Chapter 12
Risk Communication and Disaster Information

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Abstract This chapter explains who needs to communicate about disaster risks and how. It also discusses what the critical information are especially in response to disasters and further how to educate people in preparation against disasters.

Keywords Bidirectional communication · Disaster education · Disaster information · Reconstruction information · Risk communication

12.1 Risk Communication

12.1.1 What Is Risk Communication?

A literal interpretation of the phrase "risk communication" is to let people know information about risks. We sense risk when we face situations that can cause hazardous damage. The risk communication about exposure to radiation from the Fukushima Daiichi NPP accident (Hatamura et al. 2015; IAEA 2015), therefore, was aiming at communicating the possibilities of damage to health from radiation exposure.

What information about risk to inform people is a highly sensitive issue. For example, International Commission on Radiological Protection (ICRP) gave the information about the level of health risk from radiation exposure caused by Fukushima-1 NPP accident saying every additional 100 mSv radiation exposure throughout the lifetime adds 0.5% to the possibility of cancer-caused death. It is hard to believe that the people properly received and understood such expert information in numbers (ICRP 2007, 2011).

The risk psychologist Slovic (1987) claimed that ordinary people, instead of judging the size of risk by numeric information with probability values, evaluate

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risk with rough psychologic measures about the severity of damage and level of uncertainty in the damage to take place. If that is the case, it would have been difficult for many people to accurately understand the risk information about radiation exposure by ICRP. On the other hand, risk communication by the government through press conferences immediately after the accident repeated there were no immediate effects on the human body. People were eager to know if they could do nothing if there were no effects or even if there were no immediate effect would there be effects in the future and, if so, what preparations they should take.

12.1.2 What Information to Provide with Risk Communication

Information expected with risk communication is the size of the risk and how to respond to it. That is not only to inform the risk size to people that are about to or in the future be exposed to a risk, but also to explain how to avoid and reduce the influence on people that are being exposed to the risk.

Janis and Mann studied decision-making at times of crisis (Janis and Mann 1977) and found that people in general tend to judge that the impact of the risk is less if they cannot find effective responses to the risk or stick to actions they have been taking to the point, even when they are informed of an approaching risk. Informing only the size of a risk hampers proper reaction to it, and it is important to explain how to cope with it with risk communication. The risk communication in Sect. 12.1.1, in addition to giving information about risks with radiation to people with possible harms to their health, should have explained, for example, how to measure radiation, methods of decontamination, how to select uncontaminated food, and the need for evacuation.

Fukushima Prefecture, after the breakout of the nuclear accident, opened a window and a health consultation hotline for its residents to carry out risk communication for inquiries about radiation exposure. The residents had a variety of questions starting from the level of radiation, influence on health, possibility of food contamination, how to lead their lives, decontamination, evacuation, and so on. During the early stages, many questions were about sizes of risks from radiation exposure, but as time passed by, they were more about how to handle radiation exposure (Osawa et al. 2015).

Osawa et al. summarized the points and problems with risk communication about radiation exposure based on their experience of answering inquiries from residents at the consultation window: “Using technical terms like Sievert (Sv) or Becquerel (Bq) made it difficult to explain and have residents understand the risk of radiation exposure. At the time, even the specialists and scientists had different opinions about health hazards from low-level radiation exposure of 10 mSv or less, and it was difficult for the residents to understand the information we gave. We had to show our empathy to the residents’ feelings that they hated and were scared of radioactive material or they would not listen to our explanation. Further, it was most important to find and inform what each and every resident, with different situations and circumstances, could do in leading life, managing health, and making actions."

12.1.3 Roles of the Sender and Receiver of Risk Communication

As we saw with risk communication on radiation exposure caused by the Fukushima-1 NPP accident, the senders of risk communication were engineers that developed the technology accompanied by risk, specialists of the utility company that employed the technology or administration staffs, all with proper knowledge of the risks. The purpose of risk communication, however, was not to persuade residents that the scientific technology had large advantages with small risks. The sender of risk communication had the responsibility and duty of providing necessary and sufficient information to have the residents recognize how the risk affected their health, lives, and natural environment, so they could make their own judgments about the needs for preparation and responses.

The audience, on the other hand, were citizens subject to possible exposure to risk then or in the future, i.e., those directly affected by events that caused risks. They were not there to receive one-way directions from the senders to accept scientific technology with risk or to select measures to avoid risk for themselves. People needed simple and clear knowledge about necessary cost and effectiveness of measures to avoid or lessen the impact of risks. Risk communication gives the necessary information to the people so they can judge if scientific technology can provide benefits they want and if the risks the scientific technology has are acceptable to them. The audience of risk communication has the rights to know information about risks and the responsibility to judge whether to accept the scientific technology with risk or not.

The sender and audience of risk communication have to acknowledge their own roles and, at the same time, the role of the other party of the communication. A lack of trust in the role of the other party will never reach common understanding through risk communication. The audience trust in the sender, i.e., scientists and engineers, has two facets: the trust about the skills of the sender and the trust about the sender's intention. The receiving side of risk communication by the sender cannot sincerely accept the information unless there is trust that the sender has necessary knowledge and skills to accurately explain the information in plain words and has the honest intention in the efforts to transfer the information in ways understandable to the audience.

The sending side, as well, needs trust in the citizen's intent and ability. Unless the audience has the intention to listen seriously to the information about risks and the ability to make judgments after thorough evaluation of the risk information, scientists and engineers would not spend the time and efforts in preparing information for risk communication out of their resources in scientific and engineering research.

12.1.4 Risk Communication of Societal Risk and Personal Risk

While we handle personal risks by ourselves, some risks are societal and require the whole society to take actions. Smoking cigarettes and being overweight are risks of the former type, whereas earthquakes and bird flu are of the latter. According to Morgan et al., ideal risk communication is different for personal and societal risks as follows (Morgan et al. 2002):

Risk communication for personal risks, with the assumption that the receiver citizens have limited time to pay attention, needs to help them understand the risks. It is, in fact, true that a general citizen is not an expert in specific risks and is not paying attention to risks all the time. Thus, risk communication has to allow the receivers to understand the risks in their own language and be able to cope with them for themselves.

Risk communication for societal risks need to support people having better knowledge about risks so they can judge whether to tolerate and accept the phenomenon with risk or not as a whole society. People have to reach an agreement for responding to a societal risk, thus, they have to review their own thinking and understand why their ideas are different from others in the same society. Risk communication has to offer opportunities for every citizen in the society to participate in discussions to reach a social agreement in responding to a societal risk.

Given the difference in risk communication for personal risks and societal risks, we can define risk communication as a bidirectional communication between citizens and specialists or citizens and administration for enhancing mutual understanding to reach an agreement about response to a risk.

12.2 Disaster Information

12.2.1 Importance of Disaster Information

Having disaster information is crucial for knowing how close the disaster is and making proper judgment of which regions are in need of assistance and which disaster responses can offer effective help. In our high information society with a variety of media passing global information in real time, the importance of disaster information is inevitably growing. In other words, whenever and whatever the circumstances, the quality of risk communication and attentiveness toward disaster information are always being monitored.

We have to remember that disaster information is first for the disaster victims and disaster struck areas. Disaster victims, however, are not just those victims at the time but also include disaster victims in the future. Figure 12.1 shows the three categories of disaster information for the different stages along the disaster management cycle.

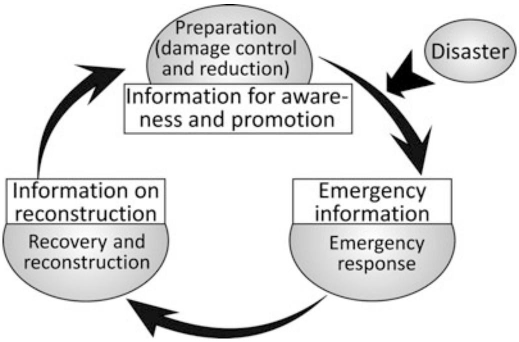

Fig. 12.1 Three types of disaster information

The cycle of three types of disaster information in Fig. 12.1, emergency information, reconstruction information, and information for awareness and promotion, is just one possible categorization for a single disaster location, and the stages do not necessarily progress in a single line in an irreversible manner. For example, emergency information and reconstruction information transferred alternatively in small cycles often mean information for awareness and promotion for disaster victims in the future.

12.2.2 Transferring Emergency Information

When hazards are about to hit, emergency information are sent out to prevent or lessen damages. Emergency information, in general, contain three elements of time, location, and size, that is, when, where, and how severe. Especially, when the hazard is almost within a reach, time information gains more emphasis, and the emergency information starts to carry the tone of a race against time.

Today with its advanced scientific technology, the Japanese society has gained new time margins by sophistication of time-related information. The Earthquake Early Warning, for example, upon detecting an earthquake occurrence, calculates the time and magnitude of strong tremors reaching regions throughout the country and sends the information out through a number of media as quickly as possible all at once. Upon receiving an earthquake early warning, systems can stop elevators at nearest floors, factory controllers can automatically stop production lines of precision machineries, and hospitals can halt surgeries before the earthquake-induced strong tremors arrive. Earthquake Early Warning is an example of an accomplished media event (cf. Sect. 3.1) that allows people to take immediate actions, based on disaster information alone, against damaging events or even before recognizing the existence of hazards.

In addition to emergency information that predicts time, location, and size of damages, a number of alerts urge people to take protective actions and evacuations. Japan Meteorological Agency sends out a large variety of information from weather warnings and advisories including emergency warnings, to weather conditions of record-breaking heavy rain in short periods. It also announces disaster management information of landslide alerts to tornado advisories, warnings and advisories of tsunami, eruption notices and warnings about active volcanoes, weather information like wind profiler (how winds are blowing at high elevations), and even information useful to our daily lives like dust and sandstorm information (MOE 2008) or ultraviolet ray indices. Local municipalities also make announcements like "evacuation orders," "evacuation advisories," and "prepare to evacuate and start evacuating elderlies."

Sophistication and, at the same time, complication of information, however, can easily lead to insufficient understanding of the information or misunderstandings. It can also end up causing troubles with people tending to wait for information or leading to serious distrust against the administration with people not tolerating failures in announcing proper alerts and making false alarms (Yamori 2013).

12.2.3 Transferring Reconstruction Information

Information about reconstruction are important for supporting disaster victims and disaster struck areas. Especially with mega-disasters over a wide area, each region has its own circumstances to follow, and continuous sending and receiving of information is particularly indispensable. The transfer of reconstruction information, however, is faced with the difficult problems of "disparity," "memory fade," and "harmful rumors," and we can hardly see any media coverage that completely meet what people are looking for.

Disparity of reconstruction information, especially, can directly lead to inequality in support. Thus, if there were differences in economic power at regions before the disaster breakout, the news coverage and amount of information sent tend to go out of balance, and the regions are stuck with the differences in economic power, or even worse, the gaps often grow bigger. For example, the amount of news coverage ranking of municipalities along the coast in Iwate Prefecture in Japan, where Disaster Relief Act applied for the 2011 Great East Japan Earthquake, remained almost unchanged. Some municipalities with small news coverage received extremely small donations even though they had suffered rather high ratio of inundation areas (Kondo 2018).

The quantity of news coverage going down with time is an unavoidable phenomenon. The coverage of the Great East Japan Earthquake dropped in the same manner for the whole and for individual regions (Kondo 2018). The small follow-up coverage failed to let the people outside of the disaster struck areas learn about post-disaster problems of lonely deaths in temporary housings or children in need of care for their mental stress. Also, even when problems of disaster capitalism are on a rise (Klein 2007), without proper coverage of the problem, people cannot reach out to provide support.

In recent years, the problem of harmful rumors is catching attention as not just the question of news coverage quantity but as its quality. Sending out the news that "harmful rumors are around" can further spread the rumors in a reproductive manner making it difficult to improve the situations. Areas struck by nuclear accidents, therefore, have the air that does not appreciate accurate news coverage of the reality. Some people displayed strong opinions about the difficulty in getting rid of, over a long time, the negative evaluation that the area is disastrous (contaminated). Some victims even showed pessimistic responses that they will just wait for the rumor to die out.

12.2.4 Information for Awareness and Promotion

One type of information effective for disaster management is detailed records of past disaster "back then" and graphic description of yet-to-come disasters "in the future." Advancements of science and technology these days have made it possible to manipulate large volumes of information to precisely describe details of past records and portray future events. Especially in predicting the future, vast amount of calculation with the supercomputer can simulate the global climate and forecast climate changes in hundreds or even thousands of years. In addition, technologies of special effects can visualize social damages including devastating destruction in urban areas with mega-earthquakes of low frequencies and disaster preparations for events that are otherwise invisible are now possible.

Efforts are also underway in utilizing information from the past to enhance the accuracy of future prediction. Records of people's movement in evacuating from tsunami attacks on record are subject to big data analysis in seeking important lessons and solutions for resolving the issues of chaos and stalling. Records of past disasters are effective for spreading and promoting disaster management efforts; however, we must understand the available records are in various forms. Old records are not necessarily replaced by new ones, and some old records are passed on through generations, or they are reevaluated.

Yamori pointed out that plotting medias that record past disaster information in a chart with two axes of intentional vs. unintentional and pictorial vs. linguistic gives a good overview of what they are (Yamori 2013). The categorization of whether one is intentional or not and linguistic or not is a relative measure, and there is no strict evaluation. Also, one style is not necessarily superior over the other, and all these media mutually complement one another (Fig. 12.2).

Let's look into some records to see if they were made intentionally with efforts to pass on messages or if we happened to lay our hands on them as byproduct of disasters. Information collected by museums are usually intentionally edited and organized. TV special programs and documentary films are also created with the producers' intentions. On the other hand, posted notices at evacuation shelters were not intended for passing on as records; however, they are important information that vividly recorded what requirements were there "back then."

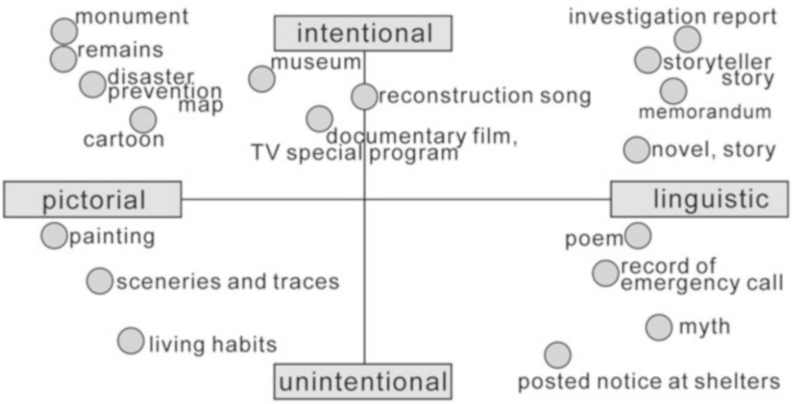

Fig. 12.2 Category of past disaster information, with some additions to Yamori (2013)

Linguistic information like memorandums, reports, and stories by storytellers are neatly arranged and easy to understand. Pictorial information, on the other hand, are easy to empathize with. In fact, paintings and remains have the power to give strong impacts on the viewers and leave messages deep within their minds. There are cases, however, that need literal explanation about why such traces of disasters were left there for the viewers to understand the situations. In other cases, stories by storytellers right in front of the remains make the information sharing effective. Another popular way of record composition gathers new photographs and remarks by visitors who were exposed to the disaster information to share on the internet or archive electronically.

Information in a variety of media can thus complement one another, and the disaster information turns more lively. There is no meaning to disaster information if they just sit there. When risk communication makes active use of them, they can have meaning for the first time.

12.3 Disaster Education

12.3.1 Transition of Concept of Learning and Disaster Education in Need

This section reviews disaster education about natural disasters for citizens including students at schools and regions since the 1995 Great Hanshin Awaji earthquake in Japan. Real efforts in disaster education started about 20 years ago, and with its short history, it still has no agreed definition. The phrase disaster education itself, however, is often talked about by people and is often understood, with the word "education" in the phrase, as something similar to school education that we are all familiar with. Because it was modeled after school education that teaches preliminarily set contents, people generally understand disaster education as an activity that teaches knowledge and skills about disaster reduction. The lack of basic knowledge and skills has been pointed out as a factor in damage widening in developing countries, and thus, teaching knowledge and skills is an important factor in disaster education. The facts in Japan, however, of low ratio of securing tall furniture to walls or reluctance in evacuation despite the immediate threat of disaster are problems not rooted in lack of knowledge or skills. Although important, teaching knowledge and skills alone does not solve problems in disaster reduction, and we need to review the way of educational activities in disaster reduction.

There are three types of learner's viewpoint about the concept of learning; (1) behaviorism learning, (2) cognitivism learning, and (3) social constructivism learning. Behaviorism and cognitivism learning focus on changes in individuals; the former means one can make an action after learning it, and the latter can recognize an object after learning about it. Social constructivism learning, on the other hand, is learning about changes in a group. It describes learning of knowledge and techniques as group sharing by its members through mutual interaction of creating and changing instead of a one-way transfer. Kariyado pointed out that current school education is based on behaviorism and cognitivism learning (Kariyado 2012). The Japanese school education system has everything to teach specified in the course of study, and understanding the contents and gaining skills to solve the quizzes are evaluated as accomplishment in education. The abovementioned disaster education is along these two styles of learning.

Disaster education, however, is different from school education because the assumption that the teacher knows everything to teach does not hold. The Great Hanshin-Awaji earthquake taught us that in disaster management, there are a number of problems with the dilemma that the right answer is not always the sole right answer. When faced with such problems, those in charge have to select what seems the best from a variety of options, and even a specialist cannot tell, "This is the right answer." At the time of the 2011 Great East Japan earthquake, a number of "unimaginable" events took place, and even experts voiced this word, for example, in "Discussions on the Current Status of Seismology" by Temporary Response Committee for the 2011 off the Pacific Coast of Tohoku Earthquake formed by the Seismological Society of Japan (SSJ 2012). In other words, we saw that experts, believed to have knowledge of the right answer, can sometimes possibly make mistakes.

Although there is no single definition of disaster education, we have to take the phrase to mean not just a one-way transfer of knowledge and skills if we want to make it meaningful. If disaster education can capture the difficulty in facing problems without a unique answer or even without any answer, interrelation of a variety of people can create, exchange, and share knowledge and skills about disaster management, and those activities make part of disaster education.

Limiting disaster management to natural disasters is general in Japan; however, that is not necessarily the case overseas. For example, in the United Kingdom, disaster education involves, in addition to natural disasters of earthquakes and typhoons, transportation accidents and fires that Japan handles as accidents (social disasters). The range of disaster management, therefore, depends on societies and times, and disasters that disaster education covers sometimes involve social disasters in addition to natural disasters.

12.3.2 Disaster Education as an Opportunity for Mutual Communication

The need for education that is not just one way, i.e., bidirectional education, is not special with disaster management and is present in fields of state-of-the-art science. In the field of science communication that deals with the relation of science and the society, it was pointed out early on that the effect of one-way education is limited, and the need to break the shell has been emphasized so far. Understanding the limitations with science, and similarly with disaster management, led to such needs. Science communication is dealing with problems that science can cast the question; however, it cannot provide the answer by itself, i.e., trans-science (Weinberg 1972).

What disaster education can learn from science communication is to acknowledge education as not just a one-way transfer of knowledge and skills but as a mutual communication. Children taking leads in evacuation drills and informing the problems they found during the evacuation to adults and specialists is an example of mutual communication. The objective of science communication, i.e., science, however, is naturally different from the objective of disaster education. If science communication and bidirectional disaster education based on social constructivism learning appear the same, that is because special interrelations in disaster reduction are taken as granted. Special interrelations in disaster management mean that humans relate to natural phenomena like earthquakes or typhoons that cause disasters through science. What this actually means is that humans scientifically explore mechanisms of natural phenomena and, with their understanding of the mechanisms, take scientific countermeasures. Basic disaster management measures in Japan have taken this interrelation as a natural assumption and have discussed uncertainties in hazard maps or climate change predictions. The method often leads to the understanding that uncertainties with individual scientific countermeasures alone are the risks. In reality, however, we are selecting scientific means from a variety of ways to deal with natural phenomena (disaster management measures) – for example, understanding them as punishment by supernatural beings like the god or taking them as mere cyclic events – and our selection of the relation itself has a risk. This viewpoint reveals that the commonly accepted disaster management measures in Japan have double risks. With science communication, the objective of communication itself is science, thus, communication about science itself is possible.

Communication with bidirectional disaster education, however, has to relate not only humans to science but also humans to natural disasters. In other words, disaster management involves a number of methods for building relations among humans and natural disasters, and whether to select scientific measures for building the relations is a point to include in the process of disaster education. Like in the case of the Nile basin before Aswan High Dam was built, a natural phenomenon that seemed to people, relating to the nature only through science, as flooding was not necessarily understood as flooding.

In bidirectional disaster education, we shall not assume that relating human to natural phenomena through science is a condition, and we need processes to think how we shall build relations with natural phenomena of earthquakes and typhoons, in other words, what we shall consider as disasters.

12.3.3 Importance of Sharing the Meaning of Disaster Management

What is important in disaster education is to recognize the problem in trying to solve issues in disaster management within the existing common framework. We have to, of course, acknowledge that disaster education is not a one-way transfer of knowledge and skills and, in addition, the reason that it is not so is not just the results of uncertainties always present with science. The uncertainties with science turn into a problem when we choose to use science as the method of disaster management, because uncertainty exists at the time of making the choice. Disaster education requires mutual communication about these two layers of risk.

For this type of disaster education, we need to set the purpose of disaster management, that is, to think what the disasters that we want to prevent are. Then we need to think how we should cope with each disaster, and if we judge that we need to take scientific measures, we shall choose a countermeasure. These processes are part of disaster education, and we need citizen participation in the selection phase. Note that the selected countermeasure has uncertainty in itself. And if the selected countermeasure is scientific, we need to evaluate the uncertainty of science in the measure. Disaster education is to build, share, and be prepared against disasters through processes of making selections with a variety of related parties about what disasters are and what it means to reduce them. Transferring knowledges and skills of how-to in case of earthquakes is just a small part of disaster education.

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