CapHaz-Net

Social Capacity Building
for Natural Hazards
Toward More Resilient
Societies

Risk education and natural hazards

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Preamble

In this report we try to answer some questions which are necessary to answer before any effective implementation of risk (disaster) education can be achieved in the school curricula (cf. Singh 2004):

- Why should risk education be taught?
- What should be its content at various stages?
- How should it be taught?
- Who is responsible for transfer of knowledge and skills through risk education?
- What methods and strategies must teachers employ to be effective?

The review of risk education practices presented in this report has benefited from the expertise of many colleagues and education practitioners in a number of European countries. In particular, we would like to thank Annett Steinführer, Christian Kuhlicke, and Fiona Tweed for their help, comments to this report and its improvements. This version of the report is based on a draft version which was presented at a workshop at a Workshop in Ljubljana on June 7 to 8, 2010 to a wider audience of around 40 participants. At the Ljubljana Workshop we discussed the ideas presented in this report with a number of experts in this field, thus enabling us to improve the content of the report. We are grateful to experts from Austria, Germany, Switzerland, the United Kingdom, Italy, Spain, Norway, Finland, the Czech Republic, France, Slovenia, and Spain/Catalonia who actively participated in the workshop. We also thank our colleagues in the CapHaz-Net team for reviewing the draft report.
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Structure

Introduction

In recent decades, an important change has occurred with regard to comprehensive treatment of natural disasters: many countries have begun taking them into account in their sustainable economic development efforts and investment strategies. This also applies to developed countries where natural hazards are usually not perceived as an important social, economic or development factor. Preventing natural hazards and reducing their impact has become increasingly important, and education is acknowledged one of the most important activities in modern societies.

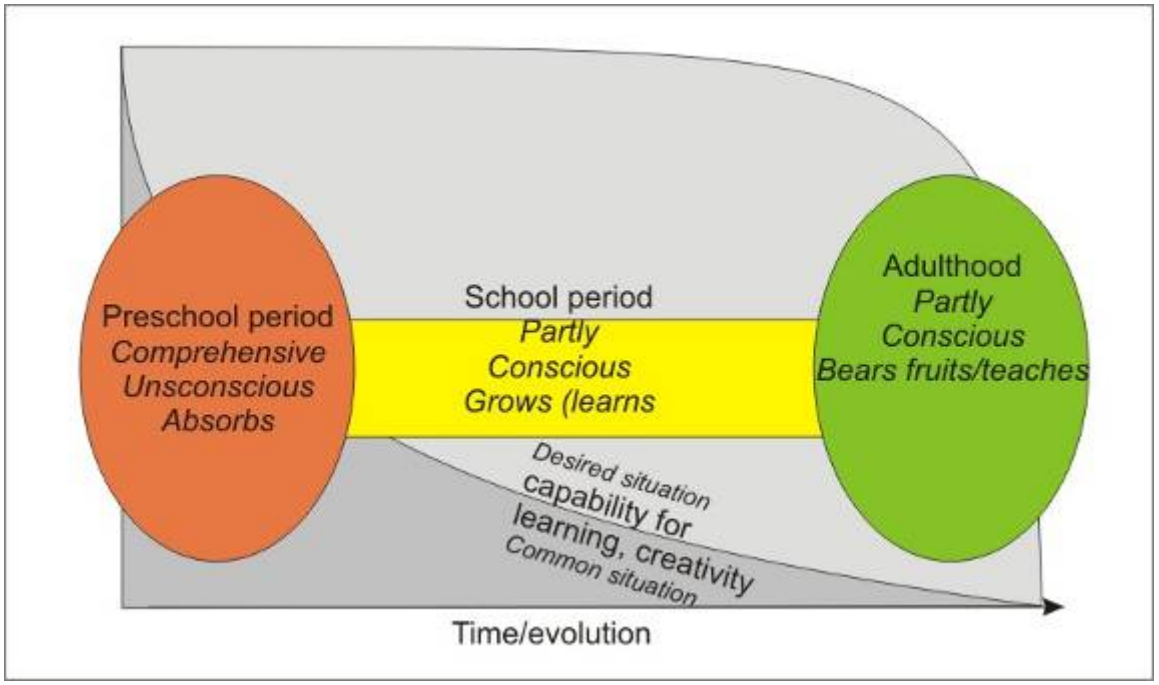

Figure 1: Evolution of education from preschool to adulthood period.

It is widely agreed that education for disaster reduction must become an integral part of any educational strategy aimed at promoting and creating thriving and sustainable societies (Towards a culture . . . 2007, 5). This is a very important issue because increasing the public's disaster preparedness may be crucial for saving lives and mitigating damage (Terpstra and Gutteling 2008, 67). The connection between social capacity building and education is also clear: building up national capacities is the best way to ensure the sustainability of educational activities over the long term (Wisner 2006; figure 1). We apply social capacity building to short term coping ability, long-term adaptive capacity and also the capacity of response with regard to disturbances, such as natural hazards (Gallopin 2006).

Risk education is related to risk communication and often it is difficult to put the boundary between them in practice. Risk education as defined in this report refers to the transfer of more generalised (thematic, organisational, technical) knowledge and skills on natural hazards and risks from professionals in teaching institutions (schools, providers of courses) to persons in schooling and training.

Since the school curricula differ conceptually even on the European level, knowledge is reflected also in the textbooks and in school practices. Risk communication on the other hand addresses the exchange of information, knowledge and attitudes between decision makers, experts, stakeholders, and the affected public and focuses on concrete risk situations (see in more detail Höppner et al. 2010).

Education also seems to be one of the crucial processes related to social vulnerability (cf. Janssen et al. 2006) – it has been noted that educating activities should be focused on presumably more vulnerable social groups, such as children or the poor, rather than society in general. By focusing on children we are both educating for lifetime and diffusing information better – children educate parents: "Junior, and senior secondary students are among the best diffusion agents for information about natural disasters, their occurrence, planned responses, and the means to mitigate effects" (Stoltman, Lidstone and DeChano 2004, 6), and "School children are excellent emissaries between home and school for information and mitigation practices relative to natural hazards and they can contribute significantly to raising awareness and public understanding of disaster vulnerability and issues" (Cardona 2004, 397).

This is one of the reasons why this report does not include analysis of tertiary education. Although risk education is a very important part of risk governance we usually don't recognize its importance because we often take it for granted. Risk education is tightly connected to awareness and behaviour: "It is believed that the number of deaths and injuries in natural disasters is significantly reduced if communities are aware of the risks they face and the disaster mitigation measures they can adopt … A population educated as to what to expect and how to react to a natural event can save lives and protect property" (Morrissey 2004, 395).

From the geographical perspective the problem of scale seems to be important, especially as regards education. Education comprises of activities of different kind which run on heterogeneous time and spatial scales. All these activities are hard to cover if one aims to make a review. In our research, we had to focus on formal education of children as it is reflected in geographical textbooks to make our research feasible; nevertheless, other educational activities are also referred to in this report.

As we tried to get a deeper understanding of the role of education, curricula and textbooks to social capacity building, we noted that the comprehension of natural hazards in different societies (in this study they are presented by different countries) also reflects general social development. We can glimpse that the "European risk education landscape" is far from uniformity and that a lot has to be done in this field of research. It is not a surprise that several research questions remain open. They are related either to suitability of different educational methods, the problem of different societies that should be addressed or simply to the purpose and aim of risk education in general.

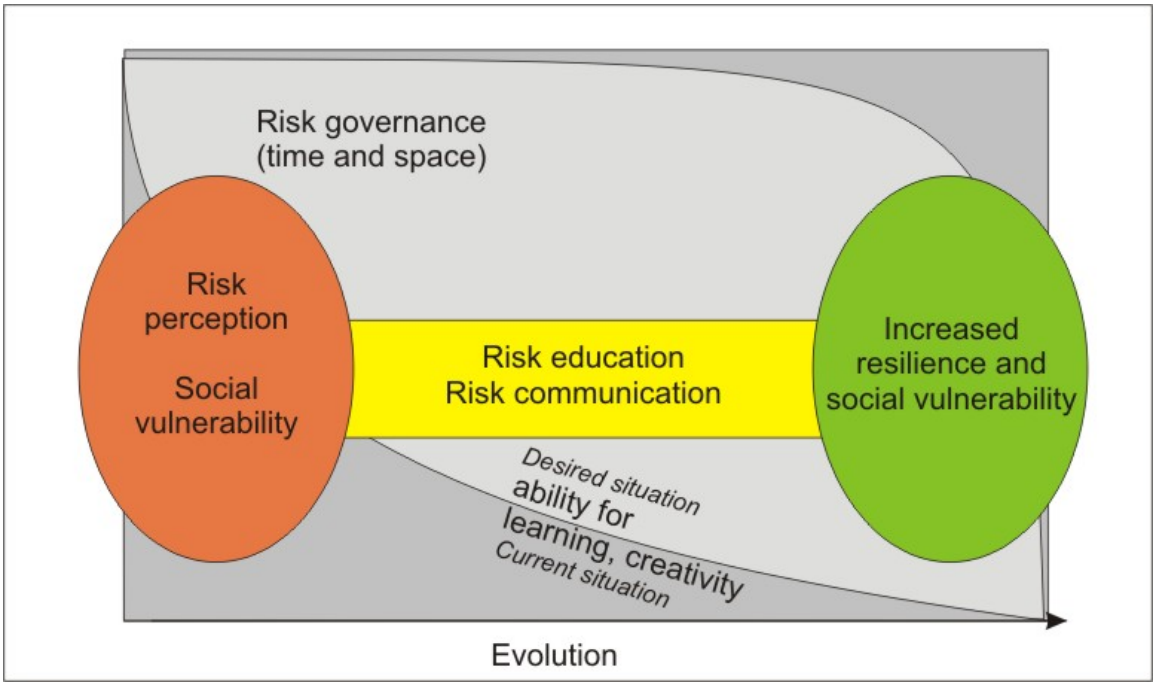

Figure 2: Education taking into account creativity within the structure of the CapHaz-Net project (current and desired situation).

The basic idea of the CapHaz-Net seems to be an excellent premise because this is one of the first projects that seek to shift the focal point of the perspective on natural hazards from a natural geographical to a social geographical or even sociological area. Here the basic question (What is the real goal of education?) can be understood from the perspective of risk governance, especially if the answer to the question is to build more resilient society. Risk education is useful only if it is a consistent part of "risk governance in time and space". Since the current situation is far from that in many fields and countries a shift in perception of risk education is needed. This would in turn help us to achieve the desired risk governance situation (see Figure 2). Because it is impossible to change all systems active in a region at various spatial and time levels, this shift can be achieved relatively quickly in education in particular because it follows a routine and well-established pattern practically around the entire globe. It would thus be possible to change the learning process by placing greater emphasis on creativity and incorporating it to a greater extent into a concrete time and place.

This change should be affected during preschool, and partly during primary- and secondary-school because this period is the most important in terms of human cognitive development: “By age three, abilities are being created, and after age three they are being improved” – any skills that children acquire from ages three to six remain with them their entire lives (Montessori 2008, 189). Children build their minds until they develop memory, and the ability to understand and think which they achieve around age six.

However, education begins only at this age and places too great an emphasis on the development of the mind. Usually great emphasis is placed on university education, during which the mind is developed by nearly adult people, who can already become parents themselves. We find it less important from the point of view of risk education because at this age people are already aware of relevant processes in the environment and already focus on topic-specific knowledge.

This kind of change of perspective in the future will clearly open new opportunities for studying natural hazards and adapting society to natural hazards, and stimulate a new

understanding of regional reality, which will contribute to social-capacity building. In this way we can also change the perspective of looking at the risk cycle (Figure 3) from usual 2D view to 3D view where risk governance (for details see the CapHaz-Net WP2 report on risk governance; Walker et al. 2009) is represented by a net of different activities such as risk perception, risk communication, and risk education (see Figure 2).

The 'net' is influenced by natural hazards which bend it according to their strength or impact. The 'net' may be put in previous position by taking different actions or by permanent activities such as risk education or communication. Depending on them is the 'gravitation' which influences the 'course' of a specific event.

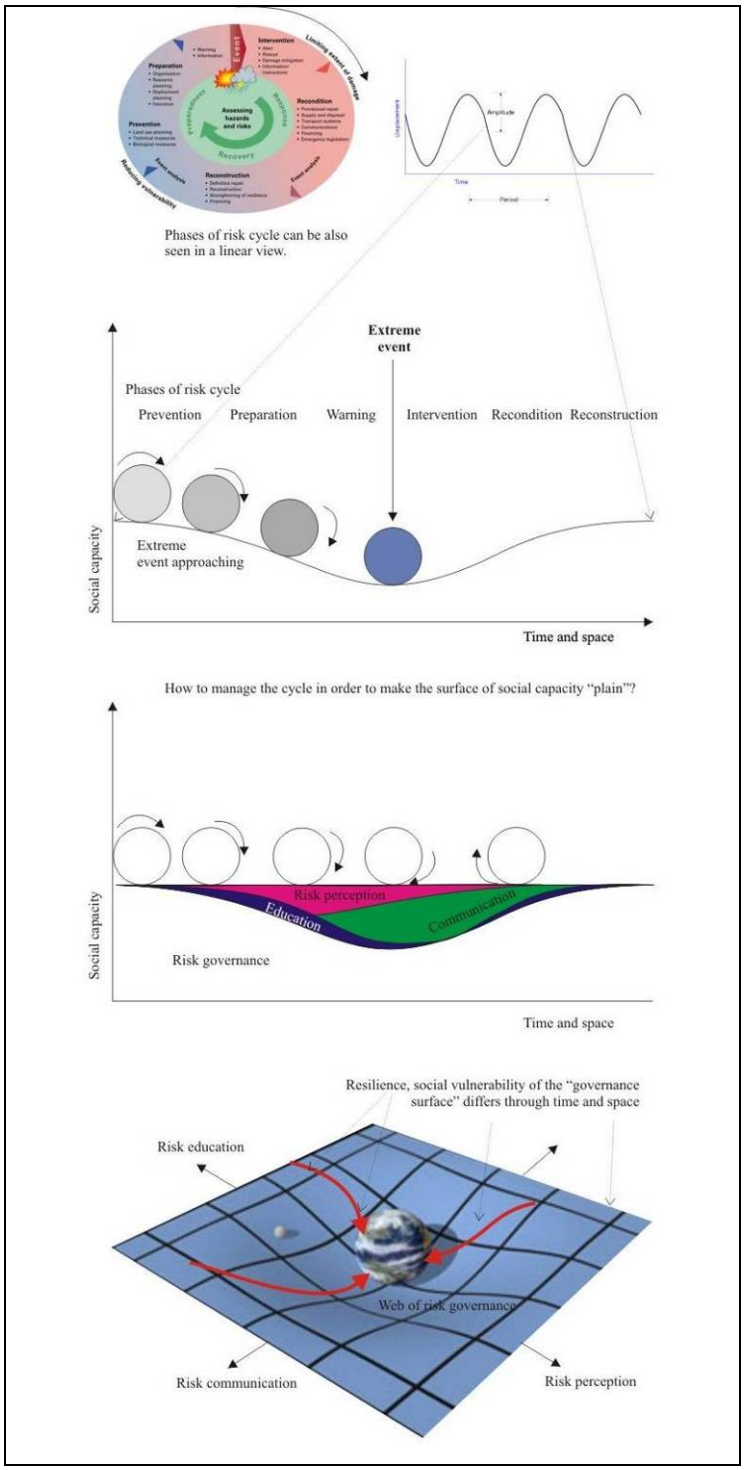

Figure 3: Risk governance within the structure of the risk cycle in 2D and 3D.

Education has to be brought as close as possible to people's perception of reality (see the CapHaz-Net WP3 report on risk perception; Wachinger and Renn 2010), which is based on psychological, emotional, cognitive and physiological properties (i.e., functioning of the brain). With regard to natural hazards, this can be achieved through a good knowledge of social vulnerability conditions (see the CapHaz-Net WP4 report on social vulnerability; Tapsell et al. 2010), experience with risk governance (Walker et al. 2009), and changed educational and communication activities. Not only nature (Gams 2001), but society as well constantly builds barriers and limitations that must be broken down through a "non-violent revolution of thinking" (cf. Montessori 2008, 233) in order for a free horizon to show itself. This will also increase the resilience of society and build social capacity in natural hazards.

Education in the field of natural hazards is actually 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 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 behaviour. But knowledge of potential reactions to a threat does not equal knowledge of actual behaviour in the face of a natural disaster (Riad, Norris and Ruback 1999) or in other words: "perceived responsibility plays an unimportant role in the (flood) preparedness decisions" (Terpstra 2009, 139). At the level of implementing this topic in schools 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 and other local stakeholders, which in turn results in the need of sufficient funds available. There is also a need to strengthen international social cooperation in risk education, especially in respect of education for post-conflict reconciliation and reconstruction, where the strategic dimension, assessment and capacity-building are in general neglected. To achieve higher level of social resilience to natural hazards and to enhance public understanding of natural disasters events as "ongoing, geographically diverse, and extending for more than just a few days when response and recovery are both considered, it is desirable to develop a broader general information base among the population" (Stoltman, Lidstone, and Dechano 2004, 2).

This can be done also by risk education activities which will improve the capacity of the population to comprehend the causes of natural disasters, to raise awareness of the processes and phenomena, to increase resilience of society, to increase personal and societal safety; this will ultimately result in behavioural change. Therefore, to raise social capacity in the field of risk education from the point of view of the scientific community three basic questions have to be answered (Stoltman, Lidstone, and Dechano 2004, 2):

- Where did the natural disaster occur?
- Why did it occur at that location or place?
- What can I do to help mitigating the effects or future risk?

Similar to health education strategies (Australian … 2010), risk education is a capacity building strategy of promotion of safety that encourages positive behaviour, leading to modification of societal and individual risk states and behaviours that prevent people from living a safe life. Risk education should be included in mainstream school curricula and it should aim to assist people in forming positive attitudes and practices.

Access to information seems to be of crucial importance to increase social capacity, which has been noted in other 'risk discourses'. Information access which can be improved also through education will result in improved understanding of processes and phenomena as well as of their consequences, and of effects of the mitigation strategies. 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.

Capacity building in terms of risk education therefore influences both, informational (early warning, prevention, mitigation, response) and implementation (recovery, development and planning) levels of disaster management. It includes development of human resources as well as development on the infrastructural and institutional levels (Muturi 2005).

The goal of risk education is therefore to improve and strengthen the capacity of education systems at the national, regional and local levels to achieve quality improvements in education activities. Further education should refer to all levels of social capacity building, namely individual, community, organization. On the individual level we should build individual knowledge and skills on risks and ways to act and the ability to find and understand information. We should also develop motivational resources such as self-confidence and their personal abilities to critically analyse information and to creatively engage in finding solutions to a problem, building personal responsibility. Psychological capacities should not be neglected in order to better cope with the psychologically adverse effects of hazardous events. On the community level social and organisational capacities should be developed by building networks between community individuals, groups and organizations and by focusing on local ownership of the education programme. Therefore social capacity building in risk education should include development of cohesion between all listed levels, improvement of knowledge and skills transfer (education methods), improvement of performance of education systems (evaluation), and program management (curricula).

Capacity building is increasingly gaining relevance in efforts to reduce the impacts of natural hazards and disasters. The Hyogo Framework for Action 2005–2015 contains several links to capacity building and inter alia especially mentions risk education: "the transfer of knowledge, technology and expertise to enhance capacity building for disaster risk reduction” (UN/ISDR 2006, 5).

In addition to the questions listed above the main question with regard to social capacity building (by risk education) still seems to be open because it is related to power relations and to changeable nature of the society: "Who has the legitimacy and the power to identify and define a ‘lack of capacity’? How is social capacity measured and by whom? What is the goal of social capacity building efforts? Are they the same for each individual, for each organization? What is the appropriate level of capacity building? What is or should the relationship between “capacity builder” and those lacing capacities be like?" According to their opinion we also have to admit that "social capacity building is usually applied with respect to non-European (or at least non-EU) countries" ... and that … "European countries were so far rather known as capacity builders; the idea that it is necessary to build capacities in Europe itself might sound somewhat awkward as it

implies that a deficit is also recognized on the part of contemporary European societies" (Kuhlicke and Steinführer 2010).

The European 'landscape of risk responsibility' between different state and non-state actors has changed much recently; the non-state actors are increasingly encouraged or even demanded by legislation to participate in the management of natural hazards. As it is described in this report on the case of Slovenia, also the European 'landscape of risk education' is a changing one. Therefore, social capacity building in Europe should not focus only on the present status but more on development and strengthening the links between institutions, on raising awareness and building capacities at all levels, in particular at the community level that can contribute to building resilience to hazards (Kuhlicke and Steinführer 2010).

This especially refers to risk education which is much more effective if it refers to local knowledge of past events in a specific area. Therefore, building social capacity by risk education should not rely (only on) changing the school curricula and preparing risk education programs but rather on educating the educators. Although risk education will still rely on teachers as individuals who are capable to transfer proper knowledge and skills to children (or any other group they teach), the improving information systems will also enable children to cope with ever larger amount of information they have to cope with. We are going to face stronger individualization of risk education which will be focused on local-specific hazards on one hand, while the education system is going to be more and more generalized in terms of methods on the other hand – building social capacity will therefore not rely only on education institutions, but rather on the capabilities of teachers and pupils in using the available information.

1 Relations between knowledge, learning, and education

Prevention begins with information. Awareness is the first step toward action. Awareness can trigger interest, interest can lead to attention, and attention can prompt action. As schools are the best venue for solving collective values, school students and teachers can serve as vehicles for building a culture of prevention.
(Towards a culture . . . 2007, 1).

1.1 Knowledge

Human behaviour is heavily influenced by the culture in which one has been socialized", where culture is "a system of attitudes, values, and knowledge (Inglehart 1997, 14–15).

Knowledge is the entire sum of information that a person imprints in his consciousness or memory through learning and studying. The information on objective reality that comprises this knowledge is logically organized and influences all human activity. According to the International Federation of Red Cross and Red Crescent Societies, conceptual framework data are the building blocks that create information. Information becomes knowledge when “it is put into a context that gives a meaning and, usually, some relevance to action or inaction” (Wisner 2006, 7). Knowledge covers universal, codified, and professional understanding, as well as local, often oral, vernacular bodies of knowledge.

One may distinguish between conceptual and procedural knowledge. Conceptual knowledge is based on data and information, and procedural knowledge is comprised of skills and abilities. According to how it is expressed, knowledge is also divided into memory, recognition, reproductive, operative, and creative knowledge; in addition, knowledge is often divided into declarative, procedural, and strategic knowledge (Tomić 1997, 15–22; Kolenc-Kolnik 2004, 9–10; Rutar Ilc and Žagar 2001, 12–14; cited in Senegačnik 2005).

If knowledge is regarded as a codified set of information, it is independent of the subject to some extent, and therefore it can be transferred to other people in the learning process (Figure 4). At the same time, the recipient or student also actively reshapes knowledge. Fran Orožen (1898; cited in Senegačnik 2005) emphasized the following in discussing geography classes: “It is also impossible for the student at this level to acquire the geographical knowledge he will need in his practical life. However, primary school must at least provide the student the extent of geographical knowledge, on the basis of which an adult husband and wife will be able to broaden their knowledge by themselves with regard to their practical needs.” If students assume an active role and interpret the transmitted knowledge, the teachers’ role is not to merely transmit knowledge (i.e., one-way communication), but to enter into dialogue with their students and motivate them.

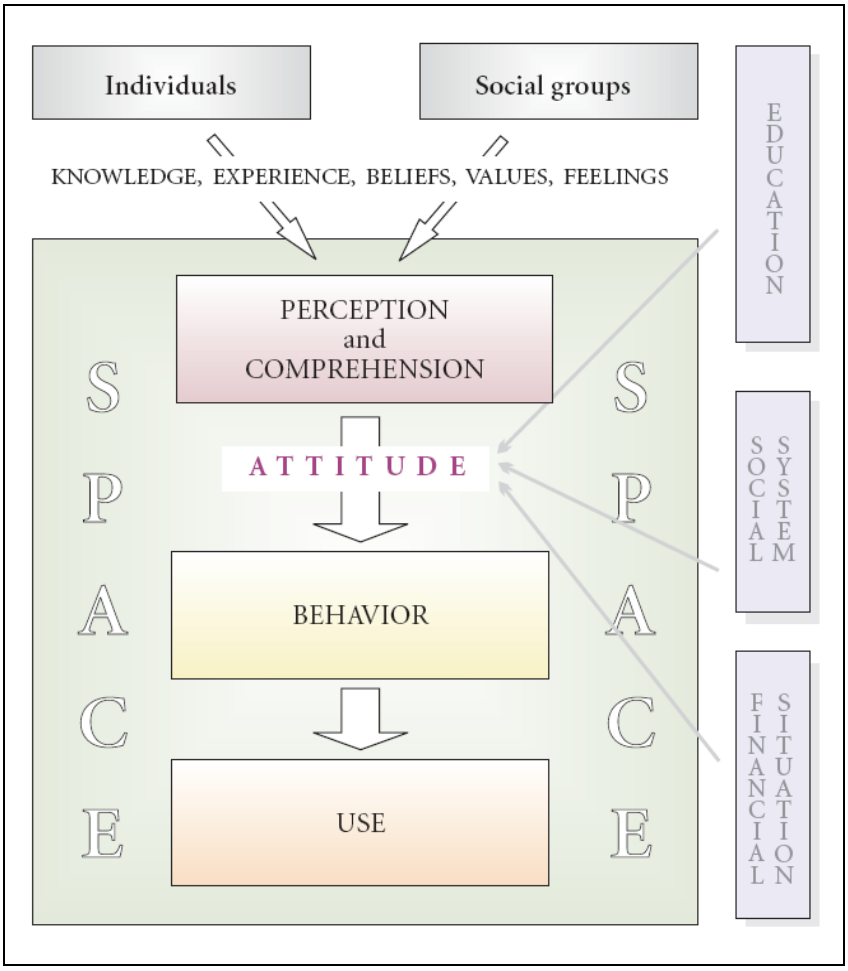

Figure 4: Awareness can only be realized through knowledge: factors and relationships between them affecting the role of individuals or social groups in education (Fridl, Urbanc and Pipan 2009).

These kinds of views on knowledge transmission are connected with the changed perception of the world witnessed in recent decades. These changes are reflected in the increasingly greater role of the individual in society (i.e., individualization), the objectification of natural processes (Komac 2009), leading to individualization of risks (Kuhlicke and Steinführer 2009; Terpstra 2009), and thus also in definitions and understanding of knowledge. This kind of development is the logical result of Descartes' Cartesian shift to oneself and one's own thought, whereby the individual receives central place as the only subject amid everything that exists.

If knowledge is thus merely a subjective transformation or the result of personal and social agreement, rather than the result of objectivity and the opportunity to verify facts, it cannot be discovered, but is literally being created. In the extreme, this would imply that students do not need teachers and textbooks to acquire knowledge. They could acquire it alone using diverse sources. From the viewpoint of natural hazards, this means that every citizen could provide for his own education about natural hazards in accordance with his opportunities and abilities (Wachinger and Renn 2010, 35).

The following example is also very informative: in Germany, more than 50 university instructors and 100 top experts worked on a single CD for use in geography classes (Senegačnik 2005, 35). Textbooks thus remain the main source of information in the majority of schools. It is also important that textbooks be a stable source of information since their in-depths changes of their contents depend on the changes of curricula. They are designed uniformly, in line with the syllabus, and contain pictures and other material that does not have to be sought

out. For these reasons and because no extensive European field research or survey was planned to be carried out among teachers as part of the CapHaz-Net project, the overview of the current situation in Europe was made based on textbooks rather than, for example, syllabuses, which differ from one another to a much greater extent that textbooks. This also refers to other regions; Morrissey (2004) reports that "to date there has been no research to determine the effect of the efforts of the past decade to increase disaster awareness amongst the school population."

The fact must be acknowledged that in practice it is difficult to expect the predominance of an individualist approach because a critical stance towards individualization of risk predominates in society. The opinion that a “single person is unable to do anything” frequently predominates. These findings call for further research in this area, especially the yet unfamiliar aspects of community risk perception, which also influence education through public participation (Wachinger and Renn 2010, 41–46).

1.2 Learning

Knowledge is primarily acquired through learning, which, however, does not merely entail accumulating information and insights, but is a creative process in which information is transformed into new insights. Learning can also be defined as personification of information in order to lend it the character of knowledge. Because this process is more important than the information itself, an important goal of education is “to learn how to learn.” Learning helps individuals form their opinions, personalities, and abilities more easily.

Learning is thus not influenced merely by the new information and sensory perceptions obtained in the learning process, but also by preliminary knowledge. Because preliminary knowledge is organized hierarchically or in the form of a network within memory, it does not make sense to learn new material if it is not connected with previously known general definitions and concepts. Specific ideas and concepts are based on general or anchorage ideas. The cognitive process comprises storing memory, organizing memory into subjective, but characteristic concepts, patterns, categories, and groups, recalling information, and forgetting (Minsky 1975; Rumelhart 1980; Schank and Abelson 1977; cited in Senegačnik 2005).

Forgetting is an important factor of the cognitive process because misconceptions about geographic phenomena or spaces can lead to knowledge renewal that is not only incomplete, but also frequently utterly inappropriate (Marentič Požarnikova, Magajna, and Peklaj 1995, 69; cited in Senegačnik 2005). Similarly, the memory of natural hazards, like social memory, remains preserved in the social sphere only for a certain period of time. The frequency of floods proves to be an effective differentiator of attitudes: in areas affected by only one catastrophic flood, the adaptation of the local communities primarily involved a downplaying of the threat (at least behavioural) while communities affected by frequent floods adapted by realising the threat. Since the losses incurred were considerable and repeated, the reoccurrence of the event was seen as realistic (Biernacki et al. 2008). In spite of the frequency of some natural processes 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 education and various kinds of public events (Figure 5). Social memory is highly subjective, which is not a problem only in individual response to natural hazards, but also a problem of society. By subjectivity, we especially mean the influence of the

mental image and “social memory” on individual and social responses to natural hazards and other events. The response is therefore usually not based on objective realities or knowledge (Komac 2009).

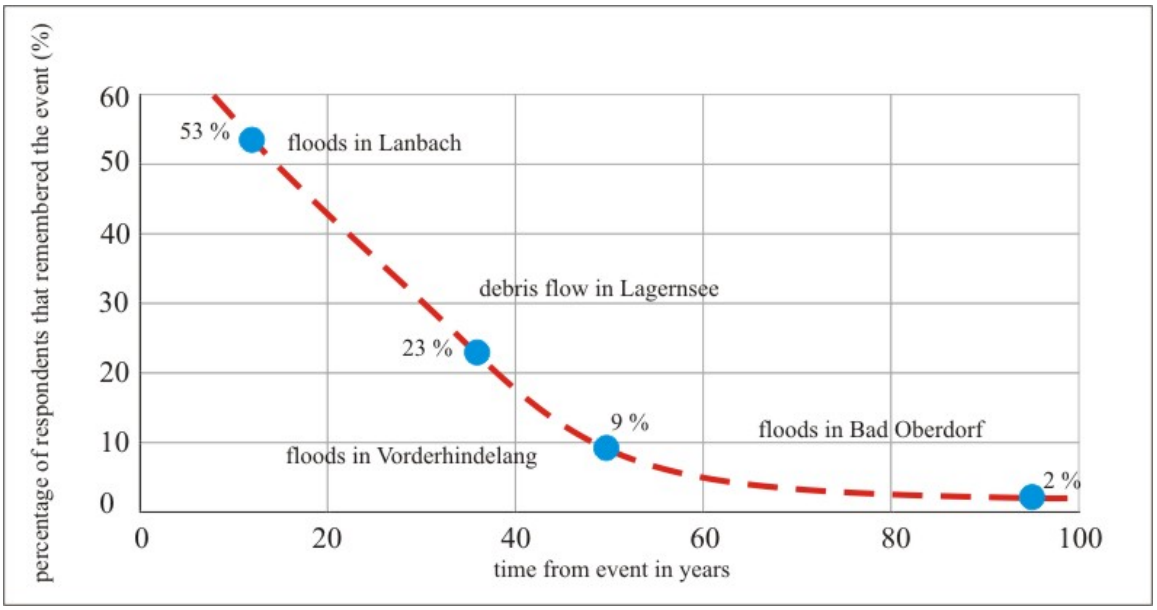

Figure 5: Memory curve showing the “half-life” of social memory of natural processes (Komac 2009).

Therefore memory, 'consciousness', experience impact on building social capacity. Less experience makes it less likely that individuals will become engaged. Experience is also the main driving behavioural response to natural hazards, as has been shown in the case of floods. People with some experience of household flooding are more than six times as likely to take protective measures. It has also been noted that people often use logarithmic rather than numerical scales (Wachinger and Renn 2010, 21, 24) which strongly influences the time-related perception of natural hazards.

There are two main approaches to the study of risk perception which also reflect in risk education: the realist approach and the constructionist approach. The realist approach to risk assumes that there is an outside objective world with risks that we can recognize and acknowledge, whereas the constructionists argue that risk is not objective, but is subjective and socially constructed (Wachinger and Renn 2010, 7, 34), with an emphasized role of the individual. In this sense, learning is an important process within the broader social context because it contributes to participation. Learning enables individuals to participate in shaping society and also encourages them to do this. Individuals use the knowledge acquired in the learning process in their lives or apply it to other levels of activity (this process is known as transfer). Spatial, conceptual, and methodological transfers (Marentič Požarnik 2003, 19; Matas 1996, 33) could also be accompanied by time transfer – that is, the transfer of knowledge through various time periods, which was primarily made possible by books.

With regard to natural hazards, inductive learning is more important than deductive learning because one usually proceeds from information and facts or regional reality to arrive at general findings. A start can be made by studying a local river or the local climate in cases of drought or heavy rainfall (Fourré, Theodossopoulos, and Evrigenis 1967, 38). Empirical learning (i.e., learning in direct contact with reality) combines direct experience, observation, discovery, and action into an inseparable whole (Kolb 1984; cited in Senegačnik 2005).

An important opinion shift has been observed in the Mulde River basin, Germany. Before the Mulde 2002 floods, almost 90% of the respondents interviewed "could not imagine that a flood like the one that occurred in 2002 could threaten them," but after the flood "almost 70 % of the people interviewed . . . indicated that an equally 'bad' or an even 'worse' event could occur again in the area" (Steinführer and Kuhlicke 2007, 95).

In learning about natural hazards, associations also play an important role; according to the principle of isolation (the Von Restorff effect), an item that stands out or is unusual and unique is more likely to be remembered (Russel 1993, 82) because it also affects the emotional level of perception next to the cognitive one.

Learning is a very important factor in building the social capacity for natural hazards. It plays an especially important role in contemporary society, which in the past decades has witnessed the increased importance of the individual. In postmodern society, learning must thus primarily encompass various knowledge transfers, especially those that are important for including individuals in the decision-making processes. This is also a very important aspect of risk governance for natural hazards because individuals are much more vulnerable if they do not have relevant information at their disposal.

1.3 Education

Education is what remains after one has forgotten everything he learned at school.
Albert Einstein

Because it is often difficult to provide direct experience in practice, this empirical learning is substituted for by case studies presented in textbooks. Textbooks serve as important educational tools in formal education (i.e., in classes in school). Classes in school are systematic processes justified in terms of teaching, whose goal is to educate individuals. Classes are composed of three factors: the student, the teacher, and the course content. According to Fran Strmčnik (2001, 68; cited in Senegačnik 2005), education is "a conscious and systematic rational and value-based interaction or polymorphic communication between the learning subject and the object of learning," in which people internalize events in objective or subjective reality and increase their knowledge about phenomena and processes in a region. Education entails not only providing information about events or phenomena, but also developing cognitive, emotional, and psychomotor skills.

Education is a comprehensive process that encompasses learning knowledge and learning skills. Learning has a long-term effect on changing the personality, and subsequently on social development as a whole. According to the UN ISDR strategy, education "encompasses formal and informal transmission of knowledge, and engagement of groups of people in identifying hazards and feasible actions to mitigate them and to prepare for the risk that cannot be reduced." Education includes the formal public and private education systems, vocational and professional training courses, community-based self assessment, local and indigenous knowledge, and public discourse involving the media, awareness campaigns, museums, memorials, and special events (Wisner 2006).

Education is also closely connected to "raising awareness" or "consciousness:" "If we want to improve things, we must turn to children, who are blank slates, neutral, and biologically indifferent to the elements that they will absorb from the environment and build into their personalities" (Montessori 2008, 17). They are capable of absorbing 'bad' as well as 'good'. In

relation to disaster risk, “consciousness” is a “useful term going far deeper into root causes of vulnerability than does the common expression ‘risk awareness’” (Wisner 2006, 8). In this regard, when referring to young children, 'risk consciousness' seems a more appropriate term than 'risk awareness'. Through education, one is thus able and obliged to improve opinions, concepts, and ideas of individuals or society. This also changes society’s relations to nature and natural processes that can harm people – that, is to natural hazards. A society that has sufficient knowledge in this area is also more adaptable and resilient and finds it easier to decide on whether it is better to evacuate a specific area or to adapt to the natural processes that represent a permanent feature of the area (Komac, Natek, and Zorn 2008). In this regard, informal education is also very important in addition to formal education; for example, informal education is reflected in social and geographical memory (knowledge) or, more concretely, in local knowledge or memory (Komac 2009).

Educating activities are usually focused on children. They are very sensitive to visual and other information connected with natural hazards, which is why it is necessary to provide them with basic education in a manner suitable to them. This will make it possible to avoid any misunderstanding or confusion regarding natural hazards and will enable people to react appropriately in the case of natural hazards. At the same time, children also strongly influence their environments and indirectly educate the adults. This seems to be a key to further improvements in social capacity building. It has been shown to be the case in the context of other environmental issues, such as recycling: children have stimulated long-term behaviour changes in adults. A good example of this is the little girl that saved herself and her family from the 2004 tsunami based what she had learned in school (Tsunami family . . . 2005). The role of parents and the media must also be mentioned in this regard; the mutual transfer of knowledge definitely reduces the vulnerability of children and their parents (Monitor . . . 2010) who are usually the most affected member of society (Sanchez et al. 2009).

We must move away from a view of education as a rite of passage involving the acquisition of sufficient knowledge and qualifications to acquire an adult station in life. The point of education should not be to inculcate a body of knowledge, but to develop capabilities including the capacity to act responsibly in the case of natural hazards, to take initiative, and to work creatively and collaboratively. Education is seen less as knowledge acquisition but more as a series of processes through which knowledge, skills, values, and actions are acquired (Murdoch 2004, 342). Inquiry-based learning seems to be a key term in this regard. By the help of teacher children construct their understanding of the natural and social world through the process of inquiry: "We do not just sit and wait for the world to impinge on us. We try to actively interpret it, to make sense of it. We grapple with it, we construe it intellectually, we represent it ourselves” (Donaldson 1978). Inquiry is not so much seeking the right answer but rather searching for appropriate solutions to questions. This approach is focused on using and learning content as a means to develop information-processing and problem-solving skills and is more student centred, with the teacher as a facilitator of learning.

Education is not preparing students for a static world, rather it must prepare learners to cope with increasingly changing and complex world. In a society in which education has focused on transmitting "what we know," it is a challenge to develop a widespread view that "how we come to know" is very important in modern society: "… *An important outcome of inquiry should be useful knowledge about the natural and human-designed worlds. How are these worlds*

organized? How do they change? How do they interrelate? And how do we communicate about, within, and across these worlds?" (Bransford, Brown and Cocking 1999).

2 Means and tools of education on natural hazards

The child absorbs his environment, takes everything from it, and embodies it in himself. With his limitless abilities, the child is not merely a creator, but also transforms humanity.
Maria Montessori (2008, 32).

2.1 General aspects of education and natural hazards

It is ironic that in societies where human life expectancy has risen by 20 years during the last century, concerns about risk have become central political issues. It is ironic, but logical: for it is precisely because the risk of starvation has receded almost to the vanishing point that people have been able to redirect their concerns from pervasive daily uncertainty concerning survival to more remote concerns such as the ecological crisis (Inglehart 1997, 36).

The past two decades have been marked by a global reorientation of research on natural hazards, illustrated by the widespread acceptance of disaster-risk reduction as a developmental imperative. This transition is based on evidence collected from natural hazards in the 1970s and 1980s that showed disaster losses to be significantly influenced by pre-existing social and economic vulnerability conditions (Holloway 2009). The changes have been accompanied by international efforts, notably by the United Nations International Strategy for Disaster Reduction (UN ISDR; International strategy . . . 2010), the International Decade for Natural Disaster Reduction (International decade . . . 2010) and the Hyogo Framework for Action 2005–2015 (Hyogo . . . 2005).

The UN ISDR encourages the use of knowledge, innovation, and education to build a "culture of safety" and a "culture of resilience" at all levels. They particularly encourage the development and application of research methods and tools for inclusion of disaster-risk reduction and recovery concepts and practices in school curricula and education material: "disasters can be substantially reduced if people are well informed and motivated to adopt a culture of disaster prevention and resilience, which in turn requires the collection, compilation and dissemination of relevant knowledge and information on hazards, vulnerabilities and capacities" (Global assessment report . . . 2009, 128).

Effective disaster-risk reduction may be developed especially by long-term activities, such as education. Often, people have the notion that natural hazards will strike others, but not them. In part, this is connected with education itself: as shown below (Section 3), textbooks often present "horrible" cases from far away, compared to which local disasters seem trivial (see also Randkau and Henrÿ 2005, 382). Consequently, there is an absence of risk perception in people's lives, community and state development planning, the educational curriculum, and media priorities. Because knowledge is clearly connected with understanding risks (in Japan the ability to imagine catastrophic images was associated with the degree of individual knowledge of and familiarity with the risk in question; Wachinger and Renn 2010, 11), perception of natural hazards and risks in the local environment should be developed with the help of education (General aspects of risk prevention . . . 2010).

Disaster preparedness should be supported by suitable actions of all stakeholders, including the media, experts, governments, and schools (Krishna 2007). Public awareness is "the extent of common knowledge about disaster risks, the factors that lead to disasters and the

actions that can be taken individually and collectively to reduce exposure and vulnerability to hazards" and it can be directly linked to education.

Although public awareness is a key factor in building the resilience of communities to disasters, we should stress that increased awareness does not necessarily lead to a reduction in disaster risks, especially in poor rural and urban households (Global assessment report . . . 2009, 130). "For the poor, the link between disasters, environmental vulnerability and poverty is a vicious one which is difficult to break … Development must be the emphasis, sustainability its objective, … environmental protection and disaster prevention … as the means" (Persaud 1993, cited in Morrissey 2004, 395). A survey in Poland revealed great difference between populations of large and small settlements in the amount of action designed to protect residents from the effects of floods and gales: less than 18 percent of respondents who lived in flood-risk areas admitted having applied flood-protection measures and there was a huge difference between urban respondents (ca. 15 percent used such measures) and rural respondents (nearly one in every two did; Biernacki et al. 2008).

We should emphasize the importance of the urban and rural poor and homeless people, who bear disproportionate levels of disaster loss and hardship (Blaikie et al. 1994; Hewitt 1997; Pelling 2003; Wisner et al. 2004; cited in Holloway 2009). In South Africa, for example, a Disaster Management Act was enforced that explicitly emphasized "education, training and disaster management research" as priorities; however, the majority of the capacity-building initiatives were led by higher-education institutions located abroad (Holloway 2009). Often, the teaching and learning institutions should transform the view from "entrenched and historic preoccupation with a crisis-oriented 'militaristic response' (e.g. hurricane Katrina, Haiti earthquake) into a socially responsive domain underpinned by developmental risk and vulnerability reduction" (Pelling and Holloway 2006).

The UN ISDR reports several good practices: the 2006–2007 international risk reduction campaign Disaster Risk Reduction Begins at School (Disaster risk reduction . . . 2006) has raised awareness of the importance of the educational agenda across certain countries. The Central American and Dominican Republic Framework for Education and Disaster Risk Reduction has been established as a Latin American regional thematic educational platform. Systematic policy or institutional commitment has been achieved in Australia, Indonesia, Iran, Laos, Nepal, New Zealand, the Philippines, Korea, and Syria. In Angola and Burundi, workshops have been held to promote the integration of disaster-risk reduction into education. In Madagascar, teaching materials and manuals on disaster-risk reduction have been developed. Mozambique has started pilot projects in primary schools to train teachers and children how to live with disasters. In Burkina Faso, environmental education has been adopted at the primary-school level and disaster-risk reduction is partly integrated into higher education (Global assessment report . . . 2009, 129).

Geography has also had an impressive scholarly tradition in the broad domain of hazards, vulnerability, disasters, and the interface between society and the environment. It has also enhanced the understanding of conditions of social vulnerability that increase the likelihood of loss and hardship. Precisely because of this, geography textbooks were selected in order to obtain more detailed insight into formal education about natural hazards in Europe (Section 3).

Although geography, as one of the basic disaster-risk sciences, is connected through education with comprehending and taking action against natural hazards, and thus also with disaster-risk management, interdisciplinary education has been recently gaining importance. Thus, in addition

to geography, natural hazards are also dealt with by other natural sciences (e.g., geology, hydrology, and biology) and the social sciences (e.g., sociology and psychology). Interdisciplinary treatment of natural hazards can also be achieved within the education system by changing the curriculum: we cover local regions at the lower levels, and then at higher levels focus on a more general view of natural hazards and society's sensitivity to them, the use of geographical information systems and remote sensing, in-depth study of literature, and case studies from the local region and abroad. The educational process should also cover topics connected with natural hazards such as climate changes and risk management (Holloway 2009). Because curricular changes are also reflected in textbooks, a special part of our study is dedicated to this aspect (Section 3).

Education is important in both traditional societies and modern European society. In Europe, its importance is often diminished due to increasing application of technology, population mobility, and individualization. Individualization is the tendency towards independence and uniqueness, which is strengthened on the basis of selective integration, and increased choice of people, goods and ideas in the local and global scale – that is, in terms of content and the time and space (Mlinar 2008, 13; for more details on risk individualization, please refer to the WP-1 report). The consequence of the diminished importance of education is also the loss of memory of past natural hazards and a reduced ability to act.

Education also has an important impact on shaping the social capacity for natural hazards. In some cases it might be confusing to use the term "informal risk education" since education is always in one way or another formalised. In this case we should refer to it as a part of risk communication.

It is important to note that several other activities take place at the regional and local levels and that there is no publicly available information about them. In addition, several NGOs and international organizations, such as the United Nations, offer teaching courses and electronically provide material that may be used in schools at teachers' initiatives. Among other topics relevant for risk education we have to mention local and indigenous knowledge, community-based hazard management, games, the media, nature trails, disaster museums, education through voluntary activities and other activities such as participatory workshops (see an example in the appendix).

2.2 Local and indigenous knowledge

In some places, local communities have well-developed traditional indigenous knowledge systems, technologies, know-how, experience, beliefs, and coping strategies, making them more resilient to natural hazards. This kind of knowledge derives at least in part from the same mechanisms evolved by animals in response to the stochasticity and complexity of their natural environment, but it has also developed in humans on an ontogenetic scale and therefore depends on individuals' cultural environment. Therefore, the perception of non-linearity has to be taken into account (Wachinger and Renn 2010, 22, 25). Local knowledge refers to knowledge built in specific regions, and is related to their unique characteristics, as they shown in the relations between society and nature or in the understanding, memorizing natural events. Indigenous knowledge refers to culturally more built-up knowledge which may be locally significant because it is "a body of knowledge built up by a group of people through generations of living in close contact with nature" (Johnson 1992) or "knowledge used by local people to

make a living in a particular environment" (Warren 1991). Often it is related to religious or other anthropological phenomena. In most cases, traditional local communities are well aware of natural hazards and they have the knowledge and administrative structures to cope with them. Therefore traditional knowledge is an important national resource that can facilitate the process of disaster prevention, preparedness, response, and recovery, which all contribute to social capacity building.

There has been an increasing acknowledgement of the relevance of indigenous knowledge because natural-hazard management has been deeply rooted in local communities that apply and use indigenous knowledge. Africa in particular has a powerful asset in environmental conservation and natural-hazard management because in some places the environmental resources are not only production factors with economic significance but also have their place within the sanctity of nature. For example, indigenous knowledge in climate forecasting seems important. In Kenya, Tanzania, Swaziland, and South Africa, several weather indicators have been found. Knowledge of storm routes, wind patterns and rain corridors, including the colour of clouds or birds' cries, and rings around the Sun enables people to design their hazard management long in advance by appropriately constructing types of shelter, windbreak structures, walls, and fences. The signs of coming natural events are often obvious to everyone; at other times, they may be complicated and require specific skills, knowledge, and interpretation of elders and experts. In Swaziland it has been reported that floods can be predicted from the height of birds' nests near rivers. Moth numbers can predict drought, and the presence of certain plant species indicates a low water table (Mwaura 2008; Kamara 2005; Rengalakshmi 2010).

Indigenous knowledge is also influenced by spatial and seasonal distribution of natural resources – a study in two different environments in New Zealand shows "remarkable similarities between the two knowledge systems in concepts, principles, strategies and technologies used in natural resource management" (Ulluwishewa et al. 2008). In Algeria children are taught about natural hazards through stories at the rate of one lesson per year during their six years of primary school, and during three years of secondary school they are taught about other natural phenomena such as earthquakes, floods, volcanoes (Wisner 2006, 17).

Indigenous knowledge is a very important element of the social-historical structure of certain regions today, whereas the situation in Europe seems rather different. European indigenous knowledge has been preserved only in some places. For example, in Alpine regions a link between natural hazards and adaptations of society to natural processes may be found (Komac and Zorn 2007). This is also true of Iceland where living with risk from a range of natural hazards is common place and children are taught about the Katla volcano below the Mýrdalsjökull glacier. In various cultures, indigenous knowledge has been preserved in sacred texts. We are often unaware of the fact that the descriptions of natural processes in holy books are very precise and can also be correlated with other scientific and historical records. In describing the earth, earthquakes, landslides, volcanoes, ore deposits, geothermal activity, faults, mountains, erosion, isolate rock, sinks, storms, springs, floods, droughts, and natural gas deposits, we may find that the Bible is a particularly important source for natural phenomena (Zorn and Komac 2007). Here attention must be paid to the great importance of religious leaders in the present as well: with their authority and the trust people place in them, they often significantly shape the social awareness of the world, including natural hazards, and can thus contribute to social capacity building: "Both religion and secular ideologies provide assurance

that the universe is not random, but follows a plan which guarantees that … everything will turn out well." We can observe a shift in industrial society from traditional religious and cultural norms which is related with the shift from materialist to postmaterialist values: "Religion is the dominant influence on the belief systems of most pre-industrial societies … in secular societies, the state or a strong political leader fills the role of the higher power" (Inglehart 1997, 38).

It would also be interesting to study thoroughly the importance of poetry and prose in social capacity building in greater detail. In Europe, a number of natural processes have been described in literature. Earthquake motifs were already used in extremely old folk material; for example, the ancient Slovenian ballad of Faronika the Fish from the Bača Valley, which is about a fish that carries the Earth and causes an earthquake or a flood by shaking its tail: *Oh nikarte, riba / riba faronika / zavolj otrok nedolžnih / zavoljo porodnih žena*. (Please don't, fish / Faronika the Fish / For the sake of the innocent children / For the sake of the women giving birth). This is not surprising because seven destructive earthquakes were reported in western Slovenia from 1115 to 1511, and three occurred within the last century alone. The 1755 earthquake in Lisbon was also reported in Slovenian material (e.g., "*Pesem od groze tega potresa inu potopa*" [The Song of the Horror of the Earthquake and Flood]), and there were also several reports of rock falls and landslides (Dolenc 1981). Several similar examples could be listed from other European countries, especially Alpine and Scandinavian ones. A similar importance is given to depictions of natural processes in art (McInnes 2008; Landslides in art 2010) which put us back to the question of awareness and consciousness.

A major challenge is how to reconcile indigenous knowledge and modern science, or how indigenous knowledge could be included in the modern knowledge bank – an issue strongly related to education. Indigenous knowledge is also economically important. Because it is in danger of being lost, information should be collected and analyzed through further research projects to enhance understanding of the need to integrate indigenous knowledge in social capacity building and hazard-risk reduction. Because learning is an important part of adaptation strategies, this can be done especially through risk education.

→ Indigenous knowledge has to be used for risk education in Europe.

→ There are several examples from Europe where indigenous knowledge was already used in risk education.

2.3 Community-based hazard management

Community-based hazard management is a "form of self-education by a group of people, usually residents of the same rural or urban locality, on how to reduce their disaster risk." In this type of activity, participatory methods that take into account local knowledge are important. This kind of education is often based on the operation of nongovernmental organizations, but the effect of their work is often reduced due to overly great institutionalization of procedures and the lack of political power. Any initiatives by local communities thus cannot be expressed and implemented. Here, an example from Slovenia can be used: the inhabitants of a town demanded a meeting on flood hazard with the municipal administration and the ministry of their own accord. The meeting was indeed organized, but without their attendance. The municipal administration "decided not to invite the president of the local community to the meeting . . . because the discussion was about

a complete resolution of the watercourse issue in the entire municipality" and so "representatives of all local communities should have been invited" (Predaja peticije . . . 2010).

→ Communities on different levels have to be involved in risk education.

2.4 Games, fictitious characters, and other educational material

In many countries, children's games serve as important aids in learning about natural hazards. Games are important because they present relevant topics in a way that is accessible and familiar to children. They are useful because they make children participated, involved in a project that is a fun, and at they learn through doing at the same time (Earthquake simulator 2003). Games have very strong influence on people's perception of outside world because most of them focus on visual capacities, and may improve behaviour, and therefore also influence children's awareness and consciousness. In relation to natural hazards a link with healthcare can be used: "one innovative application of video games in healthcare is their use in pain management, as the degree of attention needed to play such a game can distract the player from the sensation of pain" (Griffiths 2002; 2005). Wisner (2006, 69) draws attention to the importance of this approach: "many of the games and risk-awareness aids developed so far for children and youth use approaches that fail to explore the true nature of risk reduction." It is still a big challenge on how to use the games for social capacity building. Games may be also seen as a risk communication tool; therefore we only limit to their educational perspective in this report.

Thus, for example, the UNICEF board game *Riskland* was adapted to South African conditions and additional educational material was prepared for teaching ten- to twelve-year-old children. As part of the PACA international network of teachers for natural disasters (2010), teaching aids on floods were prepared: a CD, an exhibit, and a game. The USGS prepared an online encyclopaedia that contains various descriptions connected with volcanism including texts, photos, and other features under the label "Teacher Packets/Volcanoes" (USGS science and education . . . 2010).

From 2000 onwards, the project Safety Tour – Children Safety Olympics has been taking place in Austria; primary schools throughout Austria are participating in it. Through games, children learn how to manage threats and act in natural hazards (Safety tour . . . 2010). Slovenia carries out similar activities among the young members of fire fighters' associations, which can be found in almost every major village.

Enthusiasm can also be created among children through fictitious characters. After the 1999 earthquake in Turkey, a set of songs, videos, and books based on them were created, featuring Grandpa Quake (Grandpa Quake; Turk. Depremdede ve Doğa). This character became extremely well known because it was often used in Turkish schools (Grandpa Quake . . . 2010). In Slovenia, a similar impact was achieved with the character Snowy the Hedgehog (Sln. *Ježek Snežek*), who describes floods, earthquakes, droughts, fires, and the 112 emergency telephone number in a book series in a manner understandable to children (Novak 2004; 2006; 2007; 2008; 2009). Very similar is also Austria's Berti the Beaver (*Biber Berti*). The little beaver is portrayed in books, games, and other material that teachers can use in their classes. The beaver teaches children about natural hazards common to Austria: flash floods and avalanches (Biber Berti . . . 2010).

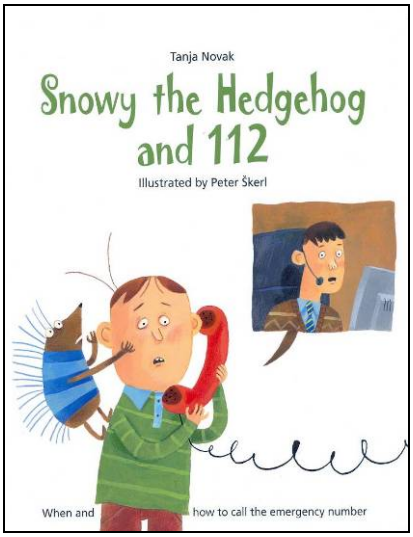

Figure 6: Snowy the Hedgehog publications.

Puppet shows staged since 2003 by the Administration for Civil Protection and Disaster Relief of the Republic of Slovenia also educate people about natural hazards. The children's puppet show features the Little Hedgehog (*Pikec Ježek*) and Fireman Hedgehog (*Gasilko Jež*), and through the adventures of these two popular characters children learn how to act in the event of natural hazards (Figure 6?). Several other events such as participatory workshops with children run in different countries. An example is described in the appendix; figure 7).

Figure 7: After the Rain – equipment for the participatory workshop with children to explore flooding and flood recovery (photograph: Sue Tapsell).

In Slovenia, an annual contest also takes place in primary schools, the goal of which is to raise awareness about natural hazards. Preschool and school children (from 3 to 15 years old) compete in producing paintings and drawings that a special committee also awards and publishes. Several competitions like these have also been organized through the UN, and the results have been published in a book (The school . . . 2001). The Netherlands organizes the school project Flood Symbol Competition. This is one of eighteen activities created in 2006 as part of the EU-funded Interreg III B project, the purpose of which was to raise awareness about floods in Germany, Great Britain, the Netherlands, Sweden, and Norway. The project was based

on the learning method of storytelling in addition to artistic skills (i.e., drawing, woodworking, and metalworking) and proficiency in foreign languages, physics, and music. The result of this school project was symbols that represent a flood in a creative way. A similar method (i.e., including art or woodworking) was also used in schools in Cambridgeshire, UK (Flood symbol . . . 2006). Party games also include instructions for simulating natural hazards in the form of training. This simulation for use in schools and camps brings to life the scenes of real disaster-response operations, which students may have only previously seen on television. Students role-play the response after a disaster strikes the mythical town of Sea Town (Simulation activities . . . 2008). An interesting example is the “tsunami story,” which is available on several websites. “Inamura no Hi” is the story of a man that noticed a precursor of a large tsunami at the earliest stage and led village inhabitants to high ground by burning harvested rice sheaves. This story was based on a true story at the time of the Ansei-Nankai Tsunami (1854), which claimed about 3,000 lives in coastal areas of western Japan (Tsunami . . . 2005).

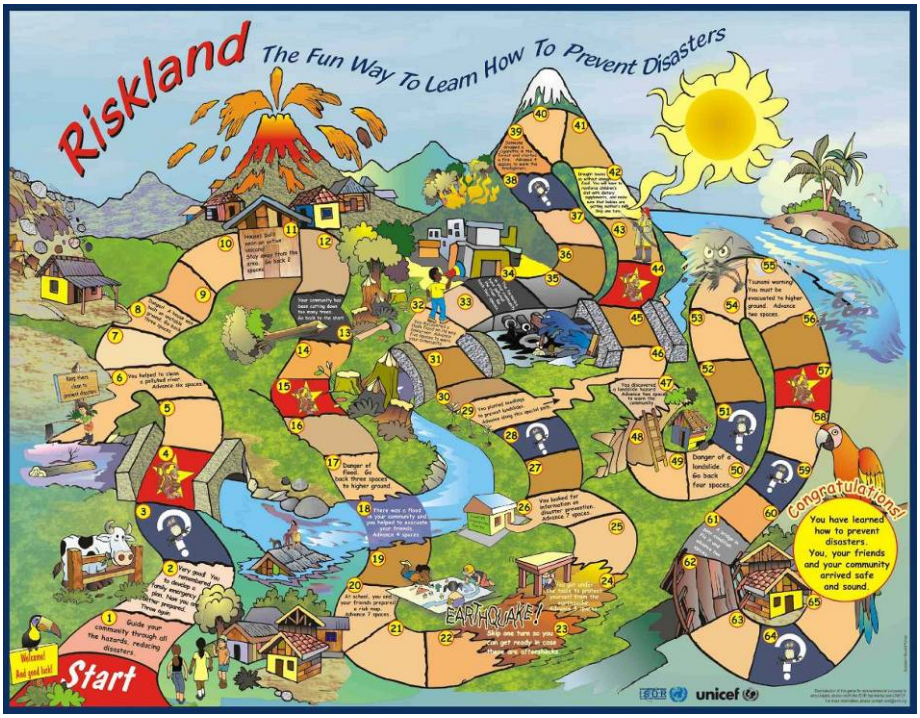

Figure 8: Riskland game board (Riskland . . . 2010).

The Internet also makes it possible to design online games for natural-hazard education; this has already been done in many countries. In Slovenia, the Administration for Civil Protection and Disaster Relief developed the game Help! (Svn. Na pomoč!). It can be played in a similar way as Parcheesi, and the Flash interface enables the players to become familiar with protection and rescue basics by using interactive dice and figurines (Na pomoč . . . 2010). A similar game is also The Trembling Earth (Svn. *Zemlja trese; Zemlja trese* . . . 2010). The USGS website presents earthquakes in an interesting manner – that is, through the letters of the alphabet (Earthquake for kids 2008). Playing cards have also often been produced for children showing various natural hazards.The online game Stop Disasters is also well known; it was developed as part of the campaign Disaster Risk Reduction Begins at School, which took place from 2006 to 2007. The goal of this somewhat more demanding strategy-based game is to protect a settlement against a coming threat (e.g., a tsunami, hurricane, forest fire, earthquake, or flood)

either through construction measures such as building dams and directing settlement to safe areas or through non-construction measures such as planting trees. The game takes ten to twenty minutes, and in the end the player is informed about the total amount of damage, the number of damaged buildings, and the number of dead and injured (Stop disasters . . . 2010). An interesting Spanish website is intended for interactive learning, focusing primarily on earthquakes (Websismo . . . 2007). The World Disaster Reduction Campaign website (World Disaster . . . 2006) offers a wide selection of games and video footage connected with natural hazards.

A similar website was designed by the Greek General Secretariat for Civil Protection (Γενική Γραμματεία Πολιτικής Προστασίας). Play and Learn presents natural hazards to children through play and comics. This activity is intended especially for learning how to take action in the event of natural hazards and protect oneself (Play and learn . . . 2010). The Italian civil protection has also prepared a website on natural hazards aimed at educating children. In addition to floods, forest fires, and earthquakes common in Italy, it also discusses industrial hazards (Sitobambini . . . 2010). Edu4hazards.org is a website that teaches young people how to react in the event of a natural hazard (Edu4hazards . . . 2007). A great deal of learning material in the form of texts, pictures, animations, and films is also available on the IRIS website (IRIS 2010). The website Origin of Avalanches (2007) presents the origin of an avalanche in a schematic manner. A French website uses animations to explain various natural hazards such as avalanches, floods, earthquakes, cyclones, and volcano eruptions (Simulation de . . . 2008). In cooperation with UNICEF, the UN ISDR developed the Riskland board game, which can be adapted and used in various countries (Riskland . . . 2010; Figure 8).

→ Risk education should start at young age where education about natural hazards is performed through game activities.

→ There is a lack of studies on the effects of games on risk perception.

2.5 The media

Mass media can be used for social capacity building because they play a significant role in education about natural hazards. Their role is often ambiguous because they also provide information which are not in favour of capacity building. The media sometimes compete with other risk-managing bodies that take different stances on what is relevant and true (cf. Höppner et al. 2010). Because the media mostly focus on one-way communication it is difficult to assess the effects of education activities. They may help people to become aware of natural hazards in their region and define their vulnerability. Usually, mass media are seen only as a tool of communication and transmission of information and are still rarely used for more thorough kinds of education, despite various technical opportunities. The critical mass of journalists and broadcasters has not yet rallied to the cause of disaster-risk reduction (Wisner 2006, 69). The media have a great deal of remaining opportunity to educate the general population about natural hazards and they could be better utilized if they presented topics relevant to local societies, especially through popular science magazines, educational TV programmes or different internet tools, including distance education.

The role of media in natural hazards' discourse is often problematic because press coverage contributes substantially to a person's perception of risk (Wachinger and Renn 2010,

12). The media play an important role in covering the immediate aftermath of disasters, which is mostly related to risk communication. In some cases, their role in education and opinion-forming may even be critical or counterproductive, particularly with regard to slow-onset disasters such as droughts.

There appears to be no clear link between the quantity of media coverage and the scale of a disaster, but there is a clear correlation between the perceived economic impact of a disaster on western markets and the media coverage (Carma . . . 2010; Wachinger and Renn 2010, 11). After the flooding in 2005, the Indian Secretary for relief and rehabilitation stated: “For the media, the world began and ended with Mumbai. We had flooding in 10 districts at the same time. It was the largest disaster faced by the state. We evacuated more than half a million people in all the other districts. Yet for most of the media, this part of the world didn’t even exist” (cited in Wisner 2006, 54). In a quantitative study of Western print media coverage of humanitarian disasters during 150 newspapers from 2003 to 2005, it was found that hurricanes Stanley and Katrina received far more attention in the global media although they caused the fewest deaths. The Kashmir earthquake attracted similar media interest to the earthquake in Bam (with 3.5 times as many deaths, or 90,000). The tsunami attracted nearly double the coverage of Darfur, but generated a similar death toll (180,000). The Darfur media interest falls to 73 articles for 180,000 deaths, Katrina generated 1,035 articles, the Asian tsunami 508 articles, the Bam earthquake 90, and hurricane Stanley 25 articles (Carma . . . 2010; Freudenberg et al. 2007).

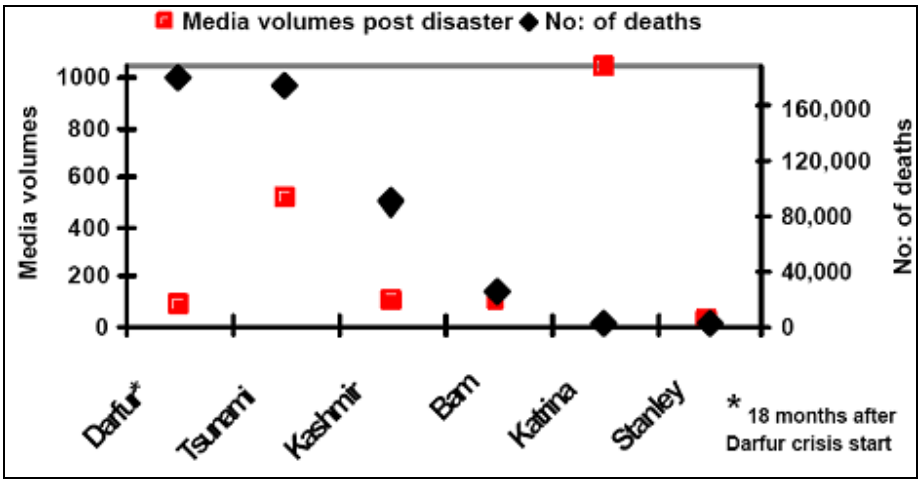

Figure 9: Relation between the scale of a disaster and media interest in the story (Carma . . . 2010, 6).

The most important media are newspapers, radio, television, and the internet. The print media vary considerably in the quality of their reporting on natural hazards and disasters. Newspapers and magazines can provide information within a short time and they can use visual means such as photographs, drawings, graphs, charts, and diagrams. Some of them have broken away from sensationalistic reporting and they provide in-depth coverage of events and their causes. Often they present educational materials in the form of easily understandable abstracts and they sometimes also provide educational contents related to natural hazards. The Da Vinci Learning programme for example offers knowledge TV channels "bringing true education … without effort, simply by watching TV … directly to your home" (Da Vinci … 2010).

Useful information is available through electronic journals and services. Reuters offers the AlertNet (2010). Its primary audience is a worldwide network of NGOs active in disasters and its stories are used by newspapers and other media. The AlertNet is also establishing a support

system for journalists to help them obtain editorial backing to write in-depth stories about natural hazards and disasters. Usually it is difficult for journalists to cover stories with complex roots. This service includes a profile of crises, timelines, “Who’s out there” guides, a register of journalists, a comprehensive media-ranking service, and online training modules. Despite this service, a critical mass of journalists has not rallied to the cause of disaster-risk reduction. Similar is the Communication Initiative, a web community made up of several dozen foundations, international and UN organizations, and NGOs. Regarding broadcasting, radio can also be used to teach the illiterate, but it does not allow the use of any visual aids. Television is a strongly visual media. Films attract people’s attention and can make a great emotional appeal to large audiences. This method is best if combined with discussion groups, in which films are used to stimulate discussion (Wisner 2006, 56).

The ISDR secretariat is working together with the Asia-Pacific Broadcasting Union to develop radio and television programming that will help people deal with natural hazards (IWS . . . 2005). In Latin America even the soap operas have been used for risk communication and risk education (Voces . . . 2010). The video features Riskland (Figure 8), a universal game that makes learning about disasters and how to be better prepared when they happen (Riesgolandia 2004).

Internet is an important multi-channel (reading, viewing, writing, talking, and listening) mode of communication. It has also become very important in natural-hazard education because it provides a great deal of information in very different forms that allow multiple uses.

As a social network, the Internet is ideal for holding videoconferences and distance education. Distance education refers to a form of education in which the teacher and learners do not have to be geographically collocated. Two-way, interactive videoconferencing technology can be an “extremely effective medium for delivering quality education” (Greenberg 2005) because “there is no significant difference in learning outcomes between traditional educational approaches and distance education.”

Therefore we should look at ways in which technology provides an edge as a tool for reaching expanded populations of students, with the attendant economic, professional, and personal benefits that this implies (Wild and Wiggins 2006, 496).

Several types of distance education have evolved; some of them offer complete educational programs whereas others focus on a certain topic or method. In Slovenia, for example, an e-learning facility named Egradiva (ESources) has been established, offering material for individual study of various subjects including natural hazards (Egradiva . . . 2010).

Recently a community for science education in Europe – Scientix – was created to facilitate regular dissemination and sharing of know-how and best practices in science education across the European Union collecting teaching materials and research reports from European science education projects financed by the European Union under the 6th and 7th Framework Programmes for Research and Technological Development (Directorate General Research), the Lifelong Learning Programme (Directorate General Education and Culture) and various national initiatives. Scientix is open for teachers, researchers, policy makers, local actors, parents and anyone interested in science education (Scientix 2010).

Technology offers live, real-time communication in which students and teachers interact audibly and they share visual materials such as slides and documents. On the other hand, communication can be asynchronous (Real time . . . 2010). Several options are possible within web-based systems, such as dissemination of information, syllabus and schedule creation,

announcements, library databases, discussion forums, test and grade book facilities, drop-boxes for student's assignments, and chat rooms (Wild and Wiggins 2006). Proponents of distance education stress the benefits of students working in a collaborative environment and forming a community. Distance education, on the other hand, assists with deeper levels of knowledge generation, to promote intuitive creativity and critical thinking, and to allow students to create a shared goal for learning. The only role of the teacher in such an environment is to create the environment, model the learning process, guide the participants, and evaluate the process, making the process and medium more friendly and intimate. Such a collaborative environment also reduces the sense of isolation (Wild and Wiggins 2006, 497).

The eTwinning initiative by the European Commission is also interesting in this regard; it developed from the Comenius school-partnership project. It is aimed at connecting teachers in joint projects as well as informal communication, through which they exchange ideas, experience, and good practices. So far, more than 83,600 teachers and 50,000 schools from 32 countries have carried out tens of thousands of joint projects (eTwinning . . . 2010). In Germany, there are websites for teachers and students focusing on natural-disaster education (Learn-line 2010), and websites that enable the implementation of interactive workshops (Arbeitsgemeinschaft) outside the regular learning process. The contents are often intended for studying natural hazards in local regions (Edurisk . . . 2010). There are a number of books on carrying out various activities connected with natural hazards: one of them provides teachers of seven- to ten-year-old children with twenty-four activities and workshops to be carried out in class (Earthquake . . . 2005). The Risk Reduction Education Network has met with wide response (Risk reduction education network . . . 2010).

In general, the Internet makes it possible to publish an abundance of learning and research material; unfortunately, the material in electronic journals is often not reliable and not fully available to the public (e.g., Directory of open-access journals vs. Sciencedirect). Encyclopedias (ABC desastres . . . 2007) and textbooks (Earthquakes and tsunamis 1997; Natural . . . 2006) are also available on the Internet. A lot of material is only accessible on CDs (CD-ROM . . . 2003; Sauvie and natural disasters . . . 2010).

In this regard, online services that offer various reviewed professional lectures must also be mentioned. One of the major ones is the Videolectures website (2010), which proves open access to nearly 8,000 lectures by 6,000 authors from the entire world. The lectures discuss socially relevant topics in all areas. Because the portal also presents various public events, we consider it – due to its users (i.e., students from the entire world) and its inclusion in the university education system – to be an environment that would be well-suited for raising awareness and educating people about natural hazards. The Ted portal is also important (Ted . . . 2010); it offers free lectures on various topics, including some intended for education.

The Internet has also made it possible to combine various GIS layers of up-to-date information that may be used useful in natural-hazard education. Examples include Google Earth, which published thematic maps showing the depth of floodwater after Hurricane Katrina and the consequences of the Haiti earthquake. This information was very useful for communication activities (such as rapid response systems) and is also available for education.

→ The media reports are often misleading as regards risk perception and they challenge risk education efforts.

→ There is lack of studies on the effects of media reports on risk education.

2.6 Education through voluntary activities

Voluntary activities benefit the community by adding energy and new insight to projects related to natural hazards. People that offer their time, skills, and labor also educate themselves and the community about natural hazards. After the Kobe earthquake, a large number of volunteers spontaneously organized youth-volunteer initiatives, which later became community-based disaster preparedness institutions such as the Recovery stockyard in Nagoya. In New Orleans as well, many young people spent a few weeks or longer working on recovery projects (Wisner 2006, 25).

Figure 10: Scouts helping clean up after a natural disaster: after the 2007 flood in Železniki (photo: Blaž Komac).

On the global scale, the scouting movement is important in this regard; a number of projects aimed at raising awareness about natural hazards take place as part of it and scouts also participate in rescue and relief activities. Through various activities, they establish the opportunities to recognize different types of environmental hazards and natural hazards and explain why they occur, demonstrate how to help other people to be prepared to respond to environmental hazards and natural hazards in the local area, and explain how changes to the environment can influence environmental hazards and natural hazards (Girl guides . . . 2010; A natural disaster story . . . 2010; Prepare for disaster . . . 2010).

There are several other non-governmental organizations which provide education through voluntary activities. Most of them operate in non-European countries. Among them, the Risk RED non-profit organization offers educational and curriculum materials development, exchange, and evaluation with a focus on adults (the general public), children, and schools. Its purpose is to increase the effectiveness and impact of disaster risk reduction education. They assist in the collection of materials for the UNESCO and ISDR physical libraries for disaster risk reduction education, and supporting development of the Global Online Library for Disaster Risk Reduction. They also lead the DREAMS Project which is being developed to allow educational

materials to be shared, translated, adapted, and impact-tested, in order to scale up for wide dissemination of consistent disaster risk reduction messages to different audiences (Risk RED … 2010).

2.7 Nature trails

Nature trails can also be used in adult natural-disaster education. They usually run across interesting parts of a landscape, where children and adults can see the phenomena and processes in the landscape up close. Nature trails represent an important method of indirect education focused on an individual. Visitors must decide on their own whether to look at information boards, maps and drawings and to read the texts on the display boards. Information and display boards which may be important components of nature trails and can also be considered autonomous education facility, some way between a trail and a natural museum. Nature trails provide direct contact with nature; the emphasized importance of sensory perception and body movement increases this interest. This also increases the ability to learn because information obtained through experience can be more easily connected with information that is already known. Areas furnished with nature trails are well-suited for carrying out directed teaching activities. A good example is the trail set up in Dresden after the 2002 floods (Hochwasserlehrpfad . . . 2010) although educational leaflets at least in some cases do not seem to be an effective education method (McEwen et al. 2002, 290).

Figure 11: A leaflet of the trail set up in Dresden after the 2002 floods (Hochwasserlehrpfad . . . 2010).

2.8 Disaster museums

An effective approach to children and youth are disaster museums. The best-known such institution has been open in Kobe since 2002. It encompasses a natural science museum, a research institute, and a training centre. In a two-year period it had 1.2 million visitors, 42% of whom were young people (Disaster reduction and human . . . 2010). Since then, a network of such museums has been established with participating institutions from Italy, Turkey, Armenia, India, Algeria, the US, Nepal, Bangladesh, China, Japan, and Papua New Guinea (Wisner 2006, 24). One must also mention the important role of natural history and other similar museums, which exist in almost every country and often also present topics related to natural hazards.

2.9 Education provided by international organizations

Several international organizations provide education programs in natural hazards, and many of them rely on the implementation of both the Hyogo Framework for Action 2005–2015 and the

United Nations Decade of Education for Sustainable Development 2005–2014 (Towards a culture . . . 2007, 5). In general, we can point out the absence of this kind of activity in Europe.

The Progress Report on the matrix of commitment and initiatives to support the implementation of the Hyogo Framework (Progress report . . . 2005) reports about an initiative to integrate indigenous knowledge for environmental resources conservation and bio-diversity (Russia), the Disaster Risk Reduction through Schools project (Action Aid International; Bangladesh, Nepal, India, Ghana, Kenya, Malawi, Haiti), the UNCRD program Reducing Vulnerability of School Children to Earthquake in the Asia Pacific Region, and the UNESCO Global Initiatives on Education for Disaster Reduction in the Framework of the United Nations Decade of Education for Sustainable Development (2005–2014). The United Nations University (UNU-EHS) reports about the program Strengthening Tertiary Education Programs in Disaster Risk Reduction (STEP), which is a disaster-risk reduction training and learning program developed targeting the urban sector at the global level.

Among NGOs we should mention ActionAid, which has active education and disaster departments. They lead the Disaster Risk Reduction through the Schools project, which approaches education as part of community life. This is underway in Ghana, Kenya, Malawi, Haiti, Bangladesh, India, and Nepal to promote teaching on hazards and risk reduction in schools (Action aid . . . 2010). Save the Children also works in education and disaster management with a special focus on material (shelter, food), developmental (schooling, play), and emotional (protection, psychological healing) needs of children (Save the children . . . 2010).

The Plan International organization (Plan international . . . 2010) also works in natural-hazard education in sixty-two countries. They treat children and youth not as recipients of aid but as agents of development. The International Federation of Red Cross and Red Crescent Societies has 183 members throughout the world. They provide various activities in schools including first-aid training and adaptation, and training material in coordination with local or national governments to be used at the school level. UNESCO has been working to integrate disaster-risk reduction into education at the primary and secondary levels during the International Decade of Education for Sustainable Development. In addition, the United Nations Development Program offers disaster-relevant material to be included in school teaching as well as support for country-based initiatives. The United Nations Center for Regional Development in Kobe “takes a comprehensive approach to reducing the vulnerability of school children . . . through risk awareness training that includes children, teachers, parents, community and political leaders, as well as members of the local construction industry” (Wisner 2006, 29). Despite its diversity, Europe has obviously still not felt the necessity for more thoroughly organized operation of international institutions of this kind.

In addition to national or locally-produced curricula that will be described in the next section, there are teaching programs and disaster-reduction curricula that have been disseminated internationally. The Masters of Disasters series helps teachers integrate disaster-safety instructions into core subjects such as language arts, math, science, and social studies (Disaster masters . . . 2010). The French Ministry of Ecology disseminates teaching materials and hands-on project ideas through the internet: “[T]here is currently no formal disaster-risk reduction education program in the public school system . . . however, a range of government departments and agencies provide information to schools, colleges and the public in general to raise risk awareness and mitigation measures”. In England (Wisner 2006, 116), teachers can exchange materials through the Teacher Resource Exchange moderated database of resources

and activities (Teacher resource . . . 2010). The Education International (Education international . . . 2010) organization, for example, is engaged in teacher training in the tsunami-affected province of Aceh in Indonesia, where they offer a course on natural hazards. The United Nations Disaster Management Training Program (UN-DMPT) is an important mean of knowledge transmission because it provides extensive training through a database system (United Nations disaster management . . . 2010). The iEARN (International Education and Resource Network) has been organizing Natural Disaster Youth Summits since 2005. Schools from eight European countries participate in this, including Armenia, the Czech Republic, Georgia, Russia, Slovakia, Turkey, Ukraine, and France (iEARN . . . 2010). The 2010 summit was held in Turkey and its theme was Disaster Reduction and Climate Change – Let's Create a Global Disaster Safety Map (Natural disaster youth . . . 2010).

Despite a vast amount of research carried out during the International Decade for Natural Disaster Reduction, a disappointingly small amount of the knowledge created was put into practice. In fact, this is true of a variety of initiatives; the translation from research to policy seems rather low. Therefore, specialized nodes and networks can help improve the exchange of and access to knowledge. These networks now exist for landslides, volcanoes, earthquake engineering, drought, flood, wildfires, and climate change, and other networks focus on multiple types of hazards (Wisner 2006, 62). An important breakthrough in providing education in natural hazards was the establishment of the ISDR thematic cluster or Platform on Knowledge and Education at the United Nations International Strategy for Disaster Reduction. The platform is related to the implementation of the Hyogo Framework for Action 2005–2015: Building the Resilience of Nations and Communities to Disasters, in which knowledge and education are one of the priorities. The thematic platform on knowledge and education brings together a number of international organizations, UN agencies, regional organizations, states, NGOs and networks that are committed to the Priority III of the Hyogo Framework for Actions. Within the UN ISDR a cluster was formed by several organizations that aim at strengthening networking, creating new partnerships, identifying gaps and focus areas, and collectively advancing the implementation towards concrete results for the benefit of countries in achieving the Hyogo Framework goals through knowledge and education (International strategy for disaster reduction . . . 2010). In some countries, several activities focused on disaster-risk reduction take place on the World Disaster Day. The Hyogo Framework states that "institutions dealing with urban development should provide information to the public on disaster reduction options prior to constructions, land purchase or land sale" (Wisner 2006, 56).

There is a need to train disaster management experts and professionals working in many different disciplines because they have an important disaster reduction component. One of such training courses is "The RiskCity training package" offered as a distance education course (van Westen 2010, 219), organized by Faculty of Geo-Information Science and Earth Observation (ITC), University of Twente (Nederland) as a part of the capacity building activities of the United Nations University. The package comprises a complete suite of exercise descriptions, together with GIS data and presentation materials on the various steps required to collect and analyze relevant spatial data for hazard, vulnerability and risk assessment in an urban environment (van Westen 2008, 665).

One of possible entrance points to the education system could be through the Leonardo da Vinci programme (Leonardo … 2010) which is a lifelong learning programme. Its aim is to make the EU the most competitive knowledge-based economy, with sustainable economic

development, more and better jobs, and greater social cohesion. Among other initiatives the programme supports cooperation between universities and companies and activities to boost the mobility of citizens and the efforts to ensure transparency in education and training systems in Europe, which can also be related to risk education either by teacher training or through the issues of social inclusion.

→ Work of international organizations in the field of risk education in Europe is not a coordinated activity. Neither a review exists.

3 Formal education on natural hazards

But where shall wisdom be found and where is the place of understanding?
(Job 28,12)

Despite the rapid development of technology, which enables control of natural processes or even changes and diverts them, the inclusion of natural disasters in formal education is of utmost importance for the EU countries. By formal education we mean education in institutions (usually schools) and institutionalized contents by the curricula. Formal education can include all the means, tools and approaches of education discussed in the previous chapter. Especially in the light of climate changes, the safety of individuals and countries is an important aspect of life because natural hazards affect society and, in specific circumstances, even pose a threat to settlement and spatial and economic development.

At the same time, 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 2005). The last issue also includes knowledge of the wider and immediate local region, and the phenomena and processes in it. Natural hazards in particular show that education must take into account key world problems and resolve them by using a problem-based approach, whose goal is to raise awareness about phenomena and processes, increase sensitivity to specific phenomena, and develop the ability to perceive development trends.

An important principle is derived from this: in order to be effective and influence social development, natural-disaster education must focus on concrete phenomena and processes in space. However, this is impossible without basic scholarly, cultural (including humanitarian), and psychophysical awareness of knowledge mediators, in modern society these being primarily school teachers.

3.1 Groups in formal education

3.1.1 Education of children

Although risk education at school should comply with the specific characteristics of each country, the principle objectives should be long-term, although we should also focus on short-term activities (to train children to protect themselves, to escape hazards, 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.” This is in fact a moral obligation that stems from the Universal Declaration of Human Rights (Acts 3 and 26).

The common principles for adopting natural hazard–education at the school level must focus on character and continuity of the latter. Appropriate educational methods should be developed according to students’ age, national culture, traditions, and experience. The objective of education in natural hazards is to raise responsible citizens. Depending on the age groups, different objectives, themes, and educational methods and means are suggested. We can teach natural hazards independently, as part of other specialized subjects, attach it to all school subjects, or teach it as an extracurricular subject.

The most common education method is a lecture, which relies on the role of teachers in the class that can make the subject clear and simple. Among the participative school-teaching methods, we should mention the question-and-answer method and role play, in which pupils take an active part answering precise, clear, concrete, and easily understood questions. For successful adult education, in addition to talks, questions, and experiments, we can also use public meetings and group discussion. Group discussion is an important method because it prevents adult education from looking like school, teachers can clear up points that have not been understood, and teachers only have to listen to people that present their individual experience (Fourré, Theodossopoulos, and Evrigenis 1967, 44–53).

Such methods are important because it has been noted that knowledge is transmitted from children to families. Education about natural hazards that is integrated into the educational system leads to participation of children, their families, school staff, and society.

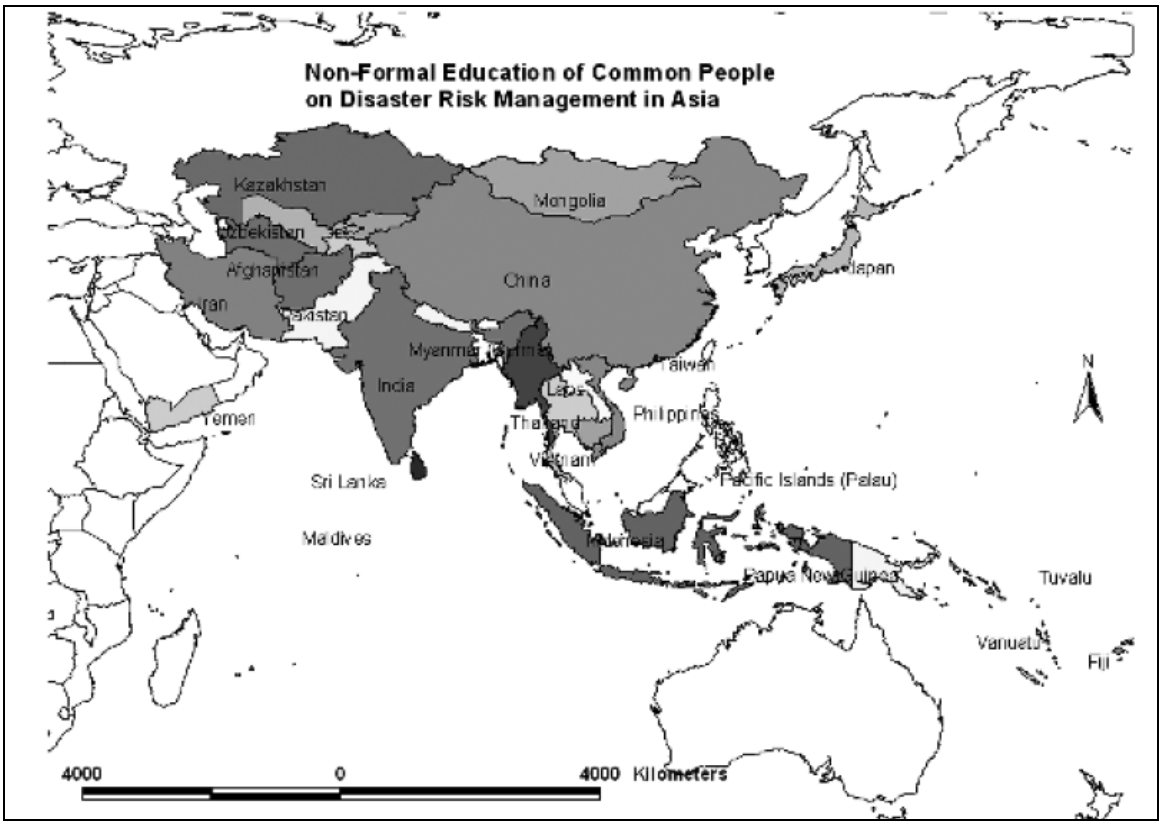

Figure 12: Adult natural-disaster education (Disaster education . . . 2007, 29).

Education about natural hazards should start in childhood and continue 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.

Taking into account the development and communication aspects described above, there is no reason for education not to begin as soon as possible or at least in primary schools: "Natural disasters education with major emphasis upon mitigation, but with attention to disaster response, should begin in the early years of schooling and continue into secondary school" (Macaulay 2004, 417). At that age, children have a smaller spatial perspective and are more attracted by developments in their local region, which they know well. The question remains

whether this type of education should already begin as early as preschool. Children can definitely learn about natural hazards in preschool. The profession does not have a uniform opinion about how preschool affects children's development; however, research shows that preschool can be an important support factor. Preschool education differs across Europe and emphasizes either protection or education (Wisner 2006). Preschools implement various programs and work in line with the curricula, which are relatively well structured. They perform several functions at the same time, including socialization, protection, teaching, and family support. The share of children attending preschools increases with age, with six-year-olds already attending primary school in most countries. In Europe, the share of children attending preschool varies, but the trends are comparable in terms of their age. The majority of European countries are developing strategies for enrolling the highest possible share of children three years old and up in preschools. This is good news because the importance of the preschool period is often ignored. During this period, children learn practically everything that they need for life (e.g., moving and communication). Because at least in some part of this period children are not attending preschool, safe life at home should constantly be improved; however, this can only be achieved by educating parents and preparing them for parenthood. Parents and teachers can point out the major dangers and explain safety measures. At that age, children learn how to control their bodies and preschool provides situations, above all games that guarantee the development of children's psychomotor functions. Special attention should be paid to children with delayed psychomotor development. The Czech Republic has several educational programs in place aimed at raising children's awareness about natural hazards and improving their safety but it has rather low coverage of pre-school children in kindergartens on the other hand. The basic information on this is already provided in preschools, where some classes focus on teaching children how to react in the event of a fire. Through stories, children also learn the most important telephone numbers. In addition, there are specific books and (online) games intended specifically for preschool children (Wisner 2006).

At the primary-school level, education should rely on moral and humanitarian aims. Special attention should be paid to six- to seven-year-olds because they are a sensitive group and are usually interested in "risk prevention culture." Teachers that are in direct and everyday contact with their pupils can perform education about natural hazards with a focus on games and practical implementation. Children can acquire a constant perception of being safe from natural hazards and also learn to strictly follow safety rules. The cognitive and physical approach to safety instruction should be integrated with regular school activity and disciplines: geography, nature studies, physics, biology, chemistry, physical training, games, sports activities, and travel. Much of this could be done through dissemination and sharing of good practices, "up-scaling" within the same country, and the application of additional political will and resources. The gaps in primary education include "teaching to the exam" or lack of teaching on locally relevant hazards (Wisner 2006, 66).

A possible school project

A one-week curriculum for a project week has been developed at the Ljubljana workshop with the topic "flooding" for secondary school children (~13 years old) who live in a flood-prone area. We present this outcome of the workshop in the report because of its well developed structure.

Skills to be developed: organisation of project work, participation in planning processes, working in environment projects, mapping of environmental phenomena, discussion and argumentation with authorities and politicians; putting into the role of a disaster manager.

Knowledge to be gained: learning about processes of the water cycle, learning how to collect and analyse data.

Product (outcome): map and presentation to parents, experts and public.

Actors: pupils, teachers of different subjects, affected persons and persons at risk, members of the local disaster management group and of civil protection, fire brigades, local planning group, invited experts, representatives of NGO's, representatives of insurances.

Tools, methods and media: Interviews with experts and residents, excursions to river and tributaries, mapping of environmental phenomena along the river, mapping of land use (changes) and infrastructure; data analysis and visualisation, presentation.

Structure:

1. Organisation of project with assistance of teachers; splitting up the group into subgroups:
   a. Group for historical documents; b. Interview group for persons at risk; c. Interview group for experts; d. Mapping group; e. Photography group.
2. Definition of area under investigation.
3. 1st excursion to get an impression of the situation; reflection of the task in the terrain.
4. Report of observations and experiences.
5. Classes about processes in the classroom.
6. 2nd excursion to the river: dealing with management issues; experiences with flood and force of water.
7. Simulation of a flood on the computer in the classroom; development of map.
8. 3rd excursion if required.
9. Finishing work.
10. Presentation of work to parents, experts and the public.

At the high-school level, on the other hand, the general principle is less theory and more practice; it seems that involvement of high-school level is a key to building social capacity as regards education. The school plays an important role in developing a positive attitude towards safety as well as in developing young people's social responsibility. This can especially be achieved by "active education methods based on real situations" (General aspects of risk prevention . . . 2010). Education about natural hazards can be performed by teachers in different subjects, by specialized teachers, and/or invited researchers and professionals such as doctors, firemen, policemen, and rescuers. Children of this age are able to identify, foresee, evaluate, and monitor various types of natural hazards, especially those related to their activities, and to actively participate in their local communities. They may already contribute actively to the prevention of major natural hazards, especially ones they may cause or encounter in their region in the future as adults during sports activities, while playing games, at home, on the road, during free time, or at work. On the other hand, adolescents may also be difficult to reach with electronic resources, although their energies can be mobilized through voluntary activities (Wisner 2006, 25). There are clearly different tactics to be employed with different age groups.

At the level of tertiary education, which is not described into detail in this report, courses containing relevant content include engineering, medicine, public health, economic, development studies, political science and policy studies, geography, biology and other natural sciences. Specialized courses in seismology, volcanology, climatology, computers, and geographic information science are also relevant for natural hazards. Research on natural hazards is most often connected to tertiary education. The findings of this research are likely to find their way into policy decisions and other disaster-risk reduction programs. At the university level, education is extremely diverse because the majority of universities around the world also offer programs connected with natural hazards. The majority of programs train disaster-management specialists. Several European countries link academic research and policy or practice at the national or local level (Albania, Austria, the Czech Republic, Finland, France, Germany, Greece, Hungary, Lithuania, Macedonia, Monaco, Portugal, Romania, Russia, Slovakia, Slovenia, Sweden, and Switzerland), which is not the case for the rest of the world. In Africa, for example, a great deal of the research on risk reduction is still carried out by foreign teams.

These topics are given special attention in Slovenia, for example, the University of Ljubljana and the University of Koper offer courses on natural hazards. The majority of EU countries have courses or professional study on natural hazards. For example, the University of Montpellier offers master's courses in "risk science," and "risk and crisis management" can be studied at the University of Paris I. The artificial divide between the "hard" approaches (engineering and the natural sciences) and the "soft" ones (political and behavioural science) should be overcome by interdisciplinary studies and approaches (Wisner 2006, 30, 67).

3.1.2 Education of adults

Next to education of children, the continuing education of adults is an essential task and concern of societies around the world because it is important for countries' development. Adult education depends on how we answer the question whether adults are still able to learn. The opinion that there is a period of life devoted to learning is found to be less peremptory than it appears. Education is a lifelong process, but adults usually use less systematic methods of learning compared to those used in school (Titmus, C. J. 1989; Holford, Jarvis, Griffin 1998). 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, seem to be more appropriate. Adult education is often organized in a network of educational centres that are situated close to people. In Asia (see Figure 12) it focuses primarily on the complex presentation of natural hazards (69%) and the presentation of earthquakes (11%), floods (9%), tsunamis (5%), drought (2%), typhoons (2%), and landslides and fires (1% each). Education is carried out primarily though training, awareness-raising programs, publications, seminars (see Table 1), and workshops (Fourré, Theodossopoulos, and Evrigenis 1967, 10–17; Disaster education . . . 2007, 32).

Table 1: A programme for disaster education for communities (Disaster education . . . 2007, A-173).

No	122
Country	Turkey
Program Name	JICA Training in Turkey (local module)
Hazard Type	multi hazard *(after 1999 Marmara Earthquake,)*
Target Group	local disaster managers, vice governors and county mayors
Major activities for non formal disaster education	seminar; lectures, simulations and local visits
Objectives/activities of the Training/Program (Relevant)	to grasp the current state of Turkey's disaster reduction policy through investigative hearings at the country's disaster reduction authorities, and to enrich the contents of the programs of the local module of the seminar by introducing successful cases of Japan's disaster prevention measures
Methods of Education	(same as major methods)
Duration	June 16 – 26, 2003, First round: Sep. 29 – Oct. 3, 2003 Second round: Oct. 6 – Oct. 10, 2003 Third round: Mar. 8 – Mar. 12, 2004 Fourth round: Mar. 15 – Mar. 19, 2004
Funding Agency	JICA and Ministry of Internal Affairs of Turkey
Evaluation System	
Conducted by	JICA and Ministry of Internal Affairs of Turkey and ADRC
Partners	
Disaster education component (independent OR part of the program)	independent
Regular OR project based activities	program based
Others/Characteristics/Remarks	
Website	http://www.adrc.or.jp/publications/annual/03/03eng/pdf/5-1-2.pdf

3.1.3 Education in relation to vulnerable groups, mobility and urban-rural divide

Other educational and organizational activities are often needed to address vulnerable groups. Gender-related questions are an important issue; whether girls and women are participating in natural hazard–related education activities. The young and females are often primarily seen as victims of disasters (Gibbs 1989; Sanchez et al. 2009), rather than as capable and knowledgeable agents of disaster-risk reduction (cf. Mitchell et al. 2008; Ronan, Crellin and Johnston 2010). The number of people living alone will increase in the future together with the increasing of the number of one-parent families and decreasing of the number of married couples having children (Mlinar 2008, 27).

Reaching street children and working children is another problem that will require innovative strategies, methods, and techniques to integrate education about natural hazards into existing outreach programs. Few of these children attend schools and they usually face many immediate dangers other than natural hazards. Therefore, the root causes of their homelessness and poverty must be understood and addressed. Addressing and reaching child-headed households seems to be another problem that has not yet been solved. This group of children, together with working children, poor children, and street children, also raises question about ongoing efforts to secure education for all. It is reported that about 100 million school-aged children throughout the world are not attending school (Wisner 2006, 26–27).

In modern world high spatial mobility has to be regarded as an important issue related to natural hazards and education. Increasing number of people is escaping from previous spatial frameworks and is being integrated into various streams and networks. To understand the dynamics of today's major developments, and its future development, it is necessary to pay attention to all 'temporary' and 'impermanent'. We should take into account increasing of (so called) *fluidity* in space. At the time of transitions from 'space of locations' to 'space of flow' the living environment can no longer be considered a fixed, closed circuit, but rather in terms of divergence and partial overlaps, consistencies and inconsistencies, of physical-spatial space, the space of residence, movement of people and the virtual space. We are entering a time

characterized by great variability, continuous fluctuations between high concentration of people and the following gap at a certain place (Mlinar 2008, 5, 251 and Fig. 13).

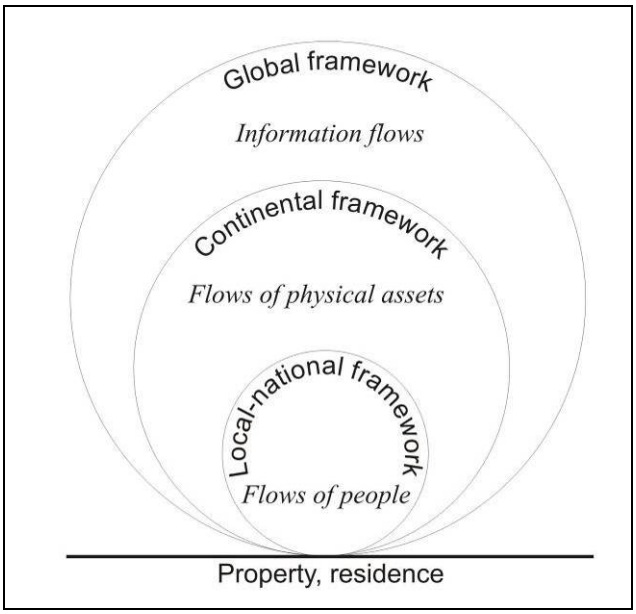

Figure 13: Dominant spatial frameworks flows of people, physical assets and ideas (Mlinar 2008, 21).

Rural-urban issues also should be taken into consideration. It has been noted that risk education provided by schools has rather low rating as an information source, either among teachers as well as among common people. School education as the source of information on the risk of extreme phenomena has very low rating and is of special interest to us: "one reason for this result might be that school education involves little or no specific local references. Additionally, the respondents were adults whose school education would have been supplemented by information received subsequently, mainly from the media." The factor that influenced most was the size of the settlement, which itself has a strong influence on the nature of the local community and on the spread of information inside that community (Biernacki et al. 2008 and Table 2).

Table 2: Sources of information about local flood and gale risk (Source: Biernacki et al. 2008).

Source of information	Share of respondents (%)
Local media	68,5
Personal observation	50,3
Family, friends	24,8
Leaflets	5,7
School	5,0
Training	2,2
Other	2,2

An important part of education of adults is educating the professionals. There are several programmes offered from different organizations (research institutions, faculties, NGO's), for different organizations (fire-fighters) and on different levels (local, regional). We do not evaluate this programmes in this report since we only focus on education in schools (e.g. Bründl et al. 2004).

→ Risk education activities should first address teachers and then the pupils.

→ There is no review of risk education programs for teachers available.

→ There is lack of risk education programs for vulnerable groups.

3.2 Curricula

3.2.1 Overview

The term “curriculum” first appeared in the United States in the beginning of 20th century and initially had a much broader meaning than “syllabus”; nonetheless, the latter meaning has recently become more commonly used in European school practice. In addition to teaching methods and aids, curricula are key to transmitting knowledge about natural hazards in schools. They entail formal publications of teaching objectives and contents according to the school type and the students’ age group, presented in a manner applicable to teaching in schools (Böhn 1999).

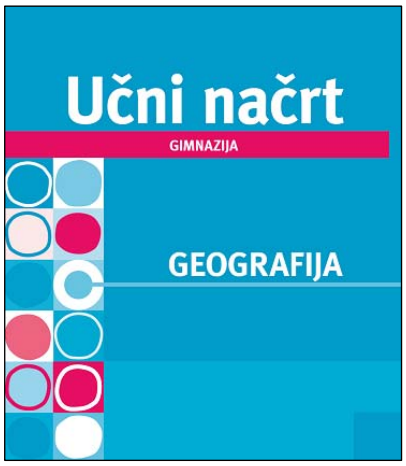

Figure 14: The Slovenian high school geography curriculum.

They are thus being used within a system whose key part is the teachers, who use them to adapt the teaching objectives and contents to the learning practice. Due to economic (e.g., poverty) and other reasons (e.g., lack of interest, lack of teachers, and standards concerning the number of students per class), it often happens that learning objectives are not met and the content is not suitably presented. In addition, teachers must have well-developed teaching skills and be highly motivated to perform their work. The result of these and a number of other factors is that the content presented in the curricula is often not appropriately presented in class or that “real-life teaching and curricula vary greatly in approach, intensity and quality” (Wisner 2006, 10). In addition, curricula vary greatly among one another and are very difficult to compare; they may contain only a few pages (e.g., in Finland) or several dozen pages (e.g., in Slovenia), in centralized education systems they follow a “top-down” structure, and in decentralized systems they are developed “from the bottom up” by students, teachers, and other community members.

Three methods of developing curricula have been established in the school system: conceptual, objective-based, and combined. The conceptually oriented curriculum is based on an encyclopaedic understanding of reality, and the teaching and learning processes depend on the course content prepared by professionals. These types of curricula are often very extensive. The objective-based approach is intended to rectify this weakness by analyzing and defining teaching objectives as the main part of curricula. However, the combined strategy has become the most widely used, combining objectives, content, methods, learning strategy, and course content.

An increasingly greater importance in curricula is also given to case studies, which follow the principle of exemplarity. This principle has become widely used because teaching based on encyclopaedic knowledge is no longer possible due to the increasing amount of information (Senegačnik 2005).

3.2.2 Country-specific findings

According to the UN ISDR report Disaster Risk Reduction Begins at School (Disaster risk reduction . . . 2006), which has given a worldwide impulse to efforts aimed at encouraging the integration of disaster-risk education in school curricula, children that are taught about natural-hazard risks "play an important role in saving lives and protecting members of the community at a time of disaster."

Table 3: List of countries with hazards teaching in primary or secondary school curriculum (Disaster education … 2007).

Algeria	France	Nepal
Argentina	Greece	New Zealand
Australia	Hungary	The Philippines
Bangladesh	Iran	Portugal
Bolivia	Japan	Romania
Brazil	Kenya	Russian Federation
British Virgin Islands	Lithuania	Senegal
Montserrat	Serbia	Sweden
Columbia	Slovenia	Tonga
Costa Rica	Madagascar	Turkey
Cuba	Macedonia	Uganda
Czech Republic	Monaco	United States of America
El Salvador	Mongolia	Venezuela

Disaster-risk education should therefore be part of the national primary and secondary school curricula to foster awareness and to better understand the immediate environment in which children and their families live and work." According to the World Conference on Disaster Reduction, 36 (40%) 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 school. This and our own data are presented in tables 3, 4 and 5.

Teaching disaster-related subjects in schools is required by law in Mexico, Romania, and New Zealand. Venezuela and Brazil report significant primary and secondary teaching at the municipal or state level. Several intensive training programs for disaster awareness took place in Istanbul after the series of earthquakes there in 1999. By the end of 2000, over 3,000 teachers were trained and certified as instructors in thirty-two districts of the city. These in turn taught more than 34,000 teachers, 6,000 personnel, and more than 350,000 parents. In this way, 826,000 children were also instructed. Through the help of sponsors, the training program was extended to three other Turkish provinces, reaching an additional 1.5 million people. In 2004/05 a five-day master instruction program was offered to 132 trainers from fifty provinces. They taught 16,000 school-based instructors, who in turn taught teachers, parents, and others, reaching at least 2.4 million people (Disaster risk reduction . . . 2006).

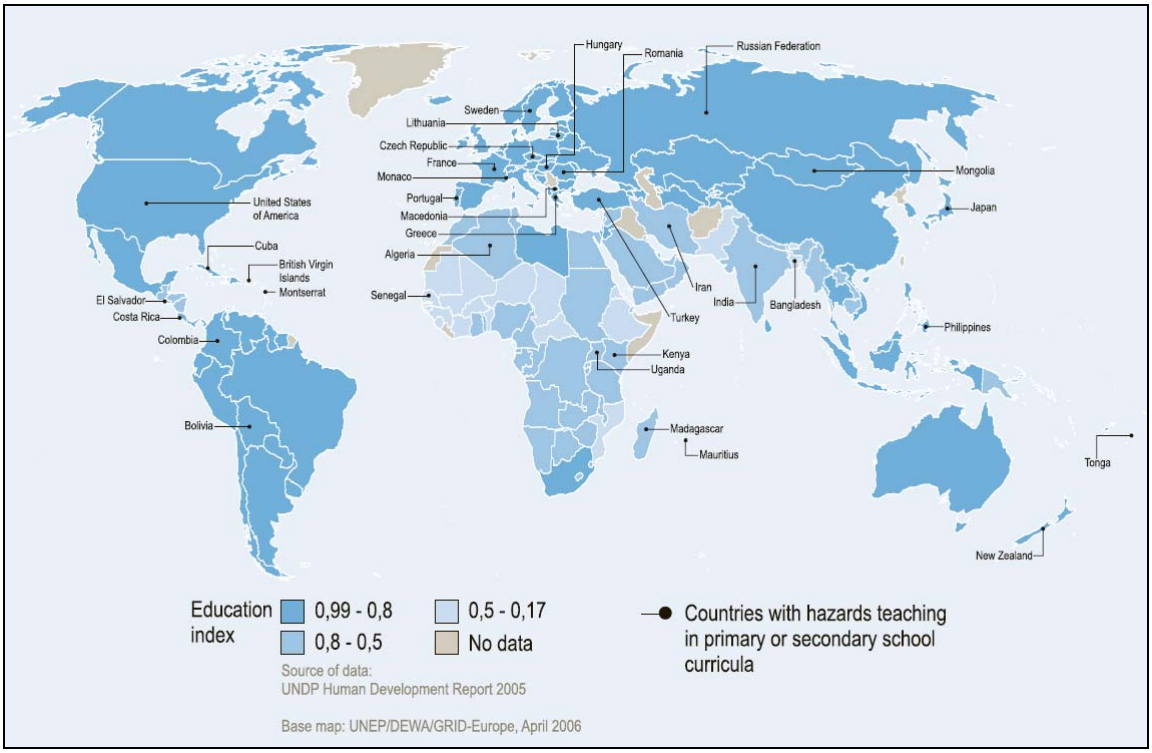

Figure 15: Countries with hazard teaching in primary- or secondary-school curricula in comparison to the education index (Disaster risk reduction . . . 2006, 9).

Figure 15 presents countries with hazard teaching in primary- or secondary school curricula (after Disaster risk reduction ... 2006) in relation to the education index. Education index is measured by the adult literacy rate and the combined primary, secondary, and tertiary gross enrollment ratio (number of actual students enrolled comparing to number of potential students enrolled). The education index is a consistent part of Human development index, published every year by the United Nations. According to figure 15 countries with hazards teaching in schools in general have higher education index.

In Switzerland, RiskPlan (Riskplan . . . 2010) tools and guidelines have been prepared to learn about and implement disaster-risk reduction, and EconoMe (EconoMe . . . 2010) to justify investments in risk education.

Table 4: Check-sheet of disaster-management curriculum in UK schools (Disaster education . . . 2007, A-3).

	Flood	Landslide	Mudslide & avalanche	Earthquake	Volcano	Hurricane / cyclone	Tornado	Wildfire	Tsunami	Drought
Cause and nature of disasters	Y	Y		Y	Y					Y
Effects of disasters	Y	Y		Y	Y	Y				Y
Lessons from past disasters	Y			Y	Y	Y				Y
Disaster-risk reduction/mitigation										
Preparedness					N	N				
Response-rescue and relief										
Reconstruction and rehabilitation										
Role of community/institution										

In Slovenia, natural-disaster education is even defined by law. Article 109 of the Act on Protection against Natural and Other Disasters (Act on protection . . . 1994) stipulates that "basic knowledge about the threats of natural and other disasters and protection against them should be transmitted" in primary education, and that in secondary- and higher-education "knowledge about protection against natural and other disaster should be transmitted in line with the program guidelines."

Table 5: Countries with hazard education in primary or secondary school, plans underway to begin teaching in schools (...), non-curriculum-based teaching [...], teaching integrated into other subjects ((...)), or pilot teaching programs [[...]] (adapted from Wisner 2006, 11).

Asia and Pacific	Americas	Africa	Europe
Bangladesh	[Canada]	Algeria	[Austria]
China	Bolivia	((Ivory Coast))	Czech Republic
Iran	British Virgin Islands	Kenya	France
India	Colombia	Madagascar	Greece
(Israel)	Costa Rica	Mauritius	Hungary
Japan	Cuba	Senegal	Lithuania
Mongolia	El Salvador	[[South Africa]]	Macedonia
New Zealand	(Haiti)	Uganda	Monaco
[Papua New Guinea]	Mexico	(Zimbabwe)	Portugal
Philippines	Montserrat		Romania
Tonga	(Nicaragua)		Russia
Turkey	United States		Slovenia
			Sweden
			United Kingdom

Thus in 2009, the elective course Protection against Natural and Other Disasters was included in the primary education program, encompassing thirty-five teaching hours a year. It can be attended by students in the last three years of primary education. In this course, students become familiar with the natural and other disasters that have always accompanied humankind, learn about the active attitude of modern society to disasters, discuss risks and measures for preventing disasters, and learn about the importance of volunteerism and rescue services (Priporočilo . . . 2006). The Slovenian geography curriculum for primary schools (Učni načrt 2003) mentions natural hazards only in relation to regional-related topics (Southern and South-Eastern Europe, p. 13) and in the chapter about special-didactical guidelines (p. 37): "We direct teachers to pay particular attention to monitoring extreme natural events which often have the character of natural disasters. In such cases it is useful to speak with students about them." The Slovenian geography curriculum for high schools (Učni načrt 2008) deals with natural hazards in relation to general (weather and climate on p. 18) or regional-related topics (North America, p. 24, Australia and Oceania, p. 25).

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.

Table 6: Recent efforts in school safety and disaster-risk-reduction education (Disaster education . . . 2007, App. 6).

Country	Year initiated	School structural safety	School disaster-risk management	Hazard education in K-12 schools	School disaster-risk reduction & preparation	Teacher training	Community disaster-risk reduction	Special and other
Czech Republic	2005			X				
France	2005			X	X			
Germany	2004			X				
Greece	2005			X				
Hungary	2005, 2007			X			X	
Lithuania	2005			X				
Macedonia	2007	X						
Monaco	2005			X				
Portugal	2005			X				
Romania	2005, 2007			X			X	
Russia	2005			X	X			
Sweden	2005			X				
Turkey	2005, 2007	X		X	X	X	X	
United Kingdom	2005, 2007		X	X				

In Lithuania, natural-disaster education is intended for eleven- to-eighteen-year- olds. In Macedonia, 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. In Portugal, natural-disaster education is targeted at seven-to-fourteen-year-olds. In Romania, natural-disaster education takes place at several levels (both in schools and voluntary activities) in line with the prime minister's decree no. 139/1999 (Disaster education . . . 2007).

In Serbia natural hazards are taught at geography lessons in 5–8th grade of elementary school (1 hour per week in 5th grade and 2 hours per week in 6-8th grade). In the 5th grade earthquakes and volcanoes are presented into detail while other natural hazards (landslides, hail, and tornado) are taught in 6-8th grade. Although the curricula for 6-7th grade do not mention natural hazards, tsunamis, volcanoes and earthquakes are presented through other topics in the textbooks. In the 7th grade the textbooks discuss tsunami, volcanoes, earthquakes, drought, floods and tornadoes while landslides, floods and torrential floods are presented in the 8th grade textbooks.

Russia offers the preschool program Foundations of Life Safety for Preschool Children, in which children are taught how to act in dangerous situations on the street, in traffic, and when handling animals. Part of the primary and secondary-school program is dedicated to classes on protection against disasters, although natural hazards are not the primary focus. In Sweden, educational programs focus on fires, which are common in this country, and special attention is also dedicated to ice and water safety; however, they do not have a special program on natural hazards.

Turkey offers a uniform national course on disaster-protection basics, which also covers action in the event of natural hazards. The course is offered in primary schools and is based on an abundance of curriculum-based teaching material. In England, children primarily learn about natural hazards in geography classes. Although the emphasis is on physical geography, they also discuss socially relevant topics. The program is defined in detail in the national curriculum (Disaster education . . . 2007).

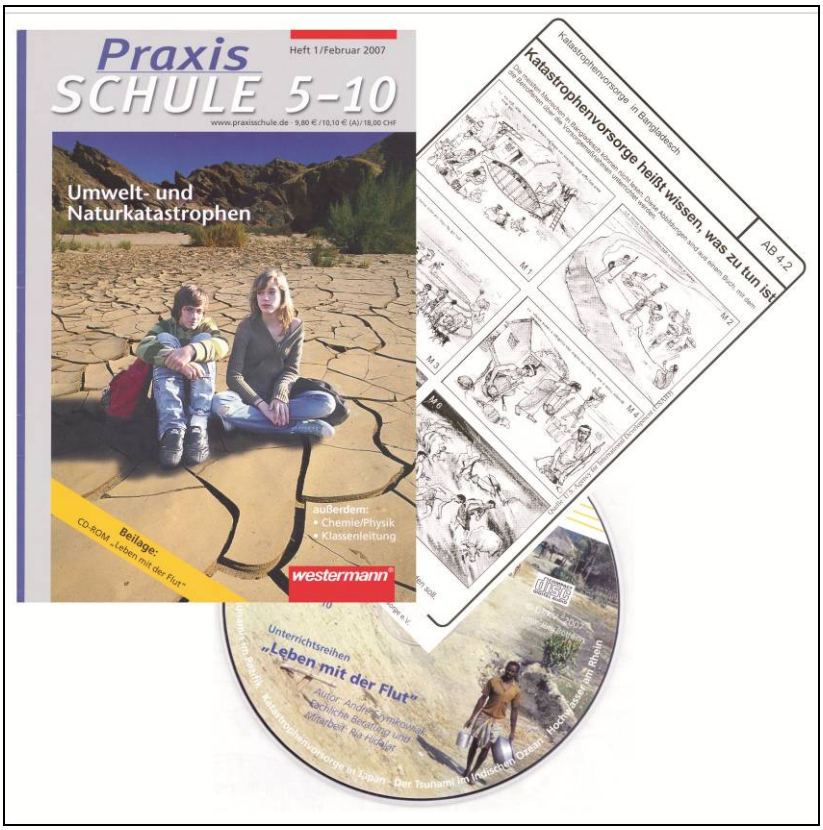

Figure 16: Some German publications for helping teachers to prepare for lessons on natural hazards.

In Germany each 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. Children also study the risk of earthquakes in their home region (Global assessment report . . . 2009, 130). Some states have already included natural hazards as own lessons (e.g. Nordrhein-Westfalen, Schleswig-Holstein; Szymkowiak 2006a, 7). For the purpose of such lessons some Magazines have published topic issues to help teacher to prepare for lessons on natural hazards (e.g. Praxis Geographie, Vol. 36 (2006), No. 12 – titled: Naturgefahren/Natural hazards); Praxis Schule 5–10, Vol. 18 (2007), No. 1– titled: Umwelt- und Naturkatastrophen/Environmental and Natural Disasters). In addition to this the German Committee for Disaster Reduction published some material for the same purpose (e.g. CD-ROM titled Leben mit der Flut/Living with flooding); Szymkowiak 2006b; Figure 16).

We also have to mention a research on teaching resources development and curriculum promotion on natural hazards mitigation at high school level was carried out in Taiwan resulting in positive learning outcomes in both students' learning achievement and attitude toward typhoon hazard mitigation. They stress that group discussions enhance students' thinking and experience sharing on the perceptions about typhoon hazards preparedness and mitigation. Also, direct observation after a disaster has proved to be one of the most effective means of learning for hazard precaution and mitigation. It has been noted that next to natural phenomena less attention has been paid to precautions against natural hazards and hazards mitigation. Therefore, the hazards mitigation curriculum module is going to be added as a topic in the national high school curriculum guidelines. But activities should not end there since the study has also indicated the importance of the classroom teacher's attitudes on the implementation of

innovative curriculum; therefore, also the teachers should be included in the elaboration of the curriculum topics (Chang and Chang 2010).

- → Risk education themes can be included in the curricula of several school subjects, such as geography, social sciences, biological sciences, forensics, physics, history, and domestic sciences.
- → Risk education should start at early age.
- → There is a need of further in-depth evaluation of risk education.

4 Natural-hazards education in Europe: empirical analysis of European geography textbooks

Geography textbooks are instructional books that transmit findings and knowledge about social and landscape phenomena and processes; that is, they follow a specific program and teaching, psychological, and methodical principles, and are in line with educational and school needs and tasks. This is connected with a basic issue regarding textbooks and education: they are intended for students, but are evaluated and assessed by adults. Therefore students could be involved in developing and preparing textbooks and work together with their teachers.

Figure 17: Library of the Georg Eckert Institute for International Textbook Research (photography Matija Zorn).

Textbooks are composed media, which combine text equally with pictures, maps, charts, diagrams, and tables. Some classify them among teaching means because they bear information, and some classify them among teaching aids because they represent objects that enable students to obtain knowledge. To students, textbooks are sources of information; they are useful for both providing knowledge and independent learning, which is why they contribute significantly to the effectiveness of classes and independent learning. Textbooks thus serve as "the basic ideological, conceptual, and didactic orientation of the teacher's and student's work" (Strmčnik 1975, 263), although formally speaking they are merely one of the means for achieving educational objectives (more on this topic in: Bamberger 1990; Haubrich et al. 1997; Justin et al. 2003; Malić 1986; 1992; Kovač et al. 2005; Krämer 1991; Thöneböhn 1992; Wright 1987; cited in Senegačnik 2005).

Textbooks are usually officially recognized aids because they provide content that a society generally agrees should be passed on to future generations. Thus in Slovenia, for example, textbooks are officially recognized as the basic teaching materials for achieving the educational objectives defined in the curriculum (Official Gazette of the Republic of Slovenia, no. 2/2000, 121). Geography and history textbooks help explain who we are to young people (Pingel 1999, 7–8) and the nature of the world around us. Textbooks thus also play an educational role, which indicates a connection between knowledge and basic values (Senegačnik 2005).

Figure 18: Samples of geographical textbooks with natural-hazards-related front covers (Library of the Georg Eckert Institute for International Textbook Research; photography Matija Zorn).

With regard to textbooks, the main problem of curricula is their potential inability to be realized or carried out, primarily connected with obtaining data. This is also connected with outdated textbooks: they are usually useful for approximately ten years and take five years to be produced (Pingel 1999, 35), or produced even only one year, which is usually the case in Slovenia (Senegačnik 2005, 85).

A major issue is also the fact that textbook authors are often insufficiently critical towards the society in which they are living, which is especially reflected in their relationship to ideologies, and cultural issues such as ethnic minorities and disadvantaged social communities. Textbooks often do not merely disseminate information, but also ideology, many are also culturally rooted. One-sided concepts created by textbooks can be improved through international comparison and revision (Zorn 1997; Pingel 1999). Textbooks should not merely represent a collection of data, but should lend a new quality to the text: “a mechanical collection of separate course content is not the same as a whole of interconnected contents, which belong together by internal logic” (Blažič et al. 2003, 253). In this regard, it is also important to follow the logic systems of various disciplines. The following has thus been established (Medved 1977;

Zgonik 1995, 25; Brinovec 2004, 24): a linear distribution of course content (course content that is covered at a lower level is not covered again later on), a concentric distribution of course content (course content continues to return to the content already processed, but each time at a higher level), and a spiral distribution of course content.

With textbooks dealing with Earth sciences, it is especially important to horizontally and vertically connect various disciplines dealing with the same phenomena and processes in a landscape. Secondary-school students that had been made aware of connections with history solved geographical problems 33.3% better than those that had not been made aware of this connection (Strmčnik 2001, 272; cited in Senegačnik 2005, 45).

Textbooks also reflect the criteria that had been used for selecting contents of school classes. At the end of the 1980s, German school geography focused on the following: importance for life, relation to space and the student, spatial importance, importance of the content as illustrative material, importance for the discipline of geography and related spatial sciences, global importance, exemplarity and possibility of transfer, problem-orientation, feasibility in class, methodological productivity, and development of work methods and techniques (Köck 1988, 56–57; cited in Senegačnik 2005). At least some of these criteria could be used in natural-disaster education.

4.1 Textbooks as means of natural hazards education

This section identifies differences between various European countries with regard to risk education. Because it was established above that a uniform method can be used for an entire area, the secondary-school geography textbooks at the Georg Eckert Institute for International Textbook Research (Georg-Eckert-Institut für internationale Schulbuchforschung) 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 1991 UNESCO authorized it to coordinate international research on textbooks. The institute's library has more than 240,000 units, of which textbooks account for 171,000 units and scholarly studies account for approximately 68,000 units (GEI . . . 2010).

A horizontal analysis of the content was conducted, which means that textbooks from various countries covering the same course were examined in terms of specific content. According to Pingel (1999, 28), the analysis and overview of textbooks belongs to a special "textbook research" category.

This study belongs to inter-textual strategies, which study the internal composition of a textbook and its components or the textbook itself. We are not interested in an expert-assessment strategy to study textbooks, in which value judgments ought to be made on the assessments of textbooks provided by teachers and other professionals; this was impossible due to the nature of the CapHaz-Net project. The result of our work is thus an analysis of the frequency of specific text and visual textbook components, and their content-related definition.

Figure 19: Samples of European geographical textbooks' covers and pages with natural-hazards-related contents (Library of the Georg Eckert Institute for International Textbook Research; photography Matija Zorn).

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. The internal structure of textbooks was analyzed and, with regard to the great importance of graphic components, photographs, maps, sketches, graphs, and newspaper abstracts were also examined.

Our study of textbook research belongs to descriptive-analytical methods and quantitative conceptual analyses, a special form of which is the “international textbook research” developed at the Georg Eckert Institute for International Textbook Research. Textbook research is an important method connected with the status, development, and characteristics of the parent

discipline because it ultimately also influences textbook producers and users (Volkmann 1997, 195–198; Pingel 1999; Justin et al. 2003; cited in Senegačnik 2005).

Although in some countries and school systems, natural hazards are also dealt with in other courses (e.g., history and natural sciences), our study focused on the overview of secondary-school geography textbooks (i.e., textbooks for tenth and eleventh grade or fourteen- and fifteen-year-old students). Although general education usually lasts until twelfth grade in Europe, school systems are not entirely comparable. In some countries (e.g., the General Certificate of Secondary Education in Great Britain), levels are not linked to a specific age, but students' progress.

In our research on risk education we have chosen to focus on children through textbooks, as the children have been found "to be the most venerable to effects of hazards" (Ronan, Cellin and Johnston 2010, 504). Why did we choose geography textbooks? The answer may be found in the article of Radkau and Henrÿ (2005, 375, 377, 387) who argue that disasters are a more marginal topic in history and civics textbooks. Analyzing German history textbooks (e.g. the rare examples of disasters are the Vesuvius eruption and the destruction of Pompeii in 79 A.D., and plague in the Middle Ages) they also found that the way how natural hazards and disasters are dealt with in these textbooks is linguistically and visually similar to the discourse found in the media is often used in secondary education textbooks. Natural hazards are no border issue in geography textbooks on the other hand. Indeed, geographical research focuses on the processes and phenomena on the contact between nature and society. In addition to this, geography textbooks tend to lean on the paradigms of physical and human geography, and therefore prove to be more analytical. Also Schmidt-Wulfen (2005, 404) recognizes that education on natural hazards is located above all in geography teaching and argues that these lessons are very popular.

According to literature review done by Ronan et al. (2010, 504) there have been only a handful of studies dealing with the benefits of preventive interventions in the form of hazard education. Therefore, our research cannot answer the question "How effective is risk education through textbooks?", as we didn't assess the effectiveness of education, which is indeed very difficult to do. Some of the related studies also assessed the effectiveness of risk education. They suggest (e.g. from New Zealand) that youth involved in school hazard education programs "reported a greater number of home-based hazard adjustments, had more correct knowledge of emergency management-related readiness and response behaviors, and lower levels of incorrect knowledge." (Ronan et al. 2010, 219). According to the same authors (Ronan et al. 2010, 503) "even simple and brief reading and discussion programs can produce tangible benefits".

On the other hand other studies (not only on children) suggest (e.g. from the west coast of the USA) that although awareness has increased due to risk education "the public has taken relatively few actions to reduce their … risk and still views … hazard mitigation as a government activity rather than a personal one" (Dengler 2005, 152). Dengler (2005, 152) also suggests that risk education is to be "the first of five strategic planning elements" to reach the goal e.g. a hazard "resilient community".

4.2 Selection and sample

Textbooks vary by design, scope, and number of appendices. The differences among them result from differences in the curricula and differences connected with the comprehension of a

landscape, which is also connected with the historical development of geography and different organization of geography classes in various countries.

In this regard, we must also mention the difference between textbook authors that do not have experience with classroom teaching or are already distant from it, and those that are actively teaching. The first strongly emphasize a thematic approach, whereas the second emphasize a regional approach (Senegačnik 2005).

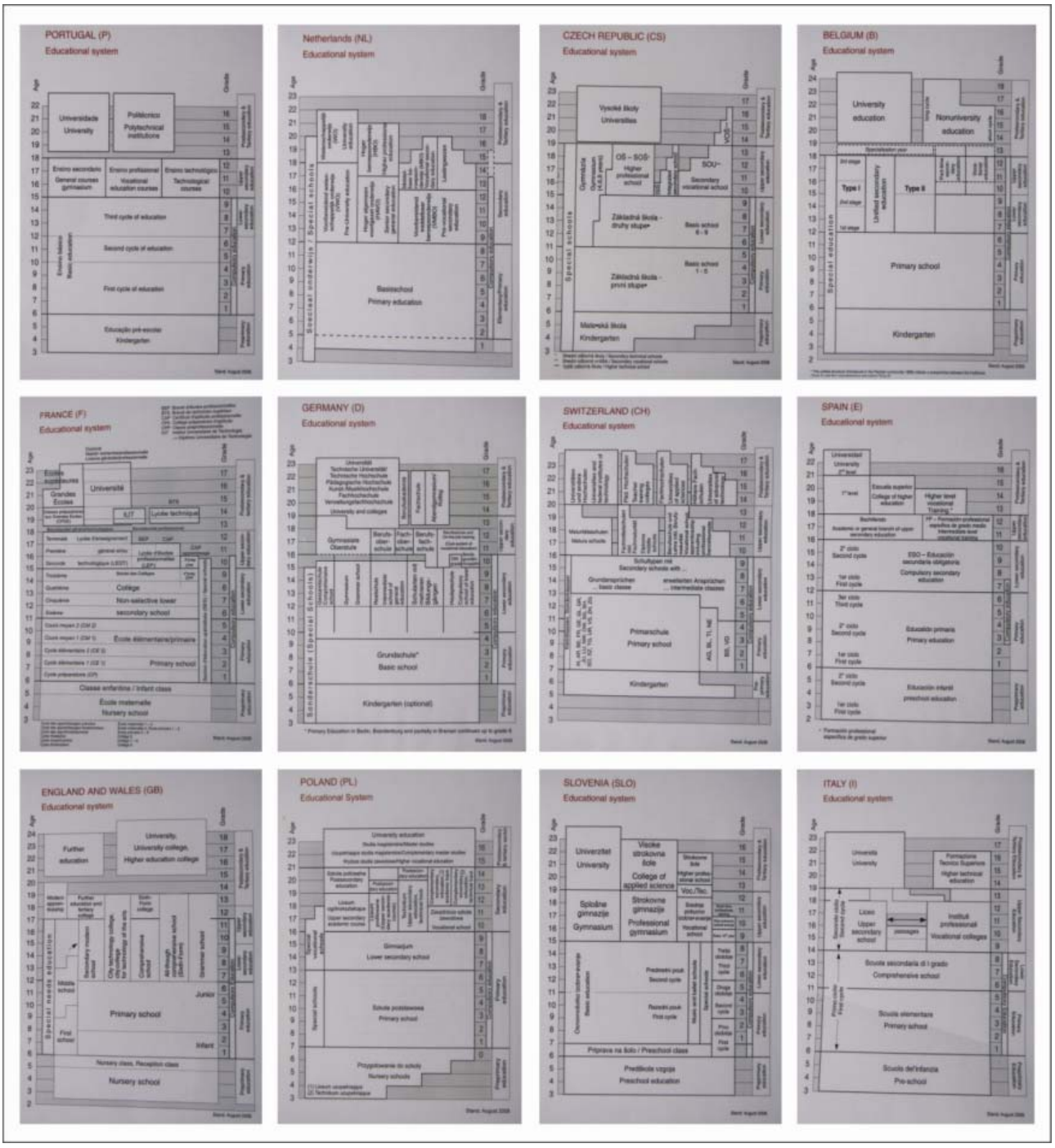

Figure 20: Sample age level and education system labels in selected European countries (Library of the Georg Eckert Institute for International Textbook Research; photography Matija Zorn).

Despite various approaches and a number of differences among textbooks, we believe that secondary-school textbooks represent a sufficiently reliable and comparable criterion for this type of study; in addition, fifteen-year-olds are already capable of comprehending reality critically and can thus already understand the complex connections of the nature-society relationship that are reflected in natural hazards. This is why many textbooks do not present natural hazards as catastrophes or disasters (realisation of hazards), but as natural phenomena that society can adapt to and view as a constant feature of a region. In defining the age level, we used special labels used at the institute's library, which compare age levels with school levels by individual country (Figure 20).

Figure 21: Cover pages of selected geography textbooks (Photography: Matija Zorn).

Due to a lack of suitable textbooks in the library's collection, the analysis could not be conducted for certain countries (Andorra, Bulgaria, Cyprus, Liechtenstein, Luxembourg, the Vatican, and San Marino); this lack of textbooks is probably due to the fact that because of their smallness (apart from Bulgaria) these countries probably use the textbooks of neighbouring countries. In addition, in some countries such as France, textbooks are developed based on a uniform national curriculum, whereas elsewhere (particularly in Germany) each country (Land) uses its own curriculum for each level and publishers can issue several textbooks for each curriculum. It

is also often impossible to establish from textbooks alone whether they are intended for a general educational or a special program attended only by few.

Figure 22: Natural hazards topics in the U.K. geography textbook “Geography Matters 1” (Photography: Matija Zorn).

Textbooks ultimately also depend on the type and importance of the curriculum in individual countries. In some countries, curricula have precisely defined contents, whereas elsewhere only objectives are specially defined. Where several textbooks were available, the one was selected that matched the age group and that had been recently created; however, for some countries no newer editions were available. The analysis also included textbooks from Russia, Belarus, and Turkey. For example, Turkey is exposed to frequent and diverse natural hazards and has a well-developed education, protection, and rescue system. Russia was included because it is a large country comparable to the European Union, while slightly differing from it in terms of its geographical research approach and also its method of treating natural hazards.

Figure 23: Pages of selected textbooks from France, Serbia, United Kingdom and Turkey (Photography: Matija Zorn).

A total of 166 textbooks from thirty-five European countries were selected and examined. The results of the textbook analysis were presented on a map showing European countries with categories for selected textbooks. The textbook analysis thus provided an insight into the current situation in various countries, in which attention must be drawn to the fact that the textbooks selected naturally do not represent the only possible selection because it was impossible to examine all the textbooks and also because the institute does not have all of them.

Table 7: Number of textbooks examined by individual country (authors' research).

Country	No. of textbooks	No. of textbook pages	No. of pages containing descriptions of natural hazards	Share of pages containing descriptions of natural hazards
Albania	3	656	6	0.91
Andorra	0	-	-	-
Austria	4	911	19	2.09
Belarus	3	868	3	0.35
Belgium	7	137	43	3.12
Bosnia-Herzegovina	6	1,083	21	1.94
Bulgaria	0	-	-	-
Croatia	4	748	11	1.47
Cyprus	0	-	-	-
Czech Republic	3	374	2	0.53
Denmark	5	503	121	24,06
England/Wales/Scotland	7	1,952	163	8.35
Estonia	3	543	18	3.31
Finland	8	1,400	41	2.93
France	4	1,452	16	1.10
Germany	10	2,226	105	4.72
Greece	2	386	9	2.33
Hungary	7	1,225	35	2.86
Iceland	7	663	33	4.98
Ireland	6	1,220	26	2.13
Italy	3	1,362	24	1.76
Latvia	3	689	14	2.03
Liechtenstein	0	-	-	-
Lithuania	3	595	4	0.67
Luxemburg	0	-	-	-
Macedonia	5	810	23	2.84
Moldova	3	714	14	1.96
Netherlands	5	1,375	62	4.51
Norway	2	720	32	4.44
Poland	5	1,618	63	3.89
Portugal	3	1,010	15	1.49
Romania	3	399	24	6.02
Russia	5	1,546	2	0.13
Serbia	5	1,020	36	3.53
Slovakia	3	254	0	0.00
Slovenia	7	831	34	4.09
Spain	4	1,614	57	3.53
Sweden	3	1060	31	2.92
Switzerland	6	1,658	26	1.57
Turkey	3	741	52	7.02
Ukraine	6	1,514	5	0.33
Total	166	37,119	1,190	3.32

The majority of textbooks examined (i.e., ten) were German. We examined seven textbooks from Belgium, Great Britain, Hungary, Iceland, and Slovenia, and six from Bosnia-Herzegovina, Ireland, and Ukraine. The number of textbooks from Denmark, Macedonia, the Netherlands, Poland, Russia, and Serbia was five. Austria, Croatia, France, and Spain contributed four textbooks each, and Albania, Belarus, the Czech Republic, Italy, Latvia, Lithuania, Moldova, Portugal, Romania, Slovakia, Sweden, and Turkey contributed three. Fewer than three textbooks

were examined for Greece and Norway. As already stated above,no suitable textbook could be found for Andorra, Bulgaria, Liechtenstein, and Luxembourg.

Accordingly, the most pages were examined in the German textbooks (i.e., 2,226), and more than 1,500 pages were examined in textbooks from Great Britain, Switzerland, Poland, Spain, Russia, and Ukraine. More than 1,000 pages were analyzed in textbooks from France, Finland, the Netherlands, Italy, Hungary, Ireland, Bosnia-Herzegovina, Sweden, Serbia, and Portugal, and more than 500 in textbooks from Austria, Belarus, Slovenia, Macedonia, Croatia, Turkey, Norway, Moldova, Latvia, Iceland, Albania, Lithuania, and Estonia. In textbooks from Denmark, Romania, Greece, the Czech Republic, Slovakia, and Belgium, over 100 pages (or a total of 1,957 pages) were examined. The majority of the textbooks were regional geographic (35.7%), about a fifth (22.6%) were more physical-geographic while 41.7% were social-geographic.

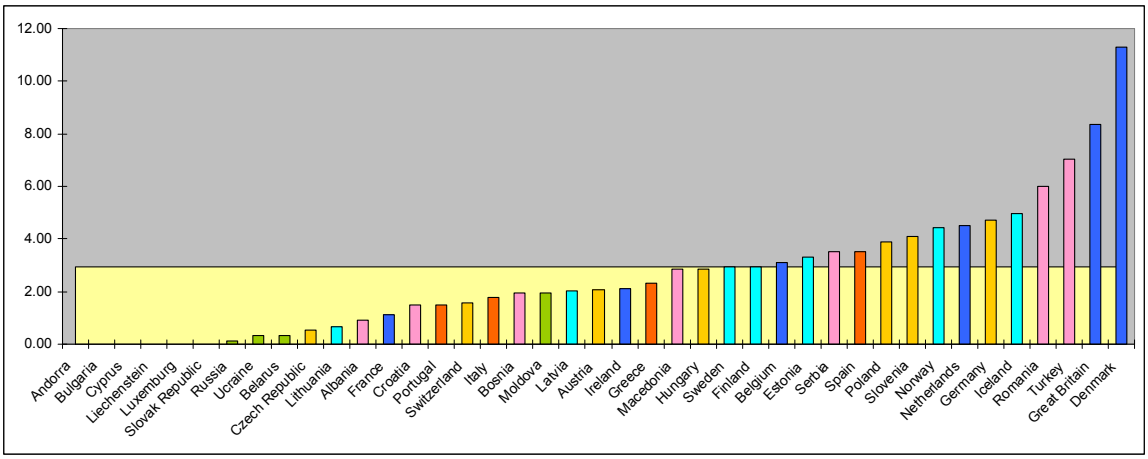

Figure 24: Average share of textbook pages containing descriptions of natural hazards by country (authors' research).

Based on geographical literature (Brinovec et al. 2000), the countries were divided into regions. Northern Europe comprises of Denmark, Sweden, Norway, Finland and Iceland, United Kingdom, Ireland, Belgium, Netherlands, Luxembourg and France are part of Western Europe, Spain, Italy, Greece and Portugal are Southern Europe, While Germany, Poland, Czech Republic, Slovak Republic, Switzerland, Austria, Slovenia and Hungary are part of Central Europe. Croatia, Bosnia and Herzegovina, Serbia, Montenegro, Romania, Albania, Macedonia and Bulgaria are part of South-Eastern Europe while the Baltic countries, Russia, Belarus, Ukraine and Moldova are in Eastern Europe.

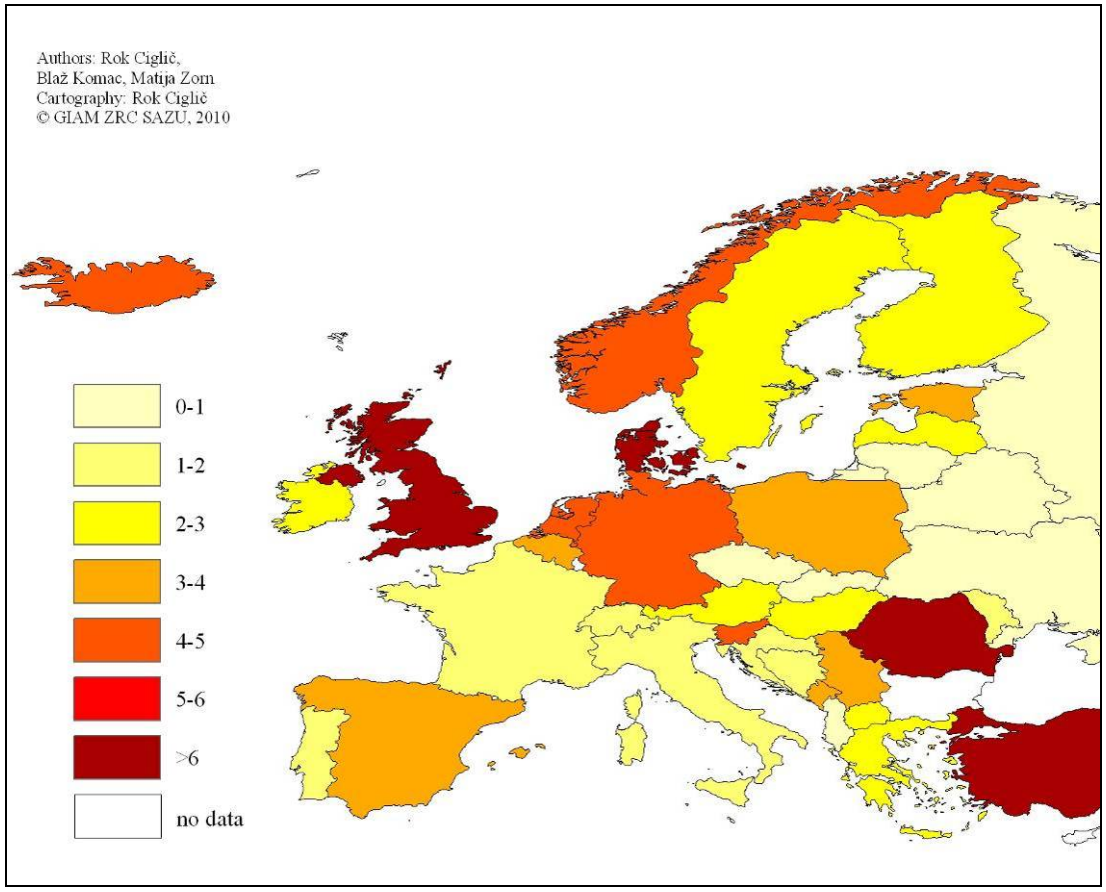

Figure 25: Natural hazards as course content expressed in the share of pages in secondary-school geography textbooks (authors' research).

According to this division, Western Europe dedicates the most attention to natural hazards (i.e., 5.2%), and Eastern Europe the least (i.e., 0.7%). The share of pages containing descriptions of natural hazards is still above 3% in Northern Europe (i.e., 3.6%) and South-eastern Europe including Turkey (i.e., 3.4%). The shares in Central and southern Europe exceed 2% (i.e., 2.8 and 2.3%, respectively).

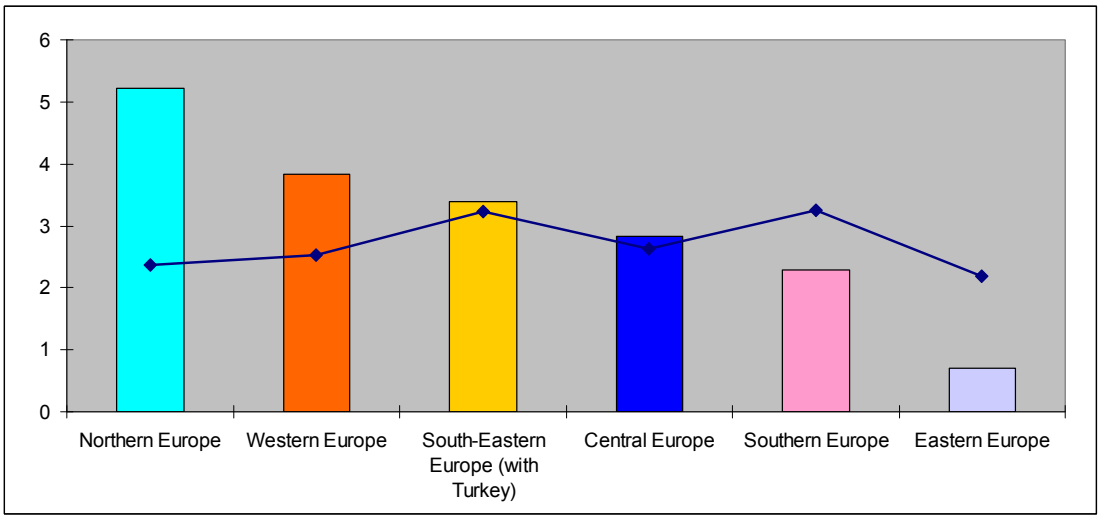

Figure 26: Average share of textbook pages containing descriptions of natural hazards by European region (columns) and average orientation of textbooks (line; 1 = social geography, 5 = physical geography; authors' research).

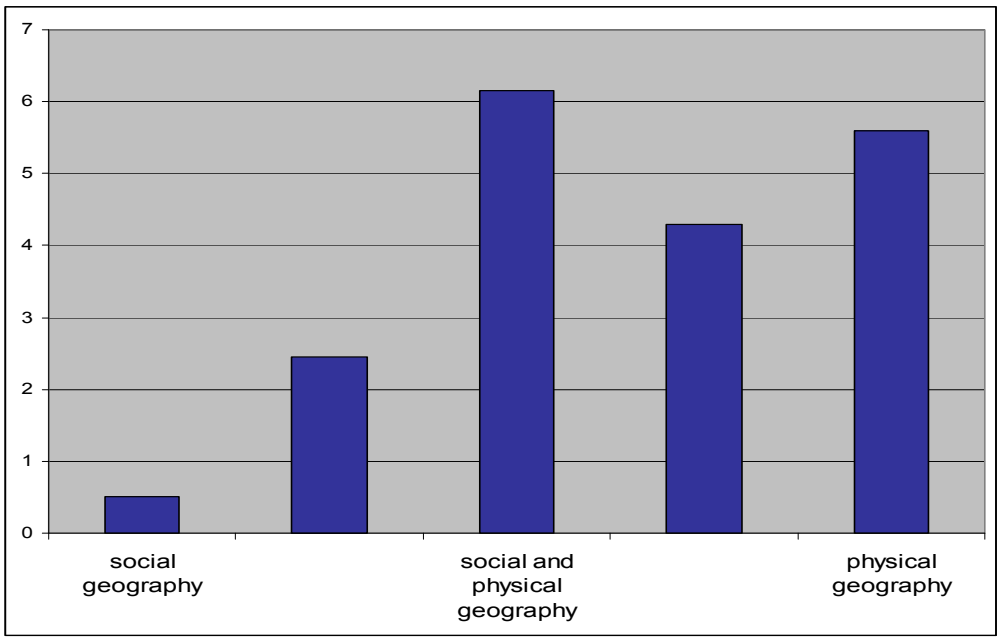

Figure 27: Textbooks according to their orientation from social to physical geography (authors' research).

There are other open questions regarding education and natural hazards at the European and also at the international level. Research gaps and criteria for evaluation of different risk education tools and methods have been identified (see table in the Appendix 9.5), as well as predominant physical-geographical orientation of natural-hazards-related topics in European geographical textbooks (Figure 36). To deal with all the difficulties and challenges, to overcome these obstacles and reach resilient society, a shift in understanding education is needed. This includes changes of education aims, methods and tools to better understand the relations between society and natural hazards and to mitigate the risk (see Appendix for details).

4.3 Types of natural hazards considered and examples of concrete disasters

It is interesting to know which natural hazards or which examples from history are described in the textbooks selected. From the perspective of the education level of European citizens, it is important to what extent the examples presented in textbooks have a general character and to what extent they refer to the European context.

From this viewpoint it is interesting to note that nearly 1,000 pages (i.e., 966) or four-fifths of the total pages in the textbooks containing descriptions of natural hazards are dedicated to descriptions of natural hazards. Specifically, natural hazards are difficult to describe without describing concrete processes and examples from history. Several good examples of presentation of natural hazards in the textbooks have been identified but we will not present them into detail in this report (see for example the textbook presented in figure 22).

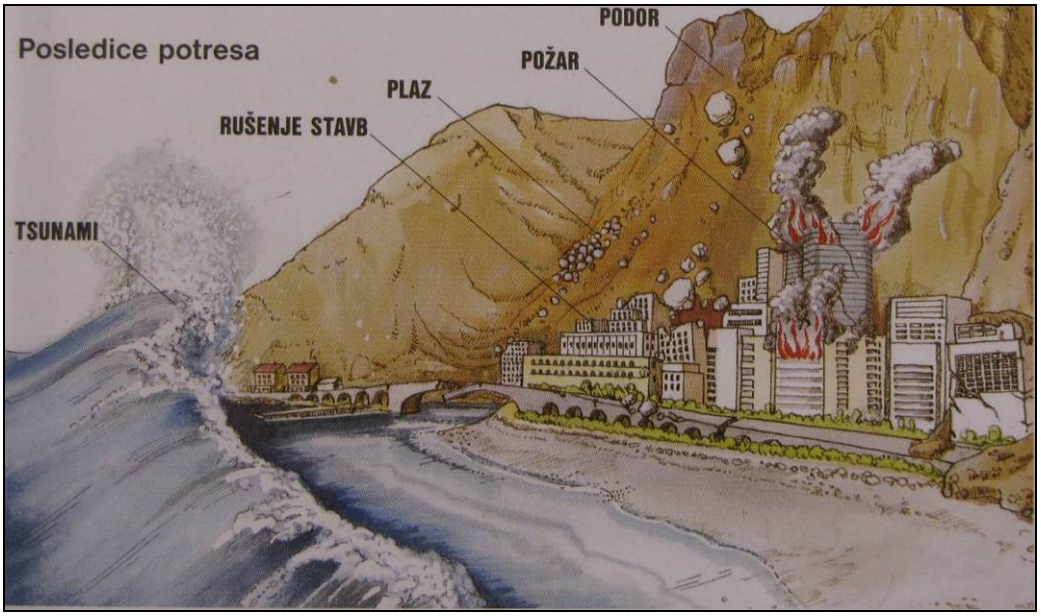

Figure 28: Graphical presentation of natural hazards related to earthquakes from a Slovenian geographical textbook (Library of the Slovenian school museum; photography Matija Zorn).

The largest share is dedicated to earthquake descriptions (23.2%), and more than one-fifth (i.e., 21.2%) of pages focus on describing volcanoes as generators of volcanic hazards. These are followed by descriptions of floods (18.1%) and, surprisingly, erosion (14.5%). The share of other natural hazards mentioned in textbooks is below 10%. Fairly large attention is directed to landslides and rockfalls (7.9%), and storms (7.1%), whereas droughts (3.5%) and avalanches (2.5%) are dealt with less often. Descriptions of wave surges and tsunamis (1.1%) are even more frequent than descriptions of forest fires (0.8%), although forest fires are quite common in southern Europe, for instance.

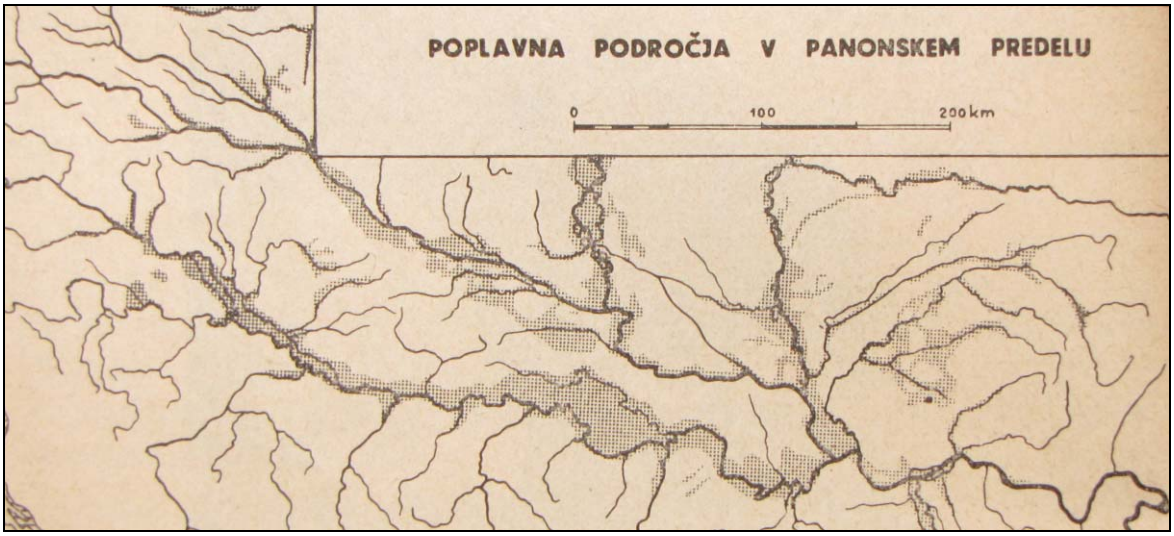

Figure 29: Flood areas of the Donau and Sava rivers as presented in textbook written by Savnik (1949; Library of the Slovenian school museum; photography Matija Zorn).

An interesting fact has been established in this regard: the number of pages dedicated to descriptions of natural hazards roughly corresponds to the number of individual events taking place in Europe over the last century. However, the number of pages containing descriptions of

natural hazards is connected more with the economic damage and number of victims of individual disasters than their number.

Table 8: Number of examples of natural-disaster descriptions in European geography textbooks (left; with number of cases) and in British geography textbooks (right) (Authors research and Disaster education . . . 2007, 11–12).

Earthquake/region		**Volcanic eruption/region**		**Storms (hurricanes) /region**		**Flood/region**		**Drought/region**	
European	British	European	British	European	British	European	British	European	British
Kobe, 19	Kobe, Japan, 1995	Italy; 30	Mount St. Helens, US, 1980	USA; 22	Mitch, Central America, 1998	Bangladesh; 20	Bangladesh, 1998	Sahel; 3	Sahel, 1980
San Francisco, 19	Maharashtra, India, 1993	USA; 19	Mount Pinatubo, Philippines, 1991	Australia; 2	Great Storm of 1987, UK, 1987	Germany; 6		India; 3	
Bam, Iran, 13	San Francisco, US, various examples	Iceland; 9	Montserrat, 1995–1997	Denmark; 2	Erin, Florida, USA, 1995	India; 5		Somalia; 2	
Izmit, Turkey, 10	Armenia, Columbia, 1999	Indonesia; 8		Finland; 2		USA; 5		Australia; 2	
Ciudad de Mexico; Mexico; 4	Armenia, 1988	Colombia; 4		Japan; 2		China; 4		Spain; 2	
Chile; 3	Los Angeles, US, 1994	Japan; 4		UK; 2		Spain; 3		Mali; 1	
Shensi, China; 2				Mexico; 2		France; 3		Ethiopia; 1	
Indian Ocean; 2		Montserrat; 4		Lithuania; 1		Italy; 3		USA; 1	
Krakatoa; 2		Congo; 3		China; 1		UK; 3		Saudi Arabia; 1	
Skopje; Macedonia; 2		Canary islands; 3		Bangladesh; 1		Mozambique; 2		Italy; 1	

This is also confirmed by one of the key hypotheses of the CapHaz-Net project; namely, that even in modern society the understanding of natural hazards is connected less with natural hazards themselves than their social impacts or their social comprehension. From this

perspective, it can be claimed that natural hazards in Europe are truly “socially and culturally constructed” (WP-1 report, D.1.1.; Kuhlicke and Steinführer 2010, 4).

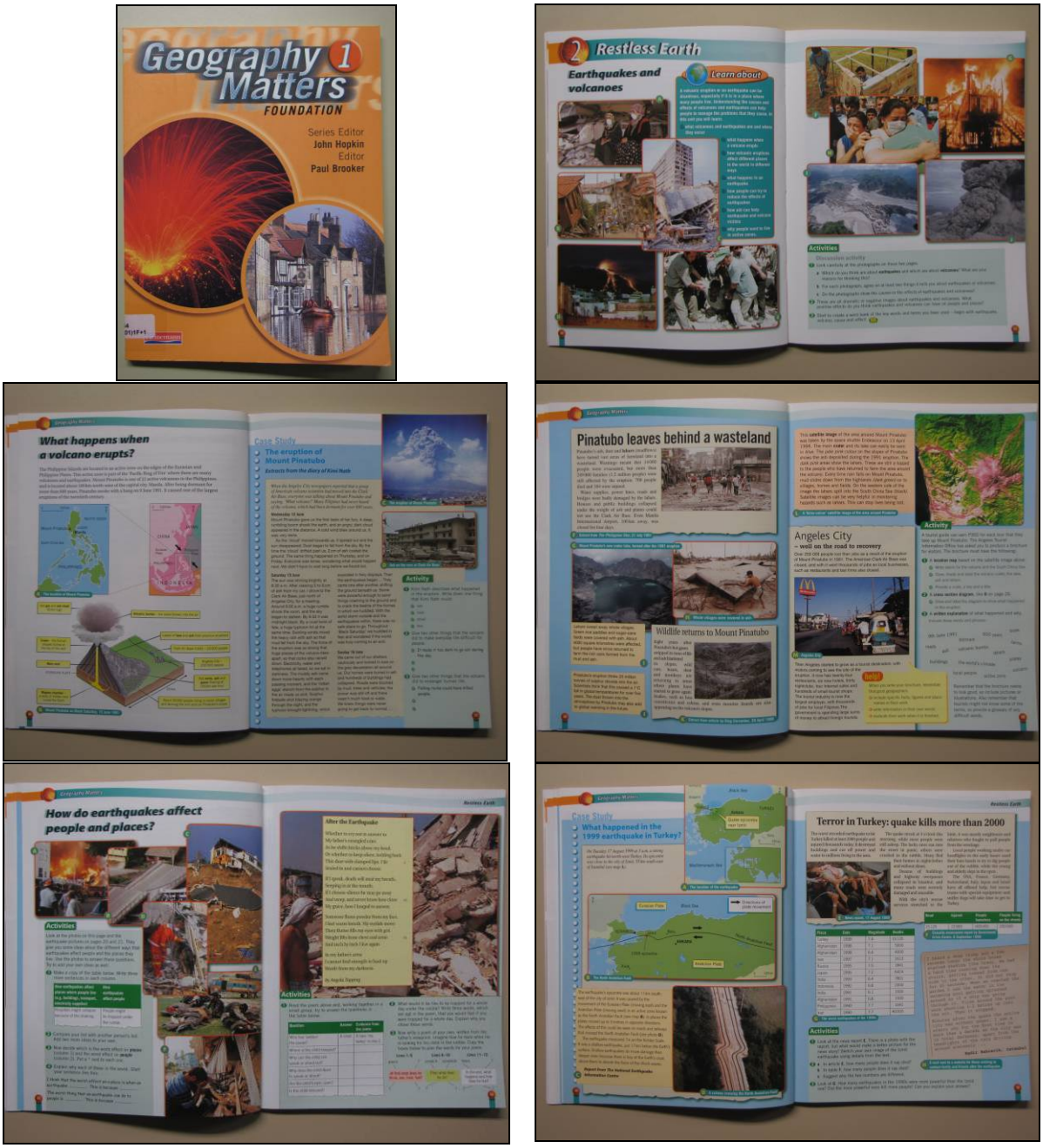

Figure 30: An example of a chapter on natural hazards in textbook (Library of the Slovenian school museum; photography Matija Zorn).

A similar picture is revealed by comparing the number of examples described in textbooks that are mentioned as part of descriptions of natural hazards. Descriptions of volcanoes (i.e., 26%) account for the largest share of concrete examples (with known locations) totalling 457. This is understandable because volcanoes are one of the most fascinating natural phenomena and thus constitute suitable teaching material. They are followed by earthquakes (24%) and floods (18%). Other natural hazards account for the remaining third of examples described.

4.4 Disasters in textbooks and in real landscape

The share of pages in European textbooks was compared to the number of events, victims, and economic damage in the last century (Urban habitat . . . 2010). In terms of the share of pages in European textbooks, earthquake descriptions are most overrepresented compared to the average (i.e., 29%). Volcanic descriptions account for almost the same share (27%), followed by descriptions of floods (23%). Descriptions of landslides are less frequent (10%) as well as of storms, although they are quite common in Europe (9%); descriptions of tsunamis (1%) and fires (1%) are also very common. The picture is different when taking into account the occurrence of individual natural hazards in Europe over the last century (i.e., from 1900 to 2005). According to the number of events, floods are the most important; there were more than 400 during this period, accounting for nearly one-fourth of all natural hazards. Storms account for one-fourth of natural hazards (i.e., 268), and major earthquakes for one-fifth of all natural hazards (i.e., a total of 232). With regard to the number of events, textbooks dedicate sufficient attention to earthquakes and floods. The number of pages dedicated to storms is clearly low, and rather long descriptions are dedicated to volcanoes.

The picture also differs if the number of pages is compared to the number of victims in Europe over the last century. Earthquakes predominate strongly, causing more than 300,000 deaths (89% of victims). Surprisingly, more than 16,000 deaths were caused by landslides (4.7%), whereas the 11,200 flood victims (3.1%) and 7,200 storm victims (2.0%) are as expected.

Table 9: Shares of pages containing descriptions in textbooks, examples described in textbooks, and events, victims, and economic damage caused by natural hazards in Europe from 1900 to 2005 (Urban habitat . . . 2010). Note: The estimate excludes data on erosion, avalanches, and drought, which account for approximately 20% of all the examples described in textbooks, because no data on the number of victims in Europe over the last century could be obtained.

	Share of textbook pages containing descriptions (estimated)	Share of examples described (estimated)	Share of events 1900–2005 (N = 1,126)	Share of victims 1900–2005 (N = 363,004)	Share of economic damage 1900–2005 (sum = $219,173,000)
Earthquake	0.29	0.28	0.21	0.89	0.34
Flood	0.23	0.21	0.39	0.031	0.440
Landslide	0.10	0.05	0.08	0.047	0.010
Volcano	0.27	0.31	0.01	0.002	0.000
Fire	0.01	0.03	0.07	0.001	0.017
Storm	0.09	0.11	0.24	0.020	0.191
Wave surge and tsunami	0.01	0.02	0.00	0.007	0.000

Although the proportion of coverage may not statistically significant represent the degree of risk education, it can give us some information. In terms of the number of victims, textbooks dedicate sufficient attention to earthquakes and floods, whereas they direct little attention to storms and high attention to volcanoes and landslides. In terms of economic damage caused by natural hazards in Europe over the past century, textbooks dedicate high attention to volcanoes and landslides, and low attention to earthquakes, floods, and storms.

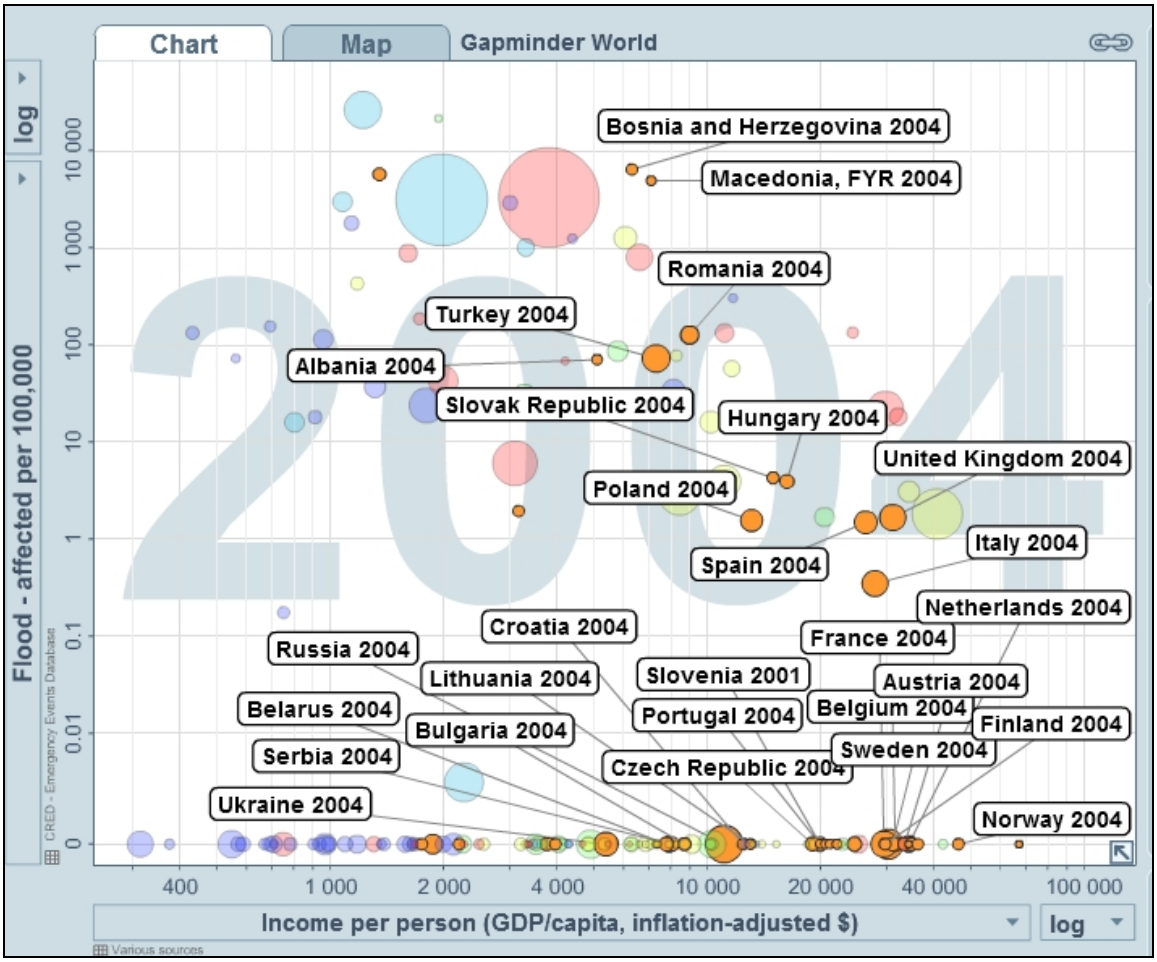

Figure 31: Population affected in 2004 floods for selected countries (Gapminder . . . 2010).

The online *Gapminder* application run by the Gapminder Foundation in from Stockholm (2010) enables an interesting comparison. It contains data on the population affected or killed in floods, storms, extreme temperatures, and earthquakes. According to the *Gapminder* (2010) data for 2004, Romania, Ireland, Turkey, Cyprus, and France predominate in the number of affected (per 100,000 inhabitants) and killed in storms. The same year, extreme temperatures affected Macedonia, Romania, Albania, Spain, and Turkey, in which Romania and Turkey reported the largest number of casualties. Earthquakes affected the largest shares of population in Turkey, Slovenia, and Germany. Most interesting are the data on the number of people affected and killed in floods: in 2004, victims were reported in Romania, Turkey, and Slovakia. The share of textbook pages describing earthquakes, floods, forest fires, and tsunamis seems right. Due to the great role of agriculture in the European economy, frequent descriptions of erosion are expected (especially examples from the Mediterranean). Descriptions of avalanches are rare and limited to specific areas (e.g., descriptions of the Alps); the situation is similar with regard to droughts. There is a complete lack of descriptions of the effects of extreme temperatures, which are manifested in the form of heat waves or extremely cold weather.

In general, the overview of examples gives the impression that natural hazards are less common in Europe because examples from elsewhere predominate. This is perhaps due to the fact that they are more spectacular or cause higher levels of casualties and economic damage, and are therefore more often reported in the media.

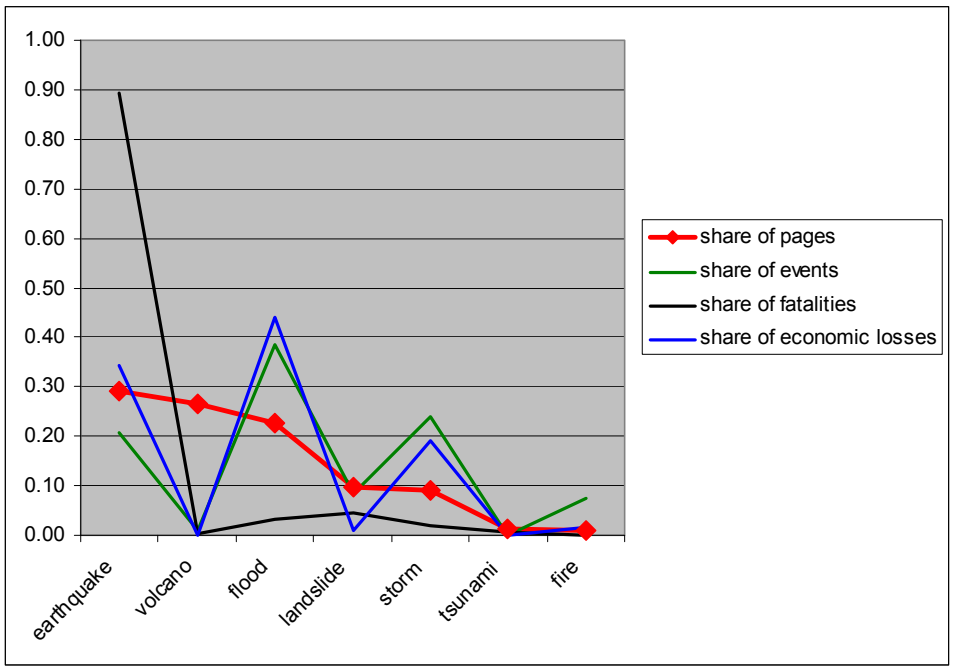

Figure 32: Shares of pages containing descriptions in textbooks, examples described in textbooks, and events, victims, and economic damage caused by natural hazards in Europe from 1900 to 2005.

→ There are practically no studies on risk education (in textbooks) and only a limited number of EU-funded research projects on risk education.

→ Risk education needs to be methodologically/didactically improved.

→ The relation between the descriptive approach (general explanation about processes and their impact) and the problem approach (case studies) should be in favour of the locally relevant natural hazards and risks.

5 Challenges of risk education in Europe

5.1 Developmental role of education

The difference between feeling secure or insecure about survival is so basic that it has led to a wide ranging but coherent syndrome of changes, from the 'survival' values' ... to the 'well-being' values" (Inglehart 1997, 42).

In recent decades, social development has been marked by an erratic shift from industrial to cybernetic revolution, or modern, industrial, to postmodern society (Inglehart 1997, 8). In contrast to industrial revolution, which presupposed a plan developed to the smallest detail that enables the production of a series of the same products, the term “cybernetic revolution” denotes the modern technology of collecting, storing, processing, and transmitting information. Information has replaced material objects and the development of telecommunications has also led to changes in relationships.

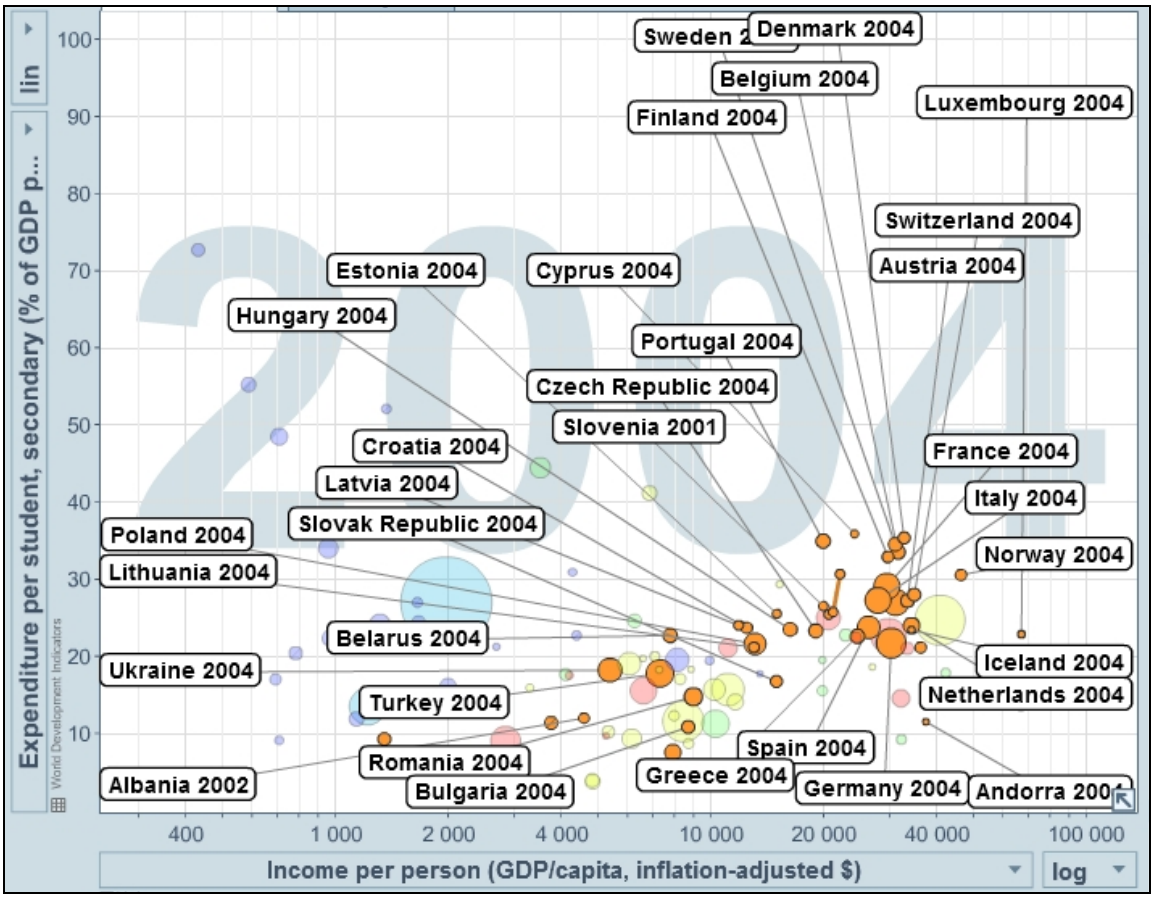

Figure 33: Expenditure per student, expressed in share of gross domestic product, compared to the 2004 gross domestic product per capita in selected countries (Gapminder . . . 2010).

In the past, creativity peaks have been typical primarily of areas with especially dense flows of diverse ideas, whereas today information is increasingly more evenly distributed in space thanks to easier access. Creativity is thus increasingly less dependent on space, and more on the characteristics of an individual. The spread of information across space is important because in the postmodern cybernetic era information also has an actual or physical impact in the landscape which is likely to increase (Komac 2009).

However, education has not kept pace with this development, although there are some initiatives for quality changes that would follow the socioeconomic development. At the same time, economic development should also adapt to the new conditions and direct greater attention to education. In terms of education, it would make sense for “the economy to switch from material production to the development of education, through which the desire for knowledge and beauty would be cultivated, and to scholarly, literary, and music publishing” (Makarovič 2003, 258).

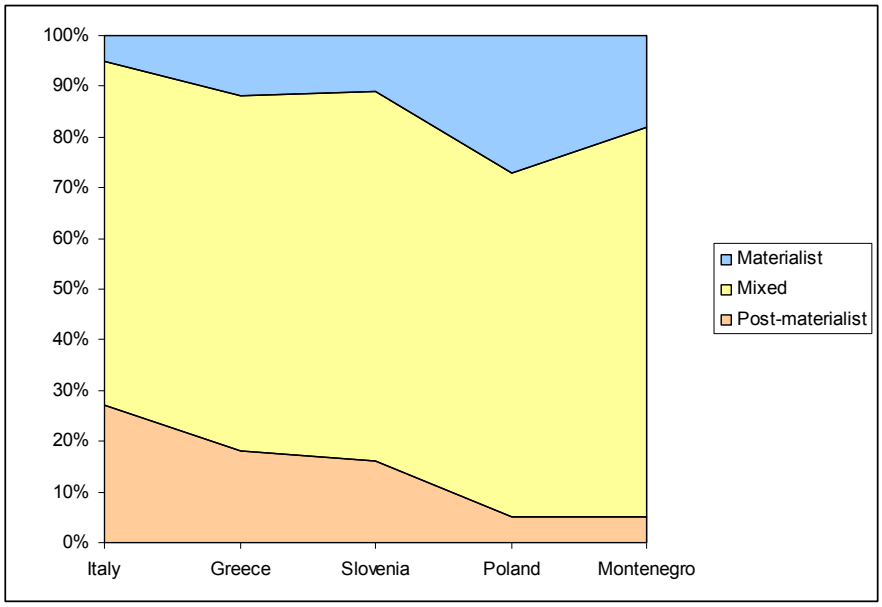

Figure 34: The share of respondents by values orientation, expressed as a percentage according to R.A.V.E. space project (2007, 22).

An interesting question is why the share of textbook pages discussing natural hazards is the smallest in Eastern Europe. This may (!) be the result of the communist conception of the world, according to which people should control and subjugate nature: "The essential and the most direct foundation of people's thought is the way man changes the nature, not the way nature changes him" (Lah 1977, 3). This view is in opposition to the view reflected in the well-known statement by Francis Bacon (1561–1626), who claimed that “Nature, to be commanded, must be obeyed.” Thus in the area of the former Warsaw Pact, the share of textbook pages dealing with natural hazards is much lower than in the rest of Europe (i.e., 1.9% as compared to 3.7%). The average slightly increases (i.e., 2.2%) if the area of Yugoslavia is included.

This is also connected with the economic issue or the differences in the development of these two European regions. The analysis established that the shares of pages containing descriptions of natural hazards in the secondary-school geography textbooks examined depend primarily on the amount of funds that individual countries allocate to education (gross domestic product, $r = 0.26$; $p < 0.1$; share of the gross domestic product dedicated to education, $r = 0.35$; $p < 0.02$; share of funds allocated to education as part of the gross national income, $r = 0.2$; $p < 0.02$).

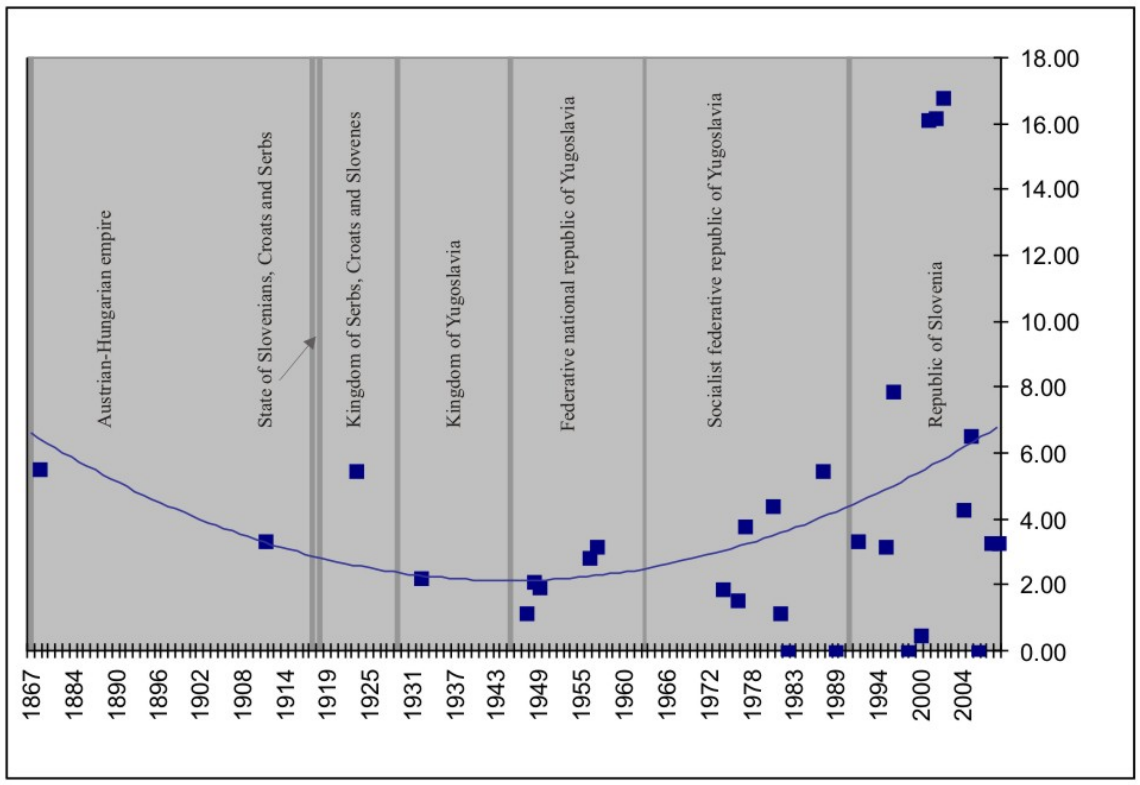

Figure 35: Share of natural hazard content in Slovenian geography textbooks compared to frequent changes in the sociopolitical systems marked by vertical gray lines.

Similar findings were also established as part of the R.A.V.E. Space Interreg IIIb CADSES project (2007, 21). The impact of socioeconomic development is also shown in the chronological historical overview of thirty geography textbooks made for Slovenia and the countries located in its territory in the last century and a half (see figure 34). Even a brief glimpse shows a difference among the political systems, which is, for instance, reflected in the level of participation.

5.2 Influence of individualization on education

The socioeconomic development described above is also connected with another aspect already emphasized several times: individualization. The “individualization revolution” is closely connected with the cybernetic revolution. In contrast to industrial globalization, which contributed to the loss of individuality, information is always individual and its bearer and user is an individual. Globalization is thus reflected in constantly adding new dimensions and the rate of globalization affects individualization.

From the viewpoint of information, an individual is an open system, but he is also (temporally and spatially) limited. The greater the opportunities for selecting information in his environment, the smaller the share of information with which he comes into contact or selects. People can select a specific possibility among those offered, but with the increasing amount of information there is also an increasingly smaller probability that two individuals will select one and the same piece of information. Differences are increasing within and between groups or, in other words, there is a trend of individualization of individuals and wider social groups (Mlinar 1994).

From the viewpoint of social development, individualization changes the relationships between individuals and the connections between them. Increased individualization also

increases the possibility of enhancing the quality of opportunities (i.e., possibilities and incentives), and thus also individuals' abilities and creativity (cf. Robinson 2006). Creativity can be encouraged and is a characteristic connected with education: "Today's thinking about 'capacity-building' is influenced by earlier ideas concerning participation, empowerment, civil society, and social movement" (Kuhlicke and Steinführer 2010) and these have been influenced and shaped by the work of Paulo Freire and the impact of Liberation Theology in South America in the 1970s and 1980s. Freire emphasized the importance of developing skills and competences to solve problems in a dialogical manner. More specifically, he argues that "learners and their own experience and knowledge are of crucial importance; second, that awareness, learning, self-esteem, and the capacity for political action are mutually reinforcing. And third, that poor and marginalized people have the right, and the capacity, to organize and challenge authority in order to create a society that is not based on exploitation and oppression."

His ideas of empowerment and participation became relevant particularly in development thinking and practice (Eade 2005, 10, 11; cited in Kuhlicke and Steinführer 2010). In this manner, a shift towards the importance of actions has been noted: "the more knowledge the individual obtains, the more autonomous of structure he becomes" (Hoogenboom and Ossewaarde 2005, 6; cited in Kuhlicke and Steinführer 2010).

Education is a process in which the more experienced – usually older people – pass on their knowledge, experience, opinions, feelings, and worldviews to the less experienced. Therefore, it is necessary for the view of education about the physical world to be idealistic to some extent. In transmitting information, it must proceed from facts or knowledge and findings, although they are imperfect. At the same time, it must present information on the physical world in a concise manner, in which it only presents the most essential part, or, in other words, what a teacher finds important at a given moment or in a specific historical period or place. Education should transcend radical subjectivism also because the lonely and increasingly pragmatic subject often decides based on current desires and impulses. However, from the viewpoint of natural-disaster management, this can be of vital importance.

Education thus fundamentally reflects our imperfect understanding of the world. This finding points to the problematic nature of this profession because teachers must nonetheless act competently – that is, as though they completely master a specific topic they discuss in class.

Individualization is the main reason why the universal criterion of value is increasingly difficult to achieve; this is also reflected in education. Due to individualization as a result of deconstructing (comprehending) reality into individual elements, increasingly less attention is dedicated to structure and complexity, which reflects the phenomena and processes in a landscape. This also often involves simplification, which leads to decomposition and returning to oneself, rather than to a deeper insight into and a new interpretation of complex reality. In the end, this has to do with the basic philosophical question of whether people are able to get to know the essence of world developments, or, in other words, whether they can seek, find, and transmit the truth, or whether truth is something they can create as a result of subjective findings.

A number of quandaries in contemporary education are connected with this very difference between imperfect knowledge and authority. Good teachers are able to admit to themselves in a Socratic manner that "all they know is that they know nothing"; paradoxically, at the same time it is difficult for them to be good teachers if they do not excel in the topic they are presenting to

children. In geography, which is discussed in greater detail in the previous section, this problem is manifested as the inability of some teachers to use the numerous options offered by modern technology or, for instance, to decide which map showing the regions of a specific continent or country is the most appropriate for use in schools or is best-suited for them. In many countries, this is connected with the problem of selecting the right textbooks because the selection often does not take into account the quality of textbooks but is instead the result of the publisher's marketing skills (Senegačnik 2005).

In addition, education clearly reflects the tension that can be observed in modern culture. On the one hand, this involves people's right to truth and, on the other, their freedom of speech, and disseminating their own ideas and views; education thus also indicates the degree of social individualization, which has been shown in the historical overview of Slovenian textbooks.

5.3 Personal nature of education

Despite a number of technical aspects reflected in diverse educational methods and aids, education definitely has a personal meaning. From the viewpoint of natural hazards, the importance of personal experience is emphasized; by definition, this experience is subjective, but nonetheless comparable to the experience of other people, including those that lived in another time or that live somewhere else.

Based on experiential knowledge, one can decide what to pass on to posterity through education with regard to natural hazards. People that have experienced disasters, and to some extent have become familiar with them, although they may not have been severely affected by them, definitely speak about natural hazards completely differently than those that have only seen these phenomena and processes in the media or read about them in books.

Because nature (e.g., through natural hazards) is closely integrated in social and cultural development, it is important for education to refresh or preserve memories; for instance, through storytelling. The stories can be both personal (concrete) and general (universal); the more the stories used in education are realistic and embodied in the concrete life they are describing, the greater symbolic potential they carry. Students respond better to a lecture or story that expresses something that the presenter or teacher has experienced. This points to the importance of indigenous knowledge (Section 3.1) in formal education, to which more attention could be paid in the future.

5.4 Place- and time-specific nature of risk education

At the core of modern education is the individual: either the teacher that provides information or the student that receives knowledge and information. On the one hand, modern digital communication has increased the importance of personal transmission of knowledge due to the larger number of possible contacts, but on the other hand this has also decreased it due to the increased spatial distance of the participants. On the one hand, the control over the distribution and filtering of information is smaller and, on the other, technological development has led to new and diverse forms of personal contacts (e.g., online social networks). The situation is paradoxical because increasing individualization increasingly emphasizes the role of teachers in the educational process as the ones collecting, processing, and transmitting information. Without a good teacher even good students make progress more slowly and with greater difficulty, despite the abundance of information available.

It follows from this that those possessing specific experience, knowledge, or partial knowledge are practically obligated to pass this on to others. In addition, education also leads to closer relationships between various cultural groups because it enables dialogue and their integration. Education is the basic duty of every society and therefore a “social consensus” is required for providing education. With regard to natural hazards, the social consensus can rely on established insufficient formal education in this area, which has been established for Europe through the analysis of secondary-school geography textbooks (Section 5). This is also indicated by the results of the survey conducted as part of the FLOODsite project (Wachinger and Renn 2010, 38), according to which only a third (32%) of respondents reported that public disaster training is a useful measure for reducing flooding problems. On the other hand, desires for structural measures continue to predominate strongly among all the answers. The great necessity of education is also confirmed by the fact that “the better educated and younger are much more sceptical with regard to the actual capabilities of public protection measures than people with lower degrees of formal education and, partly overlapping with the first group, the elderly” (Wachinger and Renn 2010, 38).

Greater inclusion of the content mentioned above in education could be achieved by including the local and municipal levels in the education system, especially with regard to getting to know the local region from the perspective of natural hazards. We should therefore contextualize natural hazards and hazardous events. Special efforts should be made not to exclude or overlook topics such as conflicts, social inequality, and exclusion. In this regard, universities can play an important role because they can have great influence in education, although they cannot control all social life or completely expand their activity in education and continued education; a fundamental goal of universities should be to re-establish innovation, argument, thought, and insight as well as the preservation and analysis of memory.

5.5 Cognitive development and education

Understanding human cognitive development can also be applied to education within modern society (Marjanovič Umek et al. 2004). Education can be perceived at three levels: (1) the preschool period (in which education is comprehensive and takes place unconsciously; children absorb information and make great progress by the beginning of primary school), (2) the school period (in which education is institutionalized and takes place at a conscious level; it is directed toward transmitting the basic notions of culture, and later on expanding them; the children are learning), and (3) adulthood, in which learning is not institutionalized, but takes place at a conscious level, with knowledge being transmitted at the same time (people teach others). Such an understanding of education is depicted in Figure 35.

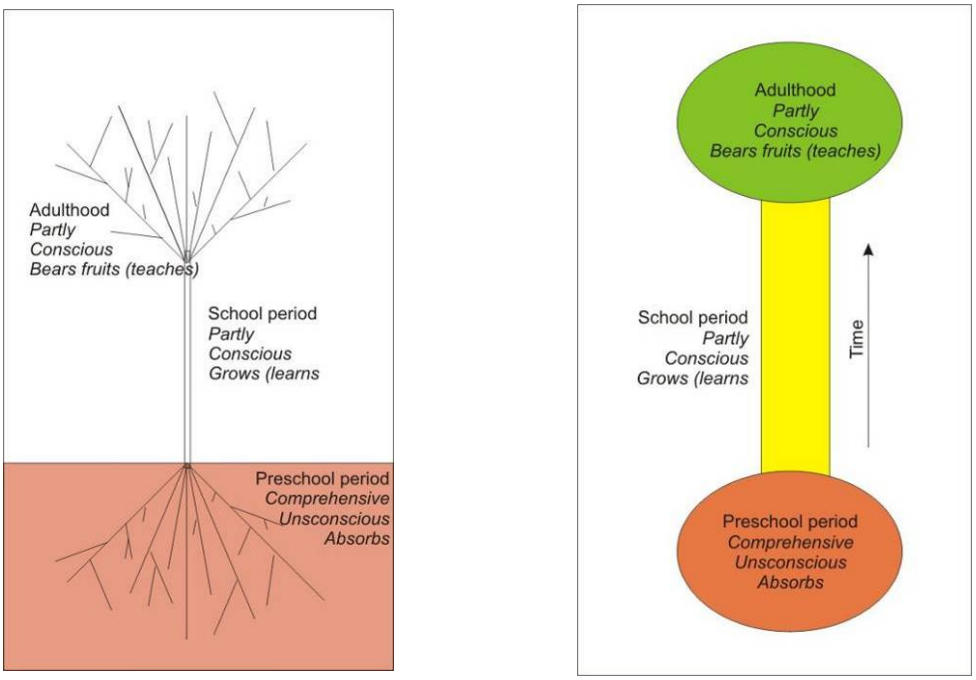

Figure 36: Education in the form of a tree (left) and a structural conceptualization of education (right).

Our understanding of education is based on the development of human cognitive abilities and intelligence, therefore concept of the richness of human capacity should be refreshed. In general, several of the current formal education systems take advantage of the human mind only to a limited extent, which is why the basic principles of educating our children should be reconsidered. Next to inquiry based learning which is already established, one of the possibilities for affecting change in education is more intense promotion of creativity (Robinson 2006). This is also suggested by the new conception of science in which knowledge and ignorance will always interact creatively (Wachinger and Renn 2010, 29).

If culture deals with establishing ideas and education with transmitting these ideas to younger generations, the basic aspect of education should be continuous updating and changing of basic ideas. Changes are usually achieved by establishing a new idea, in which a conflict occurs between the old and new idea, and this conflict is not resolved until one of them prevails. This also applies to science, which seeks new information and perspectives on reality, as well as social development. This development method is effective if new information can be objectively assessed, but it is not useful if new information is assessed using old ideas and thought patterns (de Bono 2006).

Studies of the human brain have shown that the brain functions as a limited information system that organizes itself and creates asymmetric patterns. This also forms the basis for the fact that the most effective method of changing ideas is not the result of external stimulation and the ensuing resistance, but that changes proceed from internal development. Changes are the result of assembling and disassembling information and establishing new paradigms. Even one-month-old infants have a developed memory and can thus learn through habituation and classical and instrumental conditioning; this is why they can seek structure in their experience and also organize it, “absorbing a specific pattern, and accepting the stability and precision that are derived from abstraction and organized according to the mathematical mind. This pattern can have great power and can (in some way) become part of the child. The pattern is creative and shapes the child’s personality” (Montessori 2008, 209). In the brain, human knowledge is

organized in such a way that it is effective in creating and repeating patterns, whereas the brain does not have a suitable mechanism for changing and updating these patterns. To date, education has been based on the assumption that data must first be collected and then organized into a logical system or useful ideas. The learning process is designed such that students get to know the correct facts, skills and processes. The emphasis is on the assumption that we are right. Because this is impossible in reality and negative assertions are frequent in life, this method of education limits creativity and subsequently also influence social development (de Bono 2006, 47).

5.6 Changing the education system or education methods?

Comprehension of education should be based on accepting and changing ideas, and assembling and disassembling them internally into a new logical whole.

This whole would be characterized by “unity of diversity,” which would be achieved by explaining as many different phenomena as possible in the simplest possible way (Makarovič 2003, 32). In this way, students would make progress on their own (with the help of their teachers), and in the long run great improvements in quality would be sooner or later achieved in society. Since there are different education systems in Europe, the question remains, how plausible it is to stimulate change across Europe or globally.

There are several other tools that can be learned and could enable such a leap in quality. Lateral thinking or thought is one of them. It is closely connected with creativity because it entails stimulating the process of randomness and changing, disappearing, and challenging old patterns, which stimulates the development of new ones. This process enables established or cliché patterns to connect in a new manner of their own accord, when the old pattern is interrupted. Thus, as regards natural hazards, telling anecdotes and stories is “probably the most effective way to present ideas of lateral thinking, but it is extremely difficult to acquire it” (de Bono 2006, 7).

So far, the education system has emphasized effective but imperfect vertical thinking, which should be complemented with creative or lateral thinking, in which ideas are generated and not repeated. It could be taught, or intentionally developed and encouraged in schools.

As already mentioned above, such a change in thinking is also physiologically substantiated: the brain can only pay attention for a limited period of time, during which the part is activated that can be most easily (or that is usually) activated. This involves recalling patterns, in which the things that are most often encountered and have left the most traces on the memory surface are being remembered. Because we most often use the most familiar patterns, they become even more familiar to us. The mind thus builds itself a supply of patterns prepared in advance, which form the basis for the coded transfer of messages, usually transfer through speech and words (de Bono 2006, 79).

Research on risk perception has identified a range of perception patterns that relate to key characteristics of the risk itself in the context in which the risk is taken; these patterns are called semantic risk images (Wachinger and Renn 2010, 8). This is why it is understandable that personal experience and involvement have such a great importance in risk education because they literally enable and stimulate development (Montessori 2008, 44).

From the viewpoint of education and natural hazards, we should stress that due to the importance of “familiarity” it can be presumed that in the event of a natural hazard children will act according to their closest and most familiar mental pattern. If we know how to influence these patterns and improve their quality, through planned stimulation and introduction of new mental patterns, education can have a significant impact on people’s thinking and possibly also their behaviour. Nevertheless, it seems that the role of natural hazards compared with other risks in the lives of the vulnerable people is often over-estimated.

This is connected with the already mentioned degree of the school system’s inclusion in the concrete time and space in which children live. Due to its (supra)national organization, the education system is often alienated from everyday life. Therefore the importance of lifelong education must be emphasized in natural-disaster education, in which it must focus especially on the parents of preschool and school children. In this way, a comprehensive view on children and dealing with them will be gained in the long run, which will make it easier to include content dealing with natural hazards in shaping their personality.

In Slovenia future changes of the education system will rely on sustainable development, lifelong learning, ensuring justice and equal opportunities, ensuring appropriate standards of knowledge. Natural knowledge of the environment should be linked with the history, economics and other disciplines. Children should be taught to understand the consumer society, ingenuity and creativity will be promoted: "schools must allow younger generations understand the modern world and to show that they really protect the environment and find new ways of operating in a globalized world" (Žolnir 2010).

Based on our textbook analysis, we can observe that natural-disaster education in Europe has to be improved knowledge of natural hazards. Knowing that this can be achieved through education, one must be aware that changing an education (or cognitive) system is a complex issue. Based on the above, it can be established that no drastic changes in the education system structure are required because it seems that the problem could be solved by reorganizing existing structures, information, and knowledge. The starting point for this kind of discussion is the claim that a generally accepted assumption is not necessarily right or prudent because it may exist due to historical constancy (cf. the case of analyzing Slovenian textbooks), or the question of whether Europe actually needs natural-disaster education (due to its high level of economic development). In this regard, a Slovenian example of good practice can be described:

At the end of the 1960s, the National Employment Service of the Republic of Slovenia set up the Millions for the Gifted scholarship fund to provide schooling to gifted and talented children from financially disadvantaged families.
The establishment of the scholarship fund was based on a sociological study that had been conducted in primary schools for several years and that used several hundred indicators that the researchers felt are relevant for assessing children’s giftedness. They used a discriminatory analysis, which makes it possible to simultaneously compare interconnected data and select the ones that distinguish groups from one another to the greatest extent, to develop twelve synthetic indices. These indices were then used to assess whether an individual belongs to the group of gifted and talented children.
It was initially impossible to apply for the "Zois Scholarship" (named after Sigmund Zois von Edelstein, 1747–1819), and it was only offered to children that met the criteria. In the first twenty

years, the scholarship was awarded to more than 20,000 gifted and talented secondary-school and university students.
This excellently set-up system began changing due to various interests. This example shows that studying creativity is not pure theory, but can have very practical implications. Science is capable of providing concrete methods that can contribute to doing away with social injustice and securing social welfare; however, it often meets with opposition from bureaucrats and the authorities.
It has turned out that social inequality is the main obstacle in establishing talent. At the same time, it is also an opportunity because creativity is the driver of development in that it only springs up in the interaction between an individual, the society, the nation, and humanity. The freer human work is, the more creative it is; creativity is justified when, derived from an individual, it wins recognition and affects changes in society through process and product. (Makarovič 1986, 272)

Education could thus be improved by increasing and encouraging creative expression. From the aforementioned current predominance of linear education, it follows that children attending school gradually learn not to try because they are afraid something may go wrong. Mistakes are the worst thing that can happen in our education systems; the majority of children loses this ability while growing up and are afraid to make a mistake. People are thereby literally educated out of their capacity to be creative: the main problem is how to remain and be creative in adulthood. The main task of education should be to preserve this ability and carry it on into adulthood. Research shows that divergent thinking abilities continue to develop in early adulthood and only reach their peak around age fifty (Reese et al. 2001). This refers also to education for natural hazards where local-specific and life-long education are the main activities to build social capacity and to achieve the culture of prevention in the long run.

At the same time, education is not comprehensive because it mostly focuses on reason rather than the body. The school system operates as though the purpose of public education were to produce university instructors and satisfy the needs of industrialism. In recent decades, this has resulted in an inflation of academic titles, which points to a structural problem or a lack of creativity in the sense of an ability to produce “original ideas that have value” (Robinson 2006). However, this idea is not new. Already half a century ago, Montessori (2008, 17) established the following based on her own experience:

> Young people graduate from the university with such broken minds that as individuals they have no more power to judge the period in which they live . . . The system’s superiority and indifference are supported in detail by school laws and rules that prohibit any interference in intellectual life and merely prescribe how the syllabus and examination must be carried out . . . Today, a bachelor’s degree is the most prestigious achievement of institutionalized education, . . . in the meantime it is being established that university and secondary-school graduates are totally unprepared for life or even that their ability for useful inclusion in social work is reduced. School is an institution with a pedigree and is too ossified to change its habits from the inside by itself.

The well-known Slovenian anthropologist Jan Makarovič (2003, 62) feels the same way:

> Contemporary school is a large-scale institution, dominated by a bureaucratic logic of adapting individuals to the average and a bureaucratic system of authoritarian transmission of knowledge. In modern schools, teachers are primarily bureaucrats (Makarovič 1983, 172). In these societies, education is namely the main channel of vertical mobility, which is why people do not educate themselves so much because of their desire for knowledge, but especially to achieve specific social positions. The school gives them the degrees that enable them to occupy these positions and legitimates this function by claiming that it conveys a certain amount of information. This amount is expressed in the levels of education and school grades. Creativity, which is individual and not large-scale, is naturally much more difficult to express and measure in terms of quantity and therefore does not occupy its rightful place in modern schools.

5.7 The problem of creativity

A number of studies have tried to establish which factors encourage creativity. In this regard, social (economic) inequality is undoubtedly very important, both in terms of primary inequality (i.e., family history) and tertiary inequality (i.e., attention parents pay to their children). In the Genetic Studies of Genius, Catherine Cox established that in the past few centuries (i.e., from 1450 onwards), the majority of geniuses have come from noble families, but on the other hand many important inventors had been deprived of one or both parents as children. This is associated with overcompensation as a result of the absence of a parent or being orphaned. If fathers become absent or unsuccessful in a specific social group, this affects creativity and subsequently social development: because these people "fail to sufficiently satisfy their wives' ambitions, the wives direct their ambitions to bringing up their children. The result is children's increased creativity, from which follows accelerated economic development" (Makarovič 2003, 57). Classical Greece and the modernization of Japan are described as good examples of this; the reason is supposed to lie in overcompensation, a phenomena discovered by Alfred Adler, who saw the main driving force behind human development in its need to gain recognition, which originates in the inferiority complex, which to some extent is inherent in all individuals because they are born completely helpless (Makarovič 1983, 66).

It is interesting to note that geniuses have not appeared evenly distributed throughout history, but in relatively tight clusters. This is influenced by several factors. In a specific generation, creativity depends on the creativity of previous generations, while also being influenced by external factors. Among them, the degree of political fragmentation stands out because it explains 10% of creativity variance. Within this context, the cultural heterogeneity and plurality of cultural currents and the existence of an intersection where these currents meet and interconnect are important. Switzerland stands out in this regard in Europe. Creativity is positively influenced by political independence and civil disturbances (e.g., revolutions, uprisings, social movements, and similar conflicts between the bearers of social power and other social groups), whereas political instability (e.g., military coups, dynastic conflicts, and wars) has a negative impact on creativity. The tendency to overcompensate also has an impact on the social level. Makarovič (2003, 77–81) calculated the shares of German inventors and inventions for individual decades between 1750 and 1890 in comparison to other European ones. His thesis was that the most trying period for the German lands was that from 1790 to 1809 and that these events affected the generation born twenty years prior to that (i.e., from 1770 to 1789). The data confirm the thesis because the majority of German geniuses were born between 1777 and 1789. It seems that creativity and innovations will be also the basis of future development in global economy (Thurow 1997).

Creativity depends significantly on the smallness of a country, which triggers the tendency to overcompensate, as well as on political independence, which entails the absence of discrimination and hindrance of talented people (Makarovič 1983).

The analysis of European geography textbooks (Section 3) showed great differences in understanding natural hazards even within Europe itself, which is reflected in the shares of geography textbooks dealing with this topic. The greatest discrepancy can be observed between northern versus eastern and south-eastern Europe. As already described, one of the reasons for such conditions in this area also lies in the past socioeconomic development of individual countries. In this regard, efforts should be made to enhance the unity of the education landscape and raise awareness in Eastern Europe. Greater solidarity and increased education

opportunities should be achieved, which, on the other hand, is the very prerequisite for effective international cooperation. The emphasis on individual natural hazards in Europe also clearly points to a connection between social capacity building and risk perception (see Wachinger and Renn 2010).

Education can contribute significantly to bringing the concept of natural hazards in the minds of the people as close to reality as possible. In doing this, it would probably makes sense to first and foremost take into account the impact of natural hazards on human lives (i.e., the number of deaths) and health (i.e., the number of those injured in natural hazards), and only then their economic implications (i.e., damage caused by natural hazards, insurance benefits, etc.). Here it is also important to take into account the observed increase in the damage associated with natural hazards, which influences and changes the "landscape of risk responsibility" (Johnson and Priest 2008) between various state and non-state actors (WP 2 report, Walker et al. 2009).

The material covered in geography textbooks should also reflect the fact that legislation, programs, and agencies operating at the national and European levels are encouraging or even requiring individuals to take more responsibility for their actions. The "privatization of risk" process relates strongly to how residents at risk perceive and interpret the risk associated with natural hazards. The process of building capacities should be organized as an iterative and mutual learning process that recognizes and takes into account the mismatch of expectations and actual results. It should be open to adapt established practices, norms, and policies to new knowledge, occurrences, and results. Capacity building should therefore be a dynamic learning process that needs to be innovative and open to new, surprising events. Although some kind of education, training, and/or transfer of knowledge and experience is inherent in all capacity-building efforts, this dimension only gains prominence in more recent writings. Experience, routines, and stocks of knowledge are always existent in an area where further capacities are built by education. Capacity building therefore implies the integration of "old and new knowledges and being able to apply learning in new ways and to new situations" (Johnson and Thomas 2007, 40; cited in Kuhlicke and Steinführer 2010).

6 Conclusion

In conclusion we would like to outline some major unanswered issues in the field of risk education in Europe and some research gaps and proposals for further investigation.

6.1 The problem of nature

Seeing nature as an obstacle to progress that can be overcome using modern technology rather than as a constantly changing complex of processes is prevalent misconception. Because we think that we can control nature, we often wrongly believe we can solve the natural-hazard problem simply by building structures. Instead of trying to understand the nature, features, effects, and extent of natural processes and adapt to them, including through education, we try to satisfy our immediate desires at all costs. These primarily involve the desire for profit, which is reflected in building infrastructure and industrial structures in natural-hazard areas, and the desire for comfort, which is reflected in the wish to "live in beautiful but dangerous areas such as along river banks" (Komac, Natek, and Zorn 2008).

In this relationship we have to mention the disaster capitalism and the so called shock doctrine, resulting in (for example) "the privatization of New Orleans's public schools," e.g. a process that has been previously observed in China, Sweden, Brazil, England, Hong Kong and New Orleans after Katrina (Naomi 2008). It undermines professionalism of teachers and places the development of capital and markets above that of teacher autonomy and professionalism: "The restless restructurings of schools and the schools system, the changes of roles and responsibilities, the policy fever and all the rest pursued under the neoliberal banner continually disrupt, undermine and reconfigure claims to teacher professionalism, and its social substance" (Klein 2008; Disaster capitalism 2010).

6.2 The problem of individualization

The root problem of modern education seems to be exactly in the relation between individual and authority on one hand and the problem of relativism on the other (Ratzinger 2010). This is connected to the understanding of the role of a person in modern society and to the role of hierarchical relations in society. Person can be seen as an autonomous subject, where a man is developed by himself and for himself. On the other hand, a person must be seen in relation to the community, from a dialogic perspective. The majority of the Dutch people for example regard the government as primarily responsible for protection of their possessions against potential flood damage, however, with respect to the attributed responsibility for disaster preparedness they viewed disaster preparedness as an equal responsibility between themselves and the government while some of them expressed this primarily or exclusively as a personal responsibility. In this case they are also “more likely to adjust to the hazard” and are “open to the suggestions that they should undertake some personal action to prepare for a flood disaster” (Terpstra and Gutteling 2008, 68).

With regard to risk education the absence of the concept of community seems an important issue which could be overcome by cooperative interaction and joint work. Related to this, the problem of personal responsibility seems to be related, which for example reflects in the question who to address by education: education should focus on training persons (teachers) or professionals rather than children themselves.

6.3 The escalator effect

A very common trend in the relationship between natural hazards and societies has been known as the “escalator effect” – by this, we mean the higher standards of structural protection being demanded as material wealth accumulates in natural hazard–prone land and the real or perceived threat of natural hazards intensifies. The cycle continues as more development occurs after this protection has been provided, thus increasing the natural-hazard damage potential, and so more protection is requested. In Costa Brava, for example, responses to increasing flood damage have emphasized structural solutions, including the channelization of intermittent streams (Saurí-Pujol et al. 2001). The escalator effect is an important issue when comparing the effects of risk education activities to risk perception of certain community.

6.4 Sustainable and environmental education perspective

The basic paradigm for dealing with these problematic areas should be sustainability, e. g. working responsibly with a long-term orientation. It is not good enough merely to take measures after natural hazards, but we must above all think preventatively. Focus on long-term prevention activities, such as education, would lead to respecting natural processes and the applicable legislation (Komac, Natek, and Zorn 2008).

Sustainable development in education will be achieved primarily through lifelong learning and assuring fairness and equal opportunities. Comprehensive learning about regions and the processes taking place in them already begins in preschool, especially between ages three and six, and even more strongly in primary school; this is also in line with the principles of the Hyogo Framework for Action, which supports the “inclusion of disaster risk reduction into primary and secondary schools curricula and research capacity building with an emphasis on multi-risk and socio-economic applications” (Proposal for joint work . . . 2005).

In risk education we can also learn from similar efforts such as environmental education. Growing number of schools throughout the world are including environmental education as an important part of their curriculum. Basic principles of environmental education that can also be used in risk education efforts are the following (Murdoch 2004):

- start from where the learner is (student's misconceptions should be shared in a supportive classroom situation by using open-ended questions, brainstorming, drawings),
- employ "hands-on" experience by involving students in a practical application of some basic concepts,
- foster an inquiry approach to learning by asking students to prepare a list of questions they have about a particular natural hazard,
- help students learn how to learn by for example introducing journals, setting up learning logs in the classroom, writing report cards,
- use real-life issues such as media-watch board,
- consider past, present, and possible futures by examining ways natural hazards have shaped the environment and influenced people within it, and asking students to consider the role they play in shaping the environment of future,
- develop a critical stance to "reading the world" by analyzing the images of the world portrayed in the media,
- include the exploration of values as part of the teaching and learning process by providing opportunities for students to be involved in decision-making processes,

- work towards connections across the curriculum by reading narratives, using fieldwork, mapping, and photography to record natural hazards.

6.5 Education in relation to human cognitive development

Cognitive development is strongly related to hazard-related issues, such as perception, learning, and communication. Insufficient knowledge "is an important part of the hazard problem" (Weichselgartner 2006; Weichselgartner and Kasperson 2009).

In order to understand the importance of education for the development of personality and also social development, one must briefly look at its impact on the development of people's (cognitive) abilities. The most important capacity, and the one that traditional education is worst at creating, is the ability to prolong learning to a life-long process. More learning needs to be done at home, in offices and kitchens, in contexts where knowledge is deployed to solve problems and add value to people's lives (Leadbeater 2000, 226–227).

Education should take into account human cognitive development because new findings show that even "infants and toddlers have a much higher cognitive competence" (Marjanovič Umek et al. 2004, 191). The period following age two is characterized by the rapid development of symbolic representational functions, which are reflected in the development of speech, symbolic play, and spatial and pictorial imagery; at age three, children begin to develop spatial notions, which serve as tools for understanding the world and with the help of which children can distance themselves in their minds from the "here and now"; between ages six and eleven, children significantly increase their ability to solve problems, and can think about and take into account several aspects of the same problem at the same time, although they must envisage concrete situations in thinking about the problem; during young adulthood (11/12–22/24), development is accelerated, and young people are no longer tied to concrete perceptions in their thinking and are able to form hypothetical conclusions, think about the future and their own thoughts, develop a value system, and analyze moral, philosophical, and social issues. With young people, greater emphasis should be placed on education in the form of active (voluntary) work. In early and late adulthood, people should be encouraged to participate in various forms of education. During that time, thinking is more flexible and adapted to everyday life in new ways, and its quality differs from that of formal logical thinking because it becomes primarily tied to the social context in which it functions. With age, the scope of short-term memory increases, and individual differences become even more pronounced compared to young adulthood. During this period, individuals express the greatest deal of creativity and productivity, which is connected with high cognitive skills as well as the acquired knowledge and efforts invested.

Education for natural hazards in any form, formal or informal, should take place in all periods of life. It does not suffice to teach a student something because the knowledge transmitted will be lost over time or become irrelevant in the changing social contexts. It has been established that, in practically all periods (including childhood and old age), people have a much higher cognitive competence than has been accepted until recently. At the same time, people evaluate risk according to their subjective perception (Wachinger and Renn 2010, 8), depending on their cognitive and emotional characteristics, knowledge and previous experience. Therefore, "to increase levels of protection motivation", we should address "both affective (emotional) and cognitive (informational) factors in the protective action decisions of citizens," also by fear appeals. Fear appeals work only if they are "accompanied by convincing arguments" and "are more likely to increase threat perceptions and change behaviour if they are personally

relevant and convincing," e. g. tailored to the local consequences of natural hazards (Terpstra 2009, 138).

6.6 How to maintain creativity, learning abilities in aging population?

Creativity is more a function of career than chronological age, which means it can also be stimulated in later life. Lifelong learning has a favourable effect on the development or at least retention of cognitive skills (Makarovič 2003). The education of parents should especially be emphasized because, due to their emotional and physical ties, parents are often the ones most capable of passing knowledge on to their children. Due to increased aging of the population, special attention should be directed to the inclusion and continuous education of the elderly, either in the form of voluntary activities or interest-based workshops.

6.7 Risk education and employability

In general, risk education tends to be focused on employability rather than on understanding the environment and societies' relations to it. In this view natural phenomena *per se* don't play an important role and also knowledge is re-defined as what is useful for practice of the professional activity. As regards risk education a shift towards comprehensive understanding of the relations between natural and social processes is needed, with specific regard to the activities needed for increasing resilience.

6.8 The crisis education

With regard to children's education, the term "crisis education" must be mentioned. Crisis education is a discipline that takes into account and presents to children or students those aspects of life that arouse fear or revulsion in people. This represents a very important aspect of education, not only with reference to natural hazards. In this way, diseases, disability, accidents, and death can be presented to people in an appropriate manner.

If children know these real-life topics and are not "protected" against the weight of the world, they will be more prepared as adults to enter the world, which demands responsible and prudent action from them. Crisis education prepares children for real life. In this, it does not focus on negative aspects, but a positive approach proceeding from the question of what can be done in a difficult situation to make us live better. This concept may be a useful one when introducing risk education to different communities and societies.

6.9 The problem of (obtaining the) information about risk education

The challenge is to build on all these practices, to promote them, and to encourage such teaching. Partnerships should be built to ensure coordination and to facilitate long-term strategies based on long-term plans and supported by countries. Information, innovation, and technology transfer should be stimulated, fostered, and managed (Esterhazy 2009). In this regard, governments should commit to teacher training and curriculum and textbook development to support large-scale teaching of disaster-risk reduction. Because schools are often understood to be "at the forefront for local disaster risk reduction" (Wisner 2006, 8), it is probable that about half of the countries in the world have some form of teaching about natural hazards and safety in some of their schools. In some cases, educational policy and the supply of teaching materials are decentralized to the sub-national level. The challenge is to build on these

practices, promote them in neighbouring schools, and encourage such teaching in countries where it is rare or absent. Educators and other professionals should focus more clearly on natural hazards without detracting from the work they do in other important areas, and find more direct and rapid ways of communicating with parents, policy makers, community leaders, and the children and youth themselves. Professionals, such as educators, researchers, engineers, and journalists, might be the first point of contact.

6.10 Connectivity of various education types?

Efforts should be made to connect various types (i.e., formal and informal) and levels of education, curricula should focus on interconnecting natural sciences with risk-protection and rescue activities, and natural-science knowledge about the environment should be connected with social sciences and the humanities (especially history, economics, and other disciplines), which will enable children to understand the operation of the consumer society and encourage creativity (Žolnir 2010). Education must take into account broader social development, which means it should be included in the "individualization revolution" (Makarovič 2003, 267), which goes hand in hand with the cybernetic revolution. Both strongly emphasize the relation and connections between individuals.

Especially in natural-disaster education, we should transcend the predominance of the individualistic approach and move towards a more participatory approach, which is reflected in community risk perception – "the postmodern belief that there are no universal standards of quality or universal criteria for standards of truth may be devastating if one wants to increase resilience" of society (Wachinger and Renn 2010, 41–46, 51); individualization also causes people to learn to live with change and uncertainty in a globalized, changing world (Wachinger and Renn 2010, 47).

The United Nations and other international organizations should work with countries, professionals, educators, communities, children, youth, and adults to develop coalitions and partnerships, facilitate the creation of knowledge networks, build capacity, and guide others to existing resources of training. International cooperation offers good opportunities for capacity building in natural hazards through strategic partnerships between developed and less-developed countries.

6.11 Should risk education be formalized?

There should be better integration of and links between formal education and education relying on the utilization of "local knowledge" to translate "expert knowledge" into a more accessible form. In education, the emphasis should be on transmitting knowledge about processes and phenomena in a concrete, local region; this requirement already proceeds from the fact that even in the Internet age geographical aspects must be taken into account in practice (e.g., locating educational institutions); studies show a connection between the number of scholarly institutions citing one another and the distance between them (Börner et al. 2006). At the same time, education should focus on local knowledge, comprehensive learning, and learning by doing, rather than merely on the activity of the mind; learning should be carried out using objects represented by words and concepts used, so that children's vocabulary follows their experiences (here it must be noted that learning from experience is not always transferable to environmental

processes in general (Wachinger and Renn 2010, 21). Community-based “local knowledge” can help reduce (social) vulnerability and increase social resilience (McEwen et al. 2002). Because research suggests that part of the population will ignore or disbelieve the risk, an ongoing educational program on natural hazards tailored to the specific needs of communities is essential (McEwen et al. 2002).

Risk education is important because gaps between knowledge and knowledge of specific societies can be bridged with development of socially responsive practices such as community risk assessment. Risk-education programs may increase locally, regionally, or nationally relevant knowledge about natural hazards, contributing to public discussions on adaptation strategies. In an example from South Africa, students were employed in government positions or as entry-level disaster managers (Holloway 2009).

7 Research gaps and proposals

Public understanding of natural hazards enhances the population's willingness to undertake risk reduction and emergency response plans, and is therefore an important part of social capacity building. Education for natural hazards is a long term activity that encourages the population to take a more collective approach to risk mitigation. According to the results of our study, the majority of (secondary) educational systems in Europe are underdeveloped with regard to education about natural hazards. Even if school textbooks' coverage of the topic is limited we can talk about specific illiteracy or ignorance. The situation may be improved with the development of the education system, in both children's education and adult education. Finally, the understanding of the importance of education in society should be changed, especially in decision-making; this primarily includes the gap between the knowledge producers (scientists) and knowledge users (teachers, decision makers, pupils; cf. Janssen et al. 2006; Weichselgartner and Kasperson 2009) which is reflected in the funding allocated to natural-disaster education by individual countries or local communities.

Table 10: Selected research gaps identified at the CapHaz-Net meeting on Risk Communication and Risk Education in Ljubljana, June 7-8, 2010

Topic	Research needs and gaps
Informal elements of education	Some forms of risk education are close to risk communication; therefore a definition of informal education should be clarified, if necessary. The importance of informal knowledge has changed in the last decades due to higher spatial and social mobility.
EU level	Studies of risk education, mapping of previous risk education research attempts and review of policies that support l risk education on EU-wide level are necessary to build the culture of risk. There are large country discrepancies – in some European countries teaching about natural hazards is obligatory and defined by law, curricula, while it is not in others.
Who	Questions of who to educate and who should be the educator, still need be answered (focus should be put on children but also older population has to be taught –parents, teachers, professionals, citizens– because they are responsible for children, not forgetting the teaching of the poor and other vulnerable groups). Different stakeholders should be integrated in risk education (institutional and social level); the question of responsibility, liability is related to this. Does risk education program reach the people and places in need?
How	Proper education methods and tools should be used and criteria for good (bad) risk education should be proposed. Focus should be on transmission, transfer of skills, abilities, not only knowledge (which is hard to achieve in schools). Transmission of knowledge is not satisfactory because knowledge by itself only rarely and in small instances influences behavior. Focus should be on stimulating proper, expected activities of people. Real experience is the most important in risk perception, therefore the interaction with hazard victims and risk experts is important. Nature experience helps to rise awareness.
Why (Aim)?	Aim of education should be clearly defined since education does not only include knowledge transfer but also transfer of skills and values, leading to understanding of risk education as one part of building, raising responsible citizens and building a safe-to-live environment. Is the aim holistic and are the methods specific?
Curricula, topics	There are systematic issues with how the syllabus is arranged and organized. These are considered institution issues that are to blame for the difficulties in bringing understanding of the risk of hazards and in building resilience within the communities. Part of this is the division within the subjects taught using a single subject approach rather that a multidiciplinary approach. The multidisciplinary approached may be more commonly practiced at the university level than on

Topic	Research needs and gaps
	lower ones. How to include natural hazards to curricula to fulfill selective criteria and regional coverage by curricula (national curricula do often not cover regional or local topics)? EU-wide agreement about inclusion of risk education to (different, national) curricula is necessary. Efforts have been put on measurability of attractiveness of curricula.
Multidisciplinarity, Integration, complexity and homogenization	There is a need for multidisciplinary risk education but lack of financial, institutional and other means to achieve it. On average, social dimension of natural hazards are not well covered and complex approach is rare in risk education; change is needed. Risk education can be related to climate change, sustainability, and sustainable development, building capacity in uncertain world or other similar issues. Historical, cultural elements of education should be investigated. Information about relevant topics and management could be gathered from similar educational systems such as Naturschule or (voluntary) Eco schools: children have to be aware of nature first and then they can be aware of hazards. This can be a way to place risk education in schools.
Partnership, participation	There is a problem of different responsibilities of institutions involved in risk education – who should be involved in planning and preparing the curricula? In risk education, with special regard to local contexts, partnerships should be developed with local experts, people, who have experienced a hazard, institutions including increasing number of NGO's, experts and municipalities. We identified the problem of training partitions about cross-border disaster situations, e.g. river basins.
Local knowledge and institutions	Lay and local knowledge should be included in risk education because children need to be safe from local risk in the first instance (not neglecting other risks due to high mobility of society) – special attention to be put in risk prone areas. Learning should occur within a social context, taking into account the fact that people learn by experience from one another, including concepts of observational learning, imitation, and modeling (social learning theory, sociology of knowledge). Inquiry, research based education seems to be an important tool for improvement of risk education in Europe (but it is focused on higher levels of education). Problem solving versus informational learning; within the design of textbook example, was the view of referring to how a situation can be presented (problem) to enable the student to find the information for them.
Implementation and evaluation	Are the risk education programs implementable; are there enough resources to implement them? Impact of different education tools and methods should be evaluated; Influence of personal/social experience on risk education is hard to evaluate.
Perception and textbook analysis	Mapping of case studies of natural hazards from other parts of the world mentioned in textbooks or at lectures is necessary. There is a need of a thorough analysis of risk education in Europe, either by textbook research or other scientific methods. Special care should be put on textbook selection with special regards to other subjects (next to geography).
Indigenous knowledge	There is a clear need of further research of indigenous knowledge related to natural hazards in Europe.

Table 11: Examples and resume of good and bad practices in risk education according to different criteria.

Research gap	Possible criteria for evaluation	Good practice	Bad practice
Information revolution – vast amount of information is available for education but their influence on risk education is	Availability of textbooks and other teaching material for teaching	Use of internet in education. It is hard to collect information and present them it in suitable form (textbooks)	Teachers let students to study just by themselves.

Research gap	Possible criteria for evaluation	Good practice	Bad practice
not clear.			
Globalization – context of place	Share of local case studies in risk education materials (textbooks)	The majority of examples of natural hazards are global	Only few local examples of natural hazards
Globalization – context of time	Share of recent case studies in risk education materials (textbooks)	Personal experience and recent information can be included in e-learning facilities	Several years are needed for information to be included in textbooks in spite of fast information flows
International cooperation	Presence of international cooperation in risk education programmes	International cooperation in risk education is a clear gap that can be filled by the on-going activities of different international organizations, such as UNESCO. UNESCO can focus over the longer term on capacity-building, development of training materials and training teams in field operations and seeks to promote capacity-building within the Organization itself, within the United Nations system and in the field (UNESCO – education … 2010).	There is lack of European-wide risk education programs regarding natural hazards since the geographic mobility of the population may expose them to numerous hazardous events in different parts of the world.
Age and creativity - how to maintain the level of creativity throughout people's life in the context of risk education	Share of age-related education activities presented in textbooks, availability of textbooks for different age groups	Teaching and learning don't depend on people's age	Teaching (learning) has usually been generation-limited
Individualization	Intensity of communication among people, proportion between the materialist and postmaterialist values presented in textbooks	Several education initiatives can be proposed by people themselves	Due to individualization it is hard to reach individual people
Building and strengthening networks	Networks in risk education are identified	Institutions work in coordination	Institutions work on their own, there is no data, knowledge transfer
The money problem	Share of national income spent for education	Education relies on motivated teachers	Teachers are usually low paid, in several countries education budgets face deficits, and many schools lack principals
Personal nature of education	Importance of personal experience, share of personalized reports about natural hazards in textbooks	In modern society people can learn a lot if they are willing to	In modern society relatively low percentage of population has experienced natural hazards personally
Share of contents on natural hazards in textbooks	Share of pages	The share is high in some textbooks which are dedicated to natural hazards	Low share does can mean that the topic is not covered
Share of contents on natural hazards in classes	Share of teaching hours	In some cases teachers can tell a lot about natural hazards	Strong influence of personal qualifications and interests of a teacher
Cognitive development	Age (group) of children in risk	Teaching starts as soon as possible	Teaching starts in primary school

Research gap	Possible criteria for evaluation	Good practice	Bad practice
	education		
Relation between thinking and behaviour	Impact analysis of the influence of risk education on behaviour	Teaching influences behaviour	Teaching can influence behaviour only by long or intensive “drill”; there is a lack of research data in this field
Problem of perception	Analysis of the influence of risk education on people's perception and awareness	By teaching perception of natural hazards in society can be influenced and/or changed	Teaching about natural hazards is far from bringing reality to classrooms
Connectivity	Share of informal contents in formal education	Education techniques can be joined	Low inclusion of informal contents in formal education.
Curricula and educational material	Share of natural hazards-related contents in curricula	Some countries pay special attention to natural hazards in curricula and prepare related educational material in vernacular languages	Absence of policy and guidelines in some countries on how to integrate disaster-risk reduction into curricula, education materials, and training; the inclusion of natural hazards components within the curriculum provides opportunities to incorporate geography, language, arts, mathematics, science, and vocational aspects of learning (Morrissey 2004).
Capacity of teachers and trainers	Professional qualification of teachers	Teachers are well qualified n the majority of European countries	In some countries we face lack of capacity among teachers, educators and trainers
Validation tools	Methodology	Only few programmes on natural hazards education have been evaluated and validated	We face lack of evaluation and validation of methodologies, tools and results

On average, **social dimension of natural hazards** and a complex approach are rare in risk education; support from research is needed for changes in this regard. In future studies should further investigate if and how **risk education influences risk perception, risk vulnerability and behavioural change**. If it does, an EU-wide agreement about inclusion of risk education to curricula is necessary. Currently there is great **lack of research** in the field of (school) risk education in Europe. Therefore, there is lack of knowledge about the efficacy of risk education (transmission of knowledge, skills). Since risk education does not only include specific methods, its aim should be holistic and clearly defined. A reorientation from focus on resources to **focus on risk** is also necessary.

EU-level studies of risk education on possible **improvements of curricular**, textbooks and other teaching tools and methods for risk education are necessary. A problem of different responsibilities of institutions involved in risk education has been identified and should be investigated in detail (who should be involved in planning and preparing the curricula).

There is a need for **multidisciplinary** risk education but lack of financial, institutional and other means to achieve it. Further research on **partnerships** (local, regional, sate, EU) and responsibilities (personal, institutional), liability in risk education is needed. Risk education can be related to the main topics of our times: climate change, sustainability, and sustainable development, building capacity in uncertain world and education of the future generation in general. Linkages between educational policies and risk education are rare – there is a need of educating the decision makers and a need of more intensive collaboration with them to improve

the gap between the knowledge producers (scientists) and knowledge users (teachers, decision makers, pupils) by **co-producing knowledge**.
We recommend testing different aspects of risk education in **pilot studies** because risk education is supposed to have long-term effects on people's beliefs, motivation, responsibilities, trust, behaviour, and coping strategies, especially with regard to high spatial mobility and transition from 'space of locations' to 'space of flow'. Countries that share **common natural hazards** (e.g. in shared river basins) should address educational information for students through joint efforts (development and publication of curricula, textbooks). Risk education should occur within a specific **social and spatial context** - regional and local educational programs can have a substantial long-term effect if they are focusing on local natural hazards-related issues. There is a clear need of further research of **indigenous knowledge** related to natural hazards in Europe. Last but not least, risk education should not neglect the educational values of the **internet and other media, arts, and literature**.

- → Risk reduction and social capacity building (building of risk society) are the main goal of risk education.
- → Risk education influences risk perception and behaviour, and is therefore an important integral part of social capacity building.
- → Risk education is a long-term activity and it should be put to all levels of the risk management cycle, but with different emphasis.
- → Risk education is a necessary part of risk governance.

"Children were – and still are – among the most vulnerable to disasters: they were – and generally still are – perceived as 'passive victims'. . . If children can do it, then youths can do it. If children can do it, then adults can do it. If children can do it, then some elderly people can do it" (Towards a culture . . . 2007).

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9 Appendix

The Appendix brings detailed descriptions of selected examples of good practice of risk education from some European countries that could not be included in the text of the report due to their length, and a list of selected EU-funded research projects related to risk education.

9.1 Italian experience in risk education

- National level: In Italy risk education is not included in the school curricula. National guidelines for the formation of curricula are provided, but no mention of 'risk' is included. Therefore, the initiative of risk education activities to natural hazards is left to individual schools. The national guidelines for curricula leave open spaces for the choice of different projects to be integrated in the list of compulsory subjects and it will be left to teachers to insert topics related to risk education in the space left by the guidelines to their subjects (e.g.: talk about history of natural disasters in history class, or talk about civil protection activities during civic education lessons; from the interview with dr. Torchio at the Regional Education office). When the choice is left to individual schools to choose initiatives-projects of risk education to be integrated in their curricula, these generally have the potential to be developed very thoroughly, thanks to the link with the local territory and local actors that is mainly chosen for these activities. On the other hand, the fact that the choice of undertaking such activities is free, also means that funding is left to schools or to organisations that are willing /capable to finance. This creates disparity between rich-poor schools or areas in terms of risk education. Furthermore, this means that not all schools will focus on risk education. The topic is therefore not developed uniformly on the national territory, but is instead left to the interest and initiative of individual schools or even teachers.
- Regional level: In the region Friuli Venezia Giulia, the first article of regional law n. 64 of 1986 encourages the promotion of education of citizens for the creation of a diffused awareness and responsibility in civil protection matters. A particularly fertile soil to develop the activities aimed at such goals is the school. Since the experience of the earthquake of 1976, schools in FVG generally undertake evacuation simulation activities to be prepared in case of other seismic events (from interview with Dr. Torchio at regional Education office).
- Civil Protection: the national Civil protection offers activities of risk educations that schools can chose to integrate in their curricula. These are undertaken by volunteers of local units of civil protection. Some projects are also created and implemented together with NGOs that work in the environmental field. One example of such cooperation is the project 'Operazione fiumi', created and managed in partnership with Legambiente. This project focuses on hydro-geological risk connected to rivers. A manual is available on-line for free, (http://www.legambiente.eu/documenti/2005/1111_percorsoScuola_RischioIdrogeologico/Percorsieducativi.pdf) as a guide for teachers that wish to introduce hydro-geological risk within the scope of the subjects they teach. Also, days of practical activities (such as cleaning of the river bed, reinforcement of river banks), managed by volunteers of civil protection or associates of Legambiente can be chosen and implemented by schools (http://www.legambiente.eu/campagne/intro/operazioneFiumi.php).
- These activities although not included in the school curricula, if chosen and implemented by teachers are to be considered as examples of formal education, as they become effectively part of the knowledge that pupils/students gather within their formal learning process.

Examples of risk education

Some examples of good practices of risk education in Italy, gathered from interviews and consultation of on-line informative material, follow. Examples are given of formal education for adults and children. It is important to underline that these practices are not meant to be representative of the situation in the whole Italian territory; they instead reflect the link of ISIG with the territory on Northern Italy and the focus of the Institute on Alpine hazards.

1. Formal education of adults:

- Name: Scuola superiore di Protezione Civile (High school of Civil protection)
- Actors involved: the school is managed by I.re.F (Institute of the region Lombardia for training of Public administration); the courses are open to : public administration employees, societies that manage services of public utility, private companies, media, schools (both teachers and students) and population(volunteers of civil protection and citizens)
- Activities: The school, founded in 2003 with a law of the Lombardia region (d.g.r. 14117/2003) assigning to I.Re.F the duty to provide training for volunteers and operators in the sector of Civil Protection, both offers own courses in management of natural hazards from technical to social aspects, and certifies the validity of courses run by other institutions on these themes. Prof. Marco Lombardi, scientific representative of the School, is a sociologist who since 1985 has been working on disasters; his expertise is therefore both in the academic and operative field. Highlights the importance of dealing with the theme of 'risk' in an effort to reduce social vulnerability. In fact, creating specialised volunteer operators in the sector and providing them with guidelines for preventive and emergency behaviours enhances the development of individuals' responsibility towards the environment. This in turn contributes to communities that are more aware about natural hazard and therefore less vulnerable. The impact of the school in reduction of vulnerability is also found in the work carried out with public schools in the region, for the diffusion of a 'culture of 'risk, as well as in the offer of specific courses that deal with the social dimension of management of natural hazards.
- Sources: Phone interview with Professor Marco Lombardi; consultation of website of the Scuola Superiore di Protezione Civile http://www.irefonline.it/websites/iref/staging/-home_sspc.nsf/index.htm

2. School initiatives with Civil Protection and Municipal Administrations

a. Municipality of Alba, Piedmont region

- Name: "L'acqua della collina" (The water of the hill)
- Actors involved: Municipality of Alba, local unit of Civil protection, teachers, students.
- Activities: In the year 2004/2005, the high school of Alba (Liceo scientifico "L. Cocito") has been involved in a project called "L'acqua della collina" (the water of the hill), to study the minor rivers and the specific hydro-geological structure of the area. The study together with the local unit of Civil Protection of the municipality of Alba was structured into two main chapters. A first chapters included a scientific review of instruments for evaluation of hydrological risk. The second chapter was focused on the studies performed on the territory and studies the effective hydrological risk in eight local minor watercourses. The study has

then been published in the local magazine and spread through the local press, to be made available to all the citizens.

- Source: Telephone interview with Dr. Laura Campigotto, responsible of Civil Protection activities for the Municipality of Alba
- Website (in Italian) of local newsletter of Alba, "Alba notizie" http://www.comune.alba.cn.it/COMUNE/Servizi_Uffici/servizi_staff/AlbaNotizie/AlbaNotizie_05-01.pdf

b. Primary school of Attimis, Municipality of Faedis, Friuli Venezia Giulia Region

- Name: Cresciamo sicuri" (Growing up safely)
- Actors involved: primary school pupils; teachers; volunteers and employees of Civil Protection and Fire brigades. Project funded by the regional Civil Protection;
- Activities: In 2007 the regional Civil protection of Friuli Venezia Giulia funded a pilot a project of risk education in the primary school of Attimis. The project "Cresciamo sicuri" (Growing up safely) was directed to both primary school and kinder garden and included actions aimed at the recognition of risks derived from both natural and domestic hazards. The project, in its 2 years of development, aimed specifically at providing the kids with the following tools/knowledge:
    - development of awareness about real situations of risk;
    - adoption of appropriate behaviour for specific situations of risk;
    - understanding and perception of 'fear' as a useful feeling to recognise risk;
    - knowledge of symbols /signs that signal danger;
    - knowledge of right numbers to call for intervention in a specific hazard situation;
    - knowledge of the role of different actors in the field of hazard management..

  The main themes chosen to develop this project were fear (from personal experience through fiction, to fear related to specific natural hazards such as floods and earthquakes), water, earth, and fire. These three natural elements were explored in their potential to become hazards. Scientific lectures given by experts of civil protection explained what floods, earthquakes and fires are and in what way they are threatening for human beings. Also, an historical overview of natural hazards in the area was developed by the students, through interviews with inhabitants of the municipality that witnesses the earthquake in 1976 or the flood in 1958 and research of articles on these events in the archives. Practical sessions also took place. The students visited the local civil protection unit headquarters, to see equipment and understand actions that take place in case of emergency. Furthermore, the local forest brigade guided the students on a visit of the local river, focusing attention to the water course and natural and human elements that affect the flow. The themes were all developed in parallel, within different subject already present in the school curricula. The approach to the risk education was therefore holistic and multidisciplinary and developed naturally within the frame of established curricula.
- Sources: Telephone interview with Angela Malara, teacher of Attimis primary school and author of report on the pilot project "Cresciamo sicuri". Available on-line (in Italian) at http://gold.indire.it/datafiles/BDP-GOLD000000000020BED6/descrizione_cresciamo_sicuri%5B1%5D%5B1%5D.doc

9.2 What is important for risk education in Germany?

- Sustainability of education: Children are the decision makers of the future. It is therefore the task of risk education to increase their knowledge and awareness of natural hazards.
- Children can educate their parents: It was found in several education projects and reported by the teachers of the focus group (see below), that the knowledge which children acquired in school was passed on to the parents and that this could even change the parents' behaviour. Parents trust their children and may in risky situations do as their children ask if they can explain it properly.
- Self experience and reports of flood victims: A direct relationship with people affected by a natural hazard will help raise the awareness of the risk. As self experience of a flood is the strongest factor in perception of the flood-risk (Wachinger and Renn, 2010), all educational approaches, which come as close as possible to self experience are the most helpful. The experts therefore propose to invite flood victims or helpers to schools to talk about flooding and the associated dangers and to provide advice.
- Awareness of danger during a flood: Danger could be reduced, if children would know the real dangers of floods: Electricity in basements, the power of shallow but fast-running water, the danger of pieces of wood or other objects in the water, the danger of contaminated water. Flood pictures in the media often show people walking in shallow water, which is very dangerous and cannot be recommended to children. These advices given by teachers as flood preparation could safe lives of children and their parents. But during the flood event children because of panic could forget their knowledge, therefore these themes have to be practised and the experience has to be recalled several times (at least in flood prone areas).
- Knowledge of natural processes: Awareness of nature is also "self-experience" and a precondition for the awareness of natural hazards. In this respect all projects for environmental education are helpful. The experts described experiments, which show the power of water (building dams or water wheels in brooks and creeks, and excursions to rivers and streams to investigate the animals and plants of the flood plains. These projects illustrate the importance of regular moderate flooding for the local environment and also the importance of retention areas as natural flood protection.
- Two-way communication: Children want to react on the teachers lessons, to interact and discuss and to recall information by making experiments for their own. Such as for adults also for children the information should be given in a two-way manner: Books, Flyers, Pictures and even films or computer games are not at all as helpful as the direct discussions with the teacher (or even better with a person, who has own experience with floods).
- Objectivity, neutrality and independence of experts: The public's trust in scientists seems often to be greater than that in the authorities. This may be because science is seen as independent and neutral. Therefore, in natural hazard communication and education, authorities and scientists should work together.
- Transparency of information: In all of the risk related information and education programmes it was found to be important that all the information was given and that an open relationship could be established (between the providers of advice and the people to be informed or trained).
- Age-dependent education: Risk education projects should take into account the psychological and pedagogic aspects of knowledge-transfer. To communicate danger could cause fear, which might not be appropriate for younger children, whereas teenagers might

be interested in the dangers associated with natural hazards. Younger children may enjoy excursions to flood plains whereas older children might not be interested in this type of environmental education but may like to discuss themes such as vulnerability.

- Source: results of the Focus Group 'Flood education' in Baden-Württemberg with education experts (4 teachers, 1 flood victim, 2 authorities, 1NGO) led by Dr. Gisela Wachinger in Stuttgart on May 20, 2010.

9.3 After the Rain – project summary (participatory workshops with children to explore flooding and flood recovery)

- Context: Imagine you are a teenager whose home is being flooded: your parents are telling you that you're going to have to leave and you've got 10 minutes to decide which things you'd like to take with you. It's a situation that became a reality for many young people across Yorkshire and Cumbria who were affected by the floods of 2007 and 2009. The experience of leaving your home at short notice and losing many of your belongings to floodwater is just one of the many aspects of flooding that we have been exploring with secondary school pupils through a series of interactive workshops. Building on the findings of 'Children, Flood and Urban Resilience', a research project funded by the Economic and Social Research Council, the Environment Agency and Hull City Council, the workshop uses photographs, games, anonymised interview transcripts and an Arc GIS simulation tool, all of which are contained in a specially customized suitcase, to help young people explore the effects of flood recovery.
- Methodology: The idea for the workshop stemmed from our research in Hull where we worked with 46 children and young people across the city to find out how they were affected by the floods of June 2007. During the research, the participating schools were keen for us to go back to talk to the children towards the end of the project about the findings. They were particularly keen for this to happen as previous researchers had visited their schools and failed to return. As a result, we decided to go back to the schools with a special presentation to show the children the things we had learned from them about how their lives were affected by the floods and how they had coped in its aftermath. At the heart of the workshop is 'the suitcase'. Created using £500 funding from the ESRC Festival of Social Science, this innovative, interactive resource was developed in consultation with local schools and a community artist. The end result has relevance to the curriculum of science, geography, humanities and citizenship and can be used with young people aged 14-18. The suitcase belongs to a fictional brother and sister, Lucy and Peter, who had to leave their home at short notice following a flood. It was inspired by the Lion the Witch and the Wardrobe, where an everyday object (the wardrobe) provides an entry into a different world. Through the suitcase – and the resources contained within it – we are able to create a special 'flood space' in the classroom through which students can explore the experience of flood and flood recovery.

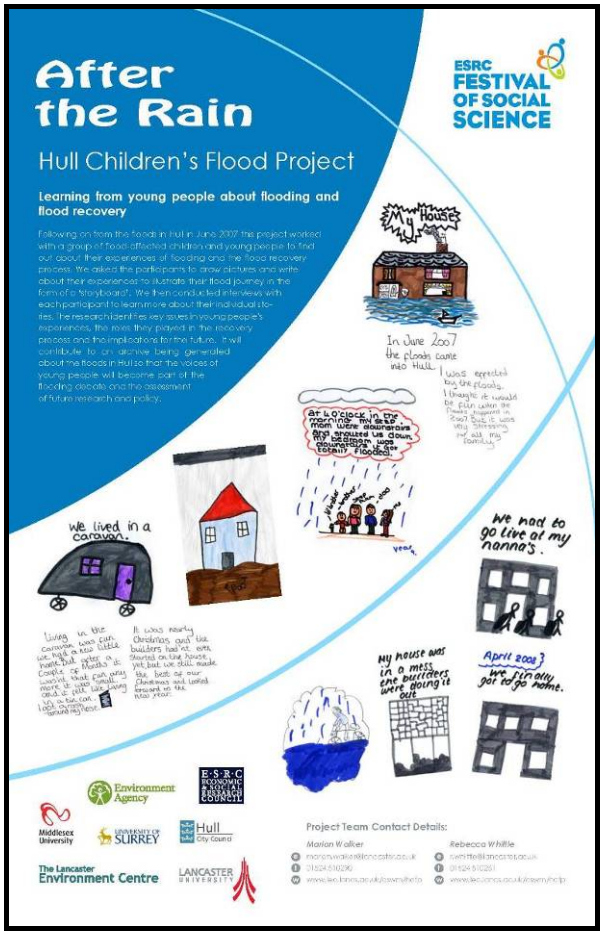

Figure 37: A poster about the After the Rain project. (provided by the authors of the project).

Designed by local artist Shane Johnstone, the outside of the suitcase appears to contain Lucy and Peter's clothes (packed as if they are going 'on holiday') but the inside of the case reveals an image of the damaged things they left behind; essentially their personal belongings, the things they didn't think to pack that are now irreplaceable. The suitcase also provides storage areas for anonymised interview transcripts, poster, whiteboard, sound effects of 'rain', and an interactive classroom-sized game of 'flood snakes and ladders (involving PowerPoint slides, participant quotes and a large inflatable dice). Extending poles create a 'no entry space' (as used on flooded homes) and a washing line attached to these allows archived photographs to be hung on display.

The workshop begins with an introduction about the research project and then leads into a PowerPoint presentation interspersed with activities working with the data including a 'what would you pack in your suitcase?' exercise, a session where the students work to 'code' and analyse an anonymised interview transcript, and a game of flood snakes and ladders. The workshop concludes with a 3D computer simulation of a 1 in 400 year flood event and a discussion about extreme weather events and climate change.

Responses to the workshops have been overwhelmingly positive. After a workshop at Morecambe Community High School, Head of Science, Dr. Phil Jumeau said: "This was a very enjoyable session. I spoke to some of the students later on and they enjoyed the workshop and said that it was 'different'. After the Rain wasn't just about 'flood recovery'. The activities had elements of the citizenship, English, science, geography and ICT curricula all packaged into one stimulating workshop that clearly got the students thinking

on a very personal level about the forces of nature and the impact that they may be having in terms of global warming and climate change. Dr Walker and Dr Whittle provided those students aspiring to studies beyond secondary school, with a great role-model and a valuable insight into research as a career."

- Contact details: Dr. Marion Walker & Dr. Rebecca Whitte (Lancaster Environment Centre, Lancaster University; marion.walker@lancaster.ac.uk, www.lec.lancs.ac.uk/cswm/hcfp).

9.4 Children, flood recovery and resilience – project summary

- Context: Relatively few accounts of flooding consider the perspectives of children and young people and the role they might play in building future resilience. Funded by the ESRC, the Environment Agency and Hull City Council, this project engages with children in Hull about their experiences of flood, flood recovery and the implications for future resilience.
- Aims and objectives: The participatory research project will identify key issues in children and young people's experiences and agency in relation to resilience to flooding and the flood recovery process. The specific objectives of the project will be to:

  - Document and understand children and young people's experiences of flooding and the flood recovery process.
  - Analyse the relationship between children's experiences and their accounts of formal and informal support in enabling or inhibiting resilience during the flood recovery process.
  - Evaluate the lessons learnt by key agencies in the delivery of services for children and young people.
  - Contribute to an archive being generated by the ongoing Hull flood study to enable the voices of children and young people to become part of the flooding debate and the assessment of future research and policy.

- Methodology: The project design is underpinned by a participatory research philosophy in which research is carried out with, rather than on, the children taking part. The style of research will generate both knowledge of the educational and social impacts upon children as well as inform policies to help alleviate some of the potential consequences of these. We will work with children in two primary schools, one secondary school and a youth group in Hull. The methodology includes story boards (where participants draw, paste pictures or use creative writing to tell their stories), short interviews and focus groups with the participants and follow-up interviews with key service providers. The project is further strengthened by working alongside an ongoing project in Hull: 'Flood, vulnerability and urban resilience: a diary based study of the real-time flood recovery process'.
- Contact details: The project team involves Lancaster University (Will Medd, Rebecca Sims and Marion Walker), the University of Surrey (Kate Burningham and Jo Moran-Ellis), Middlesex University (Sue Tapsell). Will Medd (w.medd@lancaster.ac.uk) or Marion Walker (marion.walker@lancaster.ac.uk).

9.5 A seminar on natural hazards in Serbian primary schools

- Context: Accredited seminar on "Natural disasters and teaching of geography - preventive measures and protection" is aimed at the teachers to develop students' awareness of of natural hazards in their environment and their role in the prevention of and protection from them.

- Methodology: The program stipulates that the seminar lasted two days, and 16 teaching hours. During the workshop the latest results of research and protection measures are presented to teachers in order to avoid casualties and reduce the potential financial damage. The seminar consists of theoretical and practical parts, such as field work, as well as workshops where teachers demonstrate level of knowledge adopted material in this course. During 16 hours, different topics are presented and different activities are held, among others natural hazards in general, natural hazards in Serbia, floods, landslides, earthquakes, erosion, atmospheric natural hazards, social and economic consequences of natural hazards, methods for determining natural disasters in local communities, defence systems against natural disasters, activities during natural disasters, field work and workshop.
- Contact details: The project team involves Jovan Cvijić Geographical Institute (Marko V. Milošević, Jelena Čalić; m.milosevic@gi.sanu.ac.rs).

9.6 A list of EU-funded projects and documents related to risk education

How to teach natural hazards in school

In the frame of the Naras EU-project (Natural risk assessment) and in collaboration with Eduseis (http://www.eduseis.net, an educational "cook book" has been produced for schools in order to increase knowledge related to earthquakes and seismology. Teachers and pupils will be able to learn more about science in this field and increase their awareness in disaster reduction through simple exercises and activities.

Author(s): J, J L, BERENGUER, VIRIEUX

Bibliographic reference: EUR 23109 EN (2008), 47 pp.

ISBN: 978-92-79-07083-9

http://cordis.europa.eu/search/index.cfm?fuseaction=lib.document&DOC_LANG_ID=EN&DOC_ID=99834952&pid=0&q=21BF143196BF095C29CDCBD2BAE3E95A&type=sim

How to teach natural hazards in school – Raising awareness on earthquake hazard

Abstract: In the frame of the Naras EU-project (Natural risk assessment) and in collaboration with Eduseis (http://www.eduseis.net, an educational "cook book" has been produced for schools in order to increase knowledge related to earthquakes and seismology. Teachers and pupils will be able to learn more about science in this field and increase their awareness in disaster reduction through simple exercises and activities.

Author(s): BERENGUER J L (Editor), VIRIEUX J (Editor)

Bibliographic Reference:EUR 23109 EN (2008), 47 pp.

ISBN: 978-92-79-07083-9

http://cordis.europa.eu/search/index.cfm?fuseaction=lib.document&DOC_LANG_ID=EN&DOC_ID=104263352&pid=1&q=21BF143196BF095C29CDCBD2BAE3E95A&type=sim

Natural hazards and engineering geology : Prevention and control of landslides and other mass movements

Abstract: The European School of Climatology and Natural Hazards is involved in the training and education activities of EPOCH. The course held in Lisbon in Spring 1990 dealt with the prevention and control of landslides and other mass movements. Lectures covered topics such as: - soils, rainfall and erosion; - prediction of mass movement and stability assessment; - slope instability; - landslide analysis and land use legislation; - correction methods, and - case studies. Papers and the abstracts of posters presented by the students who attended the course are also included in this volume.

Author(s): GOMES COELHO A (EDITORS), FANTECHI R, ALMEIDA-TEIXEIRA M E, OLIVEIRA R

Bibliographic Reference:EUR 12918 EN (1991) 349 pp., FS, ECU 30

ISBN 92-826-2933-3

http://cordis.europa.eu/search/index.cfm?fuseaction=lib.document&DOC_LANG_ID=EN&DOC_ID=7916572&pid=2&q=21BF143196BF095C29CDCBD2BAE3E95A&type=sim

Earthquake hazard assessment

Abstract: As part of the training and education activities of EPOCH, courses are held in cooperation with European institutions involving the execution of Community RTD programmes on climatology and natural hazards. The present volume gives the text of lectures delivered at the course held in May 1988 in Athens (Greece) on the subject of "Earthquake hazard assessment". Topics covered include the geodynamics of the Mediterranean domain, the design of earthquake resistant structures, aspects of seismography, modelling of strong ground motion, and prediction techniques.

Author(s): ALMEIDA-TEIXEIRA M E (EDITORS), FANTECHI R
Bibliographic Reference:EUR 13408 EN (1991) 195 pp., FS, ECU 16.25
ISBN 92-826-2778-0
http://cordis.europa.eu/search/index.cfm?fuseaction=lib.document&DOC_LANG_ID=EN&DOC_ID=7912932&pid=5&q=21BF143196BF095C29CDCBD2BAE3E95A&type=sim

Effective communication between the scientific community and the media

Abstract: One essential step for coping with hazardous events such as earthquakes and droughts is to reduce the vulnerability of human systems to them. This may be achieved by promoting appropriate urban planning, careful management of resources and effective education for civil protection. Warning information, aimed at promoting proper public behaviour in an emergency, is discussed. The need to improve communications between the mass media and the public, as well as between the scientific community and the mass media is emphasized.
Author(s): DE MARCHI B
Bibliographic Reference: Paper presented: Prediction and Perception of Natural Hazards, Perugia (IT), Oct. 22-26, 19
http://cordis.europa.eu/search/index.cfm?fuseaction=lib.document&DOC_LANG_ID=EN&DOC_ID=7813732&pid=6&q=21BF143196BF095C29CDCBD2BAE3E95A&type=sim

Measures to improve Higher Education/Research relations in the perspective of the ERA, Report of an independent High Level Expert Group set up by the European Commission

Abstract: To be the world's leading knowledge society is the European Union's aim. It is an ambitious aim. European expenditure on research, as a percentage of the Gross Domestic Product is less than the USA's and, although Europe is a better educated society than it was twenty-five years ago, we have not yet made curiosity and creativity central to our lives and work. And the USA and South-east Asian economies will do their best to develop faster than Europe can manage. Yet, in a future in which success comes from knowledge and from knowledge of how to use knowledge, Europe cannot afford to fail. Our standards of living, welfare provision and civil relations will be affected by the success of this project. This is an epochal project in three ways: it is not a short-term project; it is not restricted to just some areas of knowledge but requires research into social innovations, human learning and effective entrepreneurship to accompany natural science enquiries; and it invites us to consider the transformation of European societies, while preserving the values and cultures that define Europe as a civilised, diverse and vibrant continent.
Bibliographic Reference: EUR 20905 EN (2003), 72 pp.
http://cordis.europa.eu/search/index.cfm?fuseaction=lib.document&DOC_LANG_ID=EN&DOC_ID=65688882&pid=7&q=21BF143196BF095C29CDCBD2BAE3E95A&type=sim

Knowledge and learning-towards a learning Europe

Abstract: In today's innovation-driven world, learning and the command of knowledge have become the key success factors of international competitiveness. 70% to 80% of economic growth if said to be due to new and better knowledge, while the stock market value of most firms exceeding net fixed assets by a factor of three to four, is largely ascribed to the value of knowledge capita. This puts people at the centre of attention, since knowledge resides primarily in individuals. This report has been produced in the context of the IPTS Futures Project, the aim of which is to explore the extent and impact on EU-policy of technological, structural, social and political changes in Europe over the next ten years. In the first phase of the project, key drivers of change were explored in a series of expert panel meetings and workshops (Demographic and Social Trends; Information and Communication Technologies, and the Information Society; Life Sciences and the Frontiers of Life; Natural Resources and the Environment; Political and Economic Context).

Author(s): GAVIGAN J, MAHOUM S, OTTITSCH M
Bibliographic Reference:EUR 19034 EN (1999), 81pp
http://cordis.europa.eu/search/index.cfm?fuseaction=lib.document&DOC_LANG_ID=EN&DOC_ID=48762572&pid=17&q=21BF143196BF095C29CDCBD2BAE3E95A&type=sim

Education governance and social integration and exclusion

Abstract: A major tendency in late modern education in Europe is a transformation in governance from governance by rules and directives to governance by goals and results, often in combination with deregulation and decentralisation of decision-making. The implications of such a transformation is discussed in the Report in relation to different contexts of educational traditions and ideas of Bildung as well as in relation to societal consequences in terms of social inclusion and exclusion. The EGSIE project explored the implications of these transitions in education governance during the 1990s. We worked with nine national cases: Australia, Finland, Germany, Greece, Iceland, Portugal, Spain, Sweden, and the UK (England and Scotland). The studies were organized around three sets of theoretical questions: (1) What are the narratives or sagas of changes in education governance? (2) How are the subjects in education constructed? (3) What are the relations between governance and social inclusion and exclusion?
http://cordis.europa.eu/documents/documentlibrary/70595751EN6.pdf

Science education through earth observation for high schools

Start date:2007-08-01
End date:2009-10-31
Project Acronym: SEOS
Organization name: CARL VON OSSIETZKY UNIVERSITY OF OLDENBURG
Objective: Earth observation from space is relevant in science education already in high schools since it sharpens the sensibility to the natural environment and thus stimulates the willingness to learn of its relevance to everyday life conditions. This covers a broad field of experience, ranging from daily weather data to long-term climate change, from local nature to environmental hazards, with local relevance but also global systems and their interconnection. It makes also aware of the need to use most modern scientific and technical methods to obtain this information. With more than 250 members, the European Association of Remote Sensing Laboratories has high expertise in earth observation from space. Based on their research results, internet-based e-learning tutorials will be developed on selected topics in earth observation. The tutorials will be realised at first in the English language. At a later stage they will be translated into other European languages, by means of modern technical language translation tools but with added human control, to make them useable in Europe and beyond. The project covers many disciplines such as physics, mathematics, biology, geography and engineering, and focuses on the interdisciplinary character of remote sensing. Students will connect local personal observations to global perspectives, and will thus gain an understanding for the techniques needed to receive and interpret these data. Its results are thus suitable to achieve scientific literacy, which belongs to the key scientific education standards. Making earth observation with remote sensing an element of science education provides a basis for using environmental monitoring in the work-life subsequently.
Programme Acronym: FP6-AEROSPACE
Subprogramme Area: Aeronautics and space, Education and training
Contract type: Coordination action
http://cordis.europa.eu/search/index.cfm?fuseaction=proj.document&PJ_LANG=EN&PJ_RCN=9783288&pid=68&q=37758840B9A1A48AD925FE37B1D07AB6&type=sim