

The Treatment of Natural Events in Geography Curricula for Secondary Schools in Germany

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Abstract. This article explores how the German school curricula for geography in lower secondary schools deal with the term natural event, including hazards, risks, and catastrophes. It relates the selection of Germany's lower secondary curricula with the idea that geography is only a scoring subject in these schools and that today's children should be treated as the adults of tomorrow. The organization of German education in 16 autonomy regions is briefly described. The authors use the content analysis in combination with quantitative and qualitative research methods. This study includes all secondary curricula published by the regional educational ministries from 2014. After developing a category system, this paper first conducts a quantitative analysis of the terms natural risk and catastrophe, and then investigates the related contents. The outcomes of such curriculum analysis are also presented graphically. The results show that the terms as well as the contents related to them are not implemented in the same manner. A look at the terms will mostly provide the term natural catastrophe, followed by the term natural event. A close look at the kind of natural catastrophes mentioned in the curricula indicates that such catastrophes are not really relevant in the context of Germany.

Keywords: natural catastrophe, secondary curricula, Germany, content analysis

1. Introduction

Global statistics reveal a massive increase in the number of disasters and disaster impacts within the last few decades. Natural disasters have caused more than "3.3 million deaths and \$2.3 trillion is needed to mend the consequent economic damages in the last four decades" (WB, 2010, p. 10). Thus, the process of preventing and reducing natural hazards has gained in importance (Stoltman et al. 2004, p. 6). In this context, young people are educated on the basis of the idea that they would multiply the human race and that they are the adults of tomorrow. 'Hazards education in schools can play a vital role in increasing a community's capacity of being ready, willing, and able to do what is necessary to prepare for and respond to a disaster' (Stoltman et al. 2004, p. 95). Also, geography gives the possibility to study the complex relationships between human beings and the environment. On the one side students learn to understand the physical process and socio-cultural systems, as well as they broaden their perspectives about the changing of the environment. For these reasons, geography is the perfect subject for teaching natural hazards (Geipel, 1996).

A close look to the history of geographical education in Germany shows us that natural hazards have long been part of geography lessons. Natural hazards were mentioned even in German school books published in 1926, and a lot of studies having interests in geographical themes show that pupils are hugely interested in natural catastrophes and they are the most chosen subject in geography lessons across all school types and classes in Germany (Hemmer and Hemmer, 2006). An interesting question is: exactly, which role do natural catastrophes play in the instructional system of the subject geography? The design and spread of curriculum materials is one of the oldest strategies for influencing classroom instructions (Dow, 1991). For this reason, the authors analyse in this article the current situation of natural hazards in the school curricula of lower secondary schools in Germany.

2. Theoretical base

In this chapter, the current stage of research regarding natural hazards is shown. Also, the terms natural hazards, natural events, natural risks, and natural catastrophes are defined, and a short insight into the German curricula situation is given.

2.1 Research review

Stoltman et al. (Stoltman, 1996) describes how natural hazards were treated in the curricula of different nations, such as Australia and France, at the end of the 20th century. In England, the topic of natural disasters has been focused in the national curriculum on tectonic processes, geomorphologic processes, and weather and climate issues which basically falls into the category of physical geography (Sinha et al., 2009, p. 11). In France, the topic of natural catastrophes forms a fixed part of the school curriculum since 2001 with the title 'Les sociétés face aux risques'.

In Germany, the topic of natural hazards has a long tradition in geography lessons and they are mostly taught as a part of physical education. First publications on this topic in German geography didactic papers were in the year 1968 (Bauer, 1969; Fick, 1970; Brucker, 1976; Birkenfeld, 1982, Geipel 1982). It seems that interest in this theme gradually faded in the 1990s. There are only a handful of articles on this topic in this decade. Since 2000 there have been special issues that have been treating this theme from the perspective of geography didactics (Geographie Heute [2000], Praxis Geographie [2008]). The newest publications are from Hemmer et al. , 2011, and also from Otto, K. H (2011).

The investigation gap in Germany implies that national hazards have not been systematically investigated till now, which holds true for the kind represented in the current curricula in German lower secondary schools.

2.2 Definitions: Natural event, natural hazard, natural risk, and natural catastrophe.

Cutter (2001, p. 3) says, 'The distinction between hazard, risk, and disaster is important because it illustrates the diversity of perspectives on how we recognize and assess environmental threats (risks), what we do about them (hazards), and how we respond to them after they occur (disasters).' For this reason the phenomena of natural event, natural hazard, natural risk and natural catastrophe will be explained.

2.2.1 Natural event.

Dikau and Weichselgartner describe the appearance of natural processes like inundations and volcanic eruption a natural event. If the natural event goes beyond a certain limit, people see the natural event as a danger. This limit varies from one person

to another and differs from one society to another; it also changes over time (Dikau & Weichselgartner, 2005). The reasons for the appearances of such natural processes can be meteorological, geological, or biological (Plate, 2001). Natural events have no human danger (Dikau et al. , 2007). One example is inundations in and around Greenland, as they do not bear damage to people and anything having material value (Dikau et al. , 2007).

2.2.2 *Natural hazards.*

Dikau and Weichselgartner (2005) define natural hazard as a natural process that contains a potential threat for the lives and the property of human beings. The frequency and dimension of such natural processes exceed a certain level: which is related to damage to people or the living ground. 'In a more strict definition natural hazards show the possibility that in future a natural event will occur which causes damage' (Dikau et al. , 2005, p. 180). Normally authors concentrate on humans (which, we might note, is anthropocentric). Natural hazard have to be distinguished from an extreme event and a disaster. The definition of an extreme event is an unusual event; it does not necessarily cause harm.

There are different categories of natural hazards: geological hazards, hydrological hazards, meteorological hazards, and biological hazards (Dikau et al. , 2007).

2.2.3 *Natural risk.*

The term risk is closely related to natural hazard. It is described as 'a situation or event, which overwhelms local capacity, necessitating a request to national or international level for external assistance; an unforeseen and often sudden event that causes great damage, destruction and human suffering. With reference to natural hazards, the definition of risk very often is expressed as a product of two or more components'. Ansell and Wharton (1992) express it in the following way: 'risk = (likelihood of hazard occurrence) x (consequence), where the likelihood is expressed as a probability (e.g., 20%) or frequency (e.g., one in five years) of the occurrence of the disaster' (Ansell et al, 1992). The consequence means measuring the consequences of the hazard to people as well as houses and natural environments (Ansell & Wharton, 1992). It can be regarded as a mixture of three different aspects: people , who will die, people who will be injured and the damage to the environment.. The definition was confirmed by Tobin & Montz (2007), but they use instead of consequences the term vulnerability: risk= (hazard probability) x (vulnerability). 'Vulnerability is defined as the potential for loss (human, physical, economic, natural, or social) due to a hazardous event; it is the characteristics and circumstances of a community, system or asset, which make it susceptible to the damaging effects of a hazard' (UNISDR, 2009, p. 30). The scale to measure it ranges from zero to one. Risk elements are objects in an endangered area, and they are embraced as a consequence of differently used monuments (e.g., places to live), infrastructure (e.g., streets), any kind of usable surface (e.g., industrial areas or agricultural fields), and people living in these areas (Dikau et al., 2007, p. 1033).

2.2.4 *Natural catastrophe.*

The question is when a natural event becomes a natural catastrophe? The definitions of both the terms are very general, and they only relate to the term catastrophe. For example, Mechler (2004) defines natural catastrophe as an 'exceptional natural event with heavy effects for the human being and the economy'. Natural catastrophe presents a large dimension; it comes suddenly and unexpectedly in a short period. It can claim human sacrifices and cause widespread economic damage (Dikau & Weichselgartner, 2005). To measure these effects and compare it between different events, events have to

be classified. Normal criteria are the number of deaths, injured people, the damage to the economy, or the costs required for rescue and search action. Mechler (2004) says that a natural catastrophe causes the attacked region's self-aid capacity to exceed and hence the region needs supra-national or international aid. In general, this happens if the amount of deaths exceed thousands and there are large numbers of homeless people, or if there is extensive economic damage.

2.3 Curricula situation in Germany, especially for the subject geography.

Curricula are a very important element, to transmit information about natural events to the children at school. They give the baseline for teaching, the content of teaching and the objectives of teaching (Böhn, 1997). Case studies have become increasingly important in curricula—which follow the principles of exemplarity— because it is no longer possible to have encyclopedic knowledge due to the increasing amount of information (Senegačnik, 2005). There is a federal governmental system in Germany, and each of the 16 regions have their own curricula. Contents and aims can be understood in particular historical and social backgrounds. Each region has its own curricula and they are somehow different in certain details. Also, one can get information about the themes and the contents of the topics. Besides this curricula give overviews about the didactic and methodological use. Furthermore, the curricula contain introductions to the didactic and methodological implementation. And finally, one can find suggestions relating to teaching lessons. The curricula in Germany is supervised from the education ministry and thus they are authorized instructions; teachers have to stick to these instructions. In a lot of curricula the content is rather vague and hence the teacher has to decide how to fill the content (Ikonen, 2009).

In nowadays each regional government installs a curriculum commission, which creates a new curriculum in discussion with different social groups. It is not possible to present the process for all 16 regions. For this reason, the authors now provide a deeper insight into the process of curricula planning for Bavaria. The most important institution is the Ministry of Education and the State Institute of School Education and Investigation for Education ('Staatsinstitut für Schulpädagogik'). The Institute of School Education belongs to the Ministry of Education and follows its orders. A curricula commission is responsible for the precise development of specific school subjects., which chief is the representative of the subject in the ISB. Ministry officials normally appoint five teachers after the proposal of the Institute of Education; the teachers, while still working at their schools, join the commission. Besides, can be included advisors like scientists from the didactic part or the subject part of the university (Hopmann, 2010).

The contents of the curricula and standards form the base of schoolbooks and thus if the theme does not appear there, there is scant chance that it would appear in the schoolbooks (Ikonen, 2009).

The following questions emerge after going through the theoretical part:

- Which terms of natural hazards are used in different curricula?
- Which kind of natural hazards are presented in the curricula?
- Which content is related to the theme natural hazards?
- Which regions are related to the examples of natural hazards?
- What are the similarities and differences between the different curricula of the regions in terms of natural hazards?

2. Methods and resources

To analyse the curricula of the different regions in more depth, a special method known as content analysis has been chosen. Cohen et al. (2007) define content analysis simply as the process of four 'C's, namely coding, categorizing, comparing, and concluding. In addition, categorizing refers to developing meaningful categories into which words, phrases, sentences, among others, can be grouped as the units of analysis, while comparing means establishing connections between the categories. Finally, concluding stands for drawing theoretical considerations on the basis of the text and the results of the analysis (Cohen et al., 2007).

The author has used a combination of quantitative and qualitative methods in the method of content analysis (Mayring, 2002).

2.2 Quantitative and qualitative method.

2.2.1 Quantitative analysis.

Quantitative methods are used to measure different aspects, such as word places or dates of the curricula, in terms of frequency. In this investigation the categories are denoted by different terms like natural event, natural hazard, natural risk, natural catastrophe as well as by different kinds of natural hazards (e.g. earthquake) and the region related to them.

2.2.2 Qualitative analysis.

Zhang and Wildemuth (2009, p. 308) outline that the 'qualitative content analysis goes beyond merely counting words or extracting objective content from texts to examine meanings, themes and patterns that may be manifest or latent in a particular text'. In this article, the authors look at the content of the different natural hazards. According to Flick (2010, p. 405) mixing of qualitative and quantitative methods as a possibility for triangulation is 'used as a strategy of improving the quality of qualitative research'.

2.2.3 Trustworthiness.

In the case of content analysis, reliability goes along with the notions of stability, reproducibility, and accuracy (Weber, 1990, p. 120). To guarantee this, the categories have to be clearly defined and have to possess the intercoder reliability, which means that the same results of coding are obtained from two different coders. Such intercoder reliability has a value in this case 0.8 (Weber, 1990, p. 121).

2.2 Resources.

To fully capture the topic of natural hazard one has to start with the curriculum since it is the foundation for any schoolbook. The study includes every German curriculum used in lower secondary schools throughout 2014. Curricula always indicate developments in the field of education and current discourses within society (Apel, 1991, p. 6). They also provide answers to contemporary challenges. The topic of natural hazard is one example of these challenges. The authors chose geography because recent studies have not considered it in this form. The 16 federal states of Germany have cultural sovereignty, which leads to different curricula for geography across the nation. This diversity complicates a study for the entire federal territory. In total, the authors have analysed 60 curricula—all of them were represented in a digital manner so that an electronically keyword research was possible.

3. Results: Investigation of the secondary geography school curricula

In this section, the findings of the comparison between the different secondary curricula are given.

3.1 Some important results in relation to the terms natural event, natural hazard, natural risk, natural catastrophe.

3.1.1 Quantitative perspective.

First the results to the frequency of the categories natural event, natural hazard, natural risk, and natural catastrophe in the secondary curriculum are shown.

region	terms								grade	
	natural event		natural hazard		natural risk		natural catastrophe			
	R	G	R	G	R	G	R	G	R	G
BW		X					X	X	8	6
BY					X	X	X	X	5	7,10,11
BE							X	X	7,8	E
BB							X	X	7,8	7,8
HB										
HH							X	X	6	6,10
HE				X				X	9	6,8,E
MV							X	X	7-10	7-10
NI	X								8	
NRW			X	x					7-9	7-9
RP		X					X	X	7,8	7,8,11
SL	X						X	X	7,8	7,E
SN				X		X	X		6,7,8	6,7,11
ST	X						X	X	5,6,7,8	5,6,7,8
SH						X		X	5,9	
TH	X	X			X	X			6	6,8
Σ	4	4	1	3	2	4	10	11		

Table 1: Terms in the current curricula of geography in lower secondary schools in different regions of Germany

(R: Realschule; G: Gymnasium;

BW: Baden-Württemberg; BY: Bayern; BE: Berlin; BB: Brandenburg; HB: Bremen; HH: Hamburg; HE: Hessen; MV: Mecklenburg-Vorpommern; NI: Niedersachsen; NW: Nordrhein-Westfalen; RP: Rheinland-Pfalz; SL: Saarland; SN: Sachsen; ST: Sachsen-Anhalt; SH: Schleswig-Holstein; TH: Thüringen)

Table 1 shows that there is no term used in the curricula in Bremen (HB). The term used by different commissions is natural catastrophe, followed by natural event, which is used in seven regions, and then natural risk, which is used in four regions, and finally, the term natural hazard, which is used in three regions. In the regions Niedersachsen (NI), Nordrhein-Westfalen (NW) and Thüringen (TH), the term natural catastrophe simply does not appear. Only two terms appear in most cases. Only in Sachsen (SN) three terms can be found: hazard, risk, and catastrophe.

A qualitative interview investigation with the people of the commission can show the reasons behind the absence of terms in the curricula of Bremen (HB). One significant result is that the term natural catastrophe appears very often – this is because German schools usually start teaching natural events by showing the effect of a catastrophe to the children (Haubrich, 2006, p. 285). As there are schoolteachers in the commission, the term natural catastrophe plays an important role for them. Another possibility could be that people in general do not really distinguish between these different terms (Pohl et al., 2002, p. 55). If the different terms do not appear in the same curricula, cannot really be expected that schoolbook authors would emphasize the different meanings of these terms (Lichtenstein-Rother, 1970, p. 75).

Regarding the term column, it will be apparent that natural hazards are not a continuous theme that appears every school year; in most cases, it is fixed to one or two classes. Only in Sachsen (SN) and Sachsen-Anhalt (ST), the theme goes through the whole school life of the children.

4.1.2 Qualitative perspective.

In the qualitative perspective the authors will provide examples as to how the terms natural hazard, natural event etc. are described in the curricula. In many cases, the terms are only mentioned without any comment. For example, in the curricula of Hessen, one will find the term natural catastrophe or calculable natural hazard. In the curricula of Baden-Württemberg Realschule, one can read, for example, that ‘the natural hazards and their effects are continuous threat for humanity’. This sentence emphasizes the negative effects. In the curricula of Sachsen, the planners used a more neutral formulation to live with natural hazards. In some curricula, however, the terms are not only mentioned, the people of the commission sometimes put them in relation with a special natural hazard. In the curricula of Baden Württemberg, Berlin, Mecklenburg-Vorpommern and Saarland, the natural hazards come along with natural hazards out of the geomorphological direction. In the curricula of Sachsen und Mecklenburg-Vorpommern, the people of the commission use the terms in connection with climate change. No curriculum was found which define the terms as well as no difference between the terms natural event, natural risk, natural hazard, and natural catastrophes were made.

In no curriculum you can find a wide definition of the terms and that there is indeed a difference between. An interesting question is how this situation has actually evolved. The main reason is that the curricula in Germany are very vague and thus there are not much information about the theme to ascertain the direction in which it should be taught (Ikonen, 2009).

Lernbereich 4: Der asiatisch-pazifische Wirtschaftsraum		6 Ustd.
Kennen ausgewählter Staaten und Hauptstädte sowie Inseln Einblick gewinnen in den asiatisch-pazifischen Wirtschaftsraum - Lage, Abgrenzung - Leben mit Naturgefahren - Stellung in der Weltwirtschaft Kennen der dynamischen Wirtschaftsentwicklung an einem ausgewählten Staat - Wirtschaftsstruktur - Ursachen für den wirtschaftlichen Aufstieg	Arbeit mit Tabellen, Diagrammen, statistischem Material aus dem Internet → Kl. 7, LB 1 ⇒ Informationsbeschaffung und -verarbeitung Japan, „Kleine Tiger“	

Figure 1: Section of the 5th grade natural event Ministry of Education (2014)

(Translation to live with natural events)

4.2 Kinds of natural hazards in the German curricula of secondary schools in Germany.

It is not only interesting to look at how the different terms are presented but also at the different kinds of natural hazards which are represented.

4.2.1 Quantitative aspects.

Table 2: Natural hazards in the current curriculum of secondary schools in Germany (R: Realschule; G: Gymnasium)

	region																		Σ			
	BW	BY	BE	BB	HB	HH	HE	MV	NI	NRW	RP	SL	SN	ST	SH	TH						
school typ	R	G	R	G	R	G	R	G	R	G	R	G	R	G	R	G	R	G				
natural hazard	R	G	R	G	R	G	R	G	R	G	R	G	R	G	R	G	R	G				
earthquake	X		X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	26
volcanism	X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	26
tsunami			X						X					X	X	X		X	X		X	8
inudation				X	X									X	X							4
taifun									X				X	X	X							4
monsoon				X	X				X													3
flooding													X	X								2
tornado									X													1
hurricane													X									1
avalanche													X	X								2
storm													X	X								2
stormflood													X	X								2

The most treated natural hazards in the curricula are earthquake and volcanism, followed by tsunamis. Inundation, taifun, monsoon, flooding, tornado, hurricane, avalanche, storm, stormflood reach between four and one references. The number of natural hazards mentioned in each region is also different: in Bremen (HB), they do not mention any natural hazards; in Sachsen-Anhalt (SN), the commission uses two different types; in Mecklenburg-Vorpommern (MV), Nordrhein-Westfalen (NRW), Berlin (BE), Baden-Württemberg (BB) and Hamburg (HH), the commission uses four different kinds of natural hazards. In Rheinland-Pfalz, one will find a variety of natural hazards.

These results are not easy to explain. The example of tsunami is one example that society had influenced the curricula. This natural hazard appeared after the tsunami catastrophe of 2004 (Blankertz, 1986, p. 124) Volcanic eruption and earthquake are in the first place. The answer could be that these are traditional hazards, and they are in the curricula for long, and that it is a kind of tradition to include them. Another aspect could be that these hazards are also very relevant in the context of national standards (DGFG, 2014). Also, the subject of tectonic plates plays a role in every curriculum, and, as a consequence, you also look at the natural hazards that emerge out of it, such as volcanic eruptions and earthquakes.

4.2.2 Qualitative aspects.

While conducting the qualitative analysis, the authors will have a closer look to the context in which the natural hazards are used. In most of the curricula, the authors only mention natural hazards without any commentary. In some curricula, such as the Berlin Gymnasium, the commission, when they talk about natural hazards to Germany, refers to German rivers like Rheine and Elbe. In fact, the curricula of Hamburg use the rivers Rhein, Mosel, and Elbe. However, these mentions are exceptions to the rule.

Volcanic eruptions and earthquakes are mostly mentioned. In the curricula of Hessen, Berlin and Hamburg, they refer this subject to south Europe. Hence, one can read in the curricula: 'South Europe, for example, [subjects you can choose for this region] are characterized by volcanic eruptions, earthquake, and irrigated cultivation' (Ministry of Education, Hessen, 2014). Berlin (BB) and Hessen (HE) also extend the commission's focus to Asia; while Hessen (HE), Sachsen-Anhalt (SH) and Sachsen (SN) provide the example of the San Andreas Fault Zone, and Mecklenburg-Vorpommern (MV) focuses on Ozeanien. The ministries issue guidelines regarding such example for the teachers and the commission decides which example they would take for classroom teaching.

In the Hessen curricula, the commission also talks about earthquake protection and volcanic eruption safety, and also mention the different types of volcanic eruptions. The curricula do not very often provide the kinds of natural hazard which are typical for Germany.

Figure 1 shows a visual representation of the results of the quantitative and qualitative analyses of natural hazards, risk, event and catastrophe, as well as of the kinds of natural hazards.

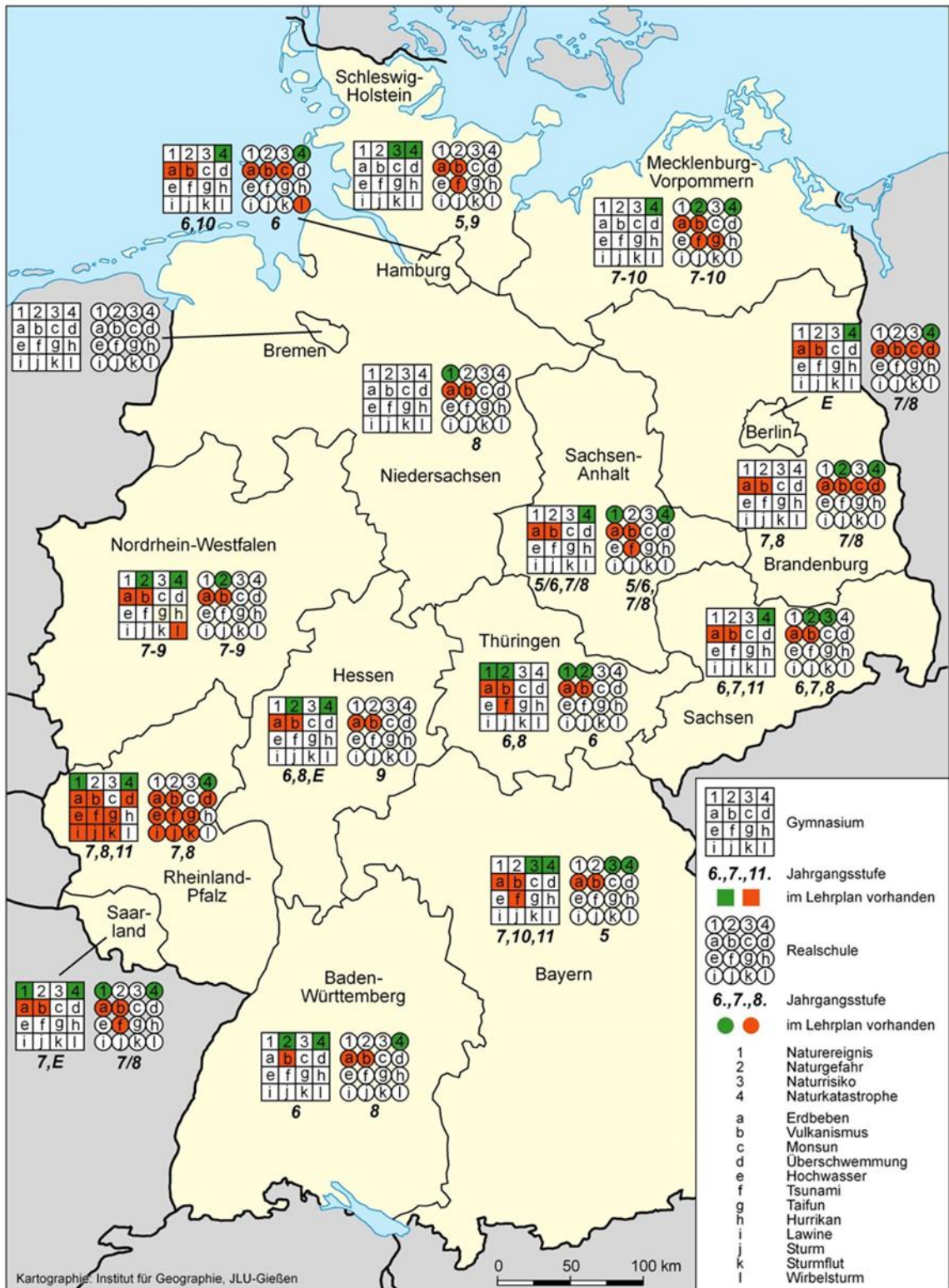


Figure 1: Natural catastrophes in the current school curricula in Germany (Designer of the map: Stefanie Zecha)

3. RESUME

This study provides a useful perspective regarding the manner in which the curriculum commission has implemented the subject of natural hazards in German curricula. It can be observed that the presentation of natural hazards differs from one region to another. A look at the terms will mostly provide the term natural catastrophe, followed by the term natural event. There are no discussions in the curricula about the different meanings of the different terms.

A close look at the kind of natural catastrophes mentioned in the curricula indicates that such catastrophes are not really relevant in the context of Germany. If the idea of natural hazards is taken from the respective regions, the curricula would do more than passing knowledge, it may encourage the learners to take an active part by examining the environment of their school buildings—they can go beyond the confines of the school yard to map their neighboring communities and meet consult their elders to gather knowledge about the extreme natural catastrophes that had taken place in the area. As a consequence, they will acquire a better understanding of the concept of disaster prevention (Petal, 2008, p. 25)

In future it would now be interesting to see, how are the natural catastrophes presented in school books and what presentation of natural catastrophes teachers have in their mind, because they teach it to the pupils.

Education in the field of natural hazards is actually all about increasing the capacities of the public to address natural disasters. The other way around: social capacity building is a key feature of education. The most important issue in this regard is the necessity to train children in new knowledge and skills related to natural hazards. Increasing knowledge and skills raise their awareness, and also change their perception regarding risk and personal responsibility, and consequently, their impact on behaviour (Riad et al., 1999).

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