

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                        |                                          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|
| RESEARCH ARTICLE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Integrating Geographic Information Systems (GIS) in Geography Education: A Case Study of Algerian Secondary and Middle School Teachers |                                          |
| Taïbi Brahim Elkhali                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Doctor                                                                                                                                 |                                          |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Higher Normal School of Laghouat (ENSL)                                                                                                |                                          |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Algeria                                                                                                                                |                                          |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Email: <a href="mailto:b.taïbi@ens-lagh.dz">b.taïbi@ens-lagh.dz</a>                                                                    |                                          |
| Doi Serial                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <a href="https://doi.org/10.56334/sci/8.7.3">https://doi.org/10.56334/sci/8.7.3</a>                                                    |                                          |
| Keywords                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | GIS; Geography Education; Spatial Thinking; Teacher Training; Educational Technology; Laghouat                                         |                                          |
| <b>Abstract</b><br>This study investigates the integration of Geographic Information Systems (GIS) into geography education in Laghouat, Algeria. While GIS has gained recognition globally for enhancing spatial thinking and inquiry-based learning, its adoption in Algerian schools remains limited. Drawing on data from a survey of 50 middle and secondary school geography teachers, the study assesses their exposure to GIS, training experiences, and attitudes toward its educational value. Results reveal that although most teachers are familiar with GIS from university courses, only a minority have received practical training or access to resources for classroom implementation. Despite these challenges, there is a strong consensus on the pedagogical potential of GIS. The study highlights key barriers to integration—including infrastructural constraints and lack of institutional support—and offers recommendations for improving GIS training, infrastructure, and curriculum alignment. These findings underscore the need for systemic interventions to bridge the gap between recognition and practice in the use of geospatial technologies in Algerian education. |                                                                                                                                        |                                          |
| <b>Citation</b><br>Elkhalil T.B. (2025 Integrating Geographic Information Systems (GIS) in Geography Education: A Case Study of Algerian Secondary and Middle School Teachers. <i>Science, Education and Innovations in the Context of Modern Problems</i> , 8(7), 25-31; doi:10.56352/sci/8.7.4. <a href="https://imcra-az.org/archive/365-science-education-and-innovations-in-the-context-of-modern-problems-issue-7-volviii-2025.html">https://imcra-az.org/archive/365-science-education-and-innovations-in-the-context-of-modern-problems-issue-7-volviii-2025.html</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                        |                                          |
| <b>Licensed</b><br>© 2025 The Author(s). Published by Science, Education and Innovations in the context of modern problems (SEI) by IMCRA - International Meetings and Journals Research Association (Azerbaijan). This is an open access article under the CC BY license ( <a href="http://creativecommons.org/licenses/by/4.0/">http://creativecommons.org/licenses/by/4.0/</a> ).<br><a href="#">Science, Education and Innovations in the Context of Modern Problems, Issue 7, Vol.VIII, 2025</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                        |                                          |
| Received: 11.01.2025                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Accepted: 20.04.2025                                                                                                                   | Published: 01.06.2025 (available online) |

## 1. Introduction

Geographic Information Systems (GIS) have transformed the way geographical phenomena are observed, analyzed, and interpreted, bringing about a major shift in both academic research and practical applications of geography. As digital tools capable of capturing, storing, managing, analyzing, and visualizing spatial data, GIS are increasingly being integrated into various fields such as urban planning, environmental monitoring, disaster management, and resource allocation (Longley et al., 2015). In recent decades, educational institutions around the world have also recognized the pedagogical value of GIS, particularly in enhancing the teaching and learning of geography.

In educational contexts, GIS has emerged not only as a technological tool but also as a conceptual framework that fosters spatial thinking, problem-solving, and inquiry-based learning. According to Bednarz and van der Schee (2006), GIS allows students to approach geographical content in an interactive and analytical manner, thus moving beyond rote memorization toward meaningful engagement with spatial data. It facilitates the visualization of complex geographical patterns, encourages the exploration of real-world problems, and nurtures critical thinking. This aligns with the goals of modern geography education, which emphasize inquiry-based learning, data interpretation, and the development of spatial literacy (National Research Council, 2006).

Numerous international studies have demonstrated the positive impact of GIS on student learning outcomes. For example, Kerski (2008) found that integrating GIS into high school curricula improved students' abilities to analyze spatial relationships, synthesize information from various sources, and draw evidence-based conclusions. Similarly, Demirci (2009) observed that the use of GIS in Turkish secondary schools contributed to more student-centered instruction and enhanced classroom engagement. These findings are supported by empirical research across multiple educational systems, where GIS has been shown to promote both cognitive and affective learning outcomes.

Despite its growing significance, the adoption of GIS in educational systems across the Global South remains limited. In Algeria, the integration of geospatial technologies in school curricula is still in its early stages. Although university geography departments occasionally include GIS modules, their reach and effectiveness vary considerably (Bensalah, 2017). In most middle and secondary schools, GIS is either absent or superficially addressed, largely due to a combination of infrastructural, institutional, and pedagogical constraints. Many teachers lack the technical training to effectively use GIS in the classroom, and schools often do not have access to the necessary hardware or software. This results in a persistent gap between the theoretical recognition of GIS's educational value and its actual implementation in teaching practices.

This study seeks to address that gap by exploring the current state of GIS use among geography teachers in the city of Laghouat, Algeria. Laghouat, located on the northern edge of the Sahara, offers a unique geographic context in which to study GIS integration. The city presents a wide range of spatial phenomena—such as desertification, urban expansion, and agricultural transformation—that can be effectively studied using GIS tools. Understanding how geography teachers in this region perceive and utilize GIS provides valuable insights into broader challenges and opportunities for GIS adoption in Algerian schools.

The research adopts a case study approach, focusing on a sample of 50 geography teachers from both middle and secondary schools in Laghouat. It aims to evaluate the level of GIS knowledge among teachers, determine whether they received GIS training at university or through professional development, and assess their attitudes toward using GIS in their teaching. The study also examines the barriers teachers face in integrating GIS, including technological limitations and the absence of institutional support. By combining descriptive analysis with qualitative insights from educators, the study provides a comprehensive overview of the current landscape and offers practical recommendations for enhancing GIS use in geography education.

Preliminary results indicate that while a significant proportion of teachers (60%) have encountered GIS during their university studies, only a minority (35%) have received practical training or have access to adequate resources in their schools. Nonetheless, a strong majority (90%) believe that GIS could be beneficial in improving geography instruction. These findings echo earlier research suggesting that teacher willingness is often high, but successful GIS integration depends on access to training, infrastructure, and curriculum alignment (Baker & Bednarz, 2003; Aladag, 2010).

In sum, the integration of GIS in geography education in Algeria is both a promising and challenging endeavor. With appropriate support and investment, GIS has the potential to transform geography teaching into a dynamic and inquiry-based discipline. This study contributes to the emerging literature on GIS in education by providing context-specific insights from a region where such research remains scarce, and by highlighting the need for systemic interventions that can bridge the gap between potential and practice.

## 2.Objectives of the Study

The main objectives of this study are:

1. To assess the level of GIS knowledge and experience among geography teachers in middle and secondary schools in Laghouat.

2. To investigate whether geography teachers have received academic or professional training in Geographic Information Systems (GIS).
3. To explore teachers' perceptions regarding the usefulness of GIS in enhancing geography education.
4. To identify the key challenges and barriers that limit the effective integration of GIS into classroom instruction.
5. To provide recommendations for improving GIS training and implementation in the geography curriculum.

### 3.Methodology

This study employed a descriptive, survey-based methodology to examine geography teachers' familiarity with and attitudes toward the use of Geographic Information Systems (GIS) in education. The research targeted a purposive sample of **50 geography teachers** from both **middle and secondary schools** in the Laghouat region of Algeria. The sample included educators with varying levels of experience and academic backgrounds.

Data were collected through a **structured questionnaire** designed to assess four key areas: (1) teachers' practical experience with GIS; (2) whether they studied GIS at the university level; (3) whether they received professional training in GIS; and (4) their perceptions of the usefulness of GIS in geography teaching. The questionnaire consisted of closed-ended questions with binary (Yes/No) response options to ensure clarity and ease of analysis.

The responses were analyzed quantitatively using **descriptive statistics** to determine the frequency and percentage of responses for each question. This approach provided a clear overview of the current status of GIS-related knowledge and perceptions among geography educators in the region.

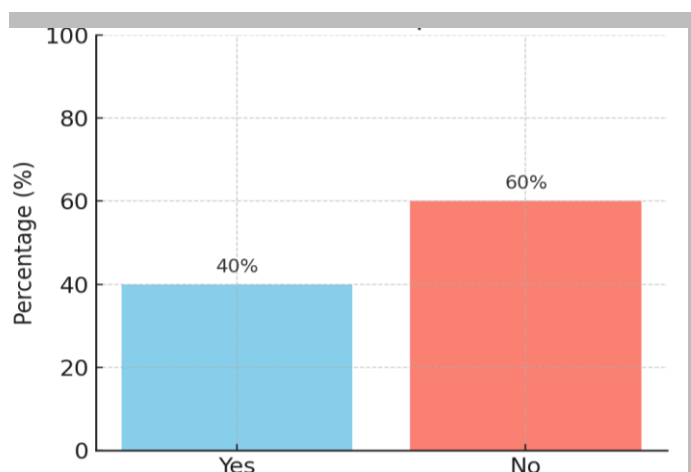
The methodology enabled the identification of significant gaps in both practical training and classroom application of GIS, despite generally positive attitudes toward its educational potential. These findings provide a foundation for recommending targeted training programs and curriculum development to enhance GIS integration in geography education.

To gain deeper insights into the integration of Geographic Information Systems (GIS) in geography education, a structured questionnaire was distributed to 50 geography teachers in Laghouat, representing both middle and secondary school levels. The results are presented in the following tables, each addressing a specific research question related to teachers' GIS knowledge, academic background, training, and perceptions. A brief analysis follows each table to interpret the key findings.

### 4.Analysis of results

- **Question 1**
- Do teachers have experience in GIS?

| Response | Percentage (%) |
|----------|----------------|
| Yes      | 40             |
| No       | 60             |

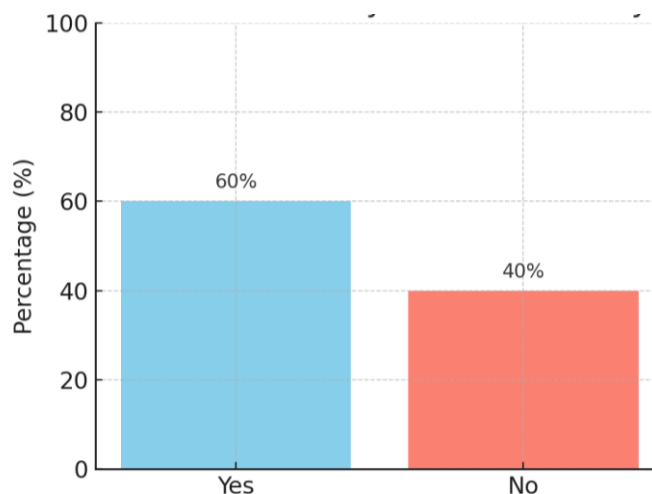


According to the data, 40% of respondents indicated that they have experience using GIS tools, while 60% reported no prior experience. This reflects a relatively low practical engagement with GIS among geography teachers, suggesting that GIS has yet to become a regular **part** of their instructional practices.

#### ▪ Question 2

- Did teachers study GIS at university?

| Response | Percentage (%) |
|----------|----------------|
| Yes      | 60             |
| No       | 40             |



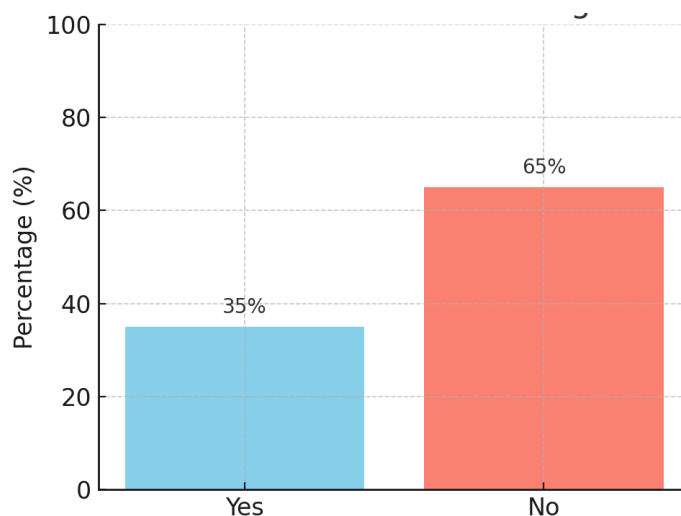
The results show that 60% of teachers studied GIS at the university level, compared to 40% who did not. This indicates that while GIS is being introduced in teacher education programs, the coverage may not be sufficient to ensure long-term competency.

#### ▪ Question 3

- Have teachers received training in GIS?

| Response | Percentage (%) |
|----------|----------------|
| Yes      | 35             |

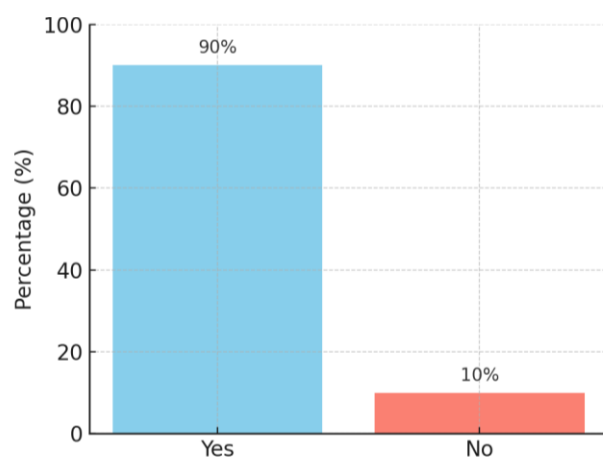
|    |    |
|----|----|
| No | 65 |
|----|----|



Only 35% of the participants reported having received formal training in GIS, while a significant 65% had not. This lack of professional development opportunities may be a critical barrier to GIS adoption in the classroom.

- **Question 4**
- Do teachers believe GIS is beneficial in teaching?

| Response | Percentage (%) |
|----------|----------------|
| Yes      | 90             |
| No       | 10             |



An overwhelming 90% of teachers believe that GIS could benefit geography education, with only 10% expressing doubt. This strong positive perception highlights a clear demand for support in integrating GIS, which could be addressed through policy and training initiatives.

## 5.Recommendations :

### 1. Provide targeted GIS training for teachers:

Organize regular workshops and professional development programs to equip geography teachers with the practical skills needed to effectively use GIS in the classroom.

### 2. Integrate GIS more thoroughly in teacher education programs:

Ensure that university curricula for geography education include both theoretical and hands-on training in GIS technologies.

### 3. Develop accessible GIS teaching materials:

Create user-friendly GIS lesson plans, digital maps, and instructional resources tailored to the needs of middle and secondary school students.

### 4. Improve infrastructure and access to technology:

Equip schools with the necessary hardware and software, including computers, internet access, and licensed GIS applications.

### 5. Foster collaboration between educational institutions and GIS experts:

Encourage partnerships between schools, universities, and professional GIS organizations to support training, curriculum development, and technical assistance.

### 6. Raise awareness of GIS benefits in education:

Promote the value of GIS in enhancing spatial thinking, problem-solving, and student engagement among educators and school administrators.

### 7. Monitor and evaluate GIS implementation:

Establish mechanisms to regularly assess how GIS is being used in schools and to measure its impact on teaching quality and student learning outcomes.

## 6.Conclusion:

This study examined the application and perception of Geographic Information Systems (GIS) in geography education among a sample of 50 teachers from middle and secondary schools in Laghouat, Algeria. The findings highlight a mixed landscape: while a significant portion of teachers had some academic exposure to GIS—mainly at the university level—the majority lacked formal training and practical classroom experience with the technology. Despite these limitations, the survey revealed a strong consensus among teachers regarding the educational value of GIS, with 90% believing that its integration could enhance geography teaching and learning.

The research underscores a critical gap between the theoretical knowledge of GIS and its practical application in educational settings. This gap is largely attributed to insufficient training opportunities, limited access to technology, and the absence of institutional support. These challenges hinder the full adoption of GIS, even though teachers are open and motivated to use it as a tool for promoting spatial thinking, critical analysis, and student engagement.

Given these insights, it is evident that enhancing the use of GIS in Algerian geography classrooms will require a multi-faceted approach. This includes investing in teacher training, integrating GIS into educational curricula, improving school infrastructure, and fostering partnerships between schools and GIS professionals. Addressing these issues will not only improve the quality of geography education but also equip students with valuable geospatial skills relevant to the 21st-century workforce.

Ultimately, this study contributes to the growing body of literature advocating for the strategic implementation of geospatial technologies in education. It calls on policymakers, educators, and academic institutions to prioritize GIS as an essential component of modern geography instruction in Algeria and beyond.

## 7. References:

1. Aladag, E. (2010). The effects of GIS on students' academic achievement and motivation in geography education. *Educational Research and Reviews*, 5(12), 781–791.
2. Alibrandi, M., & Palmer-Moloney, L. J. (2001). Making a place for space: Mapping tools and practices in the classroom. *Journal of Geography*, 100(1), 29–38.
3. Baker, T. R., & Bednarz, S. W. (2003). Lessons learned from reviewing research in GIS education. *Journal of Geography*, 102(6), 231–233. <https://doi.org/10.1080/00221340308978555>
4. Bednarz, S. W. (2004). Geographic Information Systems: A tool to support geography and environmental education? *GeoJournal*, 60(2), 191–199. <https://doi.org/10.1023/B:GEJO.0000034735.77344.b0>
5. Bednarz, S. W., & van der Schee, J. (2006). Europe and the United States: The implementation of geographic information systems in secondary education in two contexts. *Technology, Pedagogy and Education*, 15(2), 191–205.
6. Bednarz, S. W., & van der Schee, J. (2006). Geography education: The glass is half full and it's getting fuller. *International Research in Geographical and Environmental Education*, 15(2), 130–135. <https://doi.org/10.2167/irgee193.0>
7. Bensalah, K. (2017). *L'enseignement de la géographie en Algérie: enjeux et perspectives*. Alger: Office des Publications Universitaires.
8. Bensalah, L. (2017). L'enseignement de la géographie et l'utilisation des SIG en Algérie: État des lieux et perspectives. *Revue des Sciences Humaines*, 48(2), 113–125.
9. Demirci, A. (2009). How do teachers approach new technologies: Geography teachers' attitudes towards Geographic Information Systems (GIS). *European Journal of Educational Studies*, 1(1), 43–53.
10. Kerski, J. J. (2003). The implementation and effectiveness of Geographic Information Systems technology and methods in secondary education. *Journal of Geography*, 102(3), 128–137.
11. Kerski, J. J. (2008). The role of GIS in digital earth education. *International Journal of Digital Earth*, 1(4), 326–346. <https://doi.org/10.1080/17538940802420879>
12. Longley, P. A., Goodchild, M. F., Maguire, D. J., & Rhind, D. W. (2015). *Geographic Information Science and Systems* (4th ed.). Wiley.
13. National Research Council. (2006). *Learning to think spatially: GIS as a support system in the K-12 curriculum*. National Academies Press.
14. Yeh, H. C., & Chang, C. H. (2008). The integration of GIS into geography teaching by using GIS project-based learning. *Journal of Geography in Higher Education*, 32(3), 383–398.