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Research Article

Cartographic Skills in Geography Textbooks: A Comparative Analysis of Instructional Materials for Mainstream and Minority Primary Schools in Greece

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Abstract: The educational rights of the Muslim minority of Thrace, the only officially recognised minority in Greece, are safeguarded by Article 41 of the Treaty of Lausanne (1923). Within this framework, minority education has developed into a distinct subsystem of the Greek educational landscape, historically shaped by the dynamics of Greek–Turkish relations. Since the late 1990s, state policy has prioritised the qualitative improvement of educational provision, leading to targeted initiatives, such as the creation of new textbooks for minority classrooms. The present study investigates, within the field of geography education, the extent to which these textbooks cultivate cartographic skills through the use of maps, comparing the specialised minority school textbooks with those employed in mainstream public education. Situated within the field of geography education and textbook research, the study applies content analysis to the full corpus of maps contained in both textbook categories, classifying them according to a tripartite typology and the type of learning task involved. The results of the analysis demonstrate that minority school textbooks display notable deficiencies relative to their general education counterparts, particularly regarding the systematic integration of map-based learning activities. These findings suggest that the limited presence and pedagogical use of maps in minority school textbooks may contribute to the reproduction of educational inequalities, underscoring the need for policy measures to strengthen spatial and cartographic literacy in minority education.

Keywords: Minority Education; Muslim Minority of Thrace; School Textbooks; Cartographic Skills; Geography Education; Content Analysis; Spatial Thinking

Highlights:

- Comparative analysis of maps in mainstream and minority school textbooks
- Minority textbooks include 55.9% fewer maps than general education textbooks
- Contextual map use predominates in minority textbooks (44.6% of cases)

1. Introduction

Geography education in primary school plays a key role in fostering students' spatial thinking, environmental awareness and critical engagement with the world (Wakabayashi & Ishikawa, 2011; Urbańska et al., 2022; Kriewaldt, 2023). Central to this is the development of cartographic skills, which support orientation, spatial representation and problem-solving, and are widely recognised as a core dimension of geography education. In Greece, the national curriculum explicitly emphasises their systematic development (Meechandee, 2025; Binimelis Sebastián et al., 2024). However, limited research has examined how these aims are reflected in teaching materials, particularly in linguistically and

culturally diverse contexts. Although the present study focuses on the Greek context, the phenomenon of linguistic and cultural minorities constitutes a widespread and structurally significant reality across both Europe and the Americas. In such contexts, multilingual and minority education systems face comparable challenges related to curriculum design, access to disciplinary knowledge and the provision of equitable learning opportunities.

Within this educational landscape, the Muslim minority of Thrace constitutes a distinct educational subsystem shaped by the Treaty of Lausanne (1923) and subsequent legislation which was further reformed through the development of new textbooks during the early 2000s. However, it remains unclear to what extent these textbooks support the cartographic skills prioritised in the general curriculum. Comparative textbook analysis, based on content analysis and curriculum research, enables the identification of maps and map-based tasks in mainstream and minority textbooks, allowing the exploration of similarities, differences and potential gaps in learning opportunities. The present study is situated at the intersection of textbook research, geography education and educational inequality. It investigates whether minority primary school textbooks offer learning opportunities for the development of cartographic skills comparable to those provided by mainstream textbooks and discusses the implications of any disparities for students' educational experiences and inclusion in the region of Thrace.

2. Literature Review and Aims of the Study

Greek-language literature on minority education remained limited until the Education of Muslim Children Program (E.M.C.P.), which marked a turning point by fostering systematic research and promoting empirically and theoretically grounded interventions adapted to minority education. Research on the Muslim minority of Thrace has expanded since the early 2000s, reflecting growing interest in integration and educational quality; however, it has focused mainly on linguistic issues—particularly pupils' limited Greek proficiency—while largely overlooking broader dimensions of minority education, such as curriculum, policy and socio-cultural dynamics (Ampati, 2009; Konta, 2013;).

The literature further reveals the absence of systematic research on non-language subjects in minority education. This gap is particularly significant given that; Geography, History and Environmental Studies and Civic and Political Education are taught through a set of interdisciplinary textbooks in minority schools. Despite their central role in the curriculum, existing research has focused predominantly on language education, leaving the textbooks used for these subjects largely unexplored. By focusing on these neglected domains, the present study seeks to address an important gap in the literature and draw attention to potential structural inequalities embedded in curriculum and textbook design, highlighting the role of textbooks as key mediators that translate the intended curriculum into learning opportunities for pupils.

2.1. Cartographic Literacy

Cartographic literacy is widely recognised as a core dimension of geography education, encompassing the knowledge and skills required to interpret, use and create maps as well as the critical understanding of maps as socially constructed representations that reflect particular perspectives and power relations (Harley, 1989; Bednarz, 2018). It therefore extends beyond the technical decoding of symbols or the identification of locations and involves the ability to situate maps within broader cultural and political contexts.

Cartographic literacy is closely connected to spatial thinking, which enables learners to recognise spatial patterns, establish relationships among geographical phenomena and solve spatial problems (Gersmehl & Gersmehl, 2007). Through systematic engagement with maps, pupils develop cognitive tools that support increasingly abstract forms of spatial understanding and reasoning.

In contemporary societies, cartographic literacy is also linked to education for democratic citizenship, as maps play a central role in mediating sociopolitical information and shaping public understanding of issues such as migration, environmental change and territorial disputes (Perkins, 2008). Developing critical cartographic literacy therefore supports learners' capacity to evaluate sources and representations and engage reflectively with spatial information.

The concept has further expanded in response to the growing use of digital maps and geospatial technologies. Research highlights the importance of integrating digital and interactive mapping practices to equip students with the ability to navigate complex digital environments and analyse multi-layered spatial data (Goodchild, 2006; Robertson et al., 2019).

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In contemporary geography education, cartographic literacy is increasingly conceptualised as an integral component of broader frameworks of spatial thinking and spatial competence. Through the lens of spatial thinking, commonly defined as the interaction of spatial concepts, representational tools and reasoning processes (Metoyer et al., 2015), maps function as central representational and cognitive tools that support the organisation, analysis and communication of spatial information and foster higher-order cognitive processes, such as comparison, interpretation and the generation of spatial explanations (Jo & Bednarz, 2009; Metoyer et al., 2015; National Research Council, 2006).

Empirical studies further indicate that spatial thinking and spatial competence can be enhanced through well-designed learning activities and instructional interventions (Jo & Bednarz, 2014) and reliably assessed as learnable disciplinary competences (Huynh & Sharpe, 2013). A growing body of research also demonstrates the pedagogical potential of geographic information technologies, particularly geographic information systems (GIS)-based learning environments, for strengthening students' spatial reasoning and their ability to evaluate spatial data and construct spatial arguments (Kim & Bednarz, 2013).

Given this context, cartographic literacy—developed through engagement with both analogue and digital maps—constitutes an essential component of spatial competence. Maps act as cognitive tools that mediate learners' reasoning processes and engagement with spatial concepts rather than as neutral or decorative representations (Jo & Bednarz, 2009; Metoyer et al., 2015).

2.1.1. Analytical framework of cartographic skills

The present study draws on the theoretical framework of spatial thinking proposed in the field of geography education by Jo and Bednarz (2009), according to which spatial thinking is composed of three interrelated components: spatial concepts, tools of representation and processes of reasoning. Within this framework, maps are conceptualised as central representational tools that mediate students' engagement with spatial information and support the development of geographical understanding.

From this perspective, students' interaction with maps may involve different forms and levels of cognitive engagement, depending on how they are embedded in learning tasks. In particular, spatial thinking theory distinguishes between the use of spatial representations for extracting and interpreting information and the construction of spatial representations as a means of organising and communicating spatial knowledge (Jo & Bednarz, 2009; National Research Council, 2006; Huynh & Sharpe, 2013).

When students are asked to locate places, identify spatial patterns, interpret symbols or extract information from an existing map, they primarily engage with maps as external representational tools that support spatial reasoning processes (National Research Council, 2006). By contrast, when students are required to construct, complete or modify maps, they actively produce spatial representations and translate conceptual and factual information into a spatial form. This process involves the integration of spatial concepts, representational conventions and reasoning processes as a more generative use of representational tools (Gersmehl & Gersmehl, 2007; Jo & Bednarz, 2009).

Based on this theoretical perspective, the present study adopts a functional distinction between map-based activities that require students to use maps for reading and interpretation of spatial information and those that require students to produce or transform maps as spatial representations. This distinction reflects the dual role of maps within the spatial thinking framework, both as tools for analysing geographic information and as means for constructing and communicating spatial knowledge (National Research Council, 2006).

In addition to these two theoretically grounded categories, this study introduces a third category, namely the paratextual use of maps, to capture cases in which maps appear in textbooks solely as accompanying visual elements without being explicitly linked to learning tasks or student activities. This category does not derive directly from the spatial thinking framework but is introduced for analytical purposes within textbook research to document the degree to which maps are pedagogically activated in instructional materials.

In this study, the term cartographic skills is used to denote the specific map-related abilities and learning tasks examined in the analysis, whereas cartographic literacy refers to the broader educational construct associated with the development of spatial thinking and spatial competence (Græsli & Lien, 2024; National Research Council, 2006; Ramsaroop & Kwayi, 2024).

In addition, the study adopts the distinction between political and thematic maps as an analytically meaningful typology because these categories correspond to different cartographic functions and cognitive demands. Political maps

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primarily support orientation and localisation, as well as the identification of spatial units, whereas thematic maps require students to interpret spatial distributions, patterns and relationships of specific geographic phenomena. This typology therefore allows the analysis to examine not only the presence of maps in textbooks but also their potential contribution to higher-order spatial reasoning within the spatial thinking framework (Jo & Bednarz, 2009; National Research Council, 2006). In line with the classification used in Greek primary school textbooks and the national curriculum, a third category—physical maps—is also included in the analysis, referring to maps representing natural features such as relief, rivers and other elements of the physical environment (Greek Ministry of National Education and Religious Affairs, 2003, pp. 504-505).

Research on geography textbooks has grown considerably in recent years, reflecting increasing interest in how school knowledge is structured and communicated through educational materials. International research has increasingly examined the role of maps and visual representations in geography textbooks through comparative content analysis. For instance, Bagoly-Simó and Binimelis-Sebastián (2021) explored how primary school textbooks introduce maps and support the development of map skills across different educational contexts. Similarly, Artvinli and Dönmez (2020) compared geography textbooks from Turkey and England, highlighting differences in the ways map skills are presented and developed in instructional materials. Recent studies also emphasize the importance of visual elements such as maps, diagrams and photographs in shaping students' geographical understanding and supporting spatial thinking (Hilander, 2023).

2.2. Cartographic Skills in Primary Education

The systematic teaching of cartographic skills in primary education provides an essential foundation for the development of geographical competence. Research indicates that children can engage with basic map concepts from their early years of schooling provided that instruction is developmentally appropriate and adequately scaffolded (Gersmehl & Gersmehl, 2007). The process of developing skills such as recognising symbols, interpreting legends and understanding orientation typically begins with simple mapping activities and gradually progresses to include more complex operations, including the interpretation of thematic maps, thereby supporting the progressive development of spatial reasoning.

Beyond their technical dimension, cartographic skills also support critical geographical learning. They enable pupils to compare perspectives, evaluate evidence and identify spatial patterns in natural and social phenomena (Havelková & Hanus, 2019). When integrated into classroom practice, map-based activities promote active engagement with spatial information and foster the construction of spatial knowledge rather than the passive reception of geographic content.

The importance of cartographic skills in primary education is explicitly acknowledged in both national and international curricula: the Greek National Curriculum highlights their pedagogical and cognitive value across primary grades (Greek Ministry of National Education and Religious Affairs, 2003, pp. 474, 487-488, 501), and international comparative research shows that systematic integration of cartographic skills in textbooks and teaching practice is associated with higher levels of geographical competence and better preparation for addressing complex social and environmental challenges (Bagoly-Simó & Binimelis-Sebastián, 2022). Conversely, providing limited or inadequate opportunities to engage with cartographic skills may restrict pupils' access to important tools for interpreting spatial information and understanding social and environmental issues.

2.3. Cartographic Skills in the Greek Primary Curriculum

The Greek primary geography curriculum assigns a central role to cartographic skills, especially in the final two grades where geography is taught as an autonomous subject. Learning objectives emphasise maps as essential tools, requiring pupils to decode symbols and legends, understand scale and orientation, distinguish map types and recognise the information they convey. Cartographic skills are thus framed not only as technical abilities but as competences linked to broader geographical literacy and real-world applications. The curriculum further emphasises the progressive development of pupils' capacity to use maps across different scales and contexts. Learning objectives include locating Greece and its regions, distinguishing landscapes and identifying major physical features, such as mountains, rivers, plains and lakes. The gradual accumulation of such competences supports the construction of increasingly structured mental maps and provides the cognitive foundation for more advanced spatial reasoning (Greek Ministry of National Education and Religious Affairs, 2003, pp. 474-475, 487).

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Importantly, cartographic skills are not limited to receptive activities of reading and interpreting maps but also include productive and creative engagement. The methodological guidelines in the curriculum explicitly recommend the systematic use of maps and the design of map-construction activities by pupils themselves, encouraging learners to transform geographical information into meaningful spatial representations and actively engage in knowledge production (Greek Ministry of National Education and Religious Affairs, 2003, p. 486).

Finally, the curriculum describes a developmental progression between the two final grades of primary education: Grade 5 lessons focus on the geography of Greece, primarily the natural environment with links to human geography, whereas those in Grade 6 expand to include the geography of the continents, with particular emphasis on Europe (Greek Ministry of National Education and Religious Affairs, 2003, pp. 474-485). Throughout this sequenced structure, cartographic skills are positioned as core competences supporting spatial thinking, environmental awareness and spatial citizenship understood here as pupils' capacity to critically interpret and produce spatial representations, such as maps and other cartographic representations geo-media, and to use spatial information to engage with societal and environmental issues related to space (Gryl & Jekel, 2012), a competence that geography textbooks are expected to support through map-based learning activities.

Textbook research is particularly important in the context of minority education in Greece as the geography textbooks currently used in minority primary schools were developed more than 25 years ago and have not been systematically evaluated since. It is therefore necessary to examine whether these materials remain aligned with current curricular priorities and whether they provide learning opportunities comparable to those offered by contemporary mainstream school textbooks, especially with regard to the development of cartographic skills and spatial thinking.

In light of the limited research on non-language subjects in minority education, the present study aims to examine how maps are integrated into geography textbooks used in minority and mainstream primary education in Greece and to compare the learning opportunities they provide for the development of cartographic skills. More specifically, the study addresses the following research questions:

- **RQ1:** How are maps represented and categorised in geography textbooks used in minority and mainstream primary education in Greece?
- **RQ2:** What types of map-based learning activities are associated with these maps identified in the textbooks, and how do these activities support the development of cartographic skills?

3. Materials and Methods

The corpus of the study consists of the complete set of geography textbooks currently used in both general and minority primary education in Greece. The selection of materials ensured full comparability between the two subsystems in terms of grade level, thematic orientation and pedagogical function. As geography is taught as an autonomous subject only in the fifth (E) and sixth (St) grades of primary education, the textbooks corresponding to these grades were included in the analysis.

For general education, the corpus comprises the Student's Book and Workbook for Grade 5 (Geography E') and the corresponding Student's Book and Workbook for Grade 6 (Geography St'). These textbooks are used in all public primary schools in Greece, with the exception of the minority schools of Thrace, and constitute the official national standard for geography instruction. They focus exclusively on geographical knowledge, spatial reasoning and environmental awareness, following a disciplinary rather than cross-curricular approach.

For minority education, the corpus includes the complete set of Greek-language textbooks developed within the framework of the E.M.C.P. The analysed titles are: Εδώ εκεί και αλλού (Here, There and Everywhere), Οι Εμπορικοί Δρόμοι (The Trade Routes), Φτιάχνουμε μια Συλλογή (Creating a Collection), Με ένα Λεωφορείο όλοι τριγυρνάμε μες στην πόλη (By Bus Around the City), Ένα Μήνυμα σου Στέλνω (Sending You a Message), Μια Μέρα Δρόμος (A Day's Journey), Τι Ωραία που Μυρίζει (It Smells So Nice), Ο Κόσμος του Παππού και της Γιαγιάς (Grandfather's and Grandmother's World), Το Παζάρι και ο Κόσμος του (The Bazaar and Its World), Στο Παζάρι (At the Bazaar) and Τα Προϊόντα στην Αγορά (Products in the Market), Θυμόμαστε και γιορτάζουμε (We remember and celebrate).

These textbooks constitute the official teaching materials for non-language subjects in minority primary schools and represent the most comprehensive source of geography-related content within the minority curriculum. Together, the two textbook sets form a balanced corpus for the comparative analysis of map use, typology and learning activities, allowing for the identification of similarities, differences and pedagogical implications between the two educational contexts.

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3.1. Corpus of Materials: Minority and Mainstream School Textbooks

In the Greek educational system, textbooks are centrally approved and distributed free of charge, with no option for alternative series. In minority primary schools, teachers may supplement or replace minority textbooks with mainstream school textbooks when pedagogically appropriate; however, in practice, the latter are used selectively alongside the prescribed minority textbooks.

Minority education in Thrace is a distinct subsystem of the Greek educational framework and is supported by a separate set of textbooks developed within state educational interventions aimed at improving teaching quality. These textbooks are organised into two main categories—language textbooks and textbooks for non-language subjects—and comprise 12 volumes accompanied by supplementary teaching materials. Their structure and thematic scope differ substantially from those of the general education textbooks, necessitating separate examination.

Minority education textbooks were piloted during the initial phase of the E.M.C.P. and have been used in all minority primary schools in Thrace since 2000–2001, representing both a practical and symbolic intervention to upgrade minority education (Program for the Education of Muslim Children, n.d.). Prior to their introduction, minority schools used mainstream education textbooks, which created persistent difficulties due to pupils' limited Greek proficiency. The E.M.C.P. aimed to address the linguistic, cultural and pedagogical specificities of minority classrooms and the need for materials adapted to diverse learning trajectories and limited exposure to academic Greek (Askouni, 2006).

The minority school curriculum is organised into two parallel strands, a Greek-language programme and a Turkish-language programme, with slightly more instructional time allocated to the latter (Vakalios, 1997). Within the Greek-language programme, pupils are taught a set of non-language subjects, including Geography, History, Environmental Studies and Civic and Political education. To support these subjects, the 12 non-language textbooks are complemented by supplementary resources, such as a chronology, a geographical-historical-cultural atlas and sets of maps. A distinctive feature of these textbooks is their cross-curricular orientation, integrating content from the above subject areas.

The textbooks are further accompanied by a navigation guide and thematic index, enabling teachers to locate relevant content across different volumes and to establish thematic links between curriculum units and textbook sections (Magos et al., 2011).

In addition to the minority school textbooks, the corpus also includes the geography textbooks used in mainstream primary schools in Greece. Textbooks in both minority and mainstream schools constitute compulsory instructional resources and serve as the main teaching materials for pupils, although teachers maintain responsibility for selecting, adapting and sequencing the learning activities. Both textbook series were developed within state-funded initiatives and were officially commissioned by the Greek Ministry of Education rather than being produced by private publishers.

Mainstream school geography textbooks are used in all public primary schools in Greece, with the exception of minority schools in Thrace, and are designed exclusively for the teaching of geography as an autonomous subject. There is a Student's Book and a Workbook for each of the two grade levels. The Student's Books organise content into thematic units progressing from local to global scales and are supported by maps, photographs and diagrams. The Workbooks provide complementary practice and consolidation activities. Taken together, these textbooks represent the national standard for primary geography education in Greece and constitute the baseline with which to compare the materials developed for minority schools.

Figure 1 presents the research design and the analytical procedure of the study. It outlines the main stages of the analysis, from the selection of the textbook corpus to the classification of maps and the coding of map-based activities.

3.2. Methodology

Within the framework of the present study, the first step of the methodological process involved the identification and systematic documentation of all maps contained in the two sets of textbooks under examination, namely those employed in mainstream primary schools and those specifically designed for minority schools. This documentation was exhaustive, ensuring that no map was overlooked. Subsequently, a first level of classification was undertaken based on the typology of the maps, while maps on covers, endpapers and section-opening organisers were excluded as primarily decorative. The maps were categorised into three principal groups: (a) political maps, which emphasise the representation of administrative boundaries, settlements and geopolitical features, (b) physical maps, which illustrate elements of the natural environment, such as topography, hydrography and relief, and (c) thematic maps, which focus on the depiction and analysis of specific issues, including population distribution, economic activities and climatic conditions.

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This typology was deemed essential given that the type of map directly influences the skills pupils develop and the kind of knowledge they are expected to acquire (Beitlova, Popelka, & Vozenilek, 2020; Havelková, L. & Hanus, 2019). Maps were classified according to their dominant focus within the instructional context of the textbook, with representative examples from the analysed textbooks shown in Figures 2 and 3.

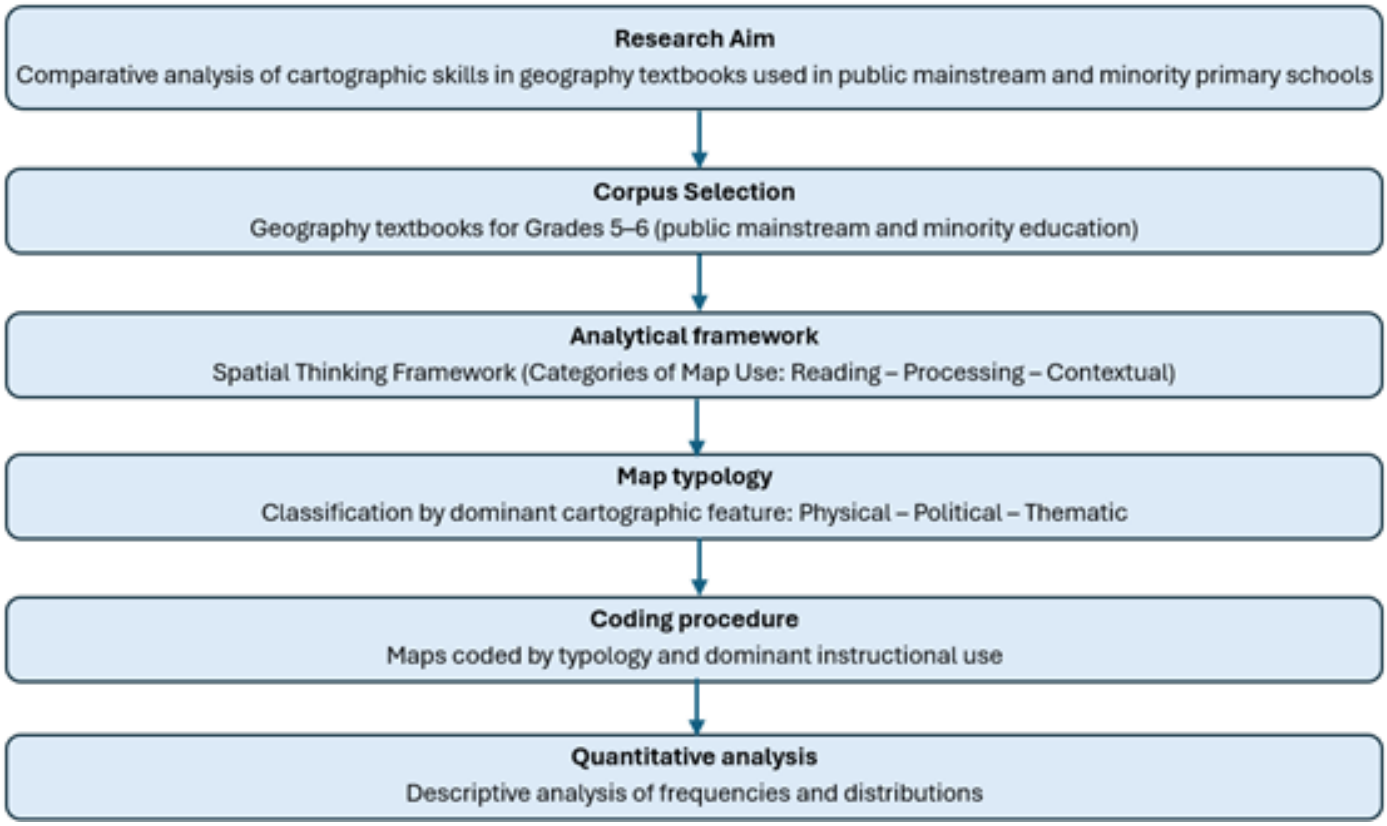

Figure 1. Research design and analytical procedure of the study.

(a) **(b)** **(c)**

Figure 2. Representative examples of map types identified in the minority education textbooks: **(a)** Political Map, **(b)** Physical Map and **(c)** Thematic Map (Here, There and Everywhere, n.d., p. 44; Sending You a Message, n.d., p. 35; The Bazaar and Its World, n.d., p. 17).

The second stage of the methodological approach focused on the classification of maps according to the manner in which they are pedagogically integrated into the textbooks and the learning tasks assigned to pupils. For this purpose, a tripartite categorisation was adopted: maps were classified as (a) reading maps if pupils are required to merely locate or recognise information already presented on the map, (b) processing maps if pupils are asked to supplement the data,

add new information or even construct a new map or (c) contextual maps if they function as accompanying visual material without being explicitly linked to a specific activity or question. This distinction facilitates both documentation of the frequency and variety of maps and evaluation of the pedagogical depth of their use—that is, the extent to which they promote active student engagement in the processes of understanding and producing spatial knowledge. In this way, the methodological analysis enables a comparative assessment of the contribution of each group of textbooks to the cultivation of cartographic skills.

(a) **(b)** **(c)**

Figure 3. Representative examples of map types identified in the mainstream education textbook for Grade 5: **(a)** Political Map, **(b)** Physical Map and **(c)** Thematic Map (Koutsopoulos et al., n.d.-a, pp. 23, 54, 56).

At this stage, it is important to clarify the analytical structure underpinning the study. At the first level of analysis, the unit of analysis was the individual map identified in the textbooks. Each map was coded as a distinct analytical unit, irrespective of its position in the textbook. Two nominal categories were used: map type (political, physical, thematic) and didactic function. The latter is distinguished between reading (locating or extracting information from the map), processing (constructing, completing, or modifying a map), and contextual use (maps included without explicit tasks or explicit textual reference to the map). This coding scheme enabled a systematic comparison of the quantitative presence and pedagogical activation of maps across the two textbook series.

3.2.1. Coding scheme and analytical procedure

Based on the analytical framework presented in Section 2.1.1, a qualitative–quantitative content analysis was conducted focusing on all map-based learning activities included in the selected geography textbooks. At the second level of analysis, the unit of analysis was defined as an individual learning activity explicitly referring to a map, regardless of whether the map was embedded in the activity instructions or provided as accompanying material.

Each activity was coded according to its pedagogical function and cognitive orientation into one of three mutually exclusive categories: a) activities requiring students to read and interpret existing maps, b) activities requiring students to produce, complete or transform maps as spatial representations, and c) paratextual uses of maps, in which maps appear only as illustrative elements without being linked to an explicit learning task.

In addition, each activity was coded according to the type of map employed, distinguishing between political, physical and thematic maps. This classification was used to examine differences in the cognitive demands and pedagogical roles associated with different cartographic representations.

The coding procedure followed a structured protocol. Initially, all map-related activities were identified through a systematic page-by-page screening of each textbook and workbook. Subsequently, activities were independently assigned to the relevant analytical categories based on the dominant learning requirement explicitly stated in the task instructions. The resulting dataset was used to calculate descriptive frequencies and proportional distributions for each textbook series, allowing for a systematic comparison of the general and minority education materials.

4. Results

This section presents the results of the comparative analysis of the maps identified in the two groups of textbooks, addressing the research questions concerning the distribution of map types and the pedagogical use of maps in the analysed textbooks. The quantitative findings are first summarised to illustrate the overall distribution and typology of maps across the datasets. For a detailed overview of all textbooks included in the study, see Appendix A (Table A1). This summary is followed by a discussion of the pedagogical implications, focusing on how the observed differences may affect the development of cartographic skills and spatial thinking among pupils.

4.1. Findings on the Number and Categories of Maps

The analysis of the textbooks revealed significant differences in both the total number and distribution of maps across the two sets of materials. In total, 183 maps were identified: 127 in the general education textbooks and 56 in the minority school textbooks. The difference of 71 maps, representing approximately 55.9% fewer maps in the minority education textbooks, indicates a substantial imbalance in the degree of cartographic representation and, by extension, in the learning opportunities offered to pupils in these two educational contexts.

Table 1. Comparative distribution of map types in general and minority education textbooks.

Type of Map	General Education Textbooks	Minority Education Textbooks	Difference	Percentage Difference
Physical	37	15	−22	−59.5%
Political	33	13	−20	−60.6%
Thematic	57	28	−29	−50.9%
Total	127	56	−71	−55.9%

As shown in Table 1, the categorisation of maps revealed that thematic maps predominate in the general education textbooks (57/127, approximately 44.9%), followed by physical maps (37/127, 29.1%) and political maps (33/127, 26%). The distribution is similar in the minority school textbooks, but with markedly lower frequencies: of the 56 total maps, 28 were thematic (50%), 15 were physical (26.8%), and 13 were political (23.2%). The dominance of thematic maps in both series suggests a shared focus on developing students' understanding of spatial distribution and relationships between natural and human phenomena.

4.2. Results by Type of Learning Activity

The analysis of maps according to the type of learning activity assigned to pupils revealed marked differences between the two groups of textbooks. As shown in Table 2, the majority of maps in the general education textbooks (59.1%) are associated with reading tasks, including observation and interpretation, though a substantial proportion (29.1%) involves processing activities—such as application, production and comparison—that require students to engage actively with cartographic material.

Table 2. Comparison of learning activity types associated with maps across textbook categories.

Type of Map	General Education Textbooks	Minority Education Textbooks	Difference	Percentage Difference
Reading	75	19	−56	−74.7%
Processing	37	12	−25	−67.6%
Contextual	15	25	+10	+66.7%
Total	127	56	−71	−55.9%

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By contrast, the minority school textbooks are dominated by maps used for contextual purposes (44.6%), indicating that maps frequently function as illustrative elements rather than as tools for active learning. Reading activities account for a smaller proportion (33.9%), while processing-oriented tasks are further limited (21.4%). This distribution highlights a tendency toward passive engagement with cartographic material, in contrast to more active uses observed in the general education textbooks.

These findings indicate both quantitative and qualitative differences in the ways maps are integrated into teaching practices across the two educational settings.

4.2.1. Illustrative examples of map-reading activities

To illustrate how map-reading activities are operationalised in the analysed textbooks, two indicative examples are presented. In the mainstream primary school textbook for Grade 5 (Koutsopoulos et al., n.d.-a, p. 23), pupils are asked to use a political map of Greece to determine the location of Athens relative to the cities of Volos and Rhodes. The task requires learners to locate settlements and interpret basic spatial relationships and orientation using the map as a representational tool for extracting spatial information; it does not require producing or modifying any cartographic representation. In a comparable map-reading activity in the minority education textbook Edo Ekei kai Allou (Here, There and Everywhere, p. 31), pupils are instructed to consult the legend of a regional map of the Rhodope area and identify key geographical and infrastructural elements (such as settlements, roads, rivers and natural features), followed by a short classroom discussion. In both cases, pupils engage primarily in the interpretation of existing cartographic representations and the extraction of spatial information, which corresponds to the category of map-reading activities adopted in the present analysis.

4.2.2. Illustrative examples of map-processing activities

To illustrate how map-processing activities are implemented in the analysed textbooks, two indicative examples are presented. In the mainstream primary school workbook for Grade 5 (Koutsopoulos et al., n.d.-b, p. 11), pupils are asked to draw their own map of Greece using the textbook map as a reference, reproducing its main spatial structure within a provided frame. The task requires learners to translate an existing cartographic representation into a new one by reconstructing spatial relationships and basic cartographic elements and therefore involves the processing and transformation of spatial information rather than the simple reading of a map. In a comparable activity in the minority education textbook Edo ekei kai allou (Here, There and Everywhere, p. 44), pupils are instructed to locate specific geographical elements and depict them on a blank map base using colours, lines and symbols. In both cases, pupils engage in the supplementation and transformation of cartographic representations by organising geographic information in spatial form, which corresponds to the category of map-processing activities adopted in the present analysis.

4.2.3. Illustrative examples of contextual use of maps

To illustrate the contextual use of maps in the analysed textbooks, two indicative examples are presented. In the mainstream primary school textbook for Grade 5 (Koutsopoulos et al., n.d.-a, pp. 153–154), a map showing the spatial distribution of ancient Greek settlements is presented alongside the narrative text describing ancient Greek communities, without being accompanied by any question, task or explicit reference to the map within the text. Similarly, in the minority education textbook Oi emporikoi dromoi (The Trade Routes, pp. 121–122), a map illustrating the migration routes of Greek populations during the 18th century is included as an accompanying visual element to the historical narrative, without any explicit reference to the map within the text or any associated activity or task for pupils. In both cases, the maps function primarily as contextual visual material supporting the written text rather than pedagogically activated representational tools, therefore corresponding to the category of contextual maps adopted in the present analysis. This classification was adopted because, in the absence of any task or textual reference, the pedagogical use of these maps is left entirely to each teacher's discretion (i.e., it may be used for reading or processing tasks, or it may not be used at all). The present study therefore records their status in a neutral and analytically impartial manner.

4.3. Distribution of Learning Activities by Type of Map

The distribution of learning activities according to the type of map provides important insight into the pedagogical emphasis of the minority geography textbooks. As shown in Table 3, thematic maps occupy a central place in the minority school textbooks (28 maps); however, their use is unevenly distributed across activity types. More specifically, they are used more frequently for contextual purposes (13 cases), while reading activities are less common (9 cases) and processing activities remain limited (6 cases). This pattern suggests that, although thematic maps are numerically prominent, they are more often employed as supportive or illustrative elements rather than as tools for active analytical engagement.

Table 3. Distribution of learning activities by map type in general and minority education textbooks.

Type of Map	General Education Textbooks Reading	General Education Textbooks Processing	General Education Textbooks Contextual	Minority Education Textbooks Reading	Minority Education Textbooks Processing	Minority Education Textbooks Contextual
Physical	23	14	0	5	3	7
Political	16	10	7	5	3	5
Thematic	36	13	8	9	6	13
Total	75	37	15	19	12	25

5. Discussion

5.1. Interpreting Quantitative Differences in Map Frequency and Typology

The quantitative imbalance revealed in the comparative analysis—only 56 of the 183 maps were found in the minority school textbook series—carries important pedagogical implications. From a cognitive and didactic perspective, the number and typological variety of maps directly influence pupils' exposure to spatial representations and, therefore, their capacity to develop cartographic literacy (Bednarz, 2018; Hus & Hojnik, 2013). When cartographic stimuli are limited, as in the minority education textbooks, students encounter fewer opportunities to analyse, interpret and correlate visuospatial data.

The predominance of thematic maps in both sets of textbooks may reflect a shared curricular intent to emphasise spatial relationships between natural and human phenomena. However, the substantially lower overall density of maps in the minority school textbooks transforms what could be a rich visual learning experience into a more restricted and fragmented one. As Gersmehl and Gersmehl (2007) point out, thematic maps act as cognitive tools that help learners transform data into structured geographic knowledge. Their limited presence, combined with their restricted pedagogical use, constrains the development of higher-order interpretive skills, hindering pupils' ability to build coherent mental representations of geographic space.

This asymmetry also resonates with broader discussions on educational equity. According to Bagoly-Simó and Sebastián (2022), the systematic inclusion of maps across the curriculum fosters continuity in spatial learning, whereas scarcity or inconsistency generates cognitive discontinuity. In this light, the underrepresentation of maps in the minority education textbooks suggests not only a quantitative gap but also a structural inequality in learning opportunities—the gap may reproduce existing disparities in geographic competence and conceptual understanding.

Furthermore, this quantitative asymmetry may be viewed as a reflection of deeper institutional and historical factors affecting minority education in Thrace. The selective integration of cartographic material mirrors a broader tension between national educational policy and the distinctive realities of bilingual schooling. The limited visuospatial content of minority school textbooks could signify not merely a curricular omission but also a symptom of how peripheral educational contexts remain marginal in the production of teaching materials. Addressing this imbalance would thus require revisions of both the content and the principles guiding textbook authorship, ensuring that the cartographic component is recognised as central to equitable geography education.

5.2. Pedagogical Interpretation of Map-Related Learning Activities

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The findings of the present study are consistent with contemporary international research on spatial thinking and spatial competence, which emphasises that meaningful engagement with maps must extend beyond simple recognition and observation tasks. These findings also highlight the pedagogical implications of the ways maps are integrated into textbook activities. Spatial thinking is conceptualised as an integrated set of spatial concepts, representational tools and reasoning processes, and the development of spatial competence depends primarily on learners' opportunities to actively use representations to analyse, interpret and communicate spatial relationships (Jo & Bednarz, 2009; Metoyer et al., 2015). From this perspective, the predominance of low-level, descriptive map–based activities identified in the minority school textbooks indicates restricted opportunities for pupils to engage in higher-order spatial reasoning.

Research on teacher education and curriculum design further demonstrates that the systematic integration of spatial concepts, tools of representation and reasoning processes is a prerequisite for fostering spatial thinking in school geography lessons (Jo & Bednarz, 2014). Consequently, the limited use of processing-oriented map activities observed in the minority education textbook series constrains the development of spatial competence by reducing pupils' exposure to tasks that require comparison, interpretation, justification and the construction of spatial explanations.

Moreover, a growing body of empirical research highlights the role of geographic information technologies, particularly GIS-based learning environments, in strengthening students' spatial thinking and spatial skills. Studies have shown that engagement with GIS-supported activities is associated with statistically significant improvements in learners' spatial thinking performance and their ability to reason about spatial relations (Lee & Bednarz, 2009). In addition, GIS learning has been found to support the development of critical spatial thinking, including the evaluation of data reliability, the construction of spatial arguments and the assessment of problem-solving validity (Kim & Bednarz, 2013).

Advances in the assessment of spatial and geospatial thinking provide further evidence that spatial competence constitutes a learnable and measurable educational outcome. The development of validated geospatial thinking instruments confirms that students' performance can be differentiated into meaningful levels of expertise, reflecting variations in their understanding of spatial relations and representational practices (Huynh & Sharpe, 2013). These findings suggest that the limited pedagogical use of maps identified in the minority school textbooks does not merely reflect authorial and curriculum design decisions but also represents a structural constraint on pupils' opportunities to develop higher-order spatial thinking and spatial competence through geography education (Jo & Bednarz, 2009; Metoyer et al., 2015).

The results of the analysis of map-based activities demonstrated that the general education textbooks promote more interactive and cognitively demanding engagement with cartographic material, whereas minority school textbooks rely predominantly on lower-demand forms of map use, especially contextual uses of maps, while processing-oriented tasks remain comparatively limited. This difference is pedagogically significant. Although reading and observation exercises are foundational for map literacy (Havelková & Hanus, 2019), genuine spatial understanding emerges only when learners move beyond simple observation and contextual exposure to actively interpret or construct maps through inquiry-driven methods (Liben, Kastens, & Stevenson, 2002; National Research Council, 2006).

The predominance of contextual, low-demand uses of map in the minority education textbooks implies that pupils are often exposed to maps more as visual aids than as tools for reasoning or exploration. By contrast, the inclusion of application and comparison tasks in the general education textbooks facilitates the cognitive transition from recognition to synthesis, fostering deeper levels of spatial reasoning (Bednarz, 2018; Gersmehl & Gersmehl, 2007).

Moreover, the greater percentage of contextual maps—those not explicitly tied to learning tasks—in the minority school textbooks suggests a more decorative or illustrative use of cartography. As Lambert and Morgan (2010) argued, maps detached from pedagogical purpose lose their cognitive value and become static visual ornaments. This observation reinforces the conclusion that minority pupils experience a narrower range of opportunities to learn (Bagoly-Simó & Binimelis-Sebastián, 2022), restricting their progression from basic recognition to analytical engagement. Such pedagogical asymmetry may restrict opportunities for the development of critical spatial thinking and, more broadly, for deeper engagement with geography learning.

In addition, the imbalance in learning activity design reveals a deeper pedagogical orientation toward transmissive rather than constructivist learning. The minority school textbooks appear to prioritise content delivery over concept construction, positioning learners as recipients rather than co-constructors of meaning. This approach runs counter to contemporary educational paradigms that emphasise inquiry, visualisation and learner agency. Embedding map interpretation and production within participatory activities—such as collaborative mapping or digital cartography—could

help bridge this gap and align minority education with more inclusive, competence-based approaches to learning geography.

5.2.1. Pedagogical Coherence and Equity in the Use of Map Types

As shown in Table 3, thematic maps are more frequent than other map types in both textbook series, yet their pedagogical integration differs considerably. In the general education series, maps are distributed across all types of learning activities—reading, processing and contextual —encouraging pupils to engage with spatial data through multiple cognitive pathways. This broader distribution reflects a constructivist model of geography education consistent with international developmental frameworks of cartographic skill acquisition (Liben, Kastens, & Stevenson, 2002; National Research Council, 2006), in which students are encouraged not only to read maps but also to use them as instruments of inquiry and communication, thereby reinforcing spatial thinking and problem-solving abilities (Bednarz, 2018).

By contrast, the minority school textbooks demonstrate a more selective and transmissive approach, where maps—particularly physical and political ones—are treated as illustrative complements rather than cognitive instruments. Although thematic maps offer some engagement potential, the comparatively limited presence of processing-oriented activities, combined with the frequent contextual use of maps, constrains students' opportunities to develop analytical reasoning and conceptual integration. According to Lambert and Morgan (2010: 35–38), this descriptive mode diminishes the transformative role of maps in learning, reducing them to passive visual references.

The imbalance in map types also bears implications for curricular coherence and educational equity. The Greek National Curriculum (Ministry of National Education and Religious Affairs, 2003) emphasises "continuous and active map use" as a core methodological principle for the last two grades of primary education. General education textbooks comply with this directive through varied and inquiry-based map activities, whereas minority education textbooks appear to diverge from it, narrowing the scope of visuospatial learning. Consequently, pupils in the minority education context receive fewer structured opportunities to develop conceptual understanding through spatial representation—a shortfall that may contribute to the persistence of inequalities in geography education.

Beyond the confines of the geography classroom, this disparity raises broader questions about the role of educational materials in social inclusion. When one segment of the student population systematically experiences reduced engagement with cognitive tools such as maps, implications extend beyond disciplinary learning, affecting pupils' opportunities to develop spatial citizenship. By limiting students' access to the symbolic language of spatial representation, these textbooks may contribute to forms of epistemic inequality in access to geographical knowledge. Addressing this challenge requires a policy shift toward more participatory textbook design processes involving minority educators and communities to ensure that learning materials reflect not only national standards but also local pedagogical realities.

6. Conclusions

This study contributes to the assessment of the effectiveness of one specific strand of the E.M.C.P., namely the development of minority school textbooks, approximately 25 years after the programme's implementation, by examining whether these materials provide learning opportunities for the development of cartographic skills comparable to those used in mainstream education. In light of the forthcoming national textbook reforms announced in Greece for the period after 2027, the findings offer timely, evidence-based guidance for future textbook design and curriculum policy, with particular emphasis on educational equity and spatial learning opportunities.

The results of the comparative analysis of geography textbooks for general and minority education revealed systematic disparities in both the quantity and the pedagogical integration of maps. The general education textbooks exhibit a coherent and content-rich cartographic structure, offering pupils a wide range of visual, interpretive and application-based learning opportunities. By contrast, the minority education series demonstrates a considerably lower density of maps that are often employed as static illustrations rather than cognitive instruments. This asymmetry affects not only the amount of exposure to spatial representations but also the depth of students' engagement with geographical concepts and reasoning.

From a pedagogical perspective, these findings highlight that cartographic skills are not peripheral abilities but a foundational component of spatial thinking and geography education. The variety and complexity of maps play a key

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role in how effectively pupils can connect symbolic representations with real-world spatial relationships. Limited engagement with such materials restricts learners' capacity to interpret, compare and construct meaning from spatial data—processes that lie at the heart of critical geographic understanding.

Taken together, these findings provide a clear answer to the research questions of the study by demonstrating both the differences in the distribution and typology of maps and the differences in the pedagogical uses of maps across the analysed textbook series.

While the present study provides important insights into the role of maps in geography textbooks, it is based on a descriptive content analysis and therefore focuses on learning opportunities as represented in the material rather than on classroom practices or student learning outcomes. Future research could build on these findings by examining how textbooks are used in practice and how they influence students' spatial thinking.

Future research could further explore comparative analysis of geography textbooks in multilingual and minority-language educational contexts across Europe. Such studies are particularly important because textbooks play a crucial role in translating curriculum intentions into concrete learning opportunities for teachers and students. Differences in the pedagogical structure, organization and content of textbooks may therefore shape classroom practices and influence students' learning experiences and outcomes (van den Ham & Heinze, 2018; Pavešić & Japelj Pavešić, 2022). The findings of the present study support this perspective, showing that differences in textbook structure and content may influence classroom practices and learning outcomes. Comparative analyses of geography textbooks in multilingual educational systems could therefore contribute to a deeper understanding of how instructional materials shape learning opportunities.

7. Recommendations for Policy and Practice

The findings call for systematic action to ensure equitable access to geography education, with the gradual integration of general education textbooks into minority schools as the most coherent solution. This would establish a unified framework, ensuring comparable opportunities for developing spatial competence and critical thinking, while aligning with the national curriculum and avoiding divergent educational outcomes. If full integration is not immediately feasible for political, administrative or linguistic reasons, the minority school textbooks should undergo a comprehensive and conceptually grounded revision. The revision process should draw on validated international frameworks for cartographic skill progression, embedding structured learning sequences that move from map recognition to analysis, synthesis and creation. This way, geography learning would evolve from a descriptive process to an inquiry-based process, empowering pupils to think through maps and use cartographic representation as a means of organising and interpreting spatial experience (Horvat & Kuzma-Kachur, 2025; Ramsaroop & Kwayi, 2024).

A key reform priority is the establishment of a permanent monitoring and evaluation mechanism, under the Institute of Educational Policy, to assess the scientific accuracy, pedagogical coherence and didactic functionality of maps across textbooks, ensuring alignment with curricula, comparability and continuous improvement. At the same time, geography education should incorporate digital tools—such as interactive maps, GIS and open-access geospatial platforms—transforming map use into a participatory learning process. For minority schools, digital cartography can mitigate material disparities while enhancing engagement and learner agency, in line with the EU's digital competence framework and the promotion of spatial citizenship. Finally, cartographic literacy extends beyond disciplinary knowledge, constituting a key dimension of democratic education and social inclusion. Ensuring equitable access to meaningful cartographic experiences for all pupils is both a pedagogical responsibility and a matter of educational justice, with geography serving as a bridge for critical awareness and shared spatial understanding in a pluralistic society. At a broader level, the results of this study suggest that the quality of map integration in school textbooks may serve as an indicator of education equity. The persistent underrepresentation of maps in minority school textbooks signifies not only a pedagogical gap but also disparities in access to cognitive tools and learning opportunities. Strengthening cartographic literacy across all educational contexts is therefore both a didactic and a social priority, directly connected to the broader goals of inclusion, participation and civic empowerment.

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Appendix A

The table presents the full set of textbooks examined, including both general and minority series for the final grades of primary education in Greece. For each textbook, the number of maps, their typology and task types are summarised. It provides the basis for the quantitative and qualitative analyses in the main text.

Table A1. Textbooks included in the analysis and the number of maps identified in each.

Educational Context	Grade / Textbook Title	Type of Material	Total Maps Identified	Activity Type (Reading/Processing/Contextual)	Map Typology (Physical/Political/Thematic)
General Education	Geōgraphia E' Dimotikou: Mathainō gia tin Ellada	Textbook	51	26/19/6	13/14/24
	Geōgraphia E' Dimotikou: Mathainō gia tin Tetradio Ergasion	Workbook	21	14/7/0	8/4/9
	Geōgraphia St' Dimotikou: Mathainō gia ti Gi	Textbook	47	35/3/9	10/14/23
	Geōgraphia St' Dimo-tikou: Mathainō gia ti Gi Tetradio Ergasion	Workbook	8	0/8/0	6/1/1
Subtotal (General Education)			127	75/37/15	37/33/57
Minority Education	Edo ekei kai allou	Textbook	21	7/4/10	9/8/4
	Oi emporikoi dromoi	Textbook	12	4/2/6	2/0/10
	Ftiachnoume mia syllogi	Textbook	1	0/0/1	1/0/0
	Me ena leoforeio oloi trigyrname mes stin poli	Textbook	1	0/0/1	0/0/1
	Ena minima sou stelnō	Textbook	6	4/0/2	3/0/3
	Mia mera dromos	Textbook	2	0/2/0	0/1/1
	Ti oraia pou myrizei	Textbook	1	1/0/0	0/0/1
	O kosmos tou pappou kai tis giagias	Textbook	0	0/0/0	0/0/0
	To pazari kai o kosmos tou	Textbook	5	0/0/5	0/0/5
	Sto pazari	Textbook	5	2/3/0	0/3/2
	Ta proionta stin agora	Textbook	1	0/1/0	0/0/1
	Thymomaste kai giortazoume	Textbook	1	1/0/0	0/1/0
Subtotal (Minority Education)			56	19/12/25	15/13/28

Total (All Textbooks)	183	—

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