Articles

Assessing the instructional quality of visuals in geography textbooks of Greek secondary education

Konstantinos Boukas, Vana Chiou

Abstract

This study aims to analyse the visual representations in geography textbooks of secondary education in Greece. A quantitative content analysis was employed for research purposes. The sample comprised two textbooks and two student workbooks. The analysis identified a total of 1.231 visuals, including maps, photographs, artworks, data tables, charts, images, sketches, and small-scale representations. The findings revealed the prevalence of photographs and small-scale representation while raised concerns regarding the lack of captions, insufficient use of maps, and a high frequency of visuals unrelated to the text. The characteristics of visuals are assessed and discussed with respect to their instructional function.

Keywords: visuals, visual analysis, geography textbooks, geography education.

Hodnocení výukové kvality vizuálních materiálů v učebnicích zeměpisu řeckých středních škol

Abstrakt

Cílem této studie je analyzovat vizuální zobrazení v učebnicích zeměpisu pro střední školy v Řecku. Pro účely výzkumu byla použita kvantitativní obsahová analýza. Vzorek

zahrnoval dvě učebnice a dva pracovní sešity pro žáky. Analýza identifikovala celkem 1 231 vizuálních zobrazení, včetně map, fotografií, uměleckých děl, datových tabulek, grafů, obrázků, náčrtků a drobných vyobrazení. Zjištění odhalila převahu fotografií a drobných vyobrazení a zároveň vzbudila obavy ohledně nedostatku popisků, nedostatečného využití map a vysoké četnosti vizualizací nesouvisejících s textem. Charakteristiky vizualizací jsou hodnoceny a diskutovány s ohledem na jejich výukovou funkci.

Klíčová slova: vizualizace, vizuální analýza, učebnice zeměpisu, výuka zeměpisu

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Introduction

Traditionally, textbooks have been the most prevalent educational resource in many education systems. They are designed to function as pedagogical means for the promotion of students' learning (Khutorskoi, 2006) and constitute a central element of the curriculum (Kasmaienezhadfard et al., 2015; Smith et al., 2021) as well as the primary teaching resource for teachers (Thang et al., 2013). Despite technological advancements that have equipped schools with modern technology-assisted tools and resources to facilitate teaching and learning, textbooks are predominantly delivered to students as a primary educational source in various education systems.

Multiple advantages of textbooks have been documented in the literature, such as ease of accessibility (Mahmood, 2011) and facilitation of the teaching and learning process (Litz, 2005). When appropriately designed, textbooks can serve as an effective educational tool (Ajibade & Elemi, 2012; Aslan & Polat, 2008), assisting students in reflecting on their experiences, visualising concepts through images (Hibbing & Ranking-Erickson, 2003), and motivating them (Darian, 2001). Additionally, research indicates that teachers consider textbooks as reliable educational tools that facilitate and enhance students' conceptual comprehension (Knight, 2015). Conversely, disadvantages have also been identified, with textbooks being referred to as "a painful continuity", the means to "official knowledge", and to examinations (Issitt, 2004, p. 684), connecting them with their most traditional implications. Nevertheless, students appear to prefer textbooks to e-books for learning, irrespective of their skills or familiarity and comfort with computer use (Woody et al., 2010).

Contemporary textbooks are enriched with a variety of visuals that constitute an important component and characterised by various visual elements such as imaging techniques, colour, and layout (Behneke, 2021). These visuals support a wide range of tasks, including paying attention, storytelling, concept comprehension, and enjoyment

(Kasmaienezhadfard et al., 2015). Multiple studies have focused on the visual representations in textbooks of different education systems, documenting their added instructional value. Specifically, research demonstrates that visuals can enhance students' creativity (Kasmaienezhadfard et al., 2015), leverage their imagination and curiosity (Fang, 1996), assist them in making connections between verbal and visual representations (Mayer et al., 1995), and improve their language skills (Fang, 1996).

1 Visual representations in geography textbooks

Geography has traditionally characterised as a visual discipline due to "the plethora of visual images used by the geographers when producing interpreting and disseminating geographical work" (Rose, 2003, p.212). Consequently, the role of visuals in geography textbooks has gained increasing importance as they serve to effectively convey geographical knowledge and spatial relationships of diverse geographical phenomena to students. As Hilander (2023, p.1) states, this "makes geography a highly visual school subject."

In recent years, a growing body of research has focused on examining different types of visual representations in geography textbook and their instructional quality characteristics (Janko & Knecht, 2013; Janko & Peskova, 2013; Keles & Nyaema, 2023; Trahorsch & Bláha, 2019; Trahorsch et al., 2019; Yasar & Seremet, 2007). Geography textbooks combine both text and visuals to facilitate student learning and enhance visual literacy. Research has highlighted the increasing use of visuals in geography textbooks such as maps, images, photographs, paintings, tables, and sketches (Janko & Knecht, 2013; Trahorch & Bláha, 2019; Yasar & Seremet, 2007). Among these visual forms, photographs have emerged as the most prevalent, particularly in geography textbooks for Czech primary and lower secondary education (Janko & Knecht, 2013; Janko & Peskova, 2013; Trahorch & Bláha, 2019), as well as in Turkish secondary education (Yasar & Seremet, 2007).

A comparative analysis of the visuals in 15 Czech-regional geography text for students of 10 and 14 years old revealed several issues related to the usability of visualisations depicting specific geographical phenomena in textbooks for younger students. These visuals were primarily found to have a motivational and decorating role, lower usability for maps compared to photographs and diagrams, and highest quality for visuals produced by long-established publishing houses (Trahorsch et al., 2019). In a related study, Trahorsh and Bláha (2019) demonstrated the extensive absence of caption for visuals and the prevalence of coloured representation in 16 textbooks from the Czech Republic. In an earlier study assessing the instructional quality of visuals in Czech human geography textbooks of lower secondary education, Janko and Knecht' analysis (2013) showed that most visuals were realistic, followed by abstract visuals,

with partially realistic ones ranking third. Moreover, while a minimal number of visuals lacked relevance to the text, the majority were found to be either text-related or text-elaborated. Regarding the captions, findings revealed that almost half of the visuals contained identifying captions, followed by visuals with extentional captions.

The analysis of geography textbooks for grades 7–8 in Finland (Hilander, 2023) revealed that most visuals depicted landscapes, with a considerable number of abstract visuals, such as maps and diagrams, and a limited number of snapshot visuals of people or geographical hazards.

In Turkish geography secondary education textbooks (Yasar & Seremet, 2007), an analysis of pictures demonstrated that their primary role was explanatory and complementary to text, with only a restricted number of pictures aimed at motivating students to express their thoughts and feelings. Generally, the majority of pictures were intended to enhance cognitive-oriented skills, rather than psychomotor skills or affective attitudes.

Despite the growing body of research on the role and quality of visual representations in geography textbooks across different countries, a significant gap persists regarding the quality characteristics of visual representations in Greek geography textbooks and their instructional characteristics to facilitate the teaching and learning process. This study, therefore, aims to address this gap by providing a comprehensive analysis of the visual representations in Greek geography textbooks for lower secondary education, focusing on their instructional characteristics and their relationship with the accompanying text.

The purpose of the present study is to analyse the visual representations in geography textbooks used in secondary education in Greece and assess the quality of their instructional characteristics. The research questions are described as follows:

1. What different types of visual representations are included in Greek geography textbooks of lower secondary education?
2. What is the thematic focus of the different types of visual representations?
3. To what extent is colour used in the visual representations?
4. To what extent are visual representations accompanied by captions, and what is their role?
5. What is the level of realism of the visual representations?
6. What is the relationship between visual representations and the text?

2 Methodology

2.1 Material – The Textbooks

The material of the present research consisted of all geography textbooks of lower secondary education in Greece, totalling four. Geography is taught as a stand-alone lesson in the first and second grades of secondary education catering to learners aged – 12 to 14 years old. Specifically, there are two books for the first grade geography curriculum: the student textbook (Pavlopoulos & Galani, 2015) and the workbook (Pavlopoulos & Galani, 2020). The student textbook spans 154 pages, and the workbook contains 66 pages. The first grade textbooks are structured into four primary teaching units: "Maps", "Natural environment", "Anthropogenic environment – People's activities" and "Continents…Snapshots". For the second grade, there is one student textbook (Aslanidis et al, 2016a) and one workbook (Aslanidis et al, 2016b). The student textbook comprises 180 pages, containing 48 lessons and an annex on the flags and capitals of European countries. The workbook consists of 64 pages, with 48 worksheets. The textbook is organised into four teaching units: "The maps", "The natural environment of Europe", "The people of Europe" and "The economic activities of Europeans".

All textbooks and workbooks are provided to students and teachers in print and colour at the beginning of each school year. Additionally, they are accessible in digital and interactive formats on Photodentro (n.d), the Greek national aggregator for educational content (http://ebooks.edu.gr/ebooks/).

2.2 Method and Coding Criteria

Quantitative content analysis was used for the data analysis. This method has been adopted widely in the content analysis of visuals in various studies (Keles & Nyaema, 2023). The unit of analysis was the visual representations of all geography textbooks and workbooks provided in lower secondary schools in Greece. The methodology and the broad criteria for the visual analysis were adopted at a great extent in combination of Janko and Knecht (2013) and Trahorch and Bláha (2019) works. The analysis criteria for the Greek geography textbooks are the following: type of visuals, thematic focus, colour, caption, realism, and relatedness of visuals to the text. The categories per analysis criterion are described in Table 1.

Table 1
Criteria of visuals' analysis

Analysis criteria	Categories
Type of Representation	Map
	Photograph
	Painting – Artworks
	Data table
	Chart
	Image
	Sketch
	Other (small-scale representations such as logos, symbol images, memos, flags, cryptograms and slides)
Thematic focus	Maps
	Natural Environment
	Human Environment
Colour	Colourful
	Monochrome
	Black and White
Caption Aptness	No
	Yes Identifying the visual
	Yes Paraphrasing or repeating a part of the text
	Yes Extentional by offering more information for the visual that is not included in the text
	Yes Activating students by asking a question or to take on a task
	Yes Combined of all or some of the above categories
Realism of Visuals	Realistic
	Partially Realistic
	Non-realistic (Abstract)
Relatedness to the text	Related to the text
	Supplementary – Explanatory of the text
	Not clearly related to the text

2.3 Results

This section presents the findings from the visual analysis. A total of 1.231 visuals are found in the geography textbooks for the lower secondary education in Greece. Specifically, the first-grade geography textbooks contain 506 visuals, with 326 located in the student textbook and 180 in the workbook. For the second grade, there are 725 visuals in total in the textbooks; 639 are found in the student textbook and 86 in the workbook.

2.3.1 Types of visuals

The visual analysis of the geography books for the first and second grades of secondary education is presented in Table 2.

Table 2
Types of visuals in geography textbooks

Types of visuals	Grade	N	%
Map	A	33	6.5
	B	57	7.9
Photograph	A	137	27.1
	B	158	21.8
Painting – Artwork	A	1	0.2
	B	3	0.4
Data table	A	16	3.2
	B	76	10.5
Chart	A	9	1.8
	B	20	2.8
Image	A	112	22.1
	B	59	8.1
Sketch	A	76	15
	B	8	1.1
Other (small-scale representations such as logos, symbol images, memos, flags, cryptograms, and slides)	A	122	24.1
	B	344	47.4

The data analysis indicated statistically significant differences between Grade A and Grade B textbooks concerning various types of visuals, $\chi^2 = 196.696(7)$, $p < 0.001$. As shown in Table 2, the descriptive statistics suggest that grade B textbooks predominantly contain maps, photographs, paintings/artworks, data tables, diagrams, and visuals categorised as "others" in contrast to Grade A textbooks where pictures and sketches that are mostly found.

2.3.2 Thematic focus of visuals

Regarding the thematic focus of the visuals, the analysis revealed that 101 (20%) visuals in Grade A textbooks focus on maps, 128 (25.3%) on the natural environment, and 238 (47%) on the human environment. Additionally, there are 39 visuals (7.7%) that do not exhibit a specific thematic focus, as they are comprised small-scale visual representations, such as symbols or notes.

In the Grade B textbooks, 95 (13.1%) visuals focus on maps, 102 (14.1%) on the natural environment, and 233 (32.1%) on the human environment. We cannot recognise a specific focus for 295 visuals (40.7%) as they are categorised as "other" and consist of small-scale representations, such as images of notes or symbols.

With regard to the thematic focus of the visuals, significant statistical differences are observed between the two grade textbooks, $\chi^2 = 165.674(3)$, $p < 0.001$. Examination of the descriptive data indicates that highest frequencies of visual representations focusing on maps, the natural environment, and the human environment are found in the Grade A textbooks, while the highest frequencies of visual representations classified under the category "other" appear in the Grade B textbooks.

2.3.3 Colour of visuals

Regarding the use of colour, the analysis revealed that, in Grade A textbooks, 469 visuals (92.7%) are multicolour, 8 visuals (1.6%) are black and white, and 29 visuals (5.7%) are monochrome. In grade B textbooks, 663 visuals (91.4%) are multicolour, 5 visuals (0.7%) black and white, and 57 visuals (7.9%) are monochrome.

Chi-square analysis indicated that there were no statistically significant differences between the two grades textbooks with respect to the colour of the visual representations, $\chi^2 = 4.229(2)$, $p = 0.121$.

2.3.4 Captions of visuals

The majority of the visuals in Grade A textbooks (n = 398, 78.7%) lack captions, while 108 visuals (21.3%) are accompanied by captions. Of these, 87 (17.2%) identify the visual, 11 (2.2%) have an extentional role by offering additional information for the visual that is not included in the text, 9 (1.8%) activate students by asking a question or taking on a task, and only 1 (0.2%) paraphrases part of the text.

For Grade B textbooks, analysis indicated that nearly half of the visuals (n = 387, 53.4%) lack captions, whereas 338 (46.6%) are accompanied by captions. Out of them, 183 (25.2%) identify the visual, 154 (21.2%) have an extentional role, and only 1 (0.1%) exhibit a paraphrasing role.

Chi-square analysis revealed significant differences between the two grades textbooks with respect to the existence of captions in visual representations, $\chi^2 = 132.452(4)$, $p < 0.001$

2.3.5 Realism of visuals

The analysis of the visual realism in Grade A textbooks revealed that 115 visuals (30.6%) are realistic, 283 (54.9%) are partially realistic and 68 (13.4%) are non-realistic. For

Grade B textbooks, the results revealed that 172 visuals (23.7%) are realistic, 449 (61.9%) are partially realistic, and 104 (14.3%) are classified as non-realistic. Statistical analysis indicated statistically significant differences between the two grade textbooks regarding the realism of the visual representations, $\chi^2 = 7.335(2)$, $p = 0.026$.

2.3.6 Relatedness to the text

The analysis for the visuals' relatedness to the text in Grade A textbooks showed that the majority of the visuals (n = 343, 67.8%) are related to the accompanying text, 58 visuals (11.5%) are not clearly related to the text, and 105 visuals (20.8%) are supplementary to the text, providing additional explanations.

For Grade B textbooks, findings revealed that 137 visuals (18.9%) are related to the text, 411 visuals (56.7%) are not clearly related, and 177 visuals (24.4%) are supplementary and explanatory of the accompanying text.

Statistical analysis demonstrated significant differences between the two grades textbooks and the relatedness of the visual representations to the text, $\chi^2 = 344.422(2)$, $p = 0.000$.

3 Discussion

The added value of visuals in students' learning is well-documented in literature. The present study aimed to analyse multiple visual representations in the geography textbooks of secondary education in Greece. The findings revealed that a considerable number of 1.231 visual representations are present in the four geography textbooks of lower secondary education in Greece; 506 in first grade textbooks and 725 in the second grade textbooks. The extensive use of visuals in geography textbooks is also supported by relevant research (Janko & Knecht, 2013; Trahorsch & Bláha, 2019; Yasar & Seremet, 2007) and can be easily interpreted given that geography is a highly visual subject.

This study indicated that small-scale representations and photographs are the most prevalent visuals in geography textbooks. The extensive presence of small-scale representations, such as logos and memos, coupled with a visual diversity imbalance in textbooks, could be problematic as they may not promote students' deep learning and understanding, and enhance spatial thinking and geographical knowledge. The predominance of photographs in geography textbooks was also supported by relevant research (Janko & Knecht, 2013; Janko & Peskova, 2013; Trahorch & Bláha, 2019; Yasar & Seremet, 2007). However, the lower frequency of maps in textbooks compared to other visuals raises some concerns given that maps comprise a critical visual geographical tool that can leverage students' spatial abilities and help them streghten their geographical skills. Similarly, the limited number of abstract visuals (tables, graphs, etc.) in geography

textbooks is likely to affect negatively students' abstract thinking (Trahorch & Bláha, 2019) about geographical phenomena and to impede their comprehension of complex relationships, analogies, and patterns recognition.

One of the key finding of this study was the widespread absence of captions in most visuals, a result that is aligned with the analysis of Czech geography textbooks (Trahorch & Bláha, 2019). Captions constitute an important part of the visuals, playing multiple roles and linking them to the text (Pozzer & Roth, 2003). They are considered essential facilitators for the meaning making of the visuals and their understanding to the readers (Gkitzia et al., 2011). The lack of captions in most visuals in the geography textbooks is of significant concern as it limits their function (Keles & Nyaema, 2023) and may lead to the reduction of their instructional efficacy. However, when captions are present, they perform multiple roles, such as identifying the visual, offering more information for the visual, activating students, or paraphrasing part of the text. The most prevalent of these is the caption that identifies the visual in the text, while it is noteworthy that a limited number of nine captions activate students to pose a question or take on a task. The presence of captions is likely to leverage the understanding of the meaning by supporting the connections with the text, and to reduce the cognitive load of the students (Keles & Nyaema, 2023).

Consistent with previous visual analyses in geography textbooks in Turkey (Yasar & Seremet, 2007) and Czech Republic (Trahorch & Bláha, 2019), this study confirmed the overrepresentation of multicolour visuals. Multicoloured visuals are attractive, facilitate the learning process, and offer valuable cognitive benefits (Mayer, 2009). Besides that, the extensive use of multicolour visual representations could be easily interpreted considering that advancements in informatics and technology have provided publishers with various means that facilitate the cost-effective production of multicolour visuals in textbooks.

A significant finding of this study is that most visuals, with the exception of small-scale representations, are related to the text, while some of them are supplementary or explanatory of the text. However, a considerable number of visuals are not related to the text, which can be considered problematic. The relation between the text and the visual is crucial for facilitating the understanding of the meaning and promoting deep learning (Kapıcı & Savaşcı-Açıkalın, 2015). Without a relation between them, students will likely struggle to interpret the meaning of the visuals and its connection to the text.

3.1 Implications for future editions

This study offers some implications for future editions of geography textbooks in Greece that can also be applied to other education systems. The findings highlight the need for meticulous consideration of the quality of the instructional characteristics of visuals in geography textbooks. The extensive presence of small-scale representations and

photographs, the frequent absence of captions, and the presence of visuals that are not directly related to the text in some cases, suggest that future editions of geography textbooks should prioritise enhancing the relevance and clarity of visuals. Taking into consideration the visual nature of geography as a subject, textbook designers and publishers should ensure the quality of the instructional characteristics of visuals that are particularly crucial for fostering deep learning and understanding of geographical phenomena, spatial relationships and knowledge transfer to authentic situations.

Visuals should be purposefully selected and appropriately accompanied by captions that activate students and promote their deep learning. Furthermore, it is likely that visuals with relatedness to the accompanying text will help students to make easily connections and enhance their understanding of the geographical information conveyed.

It is highly suggested that future editions should incorporate Behnke's (2021) suggestions of usability qualities for textbook visuals, namely aesthetics, orientation, usefulness, helpfulness, interest, and comprehensibility, to improve the quality of their instructional characteristics.

Conclusions

This study provided valuable data on the multiple types of visual representations in geography textbooks of secondary education in Greece and shed light on their instructional characteristics and quality elements.

The findings highlight certain deficiencies in visuals and their instructional quality that may affect their educational potential. The high frequency of photographs and visuals without captions, as well as the substantial presence of non-related to the text visuals should be taken into consideration by textbooks designers in future editions. Behnke (2021) suggests six usability qualities for visuals of textbooks; aesthetics, orientation, usefulness, helpfulness, interest and comprehensibility. These qualities are likely to maximise the meaning making and assist students in easily establishing connections between text and visuals.

The quality of the visuals representations is crucial for the promotion of deep learning among students, and this becomes more imperative when considering geography which is a highly visual subject in schools.

Limitations

The study focuses on the instructional quality of geography textbooks in secondary education in Greece. Therefore, the findings cannot be generalised for other education levels in Greece or other education systems in the international context. Furthermore,

the study did not receive any feedback from teachers and students who would provide us valuable perspectives from the visuals' use during geography lessons. Future research could explore student and teachers' experiences from the use of visuals during the geography lessons and provide feedback on their instructional efficacy.

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Contact:
Dr. Vana Chiou
University of the Aegean
Department of Geography
University Hill
81132, Mytilene, Greece
Email: b.xiou@aegean.gr
ORCID: https://orcid.org/0000-0003-1594-4496

Konstantinos Boukas has graduated from the Department of Geography, University of the Aegean, Greece. Currently he is studying Economics at the Demokritus University of Thrace. ORCID: https://orcid.org/0009-0007-0756-2478

Dr. Vana Chiou is Faculty member - Laboratory Teaching Staff at the Department of Geography, University of the Aegean, Greece. Her research focuses on teaching methods, assessment, and inclusion in education. She is co-editor of the book series "Voices from the Classroom", Waxmann. Her published work includes editing books, chapters in books, and articles in Greek and international journals.