Educational strategies to reduce risk: a choice of social responsibility

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ABSTRACT

This study develops the critical reflections of the activities for information, training and education that have been conducted by a group of researchers of the Istituto Nazionale di Geofisica e Vulcanologia in recent years. In particular, from an epistemological point of view, our analysis involves: (i) science outreach, the link between science and the world; (ii) science teaching and its role in the contact between science and schools; and (iii) risk education, seen as a process that can develop a culture of risk in relation to the territory in which we live. These issues are critically analyzed on the basis of experience gained since 1995. The educational methodologies tested in 'peacetime' (in the absence of seismic events) with the EDURISK Project are compared with those experienced during an emergency in Abruzzo, Italy. Today, we increasingly refer to prevention as the primary strategy of defense against risk. However, very often the responsibility of prevention falls on others, such as the government, institutions and/or local authorities. The citizens then perceive themselves as powerless against the inevitability of natural events, and they refer to these 'rulers' for the implementation of effective prevention policies. So, as researchers, what are the most effective actions we can take to influence risk reduction and to motivate the choices of the people? Must the effectiveness of our interventions be based on scientific information or on specific training, or must it be reached through the development of values, actions and awareness? Must our interventions be oriented and developed to inform, to train or to educate?

1. Introduction

Over the last few years, there has been increasing debate in Italy regarding the social and cultural implications of research in the field of Earth Sciences. This has focused in particular on research endeavors related to the definition of hazards of natural origin, and it has also taken into consideration the significantly increasing correlated risks as a result of a marked increase in both environmental and social exposure and vulnerability. In the face of recurrent disasters caused by geological and meteorological events, the social responsibility of researchers working in different fields of inquiry concerned with the complex processes of defining natural risks (e.g. geological, seismological, volcanological, and planning) is increasingly evident. This is especially seen in the encouragement of critical analysis of the use of natural resources. There is the need to provide correct information about risks, and to make society increasingly aware of the idea of a common and shared 'geological heritage', which should foster a social construction of knowledge [Peppoloni 2011].

Reflections on the social responsibility of a researcher can be based on many different points of view; our input is part of the "study of effective teaching tools to develop awareness, values and forms of behavior, with a view to providing information and training". In this report, we would like to consider some critical reflections on the information-related and educational activities that we have carried out over the past 10 years. These have arisen from our multidisciplinary group of researchers at the Istituto Nazionale di Geofisica e Vulcanologia (INGV; National Institute of Geophysics and Volcanology) and the Istituto Nazionale di Oceanografia e Geofisica Sperimentale (INOGS; National Institute of Oceanography and Experimental Geophysics), as part of a risk education project (EDURISK Project) supported by the Department of Civil Defense.

One element that clearly characterizes our contributions with respect to the context in which the role of the geologist in society is mainly discussed is specifically the multidisciplinary dimension of our approach. Indeed, the research team includes all of the disciplines needed to make it possible to specify the various fields that define the complexity of seismic risk: geology, seismology, seismic hazard, historical seismology, earthquake engineering, and emergency psychology. What unites the research group in this case is the researcher status and research objectives, which explicitly consist of identifying risk reduction strategies (seismic, volcanic and geological), although what characterizes the research group most are the different professional skills of its members.

The aim of this report is to provide critical reflection on the priority choices we are called to make as researchers

in the field of training, information and diffusion of scientific culture. While considering that the teaching of science has a key role in facilitating contact between the 'scientific world' and the world of education, and that, in the same way, the user-accessible popularization of science represents a link with society at large, we set ourselves the problem of understanding what the educational priorities are with respect to the risks characteristic of our country, Italy.

Following our initial choices, for 10 years we have been involved in the EDURISK Project, experimenting with educational methodologies that have been implemented in 'times of peace'; in other words, methodologies not determined or influenced by emergency situations. The experience gained in the Project, however, enabled us to rapidly develop some information and training strategies in response to the emerging needs of the population affected during the emergency of the earthquake that struck L'Aquila and the Abruzzo region on April 6, 2009. These experiences have led us to reflect on what the key elements that come into play in prevention are: the concept of risk, which is often confused with hazard, and liability, and the risk attribution to different levels. More and more today we refer to prevention as a primary strategy of defense against risk.

We will therefore try to answer some questions that we have posed ourselves as researchers who have been engaged for years in the development of a risk-reduction culture. These questions are indisputably linked to the choices that we are called to make as individuals, but which are of marked social relevance. What are the most effective actions we can take to influence risk reduction and to motivate people's choices? How can we influence the opinions and choices that people make, or do not make, to reduce risk before an event happens? Must the effectiveness of our activities be based on objective information and training, or must it be aimed at developing values, knowledge and actions? In the final analysis, must our efforts be planned and designed simply to disseminate authoritative scientific information to the people, or should they set in motion real educational processes?

2. Popularization of science, science didactics and education: aims and objectives

Given that the world of research to which we belong has among its objectives the promotion and dissemination of scientific knowledge, the point from which we started is an epistemological analysis of the methods that enable us to popularize our scientific knowledge. Indeed, epistemology is the branch of philosophy that deals with conditions under which you have scientific knowledge and the methods to achieve such knowledge. This is as suggested by the etymology of the word 'epistemology', which derives from the union of the Greek words *episteme* ('certain knowledge', or 'science') and *logos* ('discourse').

The methods that we will consider, albeit with some necessary simplifications and schematization, are: the popularization of scientific knowledge, as a link between science and the world in general; the didactics or teaching of science and its contact role between 'science' and the world of schooling; and education as a process that can be used to develop a culture of risk in relation to the territory or geographical area in which we live, and hence as an agent of social change.

In the common meaning of the term, the popularization of science indicates the activity of communicating science to the general public (Figure 1). To look back at the etymology here, we can start with the Latin verb *divulgāre*, from which the Italian and English verbs *divulgare* and *divulge* originally derived. In its Italian usage, this follows the original meaning, which is directly composed of

dis- 'several parties/all directions' and vulgare 'spread, spread to the masses', the Latin *vulgus* or Italian *volgo*, the common people, populace, or general public. Instead, in English this usage of divulge, or divulgence, has taken on the more popular meaning that relates it to the implication of 'secret knowledge' (which some would argue as also particularly relevant to science). So here we take on the concept of dissemination, as the 'spread of information', again clear from the etymology of the Latin verb *disseminãre* from which the English word derives: composed of dis- 'several parties/all directions' and seminare 'seed'; hence 'to seed, or spread, knowledge widely'. What is perhaps less clear is that when we move from the action of dissemination of science to the popularization of science (dissemination to the general public), this contributes to the spreading of scientific culture without specific educational intentions. Thus the aim of popularizing science is to increase the perception of the importance of science in the context of human activities, and to strengthen its roots in society as a whole. We can therefore say that the popularization of science takes place so as to spread scientific knowledge, to create curiosity around the world of research, to describe the findings or discoveries in different areas, to talk with the community, and hence to create a link between science and society in general.

Figure 1 (above and previous page). Posters of the initiatives for the popularization of science from INGV.

A critical element that must also be carefully considered is that the practice of science communication runs the risk of often being reduced to a 'top-down' process, a negative connotation that people often have of the popularization of science, as part of its common perception.

At a different level, we find the didactics of science. The word 'didactics' comes from the Greek word *didàsko*, 'I teach', and it involves the theory and practice of teaching, with the aims of improving the effectiveness and efficiency of the teaching of teachers, and improving the effectiveness, and most of all the efficiency (reduction in time and energy) of the learning process of the student. We can therefore say that the didactics of science exercises a contact role between 'science' and the world of schooling. In this regard, the European authorities and the international scientific community recognize the importance of science didactics, and support integrated strategies to promote literacy and awareness of science from primary to secondary schools, and to heighten an interest in the sciences, thus encouraging access to the scientific profession.

Education about risk entails the activation of a present process, which starts from the knowledge of the reality in which we live, and leads us to a full awareness of the characteristics of this reality (including the nature of the hazards) and the need to act upon it to reduce this risk. Even in this case the etymology reveals a lot: the term to educate, from the Latin *ex ducere*, which literally means 'to lead out', therefore to set free, to bring to light something that is hidden.

To better understand how the knowledge process evolves, we use the data–information–knowledge–wisdom (DIKW) scheme [Wallace 2007, pp. 1-14], which clearly indicates how and when an educational process is capable of producing a social change (Figure 2). So what do we mean by 'education'? This is a process in which formal and informal knowledge are part of a system that guides understanding and action, in which the 'data' are transformed into 'information' only when they are correctly organized. The information then 'becomes' knowledge, when it is inserted into a context that gives meaning, and usually includes some relation to actions, or nonactions. And finally, the 'wisdom', which organizes the knowledge and is the result of the accumulated experience in our actions, or nonactions [Wisner 2006]. We can consider this itinerary as a useful theoretical reference framework upon which to base the education of the risk, or the 'risk education'. Risk education is a process that can affect the risk reduction itself, through explaining the life choices of individuals in relation to housing, based not only on technical knowledge, but also on emotive aspects.

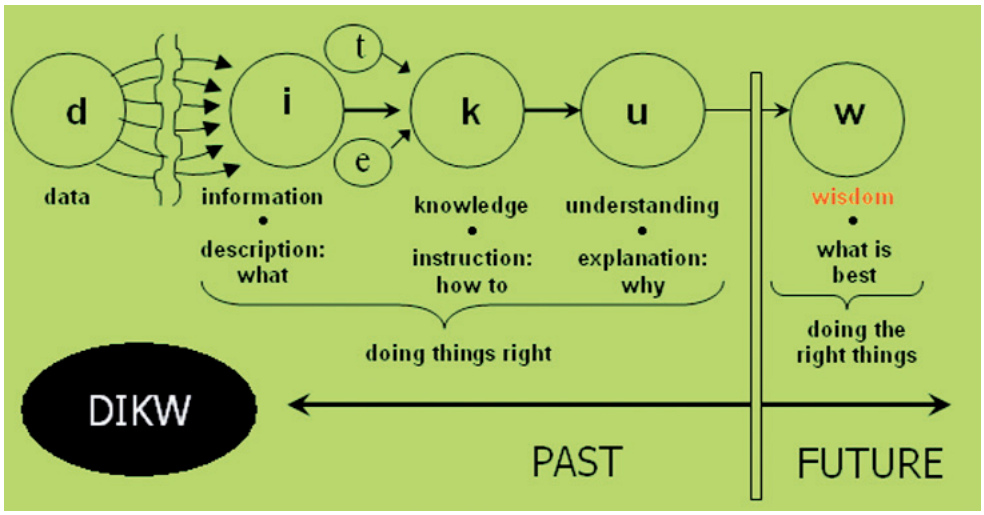

Figure 2. Flow diagram of the DIKW hierarchy.

3. EDURISK 2002-2011: ten years of risk education projects

Earthquakes and volcanic eruptions are events with which Italy has always had to come to terms with and to deal with, although the economic and social impacts of these events are becoming less and less sustainable. Starting from this consideration, over the last 10 years we have invested a substantial portion of our work in the EDURISK Project (Figure 3), which covers the area of risk education, first as seismic risk, and then as volcanic risk. EDURISK is an educational project for risk reduction.

The explicit objective of EDURISK is to promote risk awareness and an active role of citizens in risk reduction; therefore the goal is for social change. When we started this journey over 10 years ago, we were not completely aware of this; we simply thought that the spreading of knowledge, as the many different forms of knowledge that are related to natural risks, was important, and it was our duty as researchers and citizens to contribute to this goal.

The project was born and developed with the support of and within the Civil Defense system, a system clearly defined by Italian Law 225/92 as a 'service', whereby each of us, as citizens, is an essential component. The project is addressed to schools, beginning from kindergarten, or nursery school, and passing on up through secondary school. Participation in the project has involved a process of teacher training (four modules of eight hours), and an itinerary of lessons with their classes during the school year (averaging a total of 24 hours of work).

In these 10 years, we have collected and developed a wealth of knowledge and experience. We did not know what was ahead of us, as we engaged in an increasingly challenging job that has involved many people, including thousands of teachers, from Friuli to Sicily. Then there have been the many tens of thousands of children, of girls and boys, who for one year, two years, or even more, have been working passionately on a project that has helped everyone to become a responsible part of the risk reduction process (Figure 4).

Indeed, we were in the city of L'Aquila, in Abruzzo, Italy, only six months before the earthquake of April 6, 2009. We believe that our work there helped some of the 40 teachers and 800 students that came into contact with the Project, such that they could deal with such a difficult situation in a better way. The earthquake that hit Abruzzo on that April 6 led us to provide energy and human resources, to provide training and information support, throughout the whole of the emergency phase (April-September, 2009).

The educational 'strategies' after this earthquake were linked to the communication of the risk and the experience of the April 6 earthquake in L'Aquila, which also raised the issue of an 'information emergency'. The Risk Education courses that were designed and carried out during and after the emergency were dedicated to the schools and the general population, to meet the training/information needs with the intention of limiting the level of anxiety generated by the uncertainty of the situation [La Longa and Crescimbene 2009]. These courses helped people to have a better understanding of what had happened, and provided resources to adults in general for them to be more able to overcome the crisis phase. They also provided teachers in particular with specific tools to prepare educational programs and educational activities for the children/teenagers.

This experience of the earthquake brought us to reflect on the importance of addressing the problem of seismic risk reduction in its complexity through prevention strategies. This needs to take into account the different levels of intervention, in terms of initiatives to be implemented before or after a seismic event [Crescimbene et al. 2010].

Our outcome after 10 years of work can be considered positive: 3,500 to 4,000 trained teachers, from nursery to secondary school, 50,000 to 60,000 students involved in one or two year training projects, and 15 training products of the highest level widely spread in various forms (almost 120,000 manuals have been printed in various editions).

Today EDURISK is no longer a simple Project; it is a small Network that is in contact with active research centers (some INGV sections, the INOGS, and some univer-

Figure 3. Instruments of the EDURISK Project.

Figure 4. Geographical distribution of the schools involved in the EDURISK Project.

sities), and which maintains close ties of collaboration with professionals in the fields of educational planning and communication.

4. Risk education: a choice of social responsibility

The EDURISK Project experience has led us to reflect on some key elements and critical aspects of what we, as researchers, can do to develop a culture of risk reduction. The choices that affect risk reduction are those that we make, or do not make, long before an event occurs, and they are related to our perception of risk.

A first consideration concerns the concepts of hazard and risk. From a linguistic point of view, in Italian, these two terms are often used interchangeably, and from a risk education standpoint this confusion brings with it diametrically opposed behavioral reactions. If people only consider risk in relation to its component of danger in an area, an earthquake becomes the expression of the power of nature, and thus it confirms the impotence of human actions. Conversely, if the risk as such is well known to be the product of several factors, including the hazard, exposure and vulnerability, this definition introduces a good margin for possible actions for risk reduction, not only conceptually but in actual fact.

Our second consideration is a direct consequence of the first one. In our experience, we have realized that an appropriate awareness of the concept of the risk might not even be a sufficient condition to move from conscious knowledge to conscious action. Our attributions of responsibility have a dominant role in helping this passage to take place. All too often, the responsibility of doing something falls upon the shoulders of other actors: the government, institutions, local authorities, or maybe the mayor. Ordinary citizens can feel that they are powerless in the face of the inevitability of natural events, of building plans and decisions, and the regulations that govern them, and of the safety of the surroundings where they live and work. They thus transfer the responsibility for implementing effective preventive measures to those in public office.

Today, schooling also aims to educate pupils about their responsibility, and to focus attention on helping them to develop the skills that are suited to their growing responsibility, and their becoming conscientious individuals. The theme of risk knowledge, prevention and management acquires a special significance at a young age: how they can recognize dangerous situations and gain the skills to be able to evaluate and address them in a reasoned manner, so they can make informed choices. This is the minimum knowledge that all citizens need to master. The formation of skills related to prevention is strongly linked to the concepts of rights/duties and responsibilities, and it is linked to the principle of mutuality. Together with cooperation and solidarity, this mutuality is one of the value bases upon which social life is constructed.

This then brings us to our third consideration: the level of responsibility in a given context is directly proportional to the level of participation in the action in question. It would seem obvious to deduce that the higher the level of participation, the greater the sense of individual and social responsibility in making choices. In this regard, it is interesting to note that most professionals and academics now agree that there are appropriate levels of participation that correspond to different circumstances. What becomes important in this case, however, is to clarify what the level of participation expected is on the part of the public at large in any involvement processes that are taken into consideration (Table 1).

5. Conclusions

In light of these considerations, we will try to answer the questions we posed. The culture of prevention is the result of a long learning process that does not go through the simple use of information, but must be able to develop risk awareness and the acquisition of values, choices and actions with a view to reducing the risk. We therefore believe that as researchers, we are called on to make choices. We should assume the responsibility for the implementation of all of the most effective strategies, so we can have an influence on risk reduction and we can motivate the choices of the people before an event occurs. This means that the effectiveness of our concrete endeavors needs to be aimed at developing value actions and awareness, rather than relying only on information and training objectives.

In conclusion, we believe that the priority for those involved in risk-reduction strategies needs to be less pop-

	INFORM	CONSULT	INVOLVE	COLLABORATE	EMPOWER
Public participation goal	To provide the public with balanced and objective information to assist them in understanding the problem, alternatives, opportunities and/or solutions	To obtain public feedback on analysis, alternatives and/or decisions	To work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered	To partner with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution	To place final decision-making in the hands of the public
Promise to the public	We will keep you informed	We will keep you informed, listen to and acknowledge concerns and aspirations, and provide feedback on how public input influences decisions	We will work with you to ensure that your concerns and aspirations are directly reflected in the alternatives developed, and we will provide feedback on how public input influences the decisions	We will look to you for direct advice and innovation in formulating solutions, and incorporate your advice and recommendations into decisions to the maximum extent possible	We will implement what you decide
Example techniques to consider	*Fact sheets *Websites *Open houses	*Public comment *Focus groups *Surveys *Public meetings	*Workshops *Deliberative polling	*Citizen Advisory Committees *Consensus building *Participatory decision-making	*Citizen juries *Ballots *Delegated decisions

Table 1. The spectrum of public participation levels, as developed by the International Association for Public Participation (IAP2).

ularization, for the dissemination of scientific knowledge to the people, but rather education, to heighten the awareness of the population.

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