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Original article

Climate change education in Czech and Polish geography textbooks

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ABSTRACT

The article contains a comparative analysis of climate change education in geography education in Czechia and Poland. The topic of climate and its changes is one of the most current challenges for school education at the beginning of the 21st century. The aim of the research was to establish the similarities and differences in the content of teaching climate change in the core curricula and selected textbooks for teaching geography in both countries. Using the method of text analysis, the study covered the core curricula of geography and 22 geography textbooks for primary and secondary school students, including 11 Czech and 11 Polish. The quantitative analysis of the content (the term "climate" and its derivatives, and "climate change") and the qualitative analysis of the content of curriculum documents and school textbooks led to the basic conclusion that Czech and Polish students using textbooks for learning geography have the opportunity to learn content on: 1/ factors influencing climate change, 2/ causes of climate change, 3/ global warming, 4/ deforestation, 5/ desertification, 6/ melting of glaciers, 7/ consequences of climate change, and 8/ methods of counteracting climate change. By implementing the assumptions of the geography core curricula relating to climate change education and using textbooks during geography lessons, teachers can influence the pro-ecological attitudes of school children.

KEY WORDS: climate change education, geography curriculum, textbooks, text analysis, Czechia, Poland

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1. Introduction

Climate change is one of the most felt by people environmental changes impacts of modern times. Numerous researchers from many countries and regions of the world not only discuss the impact of human activity on climate change, which is generally considered obvious (IPCC, 2021), also emphasize natural factors (BAST, 2010; GOODESS ET AL., 1992), also conducte research in the field of climate education, including the impact of education on attitudes and pro-social and pro-ecological behavior of school children (HICKS & BORD, 2001; SELBY & KAGAWA, 2010; BANGAY & BLUM, 2010; KRASNY & DUBOIS, 2019; MONROE ET AL., 2019). In recent years, reports of various research teams have also been published on the state of society's knowledge about climate change and the ongoing, or recommended, activities in the field of climate education (WYSZKOWSKI ET AL., 2021, 2022; GUZY & OCHWAT, 2021, 2022a, 2022b).

Climate change education is part of education about the environment in the context of the concept of sustainable development. It has a significant impact on the development of eco-social competences, and inspires personal and social actions taken to counteract further climate change. Therefore, the main goals of climate education are to build a sustainable future, practicing the ability to influence attitudes and behaviours at social and personal levels. In climate change education, it is considered necessary not only to learn to understand climate change, but also to change one's own behaviour. Contrary to some

actions of the so-called climate change activists who rely on emotions and expose these emotions, this behaviour should refer to specific actions taken by people to counteract climate change. It is also important to know about the relationships present in the natural environment, between all its components. This knowledge, when imparted to children in the earliest school years, allows students to understand the impact of man on the environment and the consequences of these impacts.

Teaching climate change and the factors causing it is a very important task for geography teachers particulalry in shaping attitudes, beliefs and pro-environmental activities. Geography as a school subject, due to its curriculum content, including climate, climate-affecting factors, climate zones, types of climate and countries and regions that are experiencing the effects of climate change – environmental, social and economic (e.g. droughts, floods, migrations), among school subjects it is the most defiuned predestined to teach about processes and phenomena occurring in the atmosphere. Hence the authors´decision to investigate the contents of teaching about climate and its change in core curriculum and textbooks for teaching geography.

A literature review of international studies about climate change education shows the interest of researchers in recent years in the content of textbooks used by students at school. School textbooks are treated as the main source of structured knowledge for students.

One of the recent articles on climate education studies refers to climate change education in geography textbooks for secondary and higher secondary education in two countries located on different continents, in distant places – in South Africa and Norway (TRÆDAL ET AL., 2022). Authors analyzed 9 South African textbooks and 7 Norwegian textbooks, which were published in the years 2006–2016 inclusively. They also compared curricula of both countries. Authors assert that problems and solutions to climate change in textbooks are influenced by the dominant discourses of climate change in society. The overlapping nature of perspectives identified in the textbooks also demonstrated the complexity of identifying problems and solutions connected to climate change. The authors conclude that „political ecology" can offer a consistent didactical framework to examine the diversity of interests, perspectives and 'stories' about climate change at different scales. South Africa and Norway still represent somewhat different approaches to curricula development and content. While the South African curriculum is a National Curriculum and Assessment Policy and could be said to represent an instructive type (detailing the content in terms of what to teach, for how long, and when to teach it), the Norwegian curriculum can be described as target driven, with specific learning objectives and set milestones. Research by TRÆDAL ET AL (2022) was influenced by political discourse analysis (FAIRCLOUGH & FAIRCLOUGH, 2012), in the sense that they are concerned with arguments for (or against) certain types of action and the choice of policies. The research demonstrated that climate change as a topic in geography textbooks varies both between and within the curricula of Norway and South Africa. Authors found that an understanding of climate change mitigation through an ecological modernization discourse is even stronger in the South African textbooks than in the Norwegian ones.

Scientists from University of Nigeria, Nsukka, studied, how learning geography increases climate change awareness (ONUOHA ET AL., 2021). This study sampled 420 public secondary school students. Nigerian teachers have been teaching climate change content in various school subjects such as agricultural science, biology, chemistry, social studies and basic science, hence contributing to increased awareness of major environmental problems. The explicit presentation of climate change in the Nigerian curriculum appears within the geography curriculum. It is expected that it is taught to final year geography senior secondary (high) school students to expose them to the causes and consequences of climate change with relevant adaptation and mitigation strategies. The instrument for data collection used for this study was a 32-item questionnaire. Results of this study indicated that geography students possess significantly higher climate change awareness than students not enrolled to study geography.

In Great Britain, studies of economics textbooks from the point of view of education about climate change were conducted by GILLS & MORGAN (2021). The authors concluded that economics as a mainstream discipline is characterized by three 'separations': the separation of economics from politics; the separation of economic theory from socio-economic reality; and the separation of economics from ecology. The danger here, however, is that education becomes an exercise in fear-inducing apocalypse aversion, as though we were being asked to simply sacrifice and suffer in a new era of unavoidable austerity. This is not necessarily our future and this too should be made part of economics textbooks (GILLS & MORGAN, 2021).

An exploratory study from Irish researchers (WALDRON ET AL., 2019) uses thematic analysis of interview and focus group data to investigate the understandings of educators, student teachers and

data to investigate the understandings of educators, student teachers and environmental specialists on the issues of climate change, climate justice, and climate change education. The findings of this study present two contrasting perspectives on climate change and climate change education. The first perspective is predominant amongst teachers and student teachers. Its focus is on climate change as a geographical process with individual private actions as the possible solution. The second perspective, predominant amongst environmental specialists, characterises climate change as a global injustice requiring political, social and economic mobilisation.

On the other hand, in Turkey a study of geography textbooks investigated misconceptions about climate topics (BOZKURT, 2019). The study identified, discussed and showed the ways in which the representation of climate concepts in the textbook might corroborate the students' misconceptions. Appropriate corrections, explanations and visual materials were presented to explain the conceptions. The findings show that the misconceptions, or deficiencies, mentioned in previous studies still persist in newly published textbooks and academic books. BOZKURT (2019) concluded that the analyzed textbook is the only textbook in the whole country.

YOHO & RITTMANN (2018) investigated introductory-level university textbooks from four major US publishers for biology, chemistry, and physics, their study presents trends in terminology and content. The defining terms, "global warming" and "climate change" are used nearly equally. However, the first location of a working definition for climate change appears earlier. Energy technologies, climate change, and related environmental issues are found, on average, on ≤4% of textbook pages, and difference is large among individual textbooks. Discipline-based trends exist, especially for the energy technologies presented. Addressed separately as a nonrenewable, non-fossil fuel, nuclear energy was found on ≤1% of textbook pages and is unfavourably represented.

Whereas ROMÁN & BUSCH (2016) used a systemic functional analysis to study the language of chapters related to climate change in four sixth grade science textbooks adopted in the state of California. Their findings showed that these textbooks framed climate change as uncertain in the scientific community – both about whether it is occurring as well as about its human-causation. The implications for science education are discussed in relation to how the current political and public discourses on climate change, rather than scientific discourses, are influencing how textbooks discuss this topic.

In the article „Teaching Controversial Issues in Geography: Climate Change Education in Singaporean Schools" the authors investigate six Singaporean geography teachers' understandings of climate change education (HO & SEOW, 2015). The findings indicate that the participants held very different beliefs about the primary purposes of climate change education, in spite of the highly centralized national curriculum and the unambiguous state support for the science of climate change. They observed that respondents had different levels of knowledge about the causes and impacts of climate change, as well as about the scientific consensus on, and controversies surrounding, climate change.

In the context of the methods used to conduct research on climate education around the world, it can be said that climate education in schools is researched by analyzing the content of curriculum documents (core curricula or curricula), by analyzing the content of school textbooks at various levels of education, and by means of surveys to check the level of knowledge of teachers and students on this subject.

Known examples from different parts of the world show a whole range of effective concepts and ways of conducting climate education implemented in school education. They show the actions taken that are enforced by the current state of the environment (in this case: ongoing climate change). Summing up the literature review, one can also state the important role of geography in the implementation of climate education.

The aim of our research was to diagnose the similarities (or differences) in the content of teaching about climate change (including: causes, consequences, actions to prevent further changes) in core curricula and geography textbooks in Czechia and Poland. A review of the literature on climate change education shows that there has been no research on geography core curricula and geography textbooks in Central European countries so far. Therefore, this study fills the existing gap.

2. Materials and methods

The basic source of information for this study were the currently binding ministerial program documents in both countries, ie the core curricula of geography. For Poland, these were the basics introduced in 2017 in primary schools (MEN, 2017) and in 2018 in secondary schools (MEN, 2018). And for Czechia, the core curriculum from 2021, which was modified at that time (RVP ZV, 2021; RVP G, 2021) simultaneously at both levels of education, i.e. for both primary and secondary schools.

School textbooks for teaching geography, which were developed in both countries in accordance with the guidelines contained in the core curricula, were also analyzed. In the case of Polish textbooks, these are books which, after being assessed by reviewers – ministerial experts, have been approved for school use by the ministry responsible for education. Czech textbooks, both for primary and secondary schools, are also subject to an assessment procedure, but the result of this assessment is not a prerequisite for their use by schools. In this situation, students can learn from textbooks that have not received a positive evaluation by reviewers and such a situation, unfortunately, exists in Czechia in the case of textbooks for teaching geography.

Eleven Polish geography textbooks were analyzed. There were four textbooks for teaching geography in primary school for grades 5–8 (childrens aged 12–15 years), and seven for secondary schools (students aged 16–19 years): three textbooks for the basic scope and four for the extended scope of geography teaching. Books from the most popular series of textbooks in schools were selected: School and Pedagogical Publishing House for primary schools and New Era Publishing House for secondary schools.

In the case of Czech textbooks, four geography textbooks for primary school for grades 6–9 (childrens aged also 12–15 years) from the Fraus Publishing House and seven textbooks for secondary school (students also aged 16–19 years): were selected. The most popular Czech geography textbooks in secondary schools are the publications of the SPN Publishing House (the State Pedagogical Publishing House) and ČGS (the Publishing House of the Czech Geographical Society).

An important feature of the conducted study was the equal number of textbooks – eleven from each country. In addition, these are books that are used by students of the same age. In Poland, geography is a subject in grades 5–8 in primary school, and in Czechia in grades 6–9, but Czech students start school a year earlier than in Poland. In secondary schools in Poland, students learn basic geography in grades 1–3 of a three-year high school or a four-year technical school. There is a separate manual for each class. Students pursuing geography in the extended scope in grades 1–4 in high school or in grades 1–5 in technical secondary school have separate textbooks. In Czechia there is no separation of the level of teaching geography in secondary schools into basic and extended scope.

The method of text analysis was used in this research. It consisted of a quantitative analysis of textbook content. The frequency of the term "climate" and its derivatives, and the term "climate change" were counted. Climate chapters (topics) and chapters (topics) entirely on climate change, climate change sentences in non-climate chapters, and illustrations depicting or explaining climate change were counted. The qualitative analysis assessed the content of school textbooks (text and pictures) on climate change, taking into account the thematic threads addressed in them relating to global warming, desertification, deforestation, greenhouse gases, causes and consequences of climate change and ways to combat climate change.

3. Results

3.1. Climate education in the core curriculum

Climate topics are present in the geography core curricula for primary and secondary schools both in Czechia and in Poland. However, they differ in the degree of detail in the content of education and requirements. This is due to the structure of the core curriculum provisions in both countries. In Czechia, it is formulated more generally, while in Poland it is more detailed – with more content sections, with extensive detailed requirements and implementation conditions.

In quantitative terms, i.e. the number of provisions on the curriculum in the core curriculum (taking into account all its components, i.e. content, requirements and implementation conditions), in total for primary and secondary schools there are definitely more provisions in the Polish curriculum document (73) than in the Czech one (43). On the other hand, the Czech core curriculum for secondary schools is in favour of the number of content that may concern the climate (in the interpretation of teachers) (16) than in the Polish core curriculum (11). In the Polish core curriculum for secondary schools, the number of detailed requirements definitely prevails – 29, and in Czechia one there are only 8 such requirements (Table 1). At the same time, it should be emphasized that in the Czech core curriculum there is no separation into the different level of teaching geography in secondary schools into a basic or an extended scope.

The core curriculum of geography at primary school level in both countries contains many terms related to climate. Examples for individual components of the core curriculum are given in Table 2. However, the core curricula for geography at this educational level in both countries do not include the term "climate change". It is included only in the content and requirements of the Polish core curriculum at secondary school level (Table 3). The lack of such a direct distinction does not preclude

discussing climate change in geography lessons, as the core curriculum uses synonymous terms (with a broader meaning), such as geohazards in the atmosphere or global environmental problems, etc. about climate as a process in the atmosphere, about the spatial diversity of climates on Earth, the factors of this diversity as well as the consequences for nature, life and human economy.

Table 1. Climate and climate change in the components of the core curricula of geography – quantitative approach (Source: own study)

Polish				Czech		
Primary school						
Content section	Content	Requirement	Terms of implementation	Content section	Content	Requirement
9/18[1]	10	14	5	3/7[1]	13	6
Secondary school (basic version)				Secondary school (high school)		
3/16[1]	2	12	1	3/5[1]	16	8
Secondary school (extended version)						
4/23[1]	9	17	3			
Total	21	43	9	Total	29	14
Overall Total	73			43		

[1] number of thematic sections in the core curriculum in which climate issues are discussed per total number of sections in the core curriculum

Table 2. Climate and climate change in the components of the core curricula of geography – example contents for primary school (Source: own study)

Polish	Content section	8/18[1]	E.g. The natural environment of Poland against the background of Europe
	Content	10	E.g. The transitory nature of Poland's climate. Climatic, plant and soil zoning
	Requirement	14	E.g. Presents the climatic diversity of Europe and the factors that determine it
	Terms of implementation	5	E.g. ... broaden their knowledge of physical geography, learning about climate diversity and factors shaping the climate in Europe
Czech	Content section	3/7[1]	E.g. Regions of the world
	Content	13	E.g. Characteristics of their natural conditions. Climate zones - contexts and connections. Environmental problems and possible solutions
	Requirement	6	E.g. Compares and adequately assesses the natural conditions, their potential and threats. It considers what changes have occurred and can happen and what is their cause

[1] number of thematic sections in the core curriculum in which climate issues are discussed per total number of sections in the core curriculum

Table 3. Climate and climate change in the components of the core curriculum of geography – example contents for secondary school (Source: own study)

Polish	Content section	7/39[1]	E.g. Dynamics of atmospheric processes. Environmental problems of the modern world
	Content	11	E.g. Climate factors, phenomena and processes in the atmosphere. Spatial differentiation of climate elements. Climatic zones. Climate types. Tropical cyclones, whirlwinds, storms, floods, tsunamis, climate change, desertification, changes in the extent of glaciers
	Requirement	29	E.g. - presents climatic factors determining the diversity of climate on Earth; - explains the formation of meteorological and climatic geohazards (tropical cyclones, whirlwinds, desertification, climate change)
	Terms of implementation	4	E.g. The contents of section XVIII, referring to geohazards, indicate the power of natural phenomena, their mechanisms and problems related to the impact of these phenomena human life and economy
Czech	Content section	3/5[1]	E.g. Living environment (geographical)
	Content	16	E.g. Development of interaction between nature and society. Sustainable development. The boundaries of the natural environment. Global problems of humanity/geohazards. Economic and legal tools for nature and environment protection
	Requirement	8	E.g. Analyzes natural factors on specific examples. Considers the risk of the impact of some natural and social factors on the living environment at the local, regional and global level

[1] number of thematic sections in the core curriculum in which climate issues are discussed per total number of sections in the core curriculum

3.2. Climate change education in geography texbooks in primary (elementary) and secondary (high) school

In textbooks for primary school in both countries, the total number of chapters (topics) on climate is similar. There are six of them in Polish textbooks, and seven in Czech textbooks. Their varied arrangement in individual textbooks depends on the content of the textbooks, and these are conditioned by the provisions of the core curriculum. There are significant differences concerning the use of the term "climate" (and its derivatives), in favour of Polish textbooks (Table 4).

The whole chapter (topic) on climate change is only available in the Czech geography textbook for the last year of primary school (grade 9). The authors of Czech textbooks at primary school level decided to include 2 themes on climate change, one with the title: „Has the weather gone crazy?“ and the other, „Damaged Umbrella of Planet Earth“. In the introduction, they describe the story of the world's first refugee, a citizen of the Kiribati archipelago, who applied for asylum in New Zealand due to climate change. Furthermore, students will learn about climate fluctuations in history, about extreme situations caused by rising temperatures. Individual paragraphs focus on the explanation of the greenhouse effect, the description of the consequences of climate change, the text is also devoted to international cooperation (Kyoto Protocol, Paris Agreement). Apart from the graph showing the contribution of individual greenhouse gases to the warming of the atmosphere, the other illustrations have no other better than to be decorative. The second chapter deals with the problem of the ozone hole, students can compare its development from 1979 to 2016, there is also a graph of the annual course of the amount of ozone over Czechia. The text explains both the causes and consequences of ozone layer damage, including an explanation of Dobsonian units. One image also shows melanoma (skin cancer). The authors again focus on the history of observation and discovery of the ozone hole, emphasizing again international cooperation (the Vienna Convention and the Montreal Protocol).

Table 4. Climate and climate change content in Polish and Czech geography textbooks for primary school – quantitative approach (Sources: [1]Lechowicz et al., 2018a; [2]Lechowicz et al., 2019; [3]Głowacz et al., 2017; [4]Lechowicz et al., 2018b; [5]Červený et al., 2013, [6]Kohoutová et al., 2014, [7]Marada et al., 2016, [8]Marada et al., 2017)

School textbooks to classes		The whole chapter (topic) about climate		The terms "climate", "climatic conditions" and others		The whole chapter (topic) about climate change		Sentences about climate change (except for chapters entirely on climate change)		Illustrations on climate change	
PL	CZ	PL	CZ	PL	CZ	PL	CZ	PL	CZ	PL	CZ
5[1]	6[5]	0	2	108	68	0	0	0	1	0	0
6[2]	7[6]	1	3	78	106	0	0	1	8	1	1
7[3]	8[7]	2	1	116	27	0	0	2	2	0	0
8[4]	9[8]	3	1	78	22	0	2	3	4	1	2
Totality		6	7	380	223	0	2	6	15	2	3

PL – Polish textbooks, CZ – Czech textbooks

Polish and Czech geography textbooks for primary school differ significantly in the number of sentences regarding climate change in topics apart from the main chapter (topic) entirely dedicated to climate change (Table 4). Such sentences appear in Czech textbooks for each year in primary school, but this is not present in Polish textbooks (they are not present in the Polish textbook for year 5). There are more than twice as many such sentences in Czech textbooks (15 CZ/ 6 PL). On the other hand, graphical illustrations (figures) of climate change are small, and their number is similar in the textbooks of both countries (2 PL/3 CZ).

In Czech secondary (high) school geography textbooks, the number of chapters (topics) on climate is almost twice as large as in Polish textbooks (Table 5). The frequency of the use of the term "climate" in textbooks is very high (advantageous for Czech textbooks in their basic scope, and for Polish textbooks in their extended scope), but in total in Polish textbooks this sum is almost twice as high.

In Polish textbooks for secondary schools, there is one entire chapter on climate change in the basic scope, and two further chapters in the extended scope In Czech textbooks, the sum of such chapters is identical.

Table 5. Climate and climate change content in Polish and Czech geographic textbooks for secondary school – quantitative approach (Sources: [1]Malarz & Więckowski, 2019; [2]Rachwał at al., 2020; [3]Adamiak at al., 2021; [4]Malarz at al., 2019; [5]Rachwał & Kilar, 2020; [6]Świtoniak at al., 2021; [7]Rachwał at al., 2021; [8]Demek et al., 2017, [9]Matušková et al., 2014, [10]Demek et al., 2013, [11]Kastner et al., 2016, [12]Bičík & Janský, 2016, [13]Anděl et al., 2019, [14]Bičík et al., 2019)

School textbooks to classes		The whole chapter (topic) about climate		The term "climate", "climatic conditions" and others		The whole chapter (topic) about climate change		Sentences about climate change (except for chapters entirely on climate change)		Illustrations on climate change	
PL	CZ	PL	CZ	PL	CZ	PL	CZ	PL	CZ	PL	CZ
1[1] BV	1[8]	1	4	154	119	0	1	2	36	0	3
2[2] BV	2[9]	0	0	76	26	1	0	2	10	6	0
3[3] BV	3[10]	1	3	75	153	0	0	4	16	1	1
1[4] EV	4[11]	2	1	241	13	0	0	0	0	0	0
2[5] EV	PR.[12]	0	2	55	90	1	1	4	54	15	7
3[6]EV	MAK.[13]	1	0	108	64	0	1	2	25	1	0
4[7] EV	HOS.[14]	1	0	219	3	1	0	20	21	15	0
Total		6	10	928	468	3	3	34	162	38	11

Explanation: PL – Polish textbooks, CZ – Czech textbooks, BV - basic version, EV - extended version

The content of these chapters shows that in geography lessons Czech and Polish students have the opportunity to learn about natural and anthropogenic factors influencing climate change, the causes of climate change and its consequences. They will also learn about the processes of: global warming, melting of glaciers, the ozone hole, deforestation, desertification,. In the case of Polish geography textbooks, in these separate lessons (chapters) on climate change, the authors discussed examples of adaptations to ongoing climate change, as well as ways to counteract climate change.

In Czech geography textbooks for secondary schools, there are definitely more sentences referring to climate change than in Polish textbooks, and in Polish textbooks there are more than three times as many figures depicting climate change (Table 5).

Presented in Table 6 are examples of sentences related to climate change which confirm that in primary school geography lessons in Czechia this topic is discussed in socio-economic geography lessons on a global scale, while in Poland it is discussed on a regional scale – in lessons about Antarctica, the Arctic, the Baltic Sea, and about Amazonia.

Table 6. Climate change content in Polish and Czech primary school textbooks (Sources: [1]Głowacz at al., 2017; [2]Lechowicz et al., 2018b; [3]Kohoutová et al., 2014; [4]Marada et al., 2016; [5]Marada et al., 2017)

Polish	*Cl. 71, t. Baltic Sea, p. 58: "In winter, e.g. as a result of lower salinity (although in recent years the northern part of the Baltic Sea freezes over a smaller area due to climate warming ...)"* *Cl. 71, t. Conditions for the development of the energy economy, p. 213: "Unfortunately, the combustion of fossil fuels has negative effects on the environment (...) The most attention is paid to carbon dioxide emissions, the increased content of which in the atmosphere leads to global climate change."* *Cl. 82, t. Amazonia, p. 108: Deforestation of the Amazon. The Amazon rainforest absorbs carbon dioxide, the increasing concentration of which is now considered one of the factors affecting climate change on Earth.* *Cl. 82, t. Antarctica, p. 151: This is where the first symptoms of global climate change can be seen, e.g. thinning of the ice cover, thawing of permafrost. Over the poles, the phenomenon of decreasing ozone content is observed, i.e. the formation of the so-called ozone hole.* *Cl. 82, At the polar station, p. 157: Explain why climate change at the polar ends of our globe is so important that constant scientific research is carried out there?*
Czech	*Cl. 73, t. A continent of ice and cold, p. 70: „A so-called ozone hole was detected over Antarctica for the first time - it is a loss of ozone in the stratosphere. What is the importance of the ozone layer for life on our planet? Can we prevent ozone depletion? How?* *Cl. 73, t. The Arctic p. 121: „As global climate change progress, the possibilities of extracting raw materials in the Arctic also grow... "* *Cl. 84, t. Historical transformations of the landscape, p. 40: „There are mountain glaciers in the highest parts of the Alps, which are shrinking in the long term due to global climate change."* *Cl. 95, t. Are Humans the Major Cause of Climate Change? p. 37: „Explain why deforestation increases the concentration of carbon dioxide in the atmosphere. More than a hundred years ago, a Swedish chemist suggested that adding carbon dioxide to the Earth's atmosphere could change the climate..."*

Explanation: *Cl.* – class, *t.* – topic

Table 7. Climate change content in textbooks used in Polish and Czech secondary school
(Sources: [1]Malarz & Więckowski, 2019; [2]Rachwał at al., 2020; [3]Adamiak at al., 2021; [4]Demek et al., 2017; [5]Matušková et al., 2014; [6]Demek et al., 2013; [7]Bičík & Janský, 2016; [8]Anděl et al., 2019)

Polish	*Cl. 1[1], t. Mountain glaciers and ice sheets, p. 90-91:* "Research shows that the average temperature on Earth is slowly increasing. The effects of climate warming can be seen in the circumpolar regions, especially in the Arctic. As a result of global warming, the ice cover is disappearing. This causes changes both in the natural environment and in the traditional way of life of the inhabitants of the Arctic." *Cl. 2[2], t. The main areas of cultivation, p. 113:* „Due to the warming climate, the range of sorghum cultivation is gradually expanding." *Cl. 2[2], t. Human impact on the environment, introduction, p. 207:* „Global warming is the increase in air temperature on Earth. It is caused by excessive emissions of greenhouse gases into the atmosphere, such as carbon dioxide, nitrogen oxide and methane, as well as deforestation." (+ scheme Major sources of environmental pollution). *Cl. 3[3], t. The state of the environment in Poland, p. 138:* „Emission of air pollutants has many negative consequences. It causes the formation of smog, acid rain and fog, and contributes to global warming." (+ *p. 143:* These pollutants ... contribute to global warming). *Cl. 3[3], t. Protection of the natural environment in Poland, p. 148:* „It was recognized that only joint, supranational actions are able to stop unfavourable processes, such as global warming of the climate or decline in biodiversity." (+ *p. 150* - section summary: „In Poland, air pollution contributes to the formation of smog, acid rain and fog, as well as to global warming").
Czech	*Cl. 1[4], t. Altitudinal zonation, p. 101:* "The highest peak of Uhuru is covered by a glacier. As a result of global warming, the glacier is gradually melting." *Cl. 2[5], t. Water management, p. 37:* "Worldwide, water management must adapt to changing climate conditions. The distribution of precipitation in the year is changing, some regions are more often affected by drought, others suffer from more frequent occurrence of floods..." *Cl. 3[6], t. America's economy is gaining, the living environment is suffering, p. 134:* „Amazon Tropical Rainforest - Deforestation can lead to: Earth's oxygen imbalance, large amounts of CO_2 on Earth disrupting the planet's climate, less evaporation from replacement communities...greenhouse effect causing global warming..." *Nature and people Earth (Příroda a lidé Země)[7], t. Atmosphere, p. 21:* "The CO_2 content in the atmosphere has been systematically measured since 1958 and is constantly rising. Around 2030, it is estimated that there will be 0.05% CO_2 in the atmosphere, causing widespread warming of the Earth's climate…" *The macroregions of the worlds (Makroregiony světa)[8], t. Austria, p. 119*: "According to the latest research, the average temperature in the lowest layer of the atmosphere has increased by almost 2 degrees C over the last 150 years. Alpine glaciers lost about half of their former area in the same period..."

Explanation: *Cl.* – class, *t.* – topic

On the other hand, in geography lessons in secondary schools in both countries, the topic of climate change is discussed not only in climatology or hydrology lessons, but also in examples of socio-economic geography content (e.g. when discussing crops in the world). This is confirmed by the examples of sentences presented in Table 7.

4. Discussion

The study of core curricula and textbooks for teaching geography in Czechia and Poland allowed us to notice both large differences in the structure of program documents in both countries, as well as in the selection of content in core curricula and textbooks, including those relating to climate issues. It has been proven that there are more sections of content in the Polish core curriculum for primary school education, and thus also more specific content on climate. In the Czech core curriculum, the contents are more general, i.e. hidden in other – broader topics, such as "environmental problems and the possibilities for their solutions". In the core curricula for secondary schools, these differences are much clearer, because the Czech core curriculum consists of only 5 sections, but the Polish one has as many as 39. They are therefore more extensive and detailed. In the Polish core curriculum for geography, there are specific "orders" such as: "the student explains the formation of climatic geohazards – desertification, tropical cyclones, etc.", and in the Czech core curriculum there are phrases such as "the student considers the risks of certain natural factors". What's more, in the Czech core curriculum there are no terms of implementation that contain specific instructions regarding the ways and division of the implementation of the program content in individual classes.

The authors of the study also noticed significant differences between the geography textbooks in both countries. In the Czech geography textbooks for primary school there are more chapters (topics) on climate change, and there are more sentences about these changes in chapters (lessons) not entirely related to climate change, also there are slightly more illustrations referring to climate change. On the other hand, in the textbooks for secondary schools, they have the same number of chapters (lessons) on climate change, but in the

Czech textbooks there are many more sentences about climate change in the chapters (lessons) not entirely related to climate, while in Polish textbooks there are three times as many illustrations about climate change.

When comparing the results of our research on the Czech and Polish core curricula, some similarities can be noticed with those results of Norwegian and South African researchers (TRÆDAL ET AL., 2022). Although the authors of those studies focused their research on presenting the discourse on climate change and its translation into the content of geography textbooks, similar to the authors of this study in the field of climate education, they tried to find links between the content of textbooks and the education system and current curriculum documents. There is a conscious shift within countries towards using education as a tool to meet the needs of the future. There is a differentiated approach to the development and selection of content for curricula. For example, in South Africa, as in Poland, there is a national curriculum detailing what to teach, for how long and when, while the Norwegian curriculum – like the Czech one – is goal-oriented, open-ended, and gives relative freedom to schools and teachers. In South Africa, as in Poland, there is a similar mechanism for approving textbooks. This model is now abolished in Norway and the publisher is responsible for the content. In Czechia, this is a formal mechanism because schools do not have to follow it, so the consequences are similar to those in Norway. A recent similarity with TRÆDAL ET AL (2022) is that all the countries mentioned have an economy based on fossil fuels, hence it could be assumed that the political representation and other actors deciding on the pro-ecological orientation of these countries will have common interests in mitigating climate change with the use of technology, and not by reducing the extraction of fossil fuels and replacing them with renewable energy sources. The analysis demonstrated that climate change as a topic in geography textbooks varies both between and within Norway and South Africa. They found an overall emphasis on international agreements and green governance in the textbooks in both countries. The expectations regarding the South African textbooks that theywere more inclined towards the global injustice framing of climate change (civic environmentalism) and those regarding the Norwegian textbooks towards a neoliberal market-based governance (ecological modernization) were not confirmed. Differences in the contents of textbooks in Poland, Czechia, Norway and South Africa and their approaches can be traced back to differences in the curricula and educational traditions of the discussed countries.

Textbooks in the USA have been criticized for merely emphasizing the description of facts, instead of providing explanations (SMOLKIN ET AL., 2011), and promoting memorization rather than critical thinking (NATIONAL RESEARCH COUNCIL, 1990). Sentences or statements in American textbooks on climate change that were studied by ROMÁN & BUSCH (2016) are also identified in Czech and Polish textbooks. An example of such sentences is: *The melting of glaciers and polar ice caps could also increase sea level.* The authors of textbooks often describe various natural factors that can cause climate change. In some cases, these changes are also influenced by human factors, but this is not properly emphasized in the texts.

Not only the content of textbooks, but also, as research by HO & SEOW (2015) shows, teachers' knowledge and attitudes towards climate education may influence the information provided and the attitudes they shape. In spite of the prescriptive curriculum and the dominant national discourse supporting climate change, Singaporean teachers adopted diverse pedagogical positions that were aligned to their beliefs about climate change, as well as their understandings of the purpose of climate change education, thus indicating that geography teachers play an important role in providing geographical knowledge for their students in spite of contextual constraints.

5. Conclusions and recomendations

The results of this research allow the following conclusions to be drawn, which can be treated as proposed solutions (recommendations) for school geographical education in Czechia and Poland:

1. As part of geographic climate education, Polish and Czech students have the opportunity to learn about the processes taking place in the atmosphere, climatic conditions, as well as factors influencing climate change, the causes of climate change, global warming, deforestation, desertification, melting of glaciers, the consequences of climate change, and ways to combat climate change. Therefore, during geography lessons, teachers implementing climate education have the opportunity to influence the pro-ecological attitudes of schoolchildren.
2. With subsequent changes to the curricula, it is necessary to consider correcting the provisions of the core curricula of geography in primary schools in both countries, so that the content and

requirements refer to climate change in an unambiguous manner.

3. In textbooks, sentences about processes that are the result of climate change, there is no specific information about climate change (this term), and sometimes sentences about climate change are not always accompanied by an explanation of the anthropogenic causes of this process. It is worth recommending to the authors of textbooks and experts who decide on their acceptance for school use that the human element of these changes should be emphasized.

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