



Evolution of a disaster education program in the disaster cycle: from disaster recovery education to disaster risk reduction education

A. Sakurai⁽¹⁾, T. Sato⁽²⁾

⁽¹⁾ Professor, Toyo Eiwa University, aikosak@gmail.com

⁽²⁾ Professor, Tohoku University, tsato@irides.tohoku.ac.jp

Abstract

Disaster education approaches should be differentiated between those for disaster potential areas and disaster affected areas. In an area that has potential to be affected by a disaster, disaster education simply focuses on how to prepare for a coming disaster. On the contrary, when implementing disaster education after a disaster has occurred, special attention should be given to the children as disaster survivors. As years pass after a disaster, schools face a new challenge of how to teach about what happened in the disaster and what could be learnt from the disaster experiences to the pupils who do not remember or did not experience the disaster. Furthermore, what could be a model program applicable to schools that experienced different levels of disaster damage even in the same city?

In this paper, a disaster education program, “Disaster Recovery and Disaster Risk Reduction Mapping Program” (hereafter, the Program) was examined and discussed based on eight years’ implementation in Ishinomaki City, Miyagi Prefecture. Ishinomaki City was one of the most severely damaged municipalities by the 2011 Great East Japan Earthquake disaster, and widely known for the tragic incident of Okawa Elementary School, in which the lives of 74 pupils and 10 teachers were lost under school supervision. The Program has been developed through partnerships among the Ishinomaki City Board of Education, schools, an NGO and the authors as university researchers. The study analyzed data and information mainly obtained through the implementation of the Program.

The Program was started at an elementary school as disaster recovery education in 2012. It has been expanded from the coastal schools to the schools at the city center, and then schools along the Kitakami River. By 2019, nineteen schools have become model schools implementing the Program. With the expansion over time and of geographical areas, the Program was transformed to the City’s DRR education program, which covers multi-hazards including earthquake, tsunami, flood and landslides. One of key elements that enabled the evolution was utilization of topographic maps.

Though the Program was externally led in the pilot period, supporting materials were developed to help teachers conduct activities. One major product was a teachers’ guidebook to indicate steps for how to localize the Program according to the school’s situation and local disaster risk. The guidebook includes teaching plans to integrate a unit of map reading in geography class and hours of integrated studies, instruction on how to find and utilize geographic maps for DRR education, learners’ worksheets, and schools’ implementation cases. As a spin-off of the Program, a teacher training was started in 2019 to increase teachers’ map-reading skills to identify local disaster risk in the school district.

The study identified the evolution process of a disaster education program in Ishinomaki. Disaster education programs should be tailored according to a local disaster risk and experiences. At the same time, the implementation demonstrates how disaster education programs could be a replicated for different schools.

Keywords: The 2011 Great East Japan Earthquake, school-based disaster education, local disaster risk.

1. Introduction

The Great East Japan Earthquake of magnitude 9.0 occurred at 14:46 on March 11, 2011, resulting in the generation of a massive tsunami, which caused 15,884 deaths and 2,633 persons to go missing (as of March 10, 2014 by the National Police Agency of Japan). The city of Ishinomaki in the Miyagi Prefecture with a



population of 163,216 (as of October 1, 2010 by the Ishinomaki City Government) recorded the worst disaster among all the 2011 disaster-affected municipalities, in terms of death toll (3,529 deaths and 436 missing, as of August 21, 2014 by the Ishinomaki City Government). In Ishinomaki, damages to the education sector were also enormous. Fifty-one percent of the students died (166 out of 327) and 46% of the children (16 out of 35) went missing in the Miyagi Prefecture. All of the 71 educational facilities in Ishinomaki from kindergarten to high schools and special-needs schools were damaged by the 2011 disaster. Ishinomaki became known for the tragedy of the pupils of Okawa Elementary School, in which 74 out of 108 pupils and 10 teachers along with numerous local people were lost in the 2011 tsunami disaster near a riverbank bridge. Twenty-three families of the victimized children have sued the Miyagi Prefecture and the Ishinomaki City Government, and in April 2018, the Sendai High Court ruled that the deaths of the elementary school children could have been prevented if the Miyagi Prefecture and the city government had updated its disaster contingency plan.

Since the 2011 earthquake, the Ishinomaki City Board of Education has been actively promoting school safety and they have established Ishinomaki City's Committee on School Disaster Preparedness Promotion to encourage collaboration in preparing for future disasters among schools, disaster management related units of the city government, academia, and NGOs. Based on the 24 recommendations made in the investigation report of the investigation committee on Okawa Elementary School Accident, the committee reviewed the experiences of the 2011 earthquake and tsunami disasters. Thereafter, the committee produced a report of all the disaster experiences of the public schools and has been reinforcing school disaster risk reduction (DRR) capacity since then. These activities include setting up a school-community disaster management committee; introduction and regular updates of a checklist in the school disaster response manual; production and updates of supplementary reading textbooks on DRR; and introduction of early warning systems for earthquakes. However, since Ishinomaki was merged with another city and six neighboring towns in 2005, the levels of damages and progress of recovery and reconstruction have been diversified. Therefore, concrete efforts on how to improve school DRR capacity and to promote disaster education have been left to the discretion of each school.

This study describes the reconstruction and DRR (R-DRR) mapping program, which is one among the activities under the Committee on School Disaster Preparedness Promotion in Ishinomaki. The R-DRR mapping program was originally developed as a disaster recovery and DRR education program in Ishinomaki since school year (SY) 2012, and it has been implemented at 16 public elementary and junior high schools in Ishinomaki as of SY 2018. The R-DRR mapping program involves town watching and map-making in a DRR cycle. As a part of the school educational program, it is mainly taught in the school curriculum using "periods for integrated studies" (*sogoteki na gakushu no jikan*) in Ishinomaki. This program is designed to encourage children to learn about their community's natural environment and history, gather information of their community's efforts in recovery and reconstruction, DRR, and motivate them to be involved in their community's safety. The program comprises the following four steps: (a) orientation; (b) town watching; (c) information organization; (d) map making; and (e) map presentation to the school and the community. Although this is the general framework, the program encourages each school to customize the program according to their geographical location, school type, age of children, and community backgrounds in each school.

2. Purpose

The purpose of this study was to analyze the development process of the R-DRR mapping program in Ishinomaki. By reviewing the development process, this study shows the differences between the map-making program during the pre-disaster phase and this program at the post-disaster phase. This study also provides some tips to prepare a project-based disaster education activity that can be scaled-up to a disaster education program that can be implemented in many other schools.



3. Methods

The R-DRR mapping program has been developed through partnerships among the Ishinomaki City Board of Education, public elementary and junior high schools in the city, and university researchers (the authors of this study). Therefore, in this study, action research methods are used and data are analyzed, and information is mainly obtained through the implementation of the education programs at schools. The data and information include maps created by the schoolchildren, pre/post questionnaire survey results from selected schools, teaching plans, teachers' guides developed by the authors, and observation of the implementation at the schools.

4. Results

The summary of the results is shown in Fig.1. Firstly, the program was started at a pilot elementary school in the severely damaged coastal area of the city as a reconstruction mapping program in SY 2012–2013. Based on the two-year implementation [1][2], the program was expanded to the neighboring coastal schools, which were also severely damaged by the tsunami. Since then, three schools have been designated as model schools for the program by the City Board of Education in a year. The areas were further expanded from the coast to the center of the city, which experienced inundation of the tsunami, and then moved up the Kitakami River to the north, where the 2011 tsunami damages were not seen. Until SY 2019, 19 schools have become model schools, of which 5 are junior high schools and 16 are elementary schools. The grades of the pupils have also diversified. Pupils from the third grade to the seventh grade (the first year at junior high school) participated in the program at these schools. With the time-space expansion of the program, hazard types were diversified from tsunami to flood, earthquake, and landslides according to the geographical features of the school districts, and there was an additional focus on aspects covering from the reconstruction to DRR.

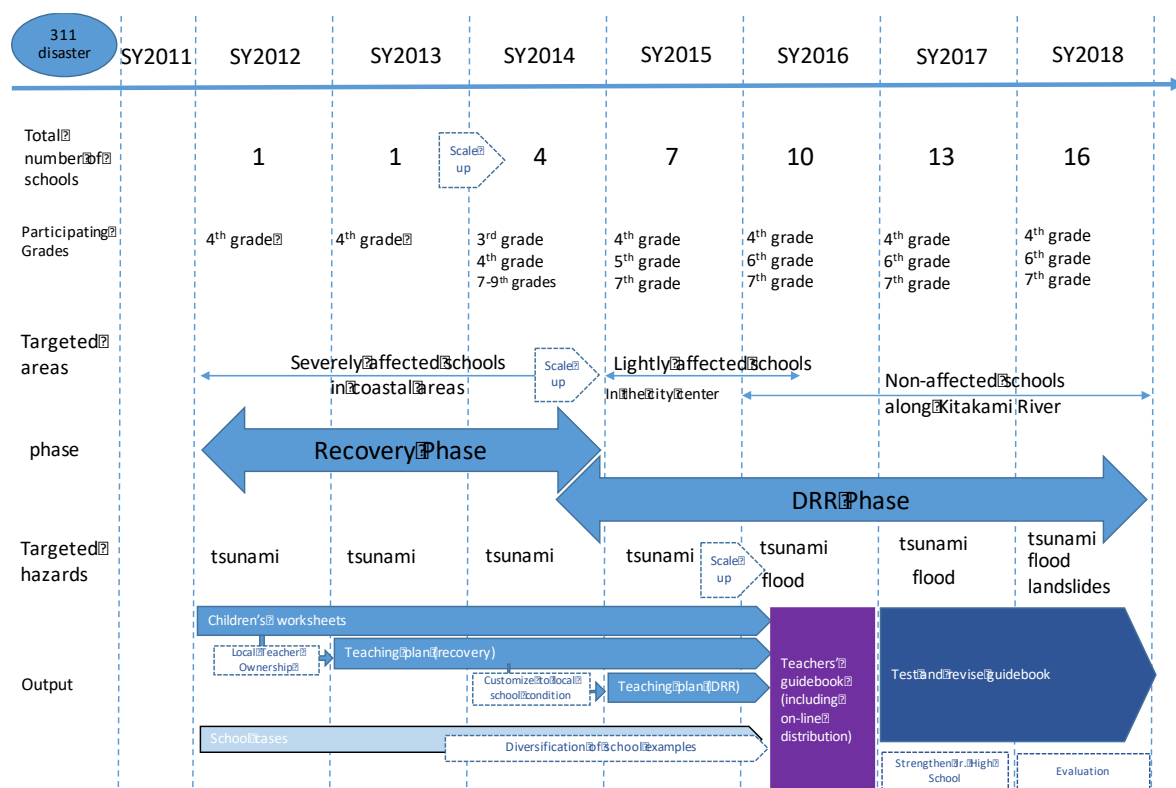


Fig. 1- Development process of the reconstruction and DRR mapping program in Ishinomaki



Secondly, in order to scale up the program to schools with different conditions, teaching guidebooks were produced in SY 2016 to include worksheets for learners, teaching plans for recovery and DRR phases, and 11 other school experiences. The teaching guidebook was aimed at supporting teachers to plan and implement the program. Chapter 2 of the guidebook shows the steps to customize the program according to the school's local conditions, and how to fit this program into the school's annual plan and DRR plan, and it contains all the developed materials and school cases. A school's local condition includes the geographical as well as socio-economic and cultural features of the school district, the family situation of the children, the school's relationships with the community's stakeholders, and the 2011 disaster experiences of the school as well as of the children and their families[3].

Thirdly, topographic maps were introduced to understand the school district's geographical features and history of land-use. The guidebook contains a special section that shows the points of teaching by using topographic maps and explanation of key legends in the maps and how to find maps from the Geospatial Information Authority of Japan's homepage.

Fourthly, in combination with the learning topographic features of the school district, the guidebook indicates examples of categories that enable the children to find points for making observations of the town. At the recovery phase, the finding points were set up, as shown in table 1. For the DRR phase, an example of the categorization is shown in table 2.

Table 1- Classification of the discovery points at the recovery phase.

Code/Color	Description of the discovery points
Silver	A place/thing newly built or fixed after the tsunami
Yellow	A place/thing that is currently under construction or under repair
Orange	A place/thing in preparation for reconstruction (a vacant lot that has been cleared of rubble is the start of reconstruction)
Red	A place/thing that children think of as dangerous or that induces anxiety
Gold	Others, including a place/thing that children think is fun, beautiful, and are proud of

(Source: created by the author)

Table 2 - Classification of the discovery points at the DRR phase.

Code/Color	Description of the discovery points
Yellow	A place/thing that is related to land shapes and/or land use 1) highland, hill, lowland 2) rice field, field, mulberry plantation field 3) residential sites 4) levy, drainage pumping station 5) land names originally come from nature
Red	A place/thing that children think of as dangerous or that induces anxiety 6) A place regarding traffic and road conditions 7) A place regarding land and ground conditions 8) A place/ thing that could be in danger during a disaster 9) A place where vulnerable people live 10) A place/thing where past disaster traces and damages are shown



Blue	<p>A place/thing that children could feel safe and secured</p> <p>11) A place/thing that could be helpful for information collection</p> <p>12) A place/ thing that could be helpful during emergency (e.g. fire fighters, police, hospitals, and fire hydrant, AED)</p> <p>13) A place/thing that could be helpful during evacuation (evacuation shelter, storage, well, emergency vending machines, dynamo, solar panel, etc.)</p> <p>14) Others</p>
Green	<p>A place/thing that could be kept long in the community; that were newly built after the disaster; and others including a place/thing that children think is fun, beautiful, and are proud of</p>

(Source: created by the author)

As seen from the two tables, there are clear differences between the reconstruction phase and the DRR phase of learning. During the reconstruction phase, the learners could be those who survived the disaster. The categories emphasize positive and future-oriented aspects of the damaged places and things. For example, the orange code in table 1 stands for a place/thing that is being prepared for reconstruction. Although a vacant lot indicates the place wherein the tsunami destroyed several houses converting them to rubble, the orange code denotes a different and a forward-looking meaning of “the start of reconstruction.” In the DRR phase, the categories include geographical features in addition to the safe/useful and dangerous places. In both categories, the common aim is to set a category to encourage the finding of attractive features in a community. During town watching, the guidebook emphasizes on interactions between schoolchildren and the local residents in the community by interviewing the people in the community’s local shops, restaurants, and factories. Children were divided into groups for visiting different areas in the school districts to collect information by finding points based on the categories and by interviewing the locals about the damages caused by the 2011 disaster. They learnt how these locals recovered from the damage to re-open their business, and how they expect the children to behave. This information is displayed in a poster-sized paper, including the area map.

5. Discussion

It can be said that the seven-year process of developing the reconstruction and DRR mapping program is almost equal to the development process of education recovery in Ishinomaki. This program has been developed since 2012 using a disaster risk cycle, from the time of recovery and reconstruction to disaster mitigation and preparedness for the future disaster.

Town watching was used originally as the tool for community planning in Japan but nowadays, it has become a popular approach for disaster-prevention map-making by local residents and school children to understand their community’s dangerous and safe places and useful things to know during a disaster in the pre-disaster period. Many programs to support local map-making have been established in Japan [4][5]. The application of town watching in disaster education has also become popular in other Asian countries such as India, Indonesia, and Malaysia [6].

As seen from the results of this study, the R-DRR mapping program is not just a safety and/or risk map. The R-DRR program is the application of town watching and map-making to a disaster recovery and DRR educational program at school. At the recovery phase, the reconstruction-mapping program at the tsunami-affected area helped schoolchildren to understand the reality of the 2011 disaster in their school district and to overcome the difficult phase with forward-thinking initiatives and by working as a team at their schools. At the DRR phase, the program helps to pass on the disaster experiences to younger generation within the same school. Since the 2011 disaster, all the elementary school children have graduated and moved onto high school. However, the current elementary school children, who may not clearly remember the 2011 disaster because they were at pre-school age at the time of the disaster, could learn from the R-DRR mapping program about what happened in their school district. Since SY 2016, fourth-grade children at the first pilot school started to



learn from the maps, which were created by the fourth-grade children in SY 2012 to SY 2014. In SY 2018, as the first time trial, the fourth-grade children started to learn about the 2011 tsunami inundation area and the height of tsunami in the school district.

Utilization of topographic maps allowed the program to be scaled up to non-tsunami affected schools—to shift the focus of the program from recovery to preparedness. Since SY 2017, at a junior high school, social science classes and periods of integrated studies have been linked to apply the students' map reading skills to study the past of their school district and the potential hazards of a natural disaster. The junior high school was not inundated with the tsunami in 2011. However, by learning from the maps, students found that the school has a potential risk of flooding since the school is surrounded by rivers. As a spin-off of the Program, a teacher training was started in 2019 to increase teachers' map-reading skills to identify local disaster risk in the school district.

This seven-year development process and the outputs of the program provide tips for making this one-time disaster education activity into a scaled-up and sustainable disaster education program, which could be implemented in other schools in the same city. Previous studies have shown that making disaster education sustainable is challenging. Since many of the disaster education projects are largely limited by time, efforts should be made toward long-term, wide-reaching, and sustainable implementation. Bottom-up mechanisms that are "custom-fitted" to a particular country and local contexts are required [7]. The first tip is putting teachers in the driver seat. Owing to the multi-disciplinary aspects of a disaster education program and the limited time and knowledge of teachers, in many cases, external supporters play a leading role to produce a program. However, once the program is formulated, the external supporters pass the driving role to the teachers at the school, while they remain as supporters. Producing a teachers' guidebook is the second tip to show the steps of planning the program. This guidebook could be more useful if combined with a training opportunity. The guidebook could be very helpful for teachers if it could include practical information, including a teaching plan, worksheet, any teaching materials used in the class, and examples from other schools. The third tip is to foster collaboration between schools and communities. Since teachers are not the residents of the school district in most cases, they do not know enough about the history and geographical features of the school district. Local residents could help teachers and children with information regarding the history of the disaster in that area and the how they coped with the disaster.

6. Conclusion

The authors of this study believe that seven consecutive years of developing and involving in the R-DDR mapping program has been a very rare and precious opportunity. This was realized through collaboration with the City Board of Education, NPOs, and teachers and university researchers for six months after the disaster occurred. Since then, the program has been continued and scaled up. The scale-up was also realized because of the collaboration among schools, schoolteachers, parents, local residents, university researchers, and the City Board of Education. To make the disaster education program more customized, scaled-up, and sustainable, further developments should be carefully observed and supported through collaboration. This is one of the indispensable efforts of schools in a disaster-affected city. How could we learn from this disaster experience? How can we bounce back from the disaster? Disaster education programs in the disaster-affected areas have an enormous role to answer these questions.

7. Acknowledgements

The authors would like to extend their great appreciation to the children, teachers, schools, and the community in Ishinomaki who conducted and supported the Reconstruction and DRR Mapping Program. The study received grants from the International Research Institute of Disaster Science (IRIDeS), Tohoku University, Japan.



8. References

- [1] Sakurai A, Sato T and Murayama Y (2014): Implementation of the reconstruction mapping program at a tsunami-affected elementary school in the recovery process from the Great East Japan Earthquake. Proc. of the 9th Annual International Workshop and Expo on Sumatran Tsunami Disaster and Recovery-AIWEST-DR 2014.
- [2] Sakurai A (2015): Disaster recovery education program in Ishinomaki, Miyagi, Proc. International Forum for Promoting Education on Disaster Resilience (Tohoku University, Sendai, Japan) 28–9.
- [3] Sakurai A, Kitaura S, Murayama Y, Sato T, (2019): Development of a community-based disaster recovery and disaster prevention education program-Based on the five-year implementation at public schools in Ishinomaki City, Miyagi Prefecture, The Japanese Journal of Safety Education, **18**(1) 23-36.
- [4] Mulyasari F, Takeuchi Y and Shaw R (2011): Implementation tools for disaster education. In: Shaw R, Shiwaku K, and Takeuchi Y. (Eds), Disaster Education: Community, Environment and Disaster Risk Management (Bingley, UK: Emerald Publication) 137–151.
- [5] Shaw R and Takeuchi Y (2009): Town watching handbook for disaster education: Enhancing Experiential Learning. European Union (EU), International Strategy for Disaster Risk Reduction (ISDR), and Kyoto University.
- [6] Shaw R and Takeuchi Y (2009): Sustainable community disaster education in Saijo City and its effectiveness in landslide risk reduction.
- [7] United Nations (2014): Education Sector Position Paper: A contribution by the United Nations to the consultation leading to the third UN world conference on disaster risk reduction.