



This discussion paper is/has been under review for the journal Natural Hazards and Earth System Sciences (NHESS). Please refer to the corresponding final paper in NHESS if available.

European education on natural disasters

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European education on natural disasters – a textbook study

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Received: 9 January 2013 – Accepted: 11 April 2013 – Published: 24 May 2013

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Published by Copernicus Publications on behalf of the European Geosciences Union.

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Abstract

Present is the role of formal education on natural disasters in Europe. To ensure a uniform overview, the study used secondary-school geography textbooks from the collection of textbooks at the Georg Eckert Institute for International Textbook Research in Braunschweig, Germany. Altogether, more than 160 textbooks from 36 European countries were examined in order to investigate how much their content (pages, text, figures) is related to natural-disasters topics, and to find out which types of hazards are presented more often. In the research it was also analyzed which disaster events are frequently used as an example.

1 Introduction

Although several international documents related to natural hazards (Hyogo, 2005; Hidayat, 2009) provide education programs in natural hazards, and many of them rely on the implementation of the Hyogo Framework and the United Nations Decade of Education for Sustainable Development 2005–2015 which, for example, mentions risk education referred to as “the transfer of knowledge, technology and expertise to enhance capacity building for disaster risk reduction” (Hyogo, 2005, p. 5), it is important to point out the relative absence of this kind of activity in Europe.

Education in the field of natural hazards or risk education is a rather under-researched field in the social sciences (e.g. Vitek and Berta, 1982; Ronan et al., 2010; Komac et al., 2011), although that education is important for governance of natural hazards (Jóhannesdóttir and Gísladóttir, 2010; Bradford et al., 2012). Risk education refers to the transfer of more generalized (thematic, organizational, technical) knowledge and skills on natural hazards and risks from professionals in teaching institutions (schools, providers of courses) to persons in schooling and training. It has a high degree of formalization and institutionalization and as it is codified in the frame of national curricula and textbooks. But one should be aware of the fact that knowledge transfer

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is not restricted to a relationship between teachers and pupils; children also transmit the risk-related knowledge to their parents and other people in their social network (Cardona, 2007; Stoltman et al., 2007; Wisner, 2006; Kuhlicke et al., 2011).

In the first instance, a distinction needs to be made between information and knowledge as well as between learning and education. We distinguish between conceptual knowledge, based on data and information, and procedural knowledge, which is comprised of skills and abilities. Knowledge can be also regarded as a codified set of information and it is therefore independent of the subject. Learning is the process acquiring knowledge. Learning involves accumulating knowledge and information and it is also understood as a creative process in which information is given an added value. Since the creative process is an individual one, learning may also be understood as a personification of information. Knowledge of natural phenomena and processes is part of general education encompassing the issues of peace and peace education, democracy and authoritarian countries, environmental protection, economizing, development and the related development of humanism, social (in)equality, and, last but not least, protection against natural hazards (Senegačnik, 2010).

The last issue also includes knowledge of the wider and immediate local region, and the geographical phenomena and processes in it. Natural hazards show that education must take into account key world problems and resolve them by using a problem-based-local-oriented approach, whose goal is to raise awareness about phenomena and processes, increase sensitivity to specific phenomena, and develop the ability to perceive development trends. This is very important with regard to natural hazards because they can only be understood if there is also solid knowledge of the environment in which they take place. An important principle is derived from this: in order to be effective and influence social development, natural-disaster and hazard education must focus on concrete phenomena and processes in space.

Since learning includes forgetting, the memory of a certain disaster remains preserved in the social sphere only for a certain period of time (Komac, 2009). In spite of the frequency of some natural processes (which play a part in people's memory;

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Biernacki et al., 2008) and numerous opportunities to provide information and keep data, people soon forget even extreme events unless they are recorded in newspapers, yearbooks, popular publications, chronicles, information panels at the site itself, or websites, or are kept vivid through socially active preservation of memory such as public and private education systems, vocational and professional training courses, community-based self assessment, local and indigenous knowledge, and public discourse involving the media, games, awareness campaigns, museums, memorials, and special events (Wisner, 2006; Komac et al., 2011).

2 Analysis

According to the World Conference on Disaster Reduction, almost a third (36 of 113) reporting countries claimed to have national efforts to teach disaster-related subjects or some form of disaster-related teaching in primary or secondary schools. In Europe, among them are the Czech Republic, France, Greece, Hungary, Portugal, Romania, Russia, Slovenia, and Sweden, to mention but a few.

Risk education themes are included in different school forms and in the curricula of several subjects, such as geography, social sciences, biological sciences, forensics, physics, history, and domestic sciences. In Macedonia, for example, children already learn about natural hazards in primary school (at ages ten to fourteen), especially in geography classes and in part also in physics, chemistry, and biology classes. The Czech chemistry and physics curricula contain certain aspects of natural hazards. In France, a seven-hour course is dedicated to natural hazards, and a special program titled First Gestures was developed for preschools. In Greece and Hungary, primary-school curricula also include natural hazards. In Germany each federal state (*Bundesland*) is responsible for its curricula and there are sixteen different curricular arrangements. Beginning in 1993, natural hazards were a required subject in seventh and eighth grades, focusing on regions of the world at risk, the causes of risk, and impact of hazards.

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Table 1 provides an overview of different risk- and hazard-related activities in different European countries.

In formal risk education, school textbooks are still the main means of teaching and learning. They are composed media, which combine text equally with pictures, maps, charts, diagrams, and tables. They follow a specific program and teaching, psychological, and methodical principles, and are in line with educational and school needs and tasks. Textbooks are a stable source of information compared to the other media and teaching resources (Schmithüsen, 2003).

One of the major school subjects in which natural hazards are being taught is geography. Geography textbooks are instructional books that transmit findings and knowledge about landscape phenomena and processes as well as social developments and problems.

This section identifies differences between various European countries with regard to risk education based upon explorative textbook research. To this end, the secondary-school geography textbooks at the Georg Eckert Institute for International Textbook Research in Braunschweig, Germany, were analyzed. This institute has what is probably the largest collection of textbooks in the world. It has been operating since 1951, and in 1985 was awarded the UNESCO Prize for Peace Education for its achievements. The institute's library has more than 245 000 units, of which textbooks account for 172 000 units and scholarly studies account for approximately 73 000 units (GEI, 2012).

This textbook study is an example of a descriptive analytical method and quantitative conceptual analysis, as is the international textbook research developed by this institute. Textbook analysis is an important method in connection with the condition, development, and features of the discipline because these affect textbook writers and users (Senegačnik, 2010). According to Pingel (2010), textbook studies belong to a special research category known as "textbook research."

A horizontal analysis of the textbooks content was conducted, which means that textbooks from various countries covering the same course were examined in terms of

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specific content. This study belongs to inter-textual strategies, which study the internal composition of a textbook and its components or the textbook itself. The result of our work is an analysis of the frequency of specific text and visual textbook components, and their content-related definition. We were interested in the share of natural hazard-related text and graphical components in the textbooks as expressed in the number of pages and graphic features (e.g. photographs, maps, sketches, and newspaper abstracts), the treatment of natural hazards, the type of disasters covered, and examples of natural hazards described in the textbooks. Our research can thus not answer the question “How effective is risk education through textbooks?” as we did not assess the effectiveness of education, which is indeed very difficult to do and requires specific in-depth research.

2.1 Textbook selection

Even though the education systems of some countries include teaching or material related to natural hazards in various school subjects (such as history and the social sciences), the focus here was exclusively on an overview of secondary-school geography textbooks (Fig. 4): more precisely, textbooks for the tenth and eleventh grades or fourteen- and fifteen-year-old students. In this regard, it should be noted that school systems are not entirely comparable because in some countries, such as the UK, grades are not linked to the students’ ages, but to their progress. An overview of records on the school systems of individual countries with grade levels and the corresponding student ages was also carried out in order to help select the textbooks (Fig. 1).

In addition to differences between textbooks for individual ages or grades, there are also differences that make it somewhat difficult to compare the textbooks. More specifically, the textbooks differ in terms of their conceptual design, scope, pictorial material, and the number of appendices. There are many reasons for these differences, including the use of different curricula and different conceptions of landscape in different cultures. One should also highlight the fact that the form a textbook takes is also influenced by the differences between authors that work as teachers and those that do not

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or do not have any teaching experience. Teachers tend to emphasize a regional approach, whereas non-teachers emphasize a thematic approach (Senegačnik, 2010). In some countries, such as France, textbooks are designed based on a uniform national curriculum, whereas in other countries, such as Germany, every federal state determines its own regional school curriculum for every grade. In addition, in some countries textbooks are defined in extremely great detail, whereas elsewhere the definitions are looser, allowing greater freedom in teaching. Another problem encountered in analyzing the textbooks was that for some textbooks it is difficult to establish whether they are intended for general use (by all the students in the class), or only for selective or specific courses attended only by some students.

Despite the different approaches and differences among the textbooks, secondary-school textbooks are reliable and sufficiently comparable to perform the analysis. We believe fourteen- to fifteen-year-olds are already capable of demonstrating sufficient critical thinking in their perceptions of the environment and can understand the complex connections between nature and society, and thus also the occurrence of natural hazards. Therefore, many textbooks do not present natural hazards as catastrophes, but as natural phenomena in a landscape to which the society must adequately adapt itself.

One of the arguments for selecting geography textbooks is that natural hazards are not an insignificant or a marginal topic in these textbooks (Radkau and Henrÿ, 2005). What is also important is the fact that geography focuses on the processes and phenomena at the juncture of nature and society. In addition, geography textbooks are based on the paradigms of physical and human geography and are therefore more analytical. According to Schmidt-Wulfen (2005), the subject of natural hazards is primarily discussed in geography classes and students find the topic very interesting.

2.2 Textbook analysis

A total of 166 textbooks from thirty-six countries were analyzed. If several textbooks were available for an individual country, the ones selected were the most recently published ones that complied with the age criteria (the selected education level).

The largest number of textbooks from one country came from Germany (ten). We also studied textbooks from Belgium, Iceland, Hungary, Slovenia, and the UK (seven textbooks from each country), Bosnia-Herzegovina, Ireland, and Ukraine (six textbooks from each country), Denmark, Macedonia, the Netherlands, Poland, Russia, and Serbia (five textbooks from each country), Austria, Croatia, France, and Spain (four), Albania, Belarus, the Czech Republic, Italy, Latvia, Lithuania, Moldova, Portugal, Romania, Slovakia, Sweden, and Turkey (three), and Greece and Norway (two). No suitable textbooks were found for Andorra, Bulgaria, Liechtenstein, Luxembourg, San Marino, or Monaco.

This also meant that the largest number of pages were examined in German textbooks (a total of 2226), and more than 1500 pages were reviewed in textbooks from the UK, Switzerland, Poland, Spain, Russia, and Ukraine. More than 1000 pages were examined in textbooks from France, Finland, the Netherlands, Italy, Hungary, Ireland, Bosnia-Herzegovina, Sweden, Serbia, and Portugal, and more than 500 pages in textbooks from Austria, Belarus, Slovenia, Macedonia, Croatia, Turkey, Norway, Moldova, Latvia, Iceland, Albania, Lithuania, and Estonia. In addition, more than 100 pages each were examined in textbooks from Denmark, Romania, Greece, the Czech Republic, Slovakia, and Belgium.

The share of pages containing descriptions of natural disasters differs greatly across individual countries (Table 2, Fig. 2). The shares range from 0 (Slovakia) to 11 % (Denmark). Less than 1 % of pages describing natural disasters can be found in seven countries, and more than 5 % can be found in four countries (Table 3). On average, 3.1 % of pages are dedicated to natural disasters.

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According to the regional classification of Europe (adapted from Brinovec et al., 2000), we divided the countries into the following regions:

- Northern Europe (Denmark, Sweden, Norway, Finland, Iceland, Latvia, Lithuania, and Estonia),
- Western Europe (UK, Ireland, Belgium, the Netherlands, Luxembourg, and France),
- Southern Europe (Spain, Italy, Greece, and Portugal),
- Central Europe (Germany, Poland, the Czech Republic, Slovakia, Switzerland, Austria, Slovenia, and Hungary),
- Southeastern Europe (Croatia, Bosnia-Herzegovina, Serbia, Montenegro, Romania, Albania, Macedonia, Bulgaria, Kosovo, and Turkey),
- Eastern Europe (Russia, Belarus, Ukraine, and Moldova).

Among these, Western Europe dedicates the most attention to natural disasters (3.8%), and Eastern Europe dedicates the least (0.7%). The shares of Northern Europe and Southeastern Europe are 3.6 and 3.4%, respectively. The share of Central Europe is 2.8% and the share of Southern Europe is 2.3% (Fig. 3).

Approximately 80% of the pages describing natural disasters present various forms of natural hazards. This is understandable because natural disasters can be most easily presented to students by describing specific forms or processes. Descriptions of prevention, risk assessment, rescue methods, types of renovation, and complex or problem-based descriptions are less common.

The largest share of concrete descriptions is dedicated to earthquakes (23.2%) and volcanic eruptions (21.2%), followed by floods (18.1%), erosion (14.5%), landslides and rock falls (7.9%), storms (7.1%), droughts (3.5%), and avalanches (2.5%). The least discussed are the impact of tidal waves and tsunamis (1.1%), and forest fires (0.8%).

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It seems that the share of textbook pages describing earthquakes and floods is sufficient. Due to the important role of agriculture in the European economy, the frequent descriptions of erosion, especially in the Mediterranean region, are not surprising. Descriptions of avalanches, tidal waves, and forest fires are rare; avalanches are mentioned primarily as part of descriptions of certain regions (e.g. the Alps). The situation is similar for droughts. The textbooks do not mention the effects of extremely high temperatures (heat waves) and extremely low temperatures (frost, glaze ice).

Comparing the ratios between the descriptions of natural disasters in textbooks (due to the available data on the occurrence of natural disasters in the past century, this comparison only takes into account earthquakes, floods, landslides, volcanic eruptions, forest fires, storms, tidal waves, and tsunamis) with the actual occurrence of natural disasters in Europe in the past century (1126 events were recorded from 1900 to 2005), it can be observed that, based on the frequency of individual events, the number of victims (a total of 363 004), and the damage caused (a total of \$219 173 000; Urban habitat, 2010), volcanic eruptions are significantly over-represented in the textbooks (Table 4). On average, they are included on 27 % of all pages describing natural disasters, even though they resulted in only a few victims and little damage compared to other types of natural disasters. Nearly a third of the pages contain descriptions of earthquakes, which is understandable because they have caused the largest number of victims (89 %) and a third of the total damage. In the past hundred years, floods have been extremely frequent in Europe (representing nearly 40 % of all disasters), causing 44 % of the total damage. Therefore, it seems more than appropriate that nearly a quarter of all the pages are dedicated to floods; moreover, the actual share of pages could be even higher. Landslides are described on 10 % of the pages, and are thus covered well given the frequency (8 %), the number of victims (5 %), and damage (1 %) they have caused in the past hundred years. Storms, which are very frequent (24 % of all the events), are only described on 9 % of the pages, which means they are underestimated considering they have caused 19 % of damage and 2 % of victims in Europe. Very little space (1 %) is dedicated to forest fires, even though based on the

frequency of their occurrence (7 %), they represented a huge problem in Europe during the period studied. Tidal waves and tsunamis are rare and therefore textbooks do not dedicate much attention to them (1 %; Urban habitat, 2010).

It can be concluded that, based on the economic damage caused in Europe by natural disasters during the past century, textbooks dedicate too much attention to volcanoes and landslides and too little attention to earthquakes, floods, and storms. Given the number of victims in Europe during this same period, the textbooks place sufficient emphasis on earthquakes and floods, and an overly large emphasis on volcanoes.

Looking at the concrete examples of natural disasters described, the readers of these textbooks get the impression that they occur more frequently outside Europe; that natural disasters have a greater impact on life on other continents and not as much in Europe or in their local environments.

The total ratio between the examples of events of natural disasters in Europe and other continents is 1 : 2.3 (Table 5). Among those in Europe, volcanic eruptions in Italy are most frequently described (altogether more than 1/3 of European examples), especially the eruption of Mount Vesuvius in 79 AD, which destroyed Pompeii.

This imbalance toward non-European hazards and disasters, respectively, is perhaps due to the fact that out of Europe disasters are more “spectacular” or cause higher levels of casualties and economic damage (Zorn and Komac, 2011), and are therefore more often reported in the media.

3 Conclusions

Education about natural hazards starts in early childhood through familiarization with the environment in which the child lives and that natural processes characteristic of it. It continues throughout life, corresponding to each person’s age, risks, duties, and responsibilities. It should cover not only the prevention of professional risks, but should be extended to all areas of activity, child or adult, that are related to the risks posed by natural hazards, particularly through the inclusion of training for various situations.

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Proper means to address and reach all relevant individuals and communities should be defined, depending on the characteristics of the society. A major difficulty, however, arises from the fact that people usually sooner or later leave formal teaching institutions. Adults usually might have a prejudice against the idea of returning to school although adult education does not necessarily mean returning to school. Therefore different methods of education, such as meetings or workshops, seem to be more appropriate.

However, also in modern society risk education is impossible without basic scholarly, cultural (including humanitarian), and psychophysical awareness of knowledge mediators, in modern society these being primarily school teachers. Risk education at school should comply with the specific characteristics of each country, but its principle objectives need to be long-term, although we should also focus on short-term activities to train children to protect themselves, to escape hazards (e.g. the example of the British girl that suitably responded to the natural developments leading to the arrival of the destructive tsunami in Asia in 2004; Education, 2013), and to be ready to administer first aid). Education about natural hazards should focus on the establishment of a “culture of risk” or a “culture of resilience and prevention” (Komac et al., 2011, p. 14)

Besides educating children, the most important issue in this regard is the necessity to train teachers in new knowledge and skills related to natural hazards. Increasing knowledge and skills raises their awareness and changes their perception of risk and personal responsibility, and therefore their impact on behavior. But knowledge of potential reactions to a threat does not equal knowledge of actual behavior in the face of a natural disaster (Riad et al., 1999) or in other words: “perceived responsibility plays an unimportant role in the (flood) preparedness decisions” (Terpstra, 2009, p. 139).

At the level of implementing this topic, there is a need for greater awareness of the special features of risk education, a need for proper materials and other resources, including cooperation with experts, local stakeholders and authorities, which in turn results in the need of sufficient funds available and the need for pan-European efforts in this area. An example is “Memo’Risks” (2012), which was developed and applied in the

Loire River catchment (France). It brings together local government and schools in order to survey local disaster risk situations and awareness. The results not only support the knowledge and motivation bases of pupils it also documents the risk perception and local knowledge about hazards.

5 Ideally, risk education is a capacity building strategy of promotion of safety that encourages positive behavior, leading to modification of societal and individual risk states and behaviors that prevent people from living a safe life. Therefore, risk education should be included in mainstream school curricula and it should aim to assist people in forming positive attitudes and practices and to participate in wider civic processes.
10 E.g. in Slovenia a step was made in this direction by introducing a special elective primary school subject titled “*Varstvo pred naravnimi in drugimi nesrečami*” (Protection against natural and other disasters) for pupils between twelve and fourteen years old (Andrejek, 2010).

15 In this regard we have to mention the basic geographic question of “place” because every natural disaster occurs under specific conditions (time) at a specific place. Knowing the “times” and “places” is essential to understanding the potential impact of natural hazards especially if the place is personalized, related to person’s everyday life. In this regard, many European textbooks still need considerable improvement, yet this is by far not to suggest restricting the teaching of natural hazards and disasters to “European”
20 ones. But to develop applicable social capacities, cases from familiar settings will help to motivate the next generations for dealing with and learning about natural hazards.

Acknowledgements. Research reported in this paper is result of CapHaz-Net Project supported by Seventh Framework Programme. Authors are thankful to Annett Steinführer for her support with textbooks analysis in Braunschweig.

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Table 2. Countries and basic information on textbooks examined.

Country	No. of textbooks	No. of textbook pages	No. of pages containing descriptions of natural disasters	Share of pages containing descriptions of natural disasters
Albania	3	656	6	0.91
Andorra	0	0	0	0.00
Austria	4	911	19	2.09
Belarus	3	868	3	0.35
Belgium	7	137	43	3.12
Bosnia-Herzegovina	6	1083	21	1.94
Bulgaria	0	0	0	0.00
Croatia	4	748	11	1.47
Cyprus	0	0	0	0.00
Czech Republic	3	374	2	0.53
Denmark	5	407	46	11.30
England/Wales/Scotland	7	1952	163	8.35
Estonia	3	543	18	3.31
Finland	8	1400	41	2.93
France	4	1452	16	1.10
Germany	10	2226	105	4.72
Greece	2	386	9	2.33
Hungary	7	1225	35	2.86
Iceland	7	663	33	4.98
Ireland	6	1220	26	2.13
Italy	3	1362	24	1.76
Latvia	3	689	14	2.03
Liechtenstein	0	0	0	0.00
Lithuania	3	595	4	0.67
Luxemburg	0	0	0	0.00
Macedonia	5	810	23	2.84
Moldova	3	714	14	1.96
Netherlands	5	1375	62	4.51
Norway	2	720	32	4.44
Poland	5	1618	63	3.89
Portugal	3	1010	15	1.49
Romania	3	399	24	6.02
Russia	5	1546	2	0.13
Serbia	5	1020	36	3.53
Slovakia	3	254	0	0.00
Slovenia	7	831	34	4.09
Spain	4	1614	57	3.53
Sweden	3	1060	31	2.92
Switzerland	6	1658	26	1.57
Turkey	3	741	52	7.02
Ukraine	6	1514	5	0.33
Total	166	35 781	1115	

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Table 3. Frequency distribution of countries regarding the share of pages describing natural disasters.

Share of pages describing natural disasters	Number of countries	Share of countries
<1 %	7	19.4 %
1–2 %	7	19.4 %
2–3 %	8	22.2 %
3–4 %	5	13.9 %
4–5 %	5	13.9 %
>5 %	4	11.1 %
Total	36	100.0 %

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Table 4. Share of textbook pages describing natural disasters, share of described examples of natural disasters, and share of occurrences, victims, and damage caused by individual types of natural disasters in Europe from 1900 to 2005 (Urban habitat, 2010).

	Share of pages describing natural disasters (estimate)	Share of described examples of natural disasters (estimate)	Share of occurrences, 1900–2005 (total = 1126)	Share of victims, 1900–2005 (total = 363 004)	Share of economic damage, 1900–2005 (total = \$219 173 000)
Earthquake	29%	28%	21%	89%	34%
Flood	23%	21%	39%	3.1%	44%
Landslide	10%	5%	8%	4.7%	1%
Volcanic eruption	27%	31%	1%	0.2%	0%
Forest fire	1%	3%	7%	0.1%	1.7%
Storm	9%	11%	24%	2%	19.1%
Waves and tsunamis	1%	2%	0%	0.7%	0%

Note: This estimate does not include data referring to erosion, avalanches, and drought, which represent a total of 20% of examples described in textbooks, because data on the number of victims in Europe caused by these types of natural disasters during the past century were not obtained.

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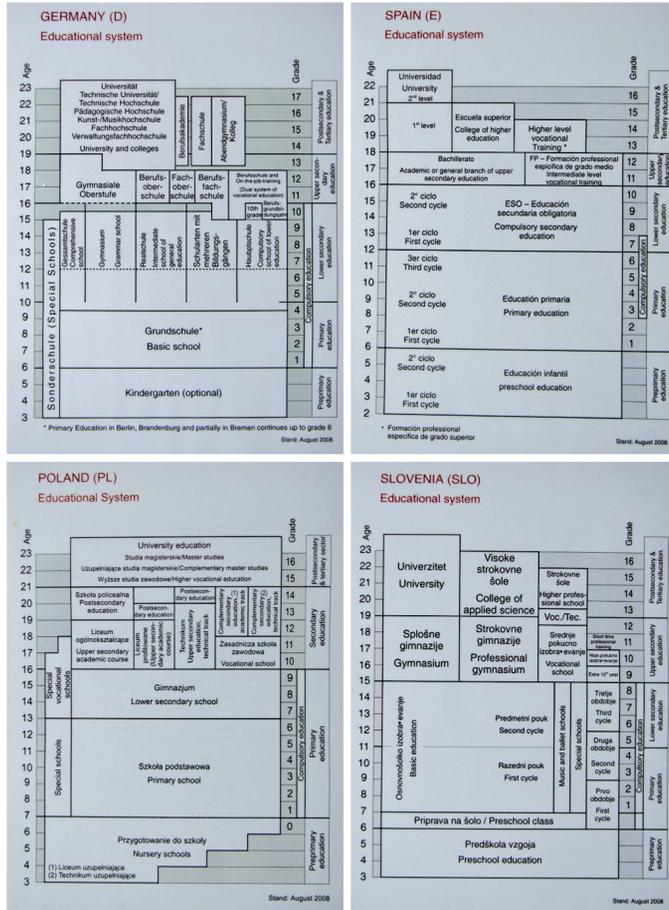


Fig. 1. Selected examples of school systems records as kept by the Georg Eckert Institute for International Textbook Research.



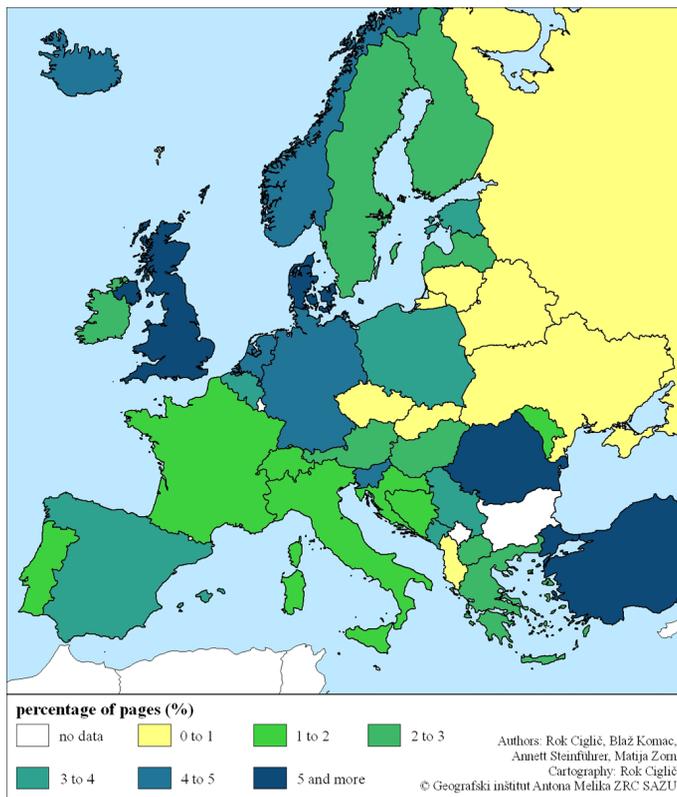


Fig. 2. Share of textbook pages containing descriptions of natural disasters.

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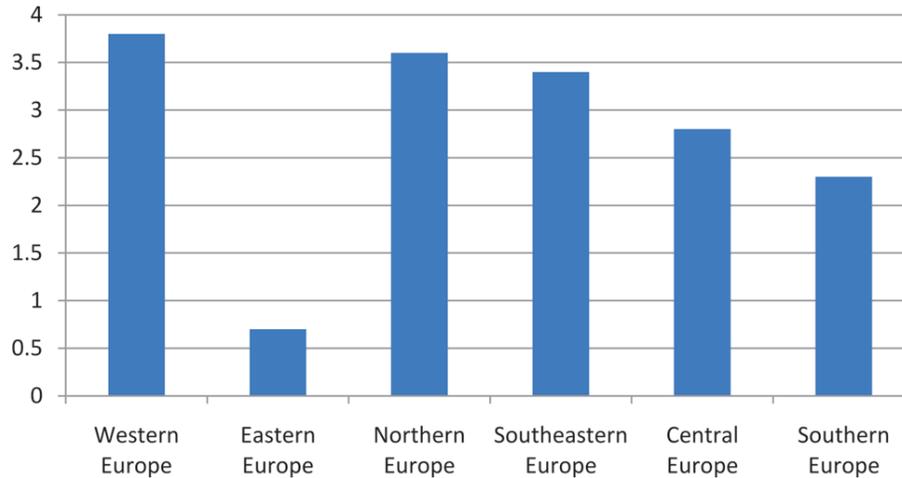
**Fig. 3.** Share of textbook pages describing natural disasters by European regions.



Fig. 4. Front pages of some European high school geography textbooks studied in the research.

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