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Figure 2 shows ... Changing discontinuous texts in Geography textbooks for higher education

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Péter Bagoly-Simó

Figure 2 Shows …
Changing Discontinuous Texts in Geography Textbooks for Higher Education

Abstract
Die Geographie erhebt den Anspruch, ein besonders medienintensives Fach zu sein, das stark auf visuelle Darstellungen unterschiedlicher Art angewiesen ist. Karten stehen für eine genuin geographische Art der Weltdarstellung, um Wissen in einer komprimierten, aber hochspezialisierten Form darzustellen. Neben Karten greift die Geographie traditionell auf eine Vielzahl diskontinuierlicher Texte zurück, nämlich Zeichnungen, Skizzen, Bilder, Fotos und Filme. Trotz dieser ausgeprägten Visualität gehört die Bildungsmedienforschung zu den Randgebieten der Geographiedidaktik, besonders was die universitäre Bildung betrifft. Vor diesem Hintergrund nimmt sich diese Arbeit vor, den Wandel von diskontinuierlichen Texten in universitären Lehrbüchern zu analysieren. Mixed Methods dienten der Erhebung von Typologie und Häufigkeit verschiedener diskontinuierlicher Textarten. Die Stichprobe bestand aus zehn Lehrbüchern der Bodenkunde, Klimatologie, Stadtgeographie, Wirtschaftsgeographie und Geographiedidaktik. Die Ergebnisse zeigen einige spezifische Merkmale der Teildisziplinen, was die Typologie der diskontinuierlichen Textelemente und deren Veränderung im Laufe der Zeit betrifft. Grundsätzlich wirken die Lehrwerke eher wie akademische Monographien als wie didaktische Werke.

1. Introduction

Research on textbooks and educational resources, in general, and Geography Education, in particular, looks back on a considerable tradition (see Bagoly-Simó, 2014, 2018, 2021). Geography claims to be a (school) subject heavily relying on visualization, with maps constituting a genuinely geographic way of encoding the world. Various studies (see section 2) showed that school Geography textbooks frequently use diverse discontinuous text types. However, scholarly work on textbooks and educational resources for higher education remains modest. Based on a meta-study of research in Geography Education, Bagoly-Simó and Hemmer (2017, 2018) showed that tertiary education belongs to the most underresearched fields within the discipline. Educational reform in primary and secondary education, particularly along paradigms based on competencies, skills, and standards, brought about an overall change in student-centeredness. For textbooks and educational media, the reforms established a stronger visual culture connected to scaffolded and, in some cases, individualized support systems for learners. While primary and secondary Geography still faces various challenges, there is minimal evidence on textbooks and educational re-

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sources for higher education. Therefore, this chapter aims to explore how discontinuous text in Geography textbooks for higher education has changed over time. As a first step, a brief literature review offers an overview of trends and tendencies in textbooks and educational media research in Geography Education with particular emphasis on discontinuous text and, whenever possible, higher education. The subsequent section describes the research methods along with the sample. Following the introduction of results, a concluding section entails a brief discussion combined with concluding thoughts.

2. Geography textbooks

Textbooks continue to play a core role in the Geography classroom. Despite emerging (digital) alternatives and aggressive political measures targeting a more digital education, textbooks have maintained their central role. The global COVID-19 pandemic showed the critical role of traditional textbooks even in economically developed societies. Based on an interview study with Geography teachers at the early stages of the pandemic, Bagoly-Simó et al. (2020) found that students in Berlin frequently used textbooks for two main reasons. On the one hand, Geography tends to rely on the concurrent use of several resources, mainly combining continuous and discontinuous text (e.g., pictures, graphs, tables, maps). For example, tasks often require students to extract information from continuous text while contrasting it with the content of maps or graphs. A single smartphone, computer, or tablet has proved less practical during the pandemic, simplifying visuals used in Geography. In addition, students living in economically precarious households had limited or no access to digital devices or the Internet. Therefore, teachers often returned to the textbook as the reliable, common source of information and tasks to achieve student progress. Another recent reason for the renaissance of the textbook, as recent observations show, is the rising number of non-specialists teaching Geography. Such teachers view textbooks as a reliable source of information and an acceptable tool for learning and assessment tasks.

The global COVID-19 pandemic and the case of non-specialist teachers show the breadth of research on Geography textbooks and other educational resources used in Geography classrooms. Surprisingly, meta-studies (Bagoly-Simó & Hemmer, 2017, 2018) diagnosed a relatively modest and episodic research interest in textbooks. Curricular reforms regularly lead to studies exploring (amended) textbook content. Indeed, studies dedicated to textbook content dominate both scholarship on textbooks in Geography Education and research in other fields using Geography textbooks as sample. While Geography educators have a more holistic view of textbooks, always considering educational objectives, Geography's epistemology, and its main contribution to educating young people, work from other fields, such as Media or Gender Studies, tends only to use Geography textbooks as a sample, disregarding the subject-specific ecosystem they are part of and often drawing questionable conclusions.

Regarding higher education, meta-studies (Bagoly-Simó, 2014, 2018, 2021) highlighted clear preferences concerning the educational levels. Secondary education is the most popular in Geography Education, followed by higher and primary education. In contrast, studies on Geography textbooks published in non-specialist journals, such as those dedicated

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to textbooks and educational resources (e.g., Bagoly-Simó, 2019), barely considered higher education.

Looking beyond the disciplinary framework, the meta-studies also showed linguistic differences. Bagoly-Simó's (2014, 2018, 2019, 2021) overviews identified core differences between scholarship published in German and English. While higher education remained outside the scope of publications in German, studies considered in international journals with English as the primary language exhibited some interest in textbooks and educational resources at the tertiary level. Overall, higher education remains a field with great potential for scholars interested in textbooks and educational resources.

In more detail, the papers focusing on the tertiary level of education are mainly praxeological, either offering valuable tips for university teaching or familiarizing faculty with novel publications and, relatively rarely, trends.

John Lidstone's (1995) arena symposium explored teaching and learning in Geography at the tertiary level. The impressive collection of papers is diverse, as it entails country reports, discussing college textbooks from the USA (Muller, 1995), Japan (Nishiwaki, 1995), China (Zhang, 1995), Brazil (Rodriguez, 1995), and Bangladesh (Mesbah-us-Saleheen & Huq, 1995); however, some reports added the specific perspective of a geographical subdiscipline, exploring, for example, Physical Geography texts in Britain (Park, 1995) or Sweden (Werner, 1995). Viewed from a historical perspective, the papers constituting the arena symposium represent a continuation of a longer tradition in work on textbooks for higher education. Along with general overview pieces acquainting faculty with textbooks for college (e.g., Salisbury, 1981, on Physical Geography in the United States), summaries traditionally offered an overview of textbook choices in Meteorology and Climatology (Giles, 1981), Environmental Geomorphology (Alexander, 1984), Statistics for geographers (Jarrett, 1988), Political Geography (Kofman, 1991), or Philosophy in Geography (Phillips, 1994).

Despite the overwhelming share of praxeological literature, selected studies also chose the empirical route. Studies interested in content explored, for example, the representation of Appalachia in North American college textbooks (Martis, 2005) or the regionalization of Africa in North American undergraduate textbooks published between 1953 and 2004 (Cole, 2008). In terms of instruction, studies also analyzed how students responded to traditional and novel, computer-assisted teaching approaches. For example, Wentz et al. (1999) found that students preferred traditional instruction assisted by GIS-based tasks and digital resources.

Despite such endeavors, research on discontinuous text in tertiary Geography textbooks still needs to be revised. Therefore, a revision of scholarship focused on textbooks and educational resources, in general, and discontinuous text, in particular, that also considers primary and secondary education, is a necessary first step before exploring the research question.

Scholars interested in primary and secondary Geography concentrated on various types of discontinuous text or visuals, from conceptual work, developing models based on various disciplines to content analysis.

Behnke's contribution "Usability Qualities of 'Well-Designed' Geography Textbooks" (2021) considered multiple fields, including Design and Media Studies, to define criteria and guidelines for those involved in product design and development. Based on her conceptual work, Behnke's (2022, 2023) combined eye-tracking and evaluative studies

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tested students' design-related preferences. Despite the Geography textbook stimuli being rich in discontinuous text, the results showed clear strategies with students only focusing on (highlighted) continuous text and, inherently, the need for explicit instructions to use discontinuous text while processing tasks. Trahorsch and Bláha (2022) also evaluated the role that the quality of visuals had on learning. A two-tier diagnostic test with elementary school students on physical-geographical visuals showed that their poor quality hindered student learning.

Other studies spotlighted various aspects of discontinuous text featured in Geography textbooks. In a contrastive study, Janko and Peskova (2013) compared Geography and German as Foreign Language textbooks for Czech lower secondary education regarding the instructional effectiveness of visuals. The quantitative content analysis showed that pictures constituted the dominant type of discontinuous text for both subjects; however, overtly visualized Geography textbooks struggled to explain abstract and complex structures and processes. Trahorsch and Bláha (2019) confirmed these findings, explaining that other types of discontinuous text were of much stronger educational value than pictures. The authors also found that the signposting and signaling in Czech Geography textbooks, ultimately leading to better integration of discontinuous text elements into the continuous text, required urgent attention. Janko and Knecht (2013) reached similar findings based on the content analysis of Human Geography textbook visuals. Their low instructional quality originates from the already described tensions between continuous and discontinuous text that the authors primarily explain through educational and cognitive psychological scholarship that remained unconsidered during textbook design and development. Additional studies also explored the quality of discontinuous text and its evaluation. For example, Trahorsch et al. (2019) analyzed maps, schemes, and photos featured in Czech Geography textbooks to visualize topics connected to Geomorphology, Hydrology, and Agriculture. Data evaluated using the scaling method showed an increasing quality of visuals with the grade, which the authors attributed to seniority in the publishing industry. A study by Behnke and Bagoly-Simó (2017) highlighted circles of recycling in German Geography textbooks, exposing various strategies educational media publishers used to reuse the same visual across products, ultimately lowering the credibility of visuals and potentially contorting factual accuracy.

Other studies integrated discontinuous text into more generic questions, such as the role of textbook visuals in shaping discourse. For example, Ilovan et al. (2018) studied how textbook visuals contributed to forming socialist citizens in communist Romania.

Given their importance for Geography as an academic discipline and as a school subject, maps and geomedia belong to the well-researched types of discontinuous text. Recent studies explored the development of map skills (e.g., Bagoly-Simó & Binimelis, 2021) and also used eye-tracking to understand students' strategies better while working with maps and geomedia.

In summary, research on Geography textbooks and educational media only attracts episodic and marginal interest. Nonetheless, the visual turn and competencies-based education require a careful (re)consideration of resources used to teach and learn Geography. While primary and secondary Geography benefits from the results of conceptual and empirical work, there is an urgent need to address visuals in higher education. Therefore, this chapter aims to explore how discontinuous text in Geography textbooks for higher education has changed over time.

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3. Method and sample

There are multiple ways to explore how visualization in Geography textbooks for higher education has changed over time. Qualitative and quantitative methods allow for exploring discontinuous text, so this study's operationalization rests on a mixed methods approach.

In the first step, qualitative methods allowed segment retrieval. Content analysis served to retrieve segments. An inductive-deductive approach allowed for a combination of categories derived from previous studies (see section 2) with others defined based on the sample. For this study, the definition of segments considered the smallest unit of every type of discontinuous text (i.e., map, graph, picture). Using in-vivo coding, each discontinuous text segment was coded into a pre-defined category. Alternatively, whenever required, new categories were added. Similarly, some pre-defined categories also needed further diversification by introducing subcategories. For purposes of intercoder reliability, a second researcher coded ten percent of the sample.

With segment retrieval concluded, the second step allowed quantitative data processing. Basic descriptive statistics helped quantify, on the one hand, discontinuous text typology and share within each textbook and, on the other hand, longitudinal comparison across various editions of each textbook.

The sample consisted of ten textbooks published by utb between 1994 and 2022. Given the multitude of geographical subdisciplines and their potentially different visualization traditions, the sample considered textbooks for five subdisciplines ranging from Physical Geography (Pedogeography and Climate Geography) through Human Geography (Urban Geography and Economic Geography) to Geography Education. Like primary and secondary education, textbook sales numbers are inaccessible to the broad public. Therefore, the sampling rested on searching for library catalogs of all German universities offering teacher training study programs in Geography. Compared to competitors, utb achieved the broadest coverage and the longest tradition, spanning, for example, in Climate Geography, 26 years.

4. Results

The results uncovered similarities and differences concerning authors' and editors' visualization choices in Geography textbooks for higher education. This section commences by first introducing the main findings along the five geographical subdisciplines. Each subsection focuses on the same features, namely the subdiscipline's status in undergraduate training, the constitution of the subsample, length and visual presentation, typology of discontinuous text, and change over time. Subsection 4.6 compares the five subsamples to highlight common trends and subdiscipline-specific particularities.

4.1 Pedogeography textbooks

Breaking with a long tradition, the study of soils (Pedogeography) underwent a gradual emancipation process from Geomorphology, becoming a separate *mandatory component* of Geography undergraduate programs across Germany. Furthermore, the national re-

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quirements for Initial Teacher Education (ITE) prescribe soils as a mandatory component of Geography programs.

This study used a *subsample* consisting of two editions of a Pedogeography textbook: its second (TB1: Stahr et al., 2012) and fourth (TB2: Stahr et al., 2020), published eight years apart. The same team of four scholars authored both editions.

Concerning *length*, TB2 showed a modest increase of 2.98 percent (10 pages) and an increase in *discontinuous text* by eleven percent (30 visuals).

The *visual presentation* of the subsample is typical of textbooks for higher education. The pages use large margins entailing definitions and additional information set in blue, such as experiments or examples. Along with the headings, some discontinuous text also entails elements of blue for easier visualization. Each chapter closes with a textbox containing questions.

TB1 and TB2 use the same set of nine *types of discontinuous text* (see Fig. 1). Figures constitute almost one-third of all visualizations, followed by tables, photos, and equations, while maps and cartoons are the least frequently used discontinuous text types. Mnemonics represented a specific type of visualization in Pedogeography.

Textbook	*n*	*Average*	*Photo*	*Textbox*	*Figure*	*Graph*	*Table*	*Map*	*Equation*	*Mnemonic*	*Cartoon*
TB1	250	0.74	13.60	12.00	28.40	10.80	16.40	1.20	13.60	3.20	0.80
TB2	280	0.80	14.29	10.00	28.93	10.71	17.86	0.71	12.86	3.93	0.71
TB3	356	0.72	0.56	0.00	21.07	18.82	8.43	10.11	41.01	0.00	0.00
TB4	346	0.63	0.22	0.44	14.91	19.96	21.27	10.31	32.89	0.00	0.00
TB5	215	0.41	6.05	24.65	30.23	6.05	6.51	26.05	0.47	0.00	0.00
TB6	379	0.54	20.58	23.22	27.44	5.54	4.75	18.21	0.26	0.00	0.00
TB7	218	0.61	11.93	18.81	32.11	20.18	9.63	6.88	0.46	0.00	0.00
TB8	258	0.66	11.63	20.16	32.95	15.50	9.30	10.08	0.39	0.00	0.00
TB9	133	0.25	0.00	45.86	36.09	3.01	14.29	0.00	0.00	0.00	0.75
TB10	143	0.27	4.90	46.15	37.06	2.80	8.39	0.00	0.00	0.00	0.70

Fig. 1 Types of discontinuous text and their relative share (%) (own calculations)

Except for cartoons, all discontinuous text types *change*d over time (see Fig. 2 on the next page). In absolute terms, TB2 contained fewer textboxes and maps, while the remaining types of discontinuous text achieved higher segment counts; however, in relative terms, only photos, tables, and mnemonics achieved higher shares of representation.

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	Photo	*Textbox*	*Figure*	*Graph*	*Table*	*Map*	*Equation*	*Mnemonic*	*Cartoon*
TB1 & TB2	20.00	-6.67	33.33	10.00	30.00	-3.33	6.67	10.00	0.00
TB3 & TB4	-1.00	2.00	-7.00	24.00	67.00	11.00	4.00	0.00	0.00
TB5 & TB6	39.63	21.34	23.78	4.88	2.44	7.93	0.00	0.00	0.00
TB7 & TB8	10.00	27.50	37.50	-10.00	7.50	27.50	0.00	0.00	0.00
TB9 & TB10	28.00	48.00	24.00	0.00	0.00	0.00	0.00	0.00	0.00

Fig. 2 Changes in the share of discontinuous text in relative values (%) (own calculations)

4.2 Climate Geography textbooks

Traditional Physical Geography emphasizes two main geospheres: the lithosphere and the atmosphere. Therefore, Climate Geography is a core *mandatory component* of every study program involving Physical Geography. National requirements prescribe that knowledge of weather and climate constitutes, just like geomorphological content, a prerequisite for all future Geography teachers.

The *subsample* exploring Climate Geography entailed two editions of Christian-Dietrich Schönwiese's *Klimatologie*. The first (TB3: Schönwiese, 1994) and the fifth edition (TB4: Schönwiese, 2020) were published over two decades apart, covering the most extensive period represented in the sample.

Regarding *length*, TB4 is 12 percent (58 pages) longer and contains 22 percent (100 visuals) more *discontinuous text* elements than TB3.

Concerning *visual presentation*, while TB3 was produced entirely in black and white and in a smaller format, TB4 used light blue for discontinuous text of various kinds, maintaining the traditional typography in black and white for the continuous text. Every chapter commences with a contextualizing paragraph that aims to set the scene and formulate educational goals – somewhat cryptically. In contrast, every chapter concludes without a summary or any aids for assessment, such as questions or tasks.

Despite several differences between the two editions, TB3 and TB4 used the same seven *types of discontinuous text* (see Fig. 1 on the previous page) for visualization. Given their central role, equations stood for the highest segment counts in both textbooks and constituted the unique visualization in Climate Geography. While TB3's further preference was figures and graphs, the fifth edition shifted the focus to tables and graphs, with figures only reaching the fourth rank. Maps, Geography's unique form of visualization, accounted for ten percent of all segments.

At a comparative glance, all seven discontinuous text types underwent a *change* from TB3 to TB4 (see Fig. 2). Photos and figures achieved lower segment counts in TB4. At the same time, tables and graphs experienced a significant increase in code count. Maps remained surprisingly stable, maintaining a share of ten percent of all segments.

4.3 Urban Geography textbooks

Human geographic content in Geography programs traditionally engages with human populations, settlements, and economic activities in one combination or another. For this study, the first human geographic subsample covered Urban Geography, one of the most dynamic subfields of the discipline. While Geography students tend to prefer a specializ-

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ation in Urban Geography, national and state prescriptions require ITE to cover Urban Geography as *a mandatory component of each program*.
Heinz Heineberg authored both textbooks that were included in the Urban Geography *subsample*. Not only are the two editions (TB5: Heineberg, 2000, and TB6: Heineberg, 2020) two decades apart, but TB6 also lists three further collaborators without any other specific information on their contributions.
Concerning *length*, TB6 is over a third (36 %, 186 pages) longer than TB5 and contains almost double as many *discontinuous text elements* (43.27 %, 164 visuals).
The *visual presentation* maintained a surprising stability over two decades. Different shades of grey and red served to diversify the visual effect of discontinuous text and some continuous text. Except for the headings, the textbooks used standard typography (italics, bold) to highlight core concepts or definitions. Most chapters started with a visual input of different types, ranging from models through pictures to sketches. A brief accompanying text explained the topic's relevance in the chapters, aiming to formulate something similar to educational goals and aims. Instead of assessment, each chapter concluded with further reading.
Seven *types of discontinuous text* elements (see Fig. 1 on page 154) served visualization purposes. Figures achieved the highest segment count in both textbooks, closely followed by maps and textboxes in TB5. In contrast, figures strongly dominated TB6, followed by textboxes and photos. Overall, the two textbooks used a mix of discontinuous text elements.
From a historical comparative perspective, six of the seven types of discontinuous text *changed* (see Fig. 2 on page 155) to a different extent. Photos experienced the most spectacular growth in both absolute and relative numbers. In contrast, despite increased absolute numbers, figures, textboxes, maps, graphs, and tables decreased in relative share. Equations remained the less frequently counted type of discontinuous text.

4.4 Economic Geography textbooks

Human Geography often combines the study of human populations and settlements differently. In contrast, economic activities have always constituted a core pillar of human geographic education, frequently representing a distinctive area of knowledge. Most Geography programs use Economic Geography as an introductory course, with matters concerning the spatiality of the economy representing a *mandatory component* of ITE programs.
The *subsample* of this study contrasts two editions of Elmar Kulke's *Wirtschaftsgeographie* [Economic Geography] published almost two decades apart (TB7: Kulke, 2004, and TB8: Kulke, 2017). In addition to its popularity among undergraduates, the textbook has enjoyed broad use in upper-secondary education for final exam preparation.
Regarding *length*, TB8 is just under ten percent (34 pages) longer than TB7. The number of *discontinuous text elements* has increased by fifteen percent (40 visuals).
Readers comparing the two editions will note that the *visual presentation* of the textbook mostly stayed the same over time. Each chapter opens with a discontinuous text element followed by continuous text in black and white, mainly relying on bolds to emphasize main concepts or definitions. In contrast, discontinuous text also uses shades of grey and red to increase the visual effect. Both editions refrain from stating specific educational

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aims, assessments, or any other type of aid. Nevertheless, interested readers will find a comprehensive list of further reading at the end of each chapter.
The textbooks constituting the subsample for Economic Geography feature seven *types of discontinuous text* elements (see Fig. 1 on page 154). Almost one-third of all segments coded figures, making them the most frequent type of discontinuous text. In order of popularity, graphs and textboxes followed, with equations constituting the least popular visualization.
When compared, the two editions showed a surprising stability concerning absolute and relative values. Maps are the discontinuous text most significantly impacted by *change* (see Fig. 2 on page 155), almost doubling in share. The only other relevant oscillation impacts a decrease in graphs by a quarter and a slight increase in textboxes.

4.5 Geography Education textbooks

Unlike students enrolled in Geography undergraduate programs, ITE students require specific knowledge concerning the teaching and learning of Geography as a school subject in primary and secondary education. Despite its long praxeological tradition, Geography Education, a *mandatory component* of ITE programs, stands for a relatively young geographical subdiscipline. Both reasons qualified Geography Education as a relevant indicator for an emerging geographical field. Also, given its nature, there could be an expectation that Geography Education will carefully consider discontinuous text types and their links to continuous text.
The present study considered the first (TB9: Rinschede, 2003) and fifth (TB10: Rinschede & Siegmund, 2022) editions of Gisbert Rinschede's *Geographiedidaktik* [Geography Education], a widely used textbook by ITE students. In contrast to the previous four editions, TB10 features a new coauthor and also lists six further collaborators contributing to the revision process.
In terms of *length*, TB10 is only slightly longer than the first edition (2.48 %, 13 pages); however, there was a slightly more substantial increase in *discontinuous text elements* (6.99 %, ten visuals).
The changes in *visual presentation* over five editions are minimal. The continuous text preserved the main typographic tools to highlight key concepts, classifications, statements, and definitions. In contrast, some types of discontinuous text, such as figures, tables, and textboxes, used shades of grey and red to improve visualization. Introductory pages start with a visual impulse followed by a brief enumeration of the chapter's content, potentially aiming for an overview of general goals. Along with a textbox listing various sources for further reading, a set of tasks supports self-evaluation and assessment.
Six *types of discontinuous text* elements (see Fig. 1 on page 154) complement the continuous text. The most striking feature of both editions is their hyperspecialization of textboxes and figures. The two types of discontinuous text account for slightly over 80 percent of all segments (TB9: 81.95 %, TB10: 83.22 %). Neither the first nor the fifth edition contained any maps. Numeric forms only made a rare appearance, while maps were missing from both editions.
Change (see Fig. 2 on page 155) is limited to only a few discontinuous text types across the two editions. Increased absolute numbers in segment count maintained a surprising stability in relative terms. Pictures, initially missing from TB9, represented the only exception as they achieved to account for almost five percent of the total segment count of

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the textbook's fifth edition. As the discontinuous text of numeric nature stayed stable across the subsample, the share of graphs and tables decreased (dramatically).

4.6 Comparative and contrastive results

Based on the ten textbooks for the five geographic subdisciplines introduced above, this section explores their similarities and differences in a comparative and contrastive manner.

The variability in *visual presentation* across the sample was limited. All textbooks were produced in black and white, with the continuous text relying on basic typographic tools to highlight concepts, definitions, or classifications. TB1–4 also contained selected continuous text in blue and light blue, adding to a more lively visual effect. All textbooks used shades of gray and an additional color, such as blue, light blue, or red.

Concerning their *structure*, most textbooks dedicated to Human Geography and Geography Education placed a discontinuous text element at the beginning of each chapter, sometimes followed by a (brief) summary of the chapter's content. At the end of each chapter, the textbooks offered recommendations for further reading or tasks/questions supporting assessment.

The ten textbooks considered for this study's sample exhibited unique combinations of continuous and discontinuous text. On *average*, the textbooks contained 0.56 visuals/page. The four textbooks dedicated to Physical Geography (TB1–4) reached the highest average visual count (0.63–0.8 visuals/page), while Geography Education textbooks made minimal use (0.25–0.27 visuals/page) of discontinuous text elements.

The textbooks presenting content from five geographical subdisciplines used between six to nine *types* of discontinuous text. The authors and editors of textbooks in the two physical-geographical fields relied on the greatest variety (9) of visuals, followed by the textbooks dedicated to Urban and Economic Geography (7) and Geography Education (6). Mnemonics represented the only *unique* type of discontinuous text specific to textbooks of a geographic subdiscipline – in this case, Pedogeography. Still, each textbook used a specific *combination* of six to nine discontinuous text types.

Concerning the *distribution* of segments across different *types of discontinuous text*, half of all visuals were figures and textboxes. Figures were most popular, accounting for almost one-third of all segments. Textboxes constituted another fifth of the total segment count. On average, graphs, tables, and equations reached a share of ten to elven percent of the total segment count. The three numeric visuals accounted for a third of all segments. Maps and pictures reached similar or somewhat lower values, while mnemonics and cartoons only played a marginal role.

The distribution of discontinuous text showed unique patterns when viewed in light of the *geographical subdisciplines*. For example, along with figures, visualization in Climate Geography heavily relied on numeric discontinuous text types and maps. In contrast, the two pedogeographic textbooks added pictures to figures for visualization. Overall, visuals heavy on text reached low segment counts in Climate Geography, but scored much higher in Pedogeography.

Geography's traditional visualization – maps – reached an overall low segment count, accounting for up to ten percent, except for Urban Geography. Furthermore, the subdisciplines also attributed different importance to maps, with Geography Education textbooks being the only ones without any cartographic representation.

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Change in discontinuous text uncovered additional relevant aspects. Overall, the five subdisciplines showcased heterogeneous visualization strategies over time. For example, TB2 only differed by 6.80 percent from TB1, whereas almost 30 percent of the discontinuous text featured in TB4 differed from the content of TB3. On average, 17.63 percent of the visuals changed, with Climate Geography and Urban Geography leading the list. In both cases, specific visuals – numeric formats in Climate Geography and pictures in Urban Geography – contributed significantly to the shifts in the segment count.

5. Discussion and conclusions

Research on textbooks and educational media, in general, and on higher education, in particular, belongs to the marginal fields of scholarly interest in Geography Education (Bagoly-Simó, 2014, 2018, 2016, 2019, 2021, 2023). This study's findings relied on previous work at the primary and secondary levels, adding a longitudinal layer by exploring change over time. Despite its many limitations, the present study contributed to research on tertiary Geography textbooks in nine main ways.

First, the overall *visual presentation* of the ten Geography textbooks for higher education resembles that of academic monographs. Regarding layout and design, only two textbooks (TB2 and TB4) on Physical Geography opted for a visual presentation and guidance that resembles textbooks. Nonetheless, many discontinuous text elements of various quality aim for content visualization, using greyscale and additional color. Future studies could explore Geography students' perceptions of these and other textbooks, particularly considering Behnke's (2021) model of usability qualities of well-designed Geography textbooks and results on student preferences for secondary school Geography textbooks (see Behnke, 2022, 2023).

Second, only a few *structural elements* of the ten volumes remind of (academic) textbooks: introductory visuals, brief chapter summaries, highlighted concepts, definitions or enumerations, further information on the margins, further reading, and (self-)evaluation tasks and questions. Only a limited number of textbooks dedicated to Physical Geography reminded of textbooks. Future research could contrast German textbooks with those published for international audiences or counterparts written in French, Spanish, or other languages. Once again, student preferences and needs require further attention to produce textbooks optimally catering to their needs (see Behnke, 2022, 2023).

Third, derived from the previous two points, the *presentation* of Geography textbooks for higher education might require a deeper exploration of alternatives, such as hybrid, augmented, and digital native content. Digital repositories could enhance data preparation, processing, and visualization, adding further skills to those already featured in the textbooks. The comparison of the two editions proved evident creativity and willingness to innovate; however, as the example of pictures shows, layout, production, and economic constraints seem to set strict boundaries to creative freedom. Furthermore, as the results of this study show, expanding the authorship during revision may limit creativity, and strict rules may be applied to conserving well-established content – including the visuals. Future studies could focus on the production process, exploring with editors and authors avenues of innovation and its constraints.

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Fourth, discontinuous text also requires *qualitative* evaluation and *quantitative* features. Most principles and criteria designed to evaluate specific types of discontinuous text, such as pictures, graphs, or textboxes, are primarily praxeological; however, theoretical models (e.g., Behnke, 2021) and empirical studies (e.g., Behnke, 2022, 2023; Janko & Knecht, 2013; Trahorsch & Bláha, 2019, 2022; Trahorsch et al., 2019) equally contribute to robust criteria allowing an improved evaluation based on specific stakeholder groups' preferences and needs. Future studies should, on the one hand, better summarize such criteria (Janko & Peskova, 2013) and, on the other hand, develop accessible and easily applicable evaluation tools for textbooks and educational resources.

Fifth, the *educational objectives* connected to discontinuous text require future attention. One of the main shortcomings of the present study is its quantitative nature. However, it is crucial to explore whether visuals complement, second, or reproduce the content described in the continuous text or, even worse, only serve decorative purposes in complete detachment from other textbook elements. Therefore, future studies could explore the links between continuous and discontinuous text to detect circles of recycling (Behnke & Bagoly-Simó, 2017) and redundant content with limited contribution to meaningful learning (Trahorsch & Bláha, 2019, 2022; Trahorsch et al., 2019).

Sixth, *joint analysis of continuous and discontinuous text* bears the potential to uncover the links between specific forms of visualization and disciplinary features. Based on the results of the present study, one crucial open question is the connection between the use of mnemonics in the Pedogeography textbooks and subject-specific knowledge. It seems vital to uncover the connection between the disciplinary structuration of knowledge, visualization options, and praxeological tradition in teaching the (sub)discipline in question.

Seventh, this study's results stress the need for studies that better *connect textbook content to its production*. Despite their relevance to Geography, maps reached an alarmingly low segment count. The results may lead to the hypothesis that not only disciplinary features (i.e., knowledge structuration, praxeological tradition in its teaching), but also editor and author agency play an essential role within the complex manuscript preparation and production process subjected to myriad technological and economic constraints. Future studies following a mixed-methods approach could further explore similar hypotheses.

Eighth, a clear strength of the present study is its longitudinal design. *Change* has the potential to showcase individual or collective decisions that may be intimately tied to subject-specific and/or production-related circumstances. While this study remained within the realm of quantitative data, future studies, as outlined above, could add valuable qualitative layers. Reflecting on change with textbook authors and editors is a promising endeavor bearing great potential to improve reader experience.

Ninth, this *contrastive* and *comparative* study spotlights diversity within Geography. The five subdisciplines reflected unique visualization patterns following individual trajectories of change. Future contrastive and comparative studies, also considering other subdisciplines, could assist us in better understanding the needs and potential of geographical subdisciplines when offering introductory texts to undergraduates.

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References

Textbooks

Heineberg, H. (2000). *Grundriß Allgemeine Geographie. Stadtgeographie* [Basic of General Geography. Urban Geography]. Schöningh utb.

Heineberg, H. (2022). *Grundriß Allgemeine Geographie. Stadtgeographie* [Basic of General Geography. Urban Geography] (6th, Updated and Extended Ed.). Schöningh utb. https://doi.org/10.36198/9783838558561

Kulke, E. (2004). *Grundriß Allgemeine Geographie. Wirtschaftsgeographie* [Basic of General Geography. Economic Geography]. Schöningh utb.

Kulke, E. (2017). *Wirtschaftsgeographie* [Economic Geography] (6th, Updated Ed.). Schöningh utb. https://doi.org/10.36198/9783838547091

Rinschede, G. (2003). *Grundriß Allgemeine Geographie. Geographiedidaktik* [Geography Education]. Schöningh utb.

Rinschede, G. & Siegmund, A. (2022). *Geographiedidaktik* [Geography Education] (5th, Rev. Ed.). Schöningh utb. https://doi.org/10.36198/9783838558622

Schönwiese, C.-D. (1994). *Klimatologie* [Climate Geography]. Ulmer utb.

Schönwiese, C.-D. (2020). *Klimatologie* [Climate Geography] (5th, Rev. and Updated Ed.). Ulmer utb. https://doi.org/10.36198/9783838553870

Stahr, K., Kandeler, E., Herrmann, L & Streck, T. (2012). *Bodenkunde und Standortlehre. Grundwissen Bachelor* [Pedogeography. Basics for Undergraduate Programs] (2nd, Corr. Ed.). Ulmer utb.

Stahr, K., Kandeler, E., Herrmann, L & Streck, T. (2020). *Bodenkunde und Standortlehre* [Pedogeography] (4th, Completely Updated Ed.). Ulmer utb. https://doi.org/10.36198/9783838553450

Further references

Alexander, C.S. (1984). Textbooks in Environmental Geomorphology: A Review. *Journal of Geography in Higher Education, 8* (1), 49–59. https://doi.org/10.1080/03098268408708899

Bagoly-Simó, P. (2014). Traditionen geographiedidaktischer Schulbuchforschung – eine Metaanalyse [Traditions of Textbook Research in Geography Education – A Meta-Analysis]. In P. Knecht, E. Matthes & S. Schütze (Eds.), *Methodologie und Methoden der Schulbuch- und Lehrmittelforschung. Methodology and Methods of Research on Textbooks and Educational Media* (S. 111–123). Klinkhardt.

Bagoly-Simó, P. (2016). Editorial: Textbooks and Educational Media. *Zeitschrift für Geographiedidaktik | Journal of Geography Education (ZGD), 44* (3), 3–4.

Bagoly-Simó, P. (2018). Science and Geography Textbooks in Light of Subject-Specific Education. In E. Fuchs & A. Bock (Eds.), *The Palgrave Handbook of Textbook Studies* (S. 141–155). Palgrave. https://doi.org/10.1057/978-1-137-53142-1_10

Bagoly-Simó, P. (2019). Research on Geography Textbooks. A Meta-Analysis of Work Published in IARTEM Proceedings. In J. Rodríguez Rodríguez, T.M. Braga Garcia & E. Bruillard (Eds.), *IARTEM 1991–2016: 15 Years Developing Textbook and Educational Media Research* (S. 237–246). IARTEM.

Bagoly-Simó, P. (2021). Doing Research on Geography Textbooks. An Overview of Methods, Samples, and Topics in International and German Journals (1960–2020). In P. Bagoly-Simó & Z. Sikorová (Eds.), *Textbooks and Educational Media: Perspectives from Subject Education. Proceedings of the 13th IARTEM Conference 2015, Berlin* (S. 134–146). Springer. https://doi.org/10.1007/978-3-030-80346-9_11

Bagoly-Simó, P. (2023). Editorial: Textbooks and Educational Media. *Zeitschrift für Geographiedidaktik | Journal of Geography Education (ZGD), 51* (1), 1–2.

Bagoly-Simó, P. & Binimelis, J. (2021). Maps and Map Skill Progression in Primary Geography in International Comparison. *Zeitschrift für Geographiedidaktik | Journal of Geography Education (ZGD), 49* (4), 211–227.

Bagoly-Simó, P., Hartmann, J. & Reinke, V. (2020). School Geography under COVID-19: Geographical Knowledge in the German Formal Education. *Tijdschrift voor economische en sociale geografie. Journal of Economic and Social Geography, 111* (3), 224–238. https://doi.org/10.1111/tesg.12452

Bagoly-Simó, P. & Hemmer, I. (2017). Geographiedidaktische Forschungen im Spiegel von ZGD 1973–2016 [Research in Geography Education in Light of ZGD 1973–2016]. *Zeitschrift für Geographiedidaktik | Journal of Geography Education (ZGD), 45* (4), 19–42.

Bagoly-Simó, P. & Hemmer, I. (2018). Kontinuität und Diskontinuitäten. 25 Jahre geographiedidaktische Forschung in GuiD/ZGD [Continuity and Discontinuities. 25 Years of Research in Geography Education in GuiD/ZGD]. In M. Dickel, L. Keßler, F. Pettig & F. Reinhardt (Eds.), *Grenzen markieren und überschreiten – Positionsbestimmungen im weiten Feld der Geographiedidaktik. Tagungsbeiträge zum HGD-Symposium 2017 in Jena* (Geographiedidaktische Forschungen, Bd. 69) (S. 38–46). redbox unipress.

Behnke, Y. (2021). Usability Qualities of 'Well-Designed' Geography Textbook Visuals. *Journal of Visual Literacy, 40* (1), 15–33. https://doi.org/10.1080/1051144X.2021.1902042

Behnke, Y. (2022). Which Factors Influence Learners' Visual Attention to Images in Geographic Learning Media? *Zeitschrift für Geographiedidaktik | Journal of Geography Education (ZGD), 50* (3), 159–179.

Behnke, Y. (2023). How Do Learners Interact with Photos, Graphics, and Maps in Geography Textbooks while Completing a Learning Task? *Zeitschrift für Geographiedidaktik | Journal of Geography Education (ZGD), 51* (1), 14–47.

Behnke, Y. & Bagoly-Simó, P. (2017). Circles of Recycling in Geographieschulbüchern [Circles of Recycling in Geography Textbooks]. In B. Aamotsbakken, E. Matthes & S. Schütze (Eds.), *Heterogenität und Bildungsmedien. Heterogeneity and Educational Media* (S. 239–251). Klinkhardt.

Cole, R. (2008). The Regionalization of Africa in Undergraduate Geography of Africa Textbooks, 1953 to 2004. *Journal of Geography, 107* (2), 61–74. https://doi.org/10.1080/00221340802186851

Giles, B. (1981). Meteorology ± Climatology: Climatology ± Meteorology Textbooks for Teaching Climatology to Geographers. *Journal of Geography in Higher Education, 5* (1), 86–94. https://doi.org/10.1080/03098268108708796

Ilovan, O.-R., Bagoly-Simó, P. & Herbstritt, G. (2018). Visual Discourse in Romanian Geography Textbooks during Socialism (1948–1989). *RRGE – Romanian Review of Geographical Education*, *VII* (2), 59–70.

Janko, T. & Knecht, P. (2013). Visuals in Geography Textbooks: Categorization of Types and Assessment of Their Instructional Qualities. *Review of International Geographical Education Online, 3* (1), 93–110.

Janko, T. & Peskova, K. (2013). Analysing the Types of Visuals in Textbooks of Geography and German Language: Considering the Instructional Functioning of Photographs. *The Anthropologist, 16* (1–2), 363–372. https://doi.org/10.1080/09720073.2013.11891363

Jarrett, D. (1988). Statistics Textbooks for Geography Students. *Journal of Geography in Higher Education, 12* (1), 107–116. https://doi.org/10.1080/03098268808709028

Kofman, E. (1991). Political Geography Textbooks for Myopic Lecturers? *Journal of Geography in Higher Education, 15* (1), 69–74. https://doi.org/10.1080/03098269108709131

Lidstone, J. (1995). Teaching with Textbooks in Undergraduate Geography Courses: Guilt, Gilt or Gilding the Lily? *Journal of Geography in Higher Education, 19* (3), 335–339. https://doi.org/10.1080/03098269508709328

Martis, K.C. (2005). Representation of Appalachia in North American Geography College Textbooks. *Journal of Geography, 104* (2), 85–92. https://doi.org/10.1080/00221340508978620

Mesbah-us-Saleheen & Huq, S. Md. M. (1995). The Role of Textbooks in Geography Study at the Undergraduate Level in Jahangirnagar University, Bangladesh. *Journal of Geography in Higher Education, 19* (3), 351–353. https://doi.org/10.1080/03098269508709334

Muller, P.O. (1995). The Contribution of Textbooks to Undergraduate Geography Instruction in the USA. *Journal of Geography in Higher Education, 19* (3), 341–343. https://doi.org/10.1080/03098269508709330

Nishiwaki, Y. (1995). The Contribution of Textbooks in the Teaching of Geography at Undergraduate Level in Japan. *Journal of Geography in Higher Education, 19* (3), 343–345. https://doi.org/10.1080/03098269508709331

Park, C. (1995). Reflections on the Role of Textbooks in the Undergraduate Teaching of Physical Geography in the British University Tradition. *Journal of Geography in Higher Education, 19* (3), 345–348. https://doi.org/10.1080/03098269508709332

Phillips, M. (1994). Teaching and Learning Philosophy in Geography from Textbooks. *Journal of Geography in Higher Education, 18* (1), 114–122. https://doi.org/10.1080/03098269408709245

Rodriguez, D.M.S. (1995). Textbooks Used in Geography Courses in Brazilian Universities. *Journal of Geography in Higher Education, 19* (3), 355–356. https://doi.org/10.1080/03098269508709336

Salisbury, N.E. (1981). Introductory Textbooks in Physical Geography: An American Perspective. *Journal of Geography in Higher Education, 5* (2), 181–196. https://doi.org/10.1080/03098268108708819

Trahorsch, P. & Bláha, J.D. (2019). Visual Representation of the Curriculum in Geography Textbooks. The Structure of Visuals in Educational Medium Analysis. *IARTEM eJournal, 11* (2), 1–20.

Trahorsch, P. & Bláha, J.D. (2022). The Influence of Textbook Visual Quality of Geographical Phenomena on Children's Conceptions. *Journal of Geography, 121* (3), 100–114. https://doi.org/10.1080/00221341.2022.2088828

Trahorsch, P., Bláha, J.D. & Chytrý, V. (2019). Comparative Analysis of the Quality of Visuals in Geography Textbooks for ISCED 1 and ISCED 2 Levels of Education. *Review of International Geographical Education Online, 9* (2), 264–283. https://doi.org/10.33403/rigeo.509255

Wentz, E.A., Vender, J.C. & Brewer, C.A. (1999). An Evaluation of Teaching Introductory Geomorphology Using Computer-Based Tools. *Journal of Geography in Higher Education, 23* (2), 167–179. https://doi.org/10.1080/03098269985443

Werner, M. (1995). Textbooks and the Teaching of the Physical Part of Geography: A Personal View. *Journal of Geography in Higher Education, 19* (3), 349–351. https://doi.org/10.1080/03098269508709333

Zhang, L. (1995). Geographical Textbooks for Chinese Undergraduate Students. *Journal of Geography in Higher Education, 19* (3), 353–354. https://doi.org/10.1080/03098269508709335

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