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ARCGIS STORYMAPS IN GEOGRAPHY LEARNING: A SYSTEMATIC LITERATURE REVIEW

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Abstract

Transformation in geography education along with the development of digital technology has opened up new opportunities to improve the quality of geography learning, one of which is through the use of ArcGIS Story Maps. This platform allows students to access spatial information dynamically and interact with maps and multimedia content, which can deepen the understanding of geography concepts. This research aims to examine the application of ArcGIS Story Maps in geography education in secondary schools, and to identify the benefits and challenges of its use. The method used was a systematic literature review of 290 studies, with 11 articles meeting the inclusion criteria. The main findings showed the use of ArcGIS Story Maps increased students' engagement, spatial thinking ability, as well as their creativity. In addition, the platform helps teachers create a more dynamic and student-centered learning environment. ArcGIS Story Maps has great potential in improving the geography learning experience, although challenges in technological infrastructure and teacher training need to be overcome to optimize its use.

Keywords: ArcGIS StoryMaps; Educational technology; Geography education; Interactive learning; Student engagement; Teaching methods

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INTRODUCTION | مقدمة

In recent years, geography education has undergone a significant transformation along with the development of digital technologies (Edelson et al., 2013; Osborne et al., 2020), especially in the context of utilizing geospatial tools and platforms (Osborne et al., 2020). As part of this shift, the use of technologies such as ArcGIS StoryMaps in geography teaching has shown great potential to improve the quality of learning and student engagement (Cyvin et al., 2022; De Miguel González & De Lázaro Torres, 2020). The tool allows users to create interactive narratives by integrating maps with multimedia content such as images, videos and text, which not only increases engagement, but also supports conceptual understanding and provides a contextualized learning experience (Bajjali, 2023).

The utilization of ArcGIS Story Maps in the field of geography education has been shown to significantly impact students' capacity to learn. The integration of GIS technology into the curriculum allows educators to adopt a more interactive and student-centered teaching approach. This will ultimately improve the quality of education (Vojteková et al., 2022). In addition, research

shows that the integration of web-based GIS technologies in the learning process can facilitate the development of sustainable learning practices. Platforms such as ArcGIS Story Maps significantly enhance students' understanding of the elements of geography as well as their understanding of natural disasters and other real-world issues. By examining complex datasets and spatial information, students can gain deeper insights into the interconnections between geographic phenomena and the importance of sustainable practices (Urbańska et al., 2021; Yli-Panula et al., 2019).

ArcGIS Story Maps is a well-established tool for integrating cartographic elements, multimedia content, and text to create dynamic and engaging narratives. The incorporation of geospatial information technologies has been identified as a valuable pedagogical approach to enhance students' learning experiences and deepen their understanding of geography concepts (Curtis, 2019; Pérez delHoyo et al., 2020). Tools such as ArcGIS StoryMaps are increasingly recognized for their potential to transform geography education by providing a platform for students to explore, analyze, and display spatial information in an interactive and dynamic manner (J. Lee, 2023).

The success of this technology in enhancing learning also relates to its ability to provide a more personalized and flexible learning experience (Yanti et al., 2023). In the context of geography education, the use of platforms such as ArcGIS Story Maps allows students to learn at their own pace, explore various topics independently, and participate in more interactive and data-driven activities (J.-M. Lee & Kim, 2024). This is particularly relevant in today's world of education, where the diversity of learning styles and student needs is increasingly recognized as an important factor in educational success. In addition, ArcGIS Story Maps also provide a space to introduce more inclusive and critical perspectives in geography teaching (Schnitzler, 2020). By integrating decolonial narratives and diverse perspectives in maps and stories, educators can help students develop a broader understanding of the role of geography in social and environmental issues (Bednarz, 2019; Stanek, 2019). This is important as global challenges such as climate change, social injustice and natural disasters are increasingly complex and require a holistic understanding.

However, despite the growing recognition of this technology, the use of ArcGIS Story Maps in geography education, especially at the secondary school level, is still not widely explored in the existing literature. Most previous studies have dealt with the use of geospatial technologies in education in general without exploring past research and specializing in this platform. For example, some studies have explored the effectiveness of Statistical Geographic Information Services (SGIS) in supporting student-centered learning (J.-M. Lee & Kim, 2024), as well as integrating technology in geospatial inquiry activities for high school students (J. Lee, 2023). In addition, several other studies highlighted the use of Google Earth in improving geospatial literacy in primary education (Indhirawati et al., 2023) and exploring the advantages and opportunities of GIS technology in geography education (Zhunissov, 2023). This suggests a research gap related to the urgency of this study to explore the use of ArcGIS Story Maps in the context of geography education. The use of this platform allows students to interact with interactive maps, access spatial information dynamically, and engage in immersive storytelling about geography issues, which cannot be achieved with traditional teaching methods such as static maps or textbooks (Berendsen et al., 2018; Groshans et al., 2019; Treves et al., 2021).

The objective of this study is to identify, develop, and integrate existing research on the use of ArcGIS Story Maps in geography education at the high school level. It is anticipated that by focusing on this specific topic, the current state of research can be elucidated, deficiencies in the

existing literature can be identified, and ArcGIS Story Maps can be utilized as an instrument to facilitate enhanced geographical learning (Vojteková et al., 2022). Notwithstanding the fact that previous reviews have addressed the broader use of geospatial technologies in education, this study will focus on examining the specific features and advantages of ArcGIS Story Maps in the context of geography education at the high school level. Accordingly, the objective of this study, which was conducted through a comprehensive literature review, is to contribute to the ongoing discourse on innovative pedagogical approaches in geography education.

METHOD | منهج

The study was conducted in accordance with the following steps: (1) formulation of the research question, establishment of the study's purpose and focus, (2) establishment of inclusion and exclusion criteria, (3) development of a literature search strategy, (4) selection of literature based on inclusion and exclusion criteria, and (5) extraction and synthesis of data.

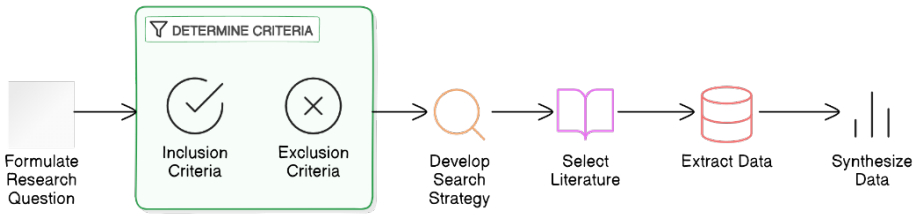

Figure 1. Research steps

Research objectives and questions

The objective of this study was to collate and analyse existing literature on the use of ArcGIS Story Maps in geographical education. The principal objective of a systematic analysis is to address a series of research questions (Medeiros & Holanda, 2019). Accordingly, this study has formulated research questions (Table 1).

Table 1. Research question

Research question (RQ)	Question
RQ 1	How can ArcGIS StoryMaps be used in high school geography lessons?
RQ 2	What is the impact of using ArcGIS StoryMaps in geography learning for students?
RQ 3	What benefits have been identified for teachers in implementing ArcGIS StoryMaps in geography learning?

Inclusion and exclusion criteria

A potential issue in a systematic study is the occurrence of selection bias, which can arise when the inclusion and exclusion criteria are not clearly defined (Nightingale, 2009). Therefore, it is essential to establish clear and objective criteria for inclusion and exclusion to minimize the likelihood of bias. This study has set forth explicit standards for inclusion and exclusion, as outlined in Table 2.

Table 2. Inclusion and exclusion criteria

Category	Inclusion	Exclusion	Reason
Study content	A study that focuses on the use of ArcGIS StoryMaps in geography learning.	Studies that discuss geospatial technologies other than ArcGIS StoryMaps	Maintaining relevance to the main topics of ArcGIS StoryMaps.

		without a primary focus on ArcGIS StoryMaps.	
Educational context	Studies that explicitly discuss the use, impact, or implementation of ArcGIS StoryMaps in geography learning in senior high school.	Studies that do not specifically discuss the use, impact, and implementation of ArcGIS StoryMaps in geography learning.	Focus on the context of geography education in senior high school.
Publication Type	Peer-reviewed journal articles. Or relevant conference proceedings.	Editorial articles, books or book reviews, opinion pieces, or letters to the editor, project reports or working papers that are not peer-reviewed.	Maintaining data quality and credibility.
Time span	Studies published in the period 2019-2024.	Studies published before 2019.	Recent studies reflect current developments and relevance in technology.
Publication Language	Studies published in English or Indonesian.	Studies published in languages other than English or Indonesian.	Ensure that the selected literature is understandable.

Literature search

A comprehensive literature search was conducted using the Publish or Perish tool. The Scopus database is employed to guarantee the caliber of the literature. Furthermore, to guarantee a comprehensive search, the Google Scholar database is employed. The search was conducted using the following key terms: ArcGIS StoryMaps, geography learning. The strings used were ("ArcGIS StoryMaps" OR "Story Maps") AND ("geography education" OR "geography teaching" OR "geography learning"). In the process of searching for information, it is essential to extract keywords, recognize the various spellings and synonyms that may exist, and connect these keywords with Boolean operators (Schön et al., 2017).

Table 3. Search query

String	Meaning	Reason
"ArcGIS StoryMaps" OR "Story Maps"	Covers ArcGIS-specific technologies and general story maps.	Captures studies on ArcGIS StoryMaps as well as variations of story map technology.
AND	Connecting two groups of terms.	Filtering literature relevant to the context of geography education.
"geography education" OR "geography teaching" OR "geography learning"	Focus on geography education, teaching, and learning.	Ensuring relevance to various aspects of geography education.

Literature selection

The results of the initial search were used to inform the selection process, which was conducted with the aim of reducing potential bias. This selection process was conducted using Covidence software, which facilitates systematic reference management. First, Covidence was used to identify and remove duplicates based on predefined inclusion criteria. To ensure the accuracy of the results, duplication identification was also performed manually. Next, each

remaining article was examined through two main stages: the first stage was an examination of the title and abstract to determine initial relevance, while the second stage involved a full review of the article's full text to ensure its eligibility according to the predefined inclusion criteria. Those articles that met the inclusion criteria were then further analyzed to evaluate their quality and suitability to the objectives of this study.

Extraction and synthesis

The data were retrieved using a form available in Excel that included the following information: author, title, year, summary, objectives, methods, and results of the study. Furthermore, Mendeley is employed to facilitate the retrieval of fundamental metadata, including author, title, and publication year. The same information, such as that pertaining to the publisher and the number of copies in print, is listed in the publication data. Concurrently, the data were merged in order to consolidate the findings of the retrieved studies.

RESULT | نتائج

A total of 290 studies were identified, of which 11 were retrieved from the Scopus database and 279 from Google Scholar. Nine studies were identified as duplicates automatically, and a further two were identified manually to ensure that no duplicates were included. Six studies were identified as duplicates. Of the 275 articles initially retrieved, 111 were subjected to title and abstract screening to assess their relevance to the topic of ArcGIS StoryMaps in geography learning. Of these, 11 met the criteria for a more comprehensive review (Figure 2). The selected articles were classified according to year of publication and database (Table 4). Data extraction was subsequently conducted for the 11 selected articles (Table 5).

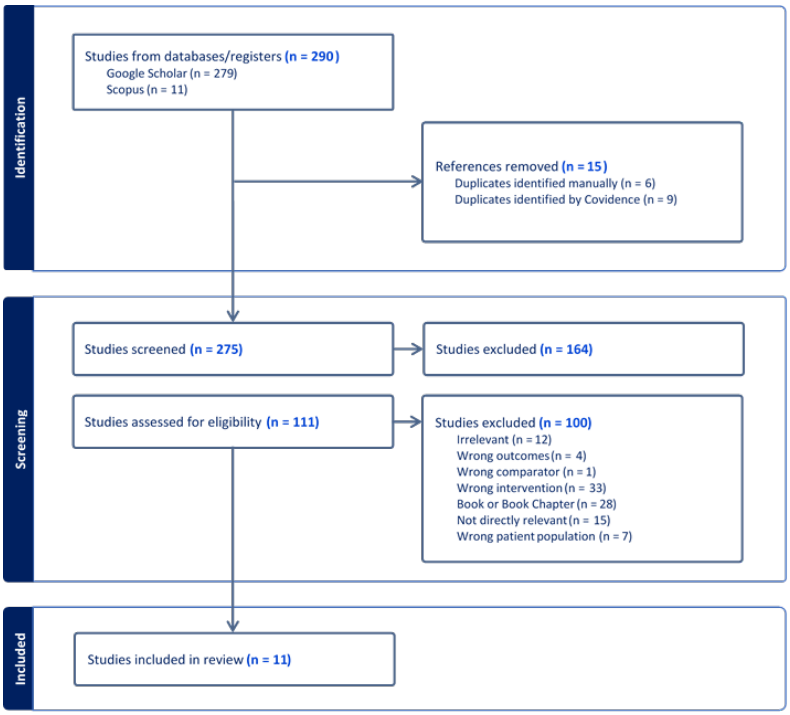

Figure 2. Article selection flow

With regard to geographical learning, the number of articles published about ArcGIS StoryMaps increased from 2022 to 2024. In 2019, there were two relevant articles, followed by one in 2022. In 2023, the number rose to six articles, while in 2024, there were two eligible

articles. With respect to publishing, the majority of articles were found in the Google Scholar database (7 articles).

Table 4. Articles by year and database

Database	2019	2020	2021	2022	2023	2024	Amount
Scopus	2				2		4
Google scholar				1	4	2	7

Table 5. Extraction of selected articles

No	Author	Study title	Journal	Findings
1	Mukherjee, (2019)	Exploring cultural geography field course using story maps	Journal of Geography in Higher Education	Story Maps can be used to capture and map students' experiences in cultural geography courses.
2	Egiebor & Foster, (2019)	Students' perceptions of their engagement using GIS-story maps	Journal of Geography	Students found GIS Story Maps interesting in geography learning, especially in student engagement.
3	Purwanto et al., (2022)	ArcGIS story maps in improving teachers' Geography awareness	Jurnal Pendidikan Geografi	ArcGIS Story Maps enhance teachers' geographic awareness.
4	Duan (2023)	Integrating story maps into case-based geography teaching	Geography	ArcGIS StoryMaps encourages the shift to case-based and student-centered learning.
5	McDaniel & Ingram (2023)	Integrating ArcGIS Online and digital story mapping for active learning in systematic geography courses	Journal of Geography in Higher Education	The integration of ArcGIS Online and StoryMaps increases student engagement and understanding.
6	Nisnala et al., (2023)	Building Creativity in Students' Spatial Thinking Skills using ArcGIS Story Maps	Jurnal Geografi: Gea	ArcGIS StoryMaps enhances students' creativity and spatial thinking skills.
7	Sari et al., (2023)	3D Street Story Map Learning Media for High School Student's Spatial Thinking Ability	Journal for Lesson and Learning Studies	The development of 3D Street Story Maps improves high school students' spatial thinking skills.
8	Panjerina et al., (2023)	Pengaruh model project based learning berbantuan story maps terhadap kemampuan berpikir kreatif pada mata pelajaran Geografi siswa SMAN 7 Malang	Jurnal Integrasi dan Harmoni Inovatif Ilmu-Ilmu Sosial	Project-based learning models with story maps improve geography students' creative thinking skills.
9	Tasliya et al., (2023)	INVESTIGATING THE IMPACT OF STORY MAPS IN DEVELOPING STUDENTS' SPATIAL ABILITIES ON HYDROMETEOROLOGICAL DISASTERS FOR E-PORTFOLIO ASSIGNMENTS	International Journal of Social Science, Educational, Economics, Agriculture Research, and Technology	Story maps and e-portfolios improve students' spatial abilities in hydrometeorological disasters.
10	Asyarifah et al. (2024)	The effect of inquiry-based learning assisted by story-map on students' spatial thinking skills in seismic studies	Jurnal Inovasi Teknologi Pendidikan	Inquiry-based learning with story maps improves students' spatial thinking skills.
11	Bukhori & Purwanto (2024)	IMPACT OF ARCGIS STORY MAPS ON GEOGRAPHY LEARNING AND REMOTE SENSING SKILLS IN MAN 1 MALANG STUDENTS	Abjadia: International Journal of Education	The use of ArcGIS Story Maps enhances student engagement and learning outcomes in geographic remote sensing.

A review of the literature on the use of ArcGIS StoryMaps in geography education reveals a variety of innovative and effective methods. In her 2019 study, Falguni Mukherjee underscored the value of ArcGIS StoryMaps in capturing students' experiences in cultural geography in depth

(Mukherjee, 2019). Additionally, students exhibited a favorable response to ArcGIS StoryMaps, indicating heightened engagement and the enhanced relevance of learning to their everyday lives (Egiebor & Foster, 2019). In a recent study, Purwanto et al. (2022) underscored the heightened awareness among geography teachers who utilize ArcGIS StoryMaps. Duan (2023) illustrated the integration of ArcGIS StoryMaps into case-based learning, thereby facilitating a student-centered approach. McDaniel & Ingram (2023) observed enhanced student engagement and comprehension when ArcGIS Online and ArcGIS StoryMaps were integrated into a systematic geography course.

How can ArcGIS StoryMaps be used in high school geography lessons?

ArcGIS Story Maps are employed in a variety of ways in the teaching of geography at the high school level. The application of ArcGIS Story Maps in a project-based learning approach is designed to facilitate the recognition of creative thinking skills (Panjerina et al., 2023). Furthermore, in inquiry-based learning, ArcGIS Story Maps are employed to facilitate the development of students' spatial thinking abilities, particularly in the context of seismic materials (Asyarifah et al., 2024)**.** ArcGIS Story Maps are utilized in case-based learning to evaluate students' level of engagement and comprehension (Duan, 2023).

Additionally, ArcGIS Story Maps are employed in digital learning environments. A combination of ArcGIS StoryMaps and e-portfolios was employed to enhance students' spatial abilities pertaining to hydrometeorological disasters (Tasliya et al., 2023a). Conversely, the advancement of ArcGIS Story Maps as an educational medium has manifested in the form of 3D Street Story Maps. Additionally, these Story Maps have been utilized to evaluate the creativity and spatial thinking abilities of high school students (Sari et al., 2023).

What is the impact of using ArcGIS StoryMaps in geography learning for students?

The utilisation of ArcGIS Story Maps has been demonstrated to have a beneficial impact on students' geographical learning outcomes. The integration of ArcGIS Story Maps with ArcGIS Online has been demonstrated to enhance student engagement in the learning of geography and the comprehension of the subject matter (McDaniel & Ingram, 2023). Furthermore, ArcGIS Story Maps have been demonstrated to positively impact the stimulation of students' creative and spatial thinking skills (Nisnala et al., 2023; Sari et al., 2023). Furthermore, the utilisation of ArcGIS Story Maps enhances the comprehension of geographical concepts among educators. This is likely to have a beneficial effect on the learning process of the students, which in turn may influence the teaching methods employed by the educators (Purwanto et al., 2022). As posited by Duan (2023), the utilisation of ArcGIS Story Maps engenders a shift in the pedagogical paradigm, whereby the learning process becomes more student-oriented. Furthermore, it has been demonstrated to influence both student engagement and academic achievement in the field of remote sensing (Bukhori & Purwanto, 2024).

What benefits have been identified for teachers in implementing ArcGIS StoryMaps in geography learning?

The incorporation of ArcGIS StoryMaps into geographical education offers a number of significant benefits to educators. One of the beneficial outcomes of employing ArcGIS Story Maps is an enhancement in teachers' awareness and understanding of geography, which can influence the manner in which they teach (Purwanto et al., 2022). Furthermore, the utilisation of ArcGIS StoryMaps has been demonstrated to refine teachers' pedagogical abilities, enhancing creativity and skills (Panjerina et al., 2023; Sari et al., 2023). Additionally, it has been shown to confer

benefits to teachers as an additional tool to facilitate more efficient, engaging, and student-focused learning processes (Duan, 2023).

DISCUSSION | مناقشة

The use of ArcGIS StoryMaps in teaching geography at the secondary school level has provided significant benefits for both students and educators. The technology offers an interactive and visual tool that can increase student engagement as well as their understanding of the subject matter (Bukhori & Purwanto, 2024; McDaniel & Ingram, 2023). In addition, ArcGIS StoryMaps stimulate the development of students' creativity, knowledge, and spatial thinking skills (Nisnala et al., 2023; Sari et al., 2023). Project-based, inquiry, and case study approaches have been shown to be effective in improving students' critical and spatial thinking skills (Asyarifah et al., 2024; Duan, 2023; Panjerina et al., 2023). The integration of these technologies in digital learning, such as e-portfolios, has also shown to improve students' spatial abilities in dealing with real-world challenges, such as hydrometeorological disasters (Tasliya et al., 2023).

For educators, ArcGIS StoryMaps not only improves their technical skills, but also helps create a more dynamic and student-centered learning environment (Duan, 2023). With the integration of these technologies, teachers can transform teaching methods to be more innovative and in line with the demands of 21st century education, as well as increase students' enthusiasm in their learning. For this reason, it is important for teachers to attend trainings that can hone their technical skills and help them design more interactive, project-based and data-driven teaching methods. Research shows training programs have demonstrated significant improvements in teachers' theoretical and practical skills, leading to better student engagement and understanding (Bal et al., 2024). Continuous professional development is essential for teachers to effectively balance technology with traditional teaching methods (Jiang, 2023).

In curriculum development, the use of ArcGIS StoryMaps can facilitate the implementation of 21st century skills-based learning approaches, such as critical thinking, creativity, and collaboration (Novia et al., 2024). Curricula that integrate these technologies provide a more engaging learning experience based on real geographic data, which can enhance students' understanding of geography topics in more depth. The integration of technology into pedagogy is essential for modern teaching, as it enhances the learning experience and adapts to the needs of students in the digital age (Kumari & Rani, 2022). To support wider adoption, education policies that support teacher training and provide access to technology are crucial. Teacher training programs significantly improve the technical competence of educators, enabling them to adopt innovative teaching methods that incorporate technology (Theodorio, 2024). Effective technology integration requires adequate infrastructure, including digital resources and internet connectivity, which are often lacking in many educational institutions (Alamin et al., 2023).

Although this technology has the potential to improve student engagement and understanding (Bukhori & Purwanto, 2024; McDaniel & Ingram, 2023), its implementation is highly dependent on curriculum readiness that can accommodate data-driven and more flexible learning approaches. In addition, ArcGIS StoryMaps supports problem-based and inquiry learning approaches that are effective for improving critical thinking and spatial skills (Sari et al., 2023). Its use in developing countries such as Indonesia, the digital divide that affects access to technological devices and internet connectivity (Jayanthi & Dinaseviani, 2022; Kartiasih et al., 2023) is a challenge. This is certainly an obstacle in the application of technology such as ArcGIS

StoryMaps. However, despite the infrastructure gap, there is potential for this technology to offer an effective solution to address the geography learning gap. With engaging and interactive visual representations, students from diverse backgrounds can more easily access complex information (Bredeweg et al., 2023). This can improve their understanding of geography concepts that are often difficult to grasp through conventional teaching methods. Therefore, to maximize the use of ArcGIS StoryMaps in Indonesia, policies are needed that support the equitable provision of technology infrastructure as well as training for teachers, especially in remote areas. The digital divide, both in terms of devices and internet, must be considered in the application of this technology to ensure all students benefit equally from this technology. Policies should address the digital divide to ensure all educators and students have equal access to technology resources (Jiang, 2023).

This study, while making an important contribution to understanding the use of ArcGIS StoryMaps in teaching geography in secondary schools, is not without limitations. First, only 11 of the 290 identified studies were included in the analysis, which may limit the ability to generalize the findings. Second, methodological inconsistencies in the existing studies may affect the reliability of the results and conclusions drawn. As the main focus of this study is on the secondary school context, the findings may not be fully applicable to other levels of education or subjects. In addition, many studies tend to emphasize the positive impacts of using ArcGIS StoryMaps, while negative impacts or implementation challenges are often under-reported, which may introduce bias in the overall evaluation. Another limitation is the use of limited databases such as Scopus and Google Scholar in the literature search. The use of only these two databases may introduce selection bias, as it is possible that relevant studies published in journals not indexed on these two platforms were missed. In addition, the limitations in the databases used in this study may hinder the inclusion of other relevant studies that may provide additional insights.

CONCLUSSION | خاتمة

The use of ArcGIS StoryMaps in learning geography in secondary schools has been shown to have a significant impact on students and teachers. Of the 290 studies identified, analysis of 11 selected studies showed that the use of this technology can improve student engagement and understanding of geography subject matter. ArcGIS StoryMaps provide a more engaging and visual learning experience, which enhances student understanding and stimulates the development of spatial thinking skills and creativity. Project-based learning, inquiry and case study approaches proved effective in improving students' critical and spatial thinking skills. For teachers, ArcGIS StoryMaps not only improves technical skills, but also helps them create a more dynamic and student-centered learning environment. By utilizing this technology, teachers can design more innovative and effective learning experiences, which in turn can improve teaching quality and student learning outcomes.

However, the limited number of studies analyzed may limit the ability to generalize the findings to a wider population. Methodological inconsistencies between studies may affect the reliability of the results obtained. The focus of this research on the secondary school context also means the findings cannot be fully applied to other levels of education or subjects. In addition, many studies further emphasize the benefits of using ArcGIS StoryMaps, while implementation challenges and negative impacts are often less discussed, which may introduce bias in the overall evaluation.

It is recommended that future research conduct a more in-depth analysis. Further research could explore the use of ArcGIS StoryMaps in various other learning contexts or educational levels, as well as identify barriers that may arise in its implementation. This will create a more comprehensive understanding of the potential and challenges of using this technology in geography learning.

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