreçam o estilo de aprendizagem visual e promovam o desenvolvimento da letracia geográfica entre futuros professores, preparando-os para se tornarem educadores profissionais capazes de enfrentar desafios globais. Os achados mostram que estudantes com estilo de aprendizagem visual apresentam níveis mais elevados de letracia geográfica do que aqueles com estilos auditivo e cinestésico.

Palavras-chave: *Estilos de Aprendizagem. Letracia Geográfica. Futuros Professores de Geografia. Habilidades Geográficas*

1 INTRODUCTION

Geography education plays a pivotal role in fostering an understanding of the world, equipping students with essential spatial, environmental, and cultural knowledge. In an increasingly globalized society (Davis & Knight, 2021), the ability to interpret geographic information is critical to addressing pressing global challenges, such as climate change, urbanization, resource distribution, and geopolitical conflicts (Oktavianto et al., 2024). Geographic literacy enables individuals to comprehend complex interrelations between humans and their environment, thus contributing to informed local, national, and international decision-making (Elsabawy, 2014; Kuruppuarachchi et al., 2023). According to the National Geographic Society, only about 25% of adults globally are considered geographically literate (W. S. Utami et al., 2018), indicating a significant gap in understanding spatial and environmental issues (Iranmanesh & Mousavi, 2022).

In geography education, learning styles are gaining attention as a key factor influencing the effectiveness of teaching and learning processes (Pascu, 2024). Learning styles refer to individual preferences in acquiring and processing information, which vary among learners and impact how well they understand and retain geographic concepts (Putri Ningrat et al., 2018). Prospective geography teachers, who will eventually guide future generations in navigating the global landscape, must possess strong geographic literacy and be aware of their learning styles to maximize their teaching potential (Asare & Amo, 2023; Cho et al., 2022).

Research shows that understanding individual learning styles can improve the quality of education by tailoring pedagogical approaches to suit diverse learners (Ssemugenyi, 2023a). Globally, educators recognize the importance of aligning instructional strategies with students' learning preferences to enhance outcomes (Volman & ’t Gilde, 2021). A study conducted by the OECD in 2019 highlights that students with teachers who adapt lessons to their learning styles are 30% more likely to perform better in understanding complex concepts, such as those in geography (Meisandy et al., 2021). Given the importance of geography in shaping well-rounded, informed citizens and the role of learning styles in educational outcomes, investigating how these two elements interact in the context of geography teacher education becomes crucial (Aliman et al., 2019; W. S. Utami et al., 2024). This study aims to bridge the gap between learning styles and geographic literacy by focusing on prospective geography teachers, who play a central role in advancing geographic understanding in future generations.

Learning styles refer to how individuals absorb, process, and retain new information (Mulyana et al., 2024). Several models exist to explain learning styles, including Kolb’s Experiential Learning Theory, which categorizes learners as convergers, divergers, assimilators, or accommodators. Individuals learn through a four-stage cycle involving concrete experience, reflective observation, abstract conceptualization, and active experimentation (Healey & Jenkins, 2000). Other popular frameworks include Gardner’s Multiple Intelligences and Fleming’s VARK model (visual, auditory, reading/writing, and kinesthetic learners), both of which provide insights into how educators can tailor their teaching strategies to different learner types (Shala et al., 2024).

On the other hand, geographic literacy is the ability to understand and apply geographical concepts and skills (Segara et al., 2018). It encompasses map-reading skills, spatial thinking, physical and human systems understanding, and awareness of global

interconnections. Geographically literate individuals can analyze geographic data, assess spatial relationships, and make informed decisions based on their understanding of the Earth's processes and patterns (Hari Utomo & Eka Putri, 2019). This literacy is essential for professionals in geography and all individuals navigating today's interconnected world.

The ontological basis of this study revolves around the interplay between learning styles and geographic literacy (Xuan et al., 2019). Existing research underscores the importance of aligning teaching methods with students' learning preferences to enhance understanding. Students taught using strategies that match their learning styles tend to achieve higher academic success. Furthermore, in geography, learning styles may influence how well prospective teachers comprehend and teach spatial concepts (Setyasih et al., 2016). The relationship between teaching methods and geographic literacy suggests that effective geography instruction should account for diverse learning styles.

The central problem is the potential disconnect between prospective geography teachers' learning styles and geographic literacy abilities (Cho et al., 2022). In many educational systems globally, there is a one-size-fits-all approach to teaching, where educators often fail to account for the varied learning styles of their students (Putri et al., 2024). This is particularly concerning in geography education, where the ability to interpret and engage with information spatially depends on how well learners can process and retain complex geographic data (van der Horst et al., 2016).

Prospective geography teachers who do not fully understand their learning styles or how to cater to diverse learners may struggle to effectively convey geographic concepts to their students (Hulseberg & Versluis, 2017; Prastiyono et al., 2021). This could result in a generation of students who are less geographically literate, potentially exacerbating existing global challenges, such as climate mismanagement, poor urban planning, and uninformed policy decisions (Muukkonen, 2023; Widodo et al., 2024). According to the United Nations, geographic literacy is fundamental in achieving several of the Sustainable Development Goals (SDGs), including climate action, sustainable cities, and responsible consumption. Therefore, a lack of educational and geographic literacy poses risks to achieving these global targets (Ahmed et al., 2020; Misiaszek, 2022).

Moreover, as geography encompasses both theoretical and practical components—ranging from understanding geospatial technologies to addressing human-environment interactions—an inability to teach these effectively due to misalignment in

learning styles may create gaps in knowledge. In the long run, this could undermine the quality of the geography teaching workforce and hinder the development of students who can think critically about spatial and environmental issues.

2 METHOD

The approach used is quantitative, using a survey method, problem-based investigation, and data analysis using Structural Equation Modeling (SEM). This approach examined the relationship between learning styles and literacy skills among geography teacher candidates. The study employs a descriptive and explanatory design. The descriptive design aims to illustrate the characteristics of students' learning styles and geographical literacy skills, while the explanatory design seeks to analyze the causal relationship between the variables studied. The study population consists of all active students in Geography Education programs at public and private universities in Indonesia. The sample was purposively selected based on the following criteria: 1) Active students in semesters 4 to 8, 2) Students with experience in learning activities related to geographical literacy. The sample selection was conducted proportionally from 19 public and private universities across Indonesia. The sample size was determined based on the requirements of SEM analysis, amounting to 249 students. Data were collected using two main types of instruments: tests and non-test instruments. Geographical Literacy Test: Multiple-choice questions based on geographical case studies designed to measure students' ability to apply, analyze, and evaluate geographical concepts. Learning Style Questionnaire: Adapted from the Felder-Silverman Learning Style Model or VARK to measure students' learning preferences. Questionnaire on Attitudes and Perceptions of Geographical Literacy: Designed to capture students' views and attitudes toward geographical literacy and Geographical skill. Additionally, Focus Group Discussions (FGDs) were conducted to gain deeper insights into students' challenges and experiences in geographical literacy learning. Data analysis was carried out using SEM with the SMART PLS software. SEM enables testing causal relationships between latent variables, considering direct and indirect relationships among variables.

3 RESULT

Measuring learning styles uses three variables: visual, auditory, and kinesthetic. The latent variable Visual Learning Style (GBV) has five valid and significant indicators, which include (VISU1), (VISU2), (VISU3), (VISU4), and (VISU5). Furthermore, the latent variable of Auditory Learning Style (GBA) has five valid and significant indicators, which include (AUDI1), (AUDI2), (AUDI3), (AUDI4), and (AUDI5). The latent variable Kinestic Learning Style (GBK) has two valid and significant indicators, which include (KIN1) and (KIN4). A confirmatory factor analysis determines whether Learning Style is a valid and significant latent variable, as seen in Table 1.

Table 1

Convergent Validity Test and Latent Variable Discrimination of Visual Learning Style

Learning Style Indicators	Item Loading	T-Statistic	C-R (AVE)	Fornell-Larcker criterion	Validity & Reliability
Visual Learning Style (GBV)					
prefer to use pictures, diagrams, or graphs in learning (VISU1)	0.730	3.626	0.803	0.673	Valid & Reliable
tend to remember information better when presented in visual form (VISU2)	0.638	2.848			Valid & Reliable
feel more focused when looking at a visual presentation or material accompanied by illustrations (VISU3)	0.709	3.643			Valid & Reliable
like using concept maps or interactive whiteboards to understand new concepts (VISU4)	0.747	3.908			Valid & Reliable
prefer to write notes or draw to process and recall information (VISU5)	0.515	2.289			Valid & Reliable
Auditory Learning Style (GBA)					
tend to remember information better when listening to oral explanations or lectures (AUDI1)	0.538	2.728	0.795	0.665	Valid & Reliable
prefer to learn through discussions or interviews involving an oral exchange of ideas (AUDI2)	0.827	9.122			Valid & Reliable
listen to audio recordings or podcasts to understand the material better (AUDI3)	0.624	3.658			Valid & Reliable
prefer to listen to audiobooks or spoken reading materials rather than read on their own (AUDI4)	0.638	4.197			Valid & Reliable

Learning Style Indicators	Item Loading	T-Statistic	C-R (AVE)	Fornell-Larcker criterion	Validity & Reliability
often use dialogue or discussion as a way to process the information I learn (AUDI5)	0.664	4.595			Valid & Reliable
Kinesthetic Learning Style (GBK)					
learn better when I can do experiments or take part in practical demonstrations (KIN1)	0.435	1.284			Valid & Reliable
likes to use manipulative tools or materials (such as models or physical materials) in my learning (KIN2)	-0.013	0.047			Not Valid & Reliable
feel more comfortable when I can move or be active in learning, for example, through role-playing or simulation (KIN3)	-0.221	0.675			Not Valid & Reliable
tend to learn better when I am directly involved in practical activities or physical involvement (KIN4)	0.581	1.379	0.797	0.819	Valid & Reliable
prefer to learn through hands-on experience rather than just listening or reading (KIN5)	-0.109	0.371			Not Valid & Reliable

Based on Table 1, all indicators in the latent variable Visual Learning Style (GBV) give a statistical value of T greater than 1.96, and the value of the original coefficient is close to the value of the mean coefficient of the subsample. The results of the AVE value for the indicator block that measures the construct can be declared to have a good discriminant validity value. This means that all indicators used in this study are declared valid as a measure of each of the construction variables because all of these indicators have a predominantly higher discriminant validity value when compared to the value of each of these indicators in measuring other construction variables (Suryadi et al., 2024). This is clarified by the value of the Fornell-Larcker criterion on the latent variable Learning Style (0.665), which is more significant than 0.500. This shows that all indicators in this study have good discriminant validity, which means that all indicators used are declared valid as a measure of each Learning Style variable (Sarker et al., 2021).

The latent variable of Geographic Literacy Ability (KLG) has five indicators: Figures, Graphs, Infographics, Narratives, and Tables. So, to find out whether KLG is a valid latent variable, a confirmatory factor analysis is used, the results of which can be seen in Table 2.

Table 2

Convergent Validity Test and Discrimination of Latent Variables of Geographic Literacy Ability

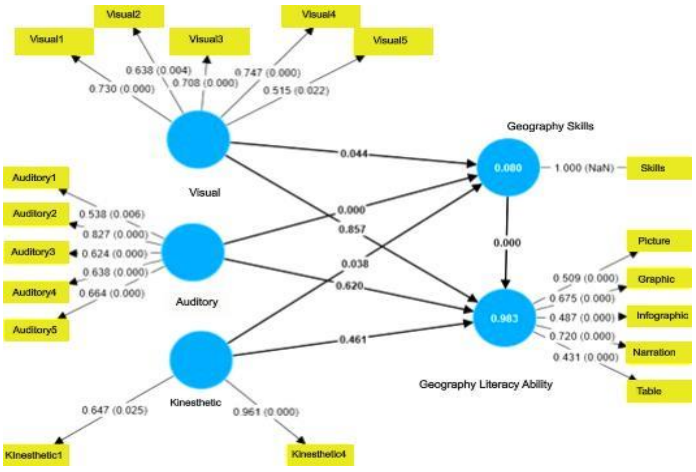
Indicator	Item Loading	T-Statistic	C-R (AVE)	Fornell-Larcker criterion
Picture	0.509	7.067		
Graphic	0.675	17.168		
Infographic	0.487	6.871	0.704	0.575
Narration	0.720	18.584		
Table	0.431	5.790		

Based on table 2, all indicators in the latent variable Geographic Literacy Ability (KLG) give a statistical value of T greater than 1.96, and the value of the original coefficient is close to the value of the subsample mean coefficient. Thus, all loading values are greater than 0.5, and statistically significant, five indicators can be used to measure KLG. The results of the AVE score have a good discriminant validity value. This is clarified by the value of the Fornell-Larcker criterion on the latent variable KLG (0.575), which is greater than 0.5. This shows that all indicators in this study have good discriminant validity, which means that all indicators used in this study are declared valid as a measure of each variable of KLG.

After the validity and reliability tests are carried out on all latent variables that have valid and reliable results, then the latent variables can be continued in the analysis in the form of a path diagram presented in Figure 1.

Figure 1

GBV, GBA, GBK Models on Literacy Ability through Geography Skills



The results of the complete model test above with the SmartPLS program can be seen from the R-Square value, which describes the model's goodness of fit. The recommended R-square value exceeds zero (Li & Rohayati, 2024). The data processing results in this study using SmartPLS provide an R-square value, as shown in Table 3.

Table 3

The goodness of Fit dari R-Square

Variable	*R-Square*
GBV, GBA, GBK → Geography Skills	0.080
GBV, GBA, GBK, Geography Skills → Literacy Skill	0.983

Table 3 explains that the contribution or proportion of the variables Auditor Learning Style (GBA), Visual Learning Style (GBV), and Kinetic Learning Style (GBK) to Geography Skills (KG) is 0.080. Meanwhile, the contribution or proportion of the variables Auditor Learning Style (GBA), Visual Learning Style (GBV), Kinestic Learning Style (GBK), and Geography Skills (KG) to Geographic Literacy Ability (KLG) was 0.983. The result of all R-square values shows that all R-square values are more significant than zero. This means that this research model has met the required Goodness of Fit. The results of the calculation of the Q square value are shown in Table 3.

$$Q2 = 1- (1-0.080) \times (1-0.983) = 0.985 \quad (1)$$

This can be interpreted as the model being able to explain KLG by 98.5% and 1.5%, explaining other variables outside the model. From the appropriate model, each path coefficient can be interpreted. These path coefficients are hypotheses in this study that can be presented in the following structural equations:

Geography Skill = –0.267 Auditor – 0.150 Visual + 0.143 Kinesthetic
Literacy Skill = –0.006 Auditor + 0.002 Visual + 0.008 Kinesthetic +
+ 0.989 Geography skill (2)

The results of the structural path coefficient (inner weight), along with the complete significance values, are shown in the following table:

Table 4

Inner Weight Test on Geography Literacy Ability with Bootstrap Sample

Effect	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
Auditor -> Geography Skills	-0.267	-0.286	0.059	4.490	0.000
Visual -> Geography Skills	0.150	0.174	0.075	2.011	0.044
Kinesthetic-> Geography Skills	0.143	0.145	0.069	2.071	0.038
Auditor -> Geography Literacy Ability	-0.006	-0.007	0.013	0.497	0.620
Visual -> Geography Literacy Ability	0.002	0.004	0.013	0.181	0.857
Kinesthetic -> Geographic Literacy Ability	0.008	0.006	0.011	0.738	0.461
Geography Skills -> Geography Literacy Ability	0.989	0.988	0.006	178.778	0.000

Based on Table 4, the coefficient with bootstrap 5000 for each variable is close to the original coefficient, so the t-statistic data on bootstrap 50 is considered stable and can be used for hypothesis testing. From the table, the interpretation of each path coefficient is as follows:

1. Auditory (AUDI) significantly and negatively affects Geography Skills (KG). This can be seen from the path coefficient marked negatively as (-0.267) with a t-statistical value of 4.490, which is greater than the t-table(0.05) = 1.96 or p-value = 0.000 < α=0.05. Thus, Auditor (AUDI) has a direct effect on Geography Skills (KG) by (-0.267), which means that every time there is an increase in Auditor (AUDI), it will decrease Geography Skills (KG) by 0.267.
2. Visual (VISU) significantly and positively affects Geography Skills (KG). This can be seen from the path coefficient marked positively as 0.150 with a t-statistical value of 2.011, more significant than the t-table(0.05) = 1.96 or p-value = 0.044 < α=0.05. Thus, Visual (VISU) has a direct effect on Geography Skills (KG) by 0.150, which means that every time there is an increase in Visual (VISU), it will increase Geography Skills (KG) by 0.150.
3. Kinesthetic (KIN) significantly and positively affects Geography Skills (KG). This can be seen from the path coefficient marked positively as 0.143 with a t-statistical value of 2.071, which is more significant than t-table = 1.96 or p-value = 0.038 < α=0.05. Thus, Kinesthetic (KIN) has a direct effect on Geography Skills (KG) by 0.143, which means that every increase in Kinesthetic (KIN) will increase Geography Skills (KG) by 0.143.

4. Auditory (AUDI) does not significantly affect Geographic Literacy Ability (KLG). This can be seen from the path coefficient marked negatively as (-0.006) with a t-statistical value of 0.497, which is smaller than the t-table(0.05) = 1.96 or p-value = 0.620 > α=0.05. Thus, the Auditor (AUDI) does not directly affect the Geographical Literacy Ability (KLG), which means that every time there is an increase in the Auditor (AUDI), it will not increase or decrease the Geographical Literacy Ability (KLG).
5. Visual (VISU) did not significantly affect Geography Literacy Ability (KLG). This can be seen from the path coefficient marked positively of 0.002 with a t-statistical value of 0.181, which is smaller than the t-table(0.05) = 1.96 or p-value = 0.857 < α=0.05. Thus, Visual (VISU) does not directly affect Geographic Literacy Ability (KLG), which means that every time there is an increase in Visual (VISU), it will not increase or decrease Geographic Literacy Ability (KLG).
6. Kinesthetic (KIN) does not significantly affect Geographic Literacy Ability (KLG). This can be seen from the path coefficient marked positively of 0.008 with a t-statistical value of 0.738, which is smaller than t-table = 1.96 or p-value = 0.461 < α = 0.05. Thus, Kinesthetic (KIN) does not directly affect Geographic Literacy Ability (KLG), which means that every time there is an increase in Kinesthetic (KIN), it will not increase or decrease Geographic Literacy Ability (KLG).
7. Geography Skills (KG) significantly and positively affect Geography Literacy Ability (KLG). This can be seen from the path coefficient marked positively of 0.989 with a t-statistical value of 178.778, greater than t-table = 1.96 or p-value = 0.000 < α = 0.05. Thus, Geography Skills (KG) have a direct effect on Geography Literacy Ability (KLG) by 0.989, which means that every time there is an increase in Geography Skills (KG), it will increase Geography Literacy Ability (KLG) by 0.989.

4 DISCUSSION

4.1 The influence of visual learning style (VISU), auditor (AUDI), and kinesthetic (KIN) on geography skills (KG)

Visuals significantly positively influence geography skills, with a coefficient of 0.150. These findings suggest that using visual materials, such as maps, diagrams, and models, helps improve geography skills. This is relevant to the characteristics of geography as a discipline that relies heavily on spatial data visualization (Aliman et al., 2019). Auditory has a significant negative influence on Geography Skills. The coefficient value of -0.267 shows that increased auditor involvement decreases geography skills. This is due to the less effective nature of auditor learning in building the practical skills required in geography, such as spatial analysis or visual tools (Mulyana et al., 2024; Pascu, 2024). Kinestik also had a significant positive effect on Geography Skills, with a coefficient of 0.143. This indicates that hands-on or physical experience-based learning approaches, such as fieldwork, improve skills in understanding geographical phenomena in depth.

Visual and kinesthetic learning styles have a significant favorable influence on geography skills based on several recent theories and research. Visual style-based learning involves observation, graphical representation, and visual media such as maps, diagrams, and videos (Prasetya et al., 2025; Prastiyono et al., 2023). Visual cognitive theory states that visually conveyed information can strengthen understanding and memory because it involves various sensory pathways in the brain (Kholiq, 2020). For example, geography lessons that include the use of interactive maps have been shown to improve students' spatial thinking abilities, which are core geography skills.

In addition, kinesthetic learning that focuses on physical activity and hands-on experience also improves geography skills. Students learn and apply the theory through approaches such as field simulation games or topographic modeling. (Prastiyono et al., 2022; Segara, 2016). Kolb's experiential learning aligns with the study's results to support this, emphasizing that hands-on experience encourages more immersive and long-lasting learning. Recent research shows that students exposed to learning methods that suit their learning style improve material mastery (Meadows, 2020; Segara et al., 2018). In

geography, students with visual learning styles demonstrate a better understanding of spatial and geographic concepts through visual aids such as digital maps.

On the other hand, kinesthetic students tend to excel in experiential activities such as field mapping or physical experiments. These findings have practical implications, including the importance of teaching tailored to students' learning styles. Teachers can combine visual and kinesthetic methods to create a more comprehensive learning experience (Zandvakili et al., 2019a). Interactive technology and project-based activities allow students with visual and kinesthetic learning styles to collaborate and complement each other in developing their geography skills (Budirahayu & Saud, 2023; Rosarian & Dirgantoro, 2020).

Auditory learning styles, characterized by a preference for verbal instruction and auditory processing, can sometimes have unintended adverse effects on acquiring skills in spatial and practical subjects such as geography. This is because auditory learners often rely on hearing and verbal cues rather than engaging directly with visual or kinesthetic materials that are essential for the development of geographic skills, such as interpreting maps, diagrams, or physical landscapes (Apriliandra & Christanto, 2020; Mbau et al., 2023). Reliance on auditory cues can lead to disconnection when students are asked to integrate visual-spatial information into their understanding. Research has shown that students with auditory learning preferences may perform better in lecture-based or discussion-oriented settings but may struggle with tasks that require active interaction with visual tools or spatial reasoning, both of which are important in geography education (Amin et al., 2020; Kusmulyono & Karimah, 2022; J. P. Utami et al., 2021).

Individuals have a variety of combinations of intelligences, including linguistic (auditory) and spatial. Theoretical perspectives, such as Gardner's theory of multiple intelligences, suggest that mismatches between dominant intelligence types and teaching methodologies can hinder skill development (CARVALHO & SANTOS, 2022; Sofologi et al., 2023). Auditory learners are encouraged to implement methods that improve spatial and practical competencies to reduce the dependence on learning styles. Further empirical studies show that although auditory learning techniques (e.g., discussions and verbal explanations) have not yet sufficiently supported conceptual comprehension they do not provide the direct or visual reinforcement necessary for practical subjects (Putri Ningrat et al., 2018; Shala et al., 2024). Auditory learners tend to struggle with subjects such as

geography when teaching methods do not include interactive or visual aids to supplement verbal instruction (Aliman et al., 2019; Oktavianto et al., 2024).

4.2 The effect of visual learning style (VISU), auditor (AUDI), and kinesthetic (KIN) on geographic literacy ability (KLG)

Visual learning style did not significantly influence Geography Literacy, although the coefficient was positive (0.002). These results show that visual materials cannot improve literacy skills without integrating learning methods that support critical analysis and concept understanding. Auditors do not have a significant influence on Geography Literacy Ability. A coefficient of -0.006 shows that the auditor element is ineffective enough in influencing geographic literacy, which requires a deep understanding of texts, data, and geospatial information. Kinetics also did not significantly influence Geography Literacy, with a coefficient of 0.008. This suggests that physical activity or practice alone cannot improve geographic literacy, requiring an analytical and interpretive component.

Learning styles, such as visual, auditory, and kinesthetic, are often thought to influence academic success by optimizing how individuals process information (Sabarun et al., 2023). However, recent research shows that relying on individual learning styles does not always significantly impact learning outcomes, including geography literacy. Several studies reveal that the effectiveness of learning styles often depends on the content and teaching methods used, not just the student's preferences (Ssemugenyi, 2023b).

Geographic literacy requires integrating various skills, such as reading maps, analyzing spatial data, and understanding relationships between regions. These multidimensional competencies mean that certain learning styles alone cannot cover all aspects of this learning (Benítez Moreno et al., 2024). A learning style-based approach without the support of a holistic learning strategy tends to be ineffective. Research shows that while visual learning styles can help students understand spatial information, and kinesthetics can facilitate learning through hands-on experience, they do not necessarily significantly improve geographic literacy. This is due to geographic literacy, which demands more analytical and critical skills and requires a more interactive and problem-based teaching approach (Heinimäki et al., 2021).

Auditory learning styles also show significant limitations in improving geographic literacy. Lecture-based teaching is often insufficient to facilitate an in-depth understanding of complex geographical concepts, especially if students are not actively involved in the learning process (Zandvakili et al., 2019b). Task-based or project-based learning approaches involving technology and collaboration are more effective in improving geographic literacy than simply adapting methods to individual learning styles (Hari Utomo & Eka Putri, 2019). This approach allows students to develop skills that are more relevant to their geographic literacy needs.

4.3 The effect of geography skills (KG) on geographic literacy ability (KLG)

Geography Skills have a powerful, significant, favorable influence on Geography Literacy Ability, with a coefficient of 0.989. These findings confirm that mastery of geography skills, such as mapping, spatial data analysis, and understanding of geographical phenomena, directly improves geographic literacy skills, as the two support each other in understanding and interpreting geographic data.

Geography skills significantly influence geographic literacy skills because they provide a practical basis for understanding and analyzing geographic information (W. S. Utami et al., 2018). Geographic literacy includes reading, analyzing, and applying spatial data from various tools such as maps, satellite imagery, or other geospatial information. According to spatial-based cognitive theory, geography skills such as spatial orientation and spatial analysis play an important role in building these abilities (Amin et al., 2020).

Research shows that geography skills, such as reading maps and using geographic information systems (GIS), directly improve the ability to understand and apply geographic concepts in various contexts. Students proficient in geography tend to have better geographic literacy, especially in understanding the relationship between humans and the environment (Xuan et al., 2019). Kolb's experiential learning theory supports this relationship by emphasizing that hands-on learning through field mapping, simulation, and spatial data analysis strengthens analytical and critical skills (Healey & Jenkins, 2000; Van Der Horst et al., 2016). This activity allows students to apply geography skills in authentic contexts, contributing to developing geography literacy.

Furthermore, empirical findings show that mastery of geography improves students' ability to understand maps and spatial data and broadens students' understanding

of global issues, such as climate change and urbanization. Geography literacy allows students to evaluate and predict the impact of spatial and environmental dynamics more accurately, supporting better decision-making. Geography skills are very influential in improving geographic literacy skills because they complement each other. Students with strong geography skills tend to understand and utilize geographic information more effectively, which is important in today's data-driven information era.

5 CONCLUSION

Research findings regarding the influence of visual, auditory, and kinesthetic learning styles on geography skills (KG) and geographic literacy skills (KLG) through different learning styles have different effects on geography skills, with visual and kinesthetic styles providing significant positive influences, while auditory styles showing significant negative influences. These findings have important implications for developing the geography education curriculum, especially opening up space for developing teaching methods that align with learning styles to improve the quality of geography learning more comprehensively and effectively. In addition to considering adapting teaching methods that suit students' learning styles, ensuring that the approach used is not only based on learning styles but also pays attention to developing analytical skills and geographical literacy. Using technology, such as GIS, digital maps, and other visual aids, can be very beneficial for improving geography skills, primarily visual and kinesthetic learning styles. In addition, problem-based learning and field activities can provide hands-on experience that strengthens understanding of geographic concepts and improves geographic literacy. However, it is important to note that learning style is not the only factor that affects learning outcomes. A more holistic teaching approach, which combines a variety of methods and technologies, is more effective in developing geography skills and geographic literacy. Therefore, geography learning should emphasize developing in-depth practical and analytical skills, understanding and solving spatial data-driven problems, and preparing to face increasingly complex global challenges.

ACKNOWLEDGMENTS

This research is a collaborative scheme funded by the Faculty of Social and Political Sciences. Thank you to the Chancellor of Surabaya State University and the dean of the Faculty of Social and Political Sciences. This research is part of lecturers' duties in higher education tri-dharma activities.

REFERENCES

Ahmed, T., Khan, M. S., Thitivesa, D., Siraphatthada, Y., & Phumdara, T. (2020). Impact of Employees engagement and knowledge sharing on organizational performance: Study of HR challenges in COVID-19 pandemic. Human Systems Management, 39, 589–601. https://doi.org/10.3233/HSM-201052

Aliman, M., Budijanto, Sumarmi, Astina, I. K., Putri, R. E., & Arif, M. (2019). The effect of earthcomm learning model and spatial thinking ability on geography learning outcomes. Journal of Baltic Science Education, 18(3), 323–334. https://doi.org/10.33225/jbse/19.18.323

Amin, S., Utaya, S., Bachri, S., Sumarmi, S., & Susilo, S. (2020). Effect of Problem Based Learning on Critical Thinking Skill and Enviromental Attitude. Journal for the Education of Gifted Young Scientists, 8(2), 743–755. https://doi.org/10.17478/jegys.650344

Apriliandra, I. R., & Christanto, L. M. H. (2020). Pembelajaran Geografi Dengan Sistem Pembelajaran. 1–8.

Asare, P. Y., & Amo, S. K. (2023). Developing preservice teachers' teaching engagement efficacy: A classroom managerial implication. Cogent Education, 10(1), 2170122. https://doi.org/10.1080/2331186X.2023.2170122

Benítez Moreno, F. J., Rodriguez Hidalgo, A. J., & Herrera-López, M. (2024). La Competencia Social Multidimensional en la Formación de las Habilidades Socioemocionales para la Mediación Escolar . Electronic Journal of Research in Education Psychology, 22(62), 151–170. https://doi.org/10.25115/ejrep.v22i62.8504

Budirahayu, T., & Saud, M. (2023). Pedagogical innovation and teacher collaborations in supporting student learning success in Indonesia. Cogent Education, 10(2). https://doi.org/10.1080/2331186X.2023.2271713

CARVALHO, A. R., & SANTOS, C. (2022). Developing peer mentors' collaborative and metacognitive skills with a technology-enhanced peer learning program. Computers and Education Open, 3, 100070. https://doi.org/10.1016/j.caeo.2021.100070

Cho, C.-K., Kim, B.-Y., & Stoltman, J. P. (2022). Photovoice and pre-service geography teachers' visual sense of place. Emotion, Space and Society, 45, 100908. https://doi.org/10.1016/j.emospa.2022.100908

Davis, K. A., & Knight, D. B. (2021). Comparing students' study abroad experiences and outcomes across global contexts. International Journal of Intercultural Relations, 83, 114–127. https://doi.org/10.1016/j.ijintrel.2021.05.003

Elsabawy, M. N. E. (2014). Geography Illiteracy and Reforming Geography Education in Egypt among University Undergraduate Students. Procedia - Social and Behavioral Sciences, 120, 394–403. https://doi.org/10.1016/j.sbspro.2014.02.117

Hari Utomo, D., & Eka Putri, A. (2019). Geography Learning Design Based on Spatial Phenomenon To Improve Higher-Order Thinking Skills. Geography and Geography Education, 3(2), 2580–1775.

Healey, M., & Jenkins, A. (2000). Kolb's Experiential Learning Theory and Its Application in Geography in Higher Education. Journal of Geography, 99(5), 185–195. https://doi.org/10.1080/00221340008978967

Heinimäki, O.-P., Volet, S., Jones, C., Laakkonen, E., & Vauras, M. (2021). Student participatory role profiles in collaborative science learning: Relation of within-group configurations of role profiles and achievement. Learning, Culture and Social Interaction, 30, 100539. https://doi.org/10.1016/j.lcsi.2021.100539

Hulseberg, A., & Versluis, A. (2017). Integrating information literacy into an undergraduate geography research methods course. College & Undergraduate Libraries, 24(1), 14–28. https://doi.org/10.1080/10691316.2017.1251371

Iranmanesh, A., & Mousavi, S. A. (2022). City and campus: Exploring the distribution of socio-spatial activities of students of higher education institutes during the global pandemic. Cities, 128, 103813. https://doi.org/10.1016/j.cities.2022.103813

Kholiq, A. (2020). How is Piaget's Theory Used to Test The Cognitive Readiness of Early Childhood in School? Indonesian Journal of Early Childhood Education Studies, 9(1), 24–28. https://doi.org/10.15294/ijeces.v9i1.37675

Kuruppuarachchi, J., Hemadila, P., & Madurapperuma, B. (2023). Comparison of the Literacy Level on Major Environmental Issues of the G.C.E. (A/L) Students of Different Disciplines in Kandy District, Sri Lanka. In Sustainability (Vol. 15, Issue 5). https://doi.org/10.3390/su15053968

Kusmulyono, M. S., & Karimah, R. (2022). Studi Tantangan dan Harapan Guru Geografi untuk Meningkatkan Kualitas Pembelajaran Daring di SMA. Jurnal Pendidikan, Sains Sosial, Dan Agama, 8(2), 475–486. https://doi.org/10.53565/pssa.v8i2.565

Li, M., & Rohayati, M. I. (2024). The Relationship between Learning Outcomes and Graduate Competences: The Chain-Mediating Roles of Project-Based Learning and Assessment Strategies. In Sustainability (Vol. 16, Issue 14). https://doi.org/10.3390/su16146080

Mbau, D., Pamungkas, B. T. T., & Hasan, M. H. (2023). Pengembangan Media Pembelajaran Berbasis Audio Visual Adobe Flash Pada Pelajaran Geografi Kelas X Di Sma Negeri 1 Rote Barat Laut. Jurnal Geografi, 19(1), 36–53. https://doi.org/10.35508/jgeo.v19i1.11682

Meadows, M. E. (2020). Geography Education for Sustainable Development. Geography and Sustainability, 1(1), 88–92. https://doi.org/10.1016/j.geosus.2020.02.001

Meisandy, R. R., Sumarmi, S., & Utomo, D. H. (2021). EXPLORING THE USE OF BLENDED PBL IN GEOGRAPHY FOR ENHANCING STUDENTS' ANALYTICAL THINKING IN THE "NEW NORMAL" CONDITION. GeoEco, 7(1), 106–120.

Misiaszek, G. W. (2022). An ecopedagogical, ecolinguistical reading of the Sustainable Development Goals (SDGs): What we have learned from Paulo Freire. Educational Philosophy and Theory, 54(13), 2297–2311. https://doi.org/10.1080/00131857.2021.2011208

Mulyana, F. R., Juniar, D. T., Malik, A. A., Mulyana, D., & Hanief, Y. N. (2024). The Influence of Cooperative Learning Models and Learning Styles on Social Skills in University Student. International Journal of Disabilities Sports and Health Sciences, 7((Special Issue 1): International Conference on Sport Science and Health (ICSSH, 2023)), 9–18. https://doi.org/10.33438/ijdshs.1368958

Muukkonen, P. (2023). Geography education to help understand discrimination in climate change and health. In Lancet (London, England) (Vol. 401, Issue 10382, pp. 1075–1076). https://doi.org/10.1016/S0140-6736(23)00325-2

Oktavianto, D., Sumarmi, S., Utaya, S., Taryana, D., & Widodo, B. (2024). Challenges in the Implementation of Telemedicine. Journal of the Geographical Institute Jovan Cvijic, 74(2), 281–289. https://doi.org/10.2298/IJGI230426006O

Pascu, M. (2024). The contribution of students' learning styles to competences development through the use of Kahoot learning platform. Cogent Education, 11(1), 2352320. https://doi.org/10.1080/2331186X.2024.2352320

Prasetya, S. P., Hidayati, A., Khamid, A., Lailiyah, F., & Prastiyono, H. P. (2025). The use of three-dimensional media in the shape of the Earth's surface to optimize the knowledge of blind students in social science subjects. British Journal of Visual Impairment, 02646196241301052. https://doi.org/10.1177/02646196241301052

Prastiyono, H., Utaya, S., Sumarmi, S., Astina, I. K., Amin, S., & Aliman, M. (2021). Development of E-Learning, Mobile Apps, Character Building, and Outdoor Study (EMCO Learning Model) to Improve Geography Outcomes in the 21st Century. International Journal of Interactive Mobile Technologies, 15(7), 107–122. https://doi.org/10.3991/ijim.v15i07.21553

Prastiyono, H., Widodo, B. S., Utaya, S., Sumarmi, Astina, I. K., Amin, S., & Isaias, P. (2023). The Development of Geomobile App-Based Outdoor Study to Improve Critical-Social Abilities and Collaborative in the 21st Century. International Journal of Interactive Mobile Technologies (iJIM), 17(24 SE-Papers), 79–95. https://doi.org/10.3991/ijim.v17i24.45945

Putri, A., Rahman, A., Purwanto, Osman, S., & Anastassia, S. (2024). Teachers Underutilize Their Learning Styles in Developing Thought-Provoking Questions: A Case Study. Başlık, volume–13–2024(volume–13–issue–2–april–2024), 479–495. https://doi.org/10.12973/eu-jer.13.2.479

Putri Ningrat, S., Tegeh, I. M., & Sumantri, M. (2018). Kontribusi Gaya Belajar Dan Motivasi Belajar Terhadap Hasil Belajar Bahasa Indonesia. Jurnal Ilmiah Sekolah Dasar, 2(3 SE-Articles), 257–265. https://doi.org/10.23887/jisd.v2i3.16140

Rosarian, A. W., & Dirgantoro, K. P. S. (2020). Upaya Guru Dalam Membangun Interaksi Siswa Melalui Metode Belajar Sambil Bermain [Teacher'S Efforts in Building Student Interaction Using a Game Based Learning Method]. JOHME: Journal of Holistic Mathematics Education, 3(2), 146. https://doi.org/10.19166/johme.v3i2.2332

Sabarun, Widiati, Utami, Suryati, Nunung, & Azman, Mohamed Nor Azhari. (2023). Measuring the Effect of Learning Style Preference on Learners' Argumentative Essay Writing Across Different Writing Strategies. Journal of Higher Education Theory and Practice, 23(5). https://doi.org/10.33423/jhetp.v23i5.5935

Sarker, T., Sarkar, A., Rabbany, M. G., Barmon, M., Roy, R., Rahman, M. A., Hossain, K. Z., Hoque, F., & Asaduzzaman, M. (2021). Evaluation of preventive, supportive and awareness building measures among international students in China in response to COVID-19: A structural equation modeling approach. Global Health Research and Policy, 6(1). https://doi.org/10.1186/s41256-021-00192-5

Segara, N. B. (2016). The Urgency of Map Literacy and Spatial Thinking for Urban Society. Journal of Social Sciences Studies, 1(1), 116–126.

Segara, N. B., Maryani, E., Supriatna, N., & Ruhimat, M. (2018). Introducing Map Literacy Model of Learning. IOP Conference Series: Earth and Environmental Science, 145(1). https://doi.org/10.1088/1755-1315/145/1/012046

Setyasih, I., N., M. V. R., Amirudin, Ach., Fatchan, Ach., & Utaya, S. (2016). The Effect of Learning Cycle 7E Model for Geographic Achievement on Multi-ethnic Students BT - Proceedings of the 1st International Conference on Geography and Education (ICGE 2016). 310–315. https://doi.org/10.2991/icge-16.2017.59

Shala, D. S., Thaçi, E., & Shala, A. (2024). Learning Styles and Motivation: Their Role in Academic Performance. Journal of Educational and Social Research, 14(3 SE-Articles), 258. https://doi.org/10.36941/jesr-2024-0071

Sofologi, M., Foutsitzi, E., Papantoniou, A., Kougioumtzis, G., Zaragas, H., Tsolaki, M., Moraitou, D., & Papantoniou, G. (2023). The Effect of Secondary Education Teachers' Metacognitive Knowledge and Professional Development on Their Tacit Knowledge Strategies. In Journal of Intelligence (Vol. 11, Issue 9). https://doi.org/10.3390/jintelligence11090179

Ssemugenyi, F. (2023a). Teaching and learning methods compared: A pedagogical evaluation of problem-based learning (PBL) and lecture methods in developing learners' cognitive abilities. Cogent Education, 10(1). https://doi.org/10.1080/2331186X.2023.2187943

Ssemugenyi, F. (2023b). Teaching and learning methods compared: A pedagogical evaluation of problem-based learning (PBL) and lecture methods in developing learners' cognitive abilities. Cogent Education, 10(1). https://doi.org/10.1080/2331186X.2023.2187943

Suryadi, Qadir Muslim, A., Setyono, L., & Nanang, A. S. (2024). the Effect of Spiritual Leadership on Organizational Resilience: Mediated By Entrepreneurial Innovation. Corporate Governance and Organizational Behavior Review, 8(1), 115–125. https://doi.org/10.22495/cgobrv8i1p10

Utami, J. P., Utaya, S., & Wagistina, S. (2021). Pengaruh model pembelajaran Geographical Inquiry pada mata pelajaran Geografi terhadap kemampuan berpikir kritis dan memecahkan masalah siswa kelas X. Jurnal Integrasi Dan Harmoni Inovatif Ilmu-Ilmu Sosial (JIHI3S), 1(8), 943–958. https://doi.org/10.17977/um063v1i8p943-958

Utami, W. S., Yani, M. T., Zain, I. M., Prastiyono, H., Setyasih, I., & Ibrahim, M. H. bin. (2024). Revealing the Independent Campus Learning Program (MB-KM) in Sustainable on Increasing The Competency of Geography Education Students. IOP Conf. Ser. Earth Environ. Sci., 1406(1). https://doi.org/10.1088/1755-1315/1406/1/012027

Utami, W. S., Zain, I. M., & Sumarmi. (2018). Geography literacy can develop Geography skills for high school students: Is it true? IOP Conference Series: Materials Science and Engineering, 296(1). https://doi.org/10.1088/1757-899X/296/1/012032

van der Horst, D., Harrison, C., Staddon, S., & Wood, G. (2016). Improving energy literacy through student-led fieldwork – at home. Journal of Geography in Higher Education, 40(1), 67–76. https://doi.org/10.1080/03098265.2015.1089477

Van Der Horst, D., Harrison, C., Staddon, S., & Wood, G. (2016). Improving energy literacy through student-led fieldwork – at home. Journal of Geography in Higher Education, 40(1), 67–76. https://doi.org/10.1080/03098265.2015.1089477

Volman, M., & ’t Gilde, J. (2021). The effects of using students’ funds of knowledge on educational outcomes in the social and personal domain. Learning, Culture and Social Interaction, 28, 100472. https://doi.org/10.1016/j.lcsi.2020.100472

Widodo, B. S., Prastiyono, H., Utami, W. S., Prabawati, I., Wahyuni, J., & Dizon, C. S. (2024). The Potential of Tourism Villages Based Learnscape as a Geography Learning Resource (Case Study in Panglipuran, Bali). Geojournal of Tourism and Geosites, 57, 2164–2175. https://doi.org/10.30892/gtg.574spl30-1383

Xuan, X., Jin, Q., Jo, I., Duan, Y., & Kim, M. (2019). The Potential Contribution of Geography Curriculum to Scientific Literacy. Journal of Geography, 118(5), 185–196. https://doi.org/10.1080/00221341.2019.1611906

Zandvakili, E., Washington, E., Gordon, E. W., Wells, C., & Mangaliso, M. (2019a). Teaching Patterns of Critical Thinking: The 3CA Model—Concept Maps, Critical Thinking, Collaboration, and Assessment. SAGE Open, 9(4), 2158244019885142. https://doi.org/10.1177/2158244019885142

Zandvakili, E., Washington, E., Gordon, E. W., Wells, C., & Mangaliso, M. (2019b). Teaching Patterns of Critical Thinking: The 3CA Model—Concept Maps, Critical Thinking, Collaboration, and Assessment. SAGE Open, 9(4), 215824401988514. https://doi.org/10.1177/2158244019885142

Authors' Contribution

All authors contributed equally to the development of this article.

Data availability

All datasets relevant to this study's findings are fully available within the article.

How to cite this article (APA)

Utami, W. S., Widodo, B. S., Prabawati, I., Zain, I. M., & Prastiyono, H. (2026). POSITIVE SYNERGY BETWEEN GEOGRAPHIC LITERACY AND SKILLS: INSIGHTS FROM PROSPECTIVE TEACHERS. *Veredas Do Direito*, 23(2), e234188. https://doi.org/10.18623/rvd.v23.n2.4188