

DEVELOPMENT OF THE DISASTER PREVENTION AND MINIMIZATION EDUCATIONAL PROGRAM FOR RECONSTRUCTION AFTER THE KUMAMOTO EARTHQUAKE

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ABSTRACT: This study developed a disaster prevention education program for children who continued to live in the Aso area after the Kumamoto earthquake with the aim to enhance their disaster prevention capabilities and to help them take active roles in the reconstruction of the region. This study clarified the objectives, teaching materials, learning methods of the disaster risk prevention education program after the disaster, and clarified the educational effects of the program. The study set the evaluation criteria based on the MEXT curriculum guideline called “Zest for Living”. It has become evident that, the knowledge based on the local historical experiences can be a good starting point for the reconstruction immediately after the Kumamoto earthquake. One of the educational effects of the program was, as it became clear that the local children are deeply interested in the wisdom and customs of reading and understanding nature. The program successfully raised children’s level of awareness from the classroom education of disaster prevention to regional disaster prevention in the three years it has been implemented. Furthermore, with the passage of time after the disaster, it has become apparent that the programs called ‘Prediction of Danger and Taking Independent Action’, which aims at recognizing dangers associated with various disasters and ‘Contributing to Society and Basics for Disaster Service Workers’ can also be implemented.

Keywords: Kumamoto Earthquake, Disaster Prevention Educational Program, Aso

1. INTRODUCTION

Disaster Risk Education plays an important role in overcoming the memory of the disaster and in providing preparation for future disasters. The objectives and programs of disaster risk prevention education differ according to the periods prior to the disaster, at the time of the disaster and in the periods of recovery and reconstruction. Most of the disaster prevention programs deal with the pre-disaster phase. Many of these programs use simulation models (Yamada, 2006) and hazard maps (Cheng-Chien, 2018), (Nakatani, 2018). The contents of learning include evacuation training to ensure safety and the understanding and prediction of the hazards associated with disasters.

On the other hand, there are not many disaster prevention education programs for recovery and reconstruction. In particular, there is a lack of disaster prevention training programs that would foster attitudes which promote participation, cooperation and contribution to the safety of the area during times of recovery and reconstruction. It is important to provide such education to those children who will continue to live in disaster-stricken areas that fosters their attachment to the community and promotes attitudes which contribute to the recovery and reconstruction.

Two months after the Great East Japan Earthquake, Iwate Prefecture designed an education program called: “Iwate’s Reconstruction Education” with the goal of “nurturing people who love their hometown and are involved in the reconstruction and development” (Murakami,2018).

As a response to the 2011 Great East Japan Earthquake, the Ministry of Education, Culture, Sports, Science and Technology (MEXT) set up an expert committee for reviewing disaster prevention education and management. MEXT published a revised material in 2013 titled Zest for Living. It includes not only evacuation procedures during disasters, but also educational programs from the viewpoint of local life and customs(MEXT,2013).

From the viewpoint of reconstruction following the 2016 Kumamoto earthquake, promotion of disaster prevention education is required based on traditional lifestyle and knowledge that have helped local people to coexist with the volcano and overcome natural disasters, such as eruptions and landslides. Especially during times of disasters, the traditional lifestyle, knowledge and feelings of local patriotism are considered to have helped the children psychologically. On the other hand, education psychology studies reported that children who had experienced disasters have to deal with the effects of serious psychological stress in daily life

(Fujimori, 2011). Therefore, it is important to clarify the objectives of the educational program, the teaching material and learning methods that are to be considered during the post-disaster recovery and reconstruction period. This study aimed to develop a disaster risk educational program, which promotes place attachment for reconstruction from disasters and fosters awareness for disaster prevention. This study carried out the disaster prevention education program in the three years immediately after the 2016 Kumamoto earthquake. It also clarified the objectives of the teaching materials, the learning methods of the disaster risk prevention education in the time after the disaster and clarified the educational effects of the program.

2. RESEARCH METHODS

2.1 Research Area

The Aso area suffered from natural disasters such as the Kumamoto earthquake (April 2016), the northern Kyushu torrential rain (July 2012), and the eruptions of Mt. Aso (September 2015, October 2016).

The topographic characteristic of Aso is that it is a huge caldera which was created by four volcanic eruptions with pyroclastic flows. Inside the outer rim of the somma caldera is home to a vast grassland lying at 700 to 800 meters above sea level.

The annual rainfall reaches approximately 3,200 mm in Aso which makes it the second highest rainfall in Japan. The wind from the Ariake Sea southwest of Kumamoto at 1,000m altitude meets with the wind from the Pacific Ocean to cause heavy rainfall in the Aso area during the summer. Also, the influence of the hot and humid air flow from the East China Sea increases the possibility of torrential rains in the rainy season (Tanaka,2010).

The volcanic soil and the weather conditions are not suitable for cultivation, so the Aso area was developed using drainage engineering techniques and the local people have been using the grassland for livestock for centuries. The grasslands in Aso have been managed by local agricultural activities such as controlled burning, mowing and pasturage for centuries. The grasslands of Aso are managed as commons in the region. On the other hand, the decline of the livestock industry and the increasingly aging population, the landscape management of grasslands has become increasingly difficult. To address the shortage of manpower, the volunteer activity in Aso attracted a lot of motivated people outside of Aso since 1990's

The Aso area was designated as a national park in 1934. The grasslands of Aso were certified as Globally Important Agricultural Heritage Systems (GIAHS) in 2013, and they were also certified as Geopark in 2014. The international reputation of the grasslands of Aso has increased. (Machida, 2019)

2.2 The objective of the Disaster Prevention and Minimization Educational Program

The study set the evaluation criteria based on "Zest for Living", the Ministry's curriculum guideline(MEXT,2013). In "Developing disaster prevention education that fosters "Zest for Living", set the following three aims for disaster prevention education(tab.1).

The following articles from the Education Ministry guidelines are incorporated into the elementary school curriculum: "to help pupils become aware of the close relationship between the national land, people's lives and livelihoods" from the objectives of Social Studies; "to help pupils develop interest in the relationships between themselves, the people around them, the various local places, public facilities; to enable them to appreciate their locality and to develop a feeling of attachment to it; at the same time, to enable them to think about their roles and actions as members of their groups or society and to act safely and appropriately" from the objectives of Life Environment Studies.

Table 1 Disaster prevention education of "Zest for Living"

The criteria of "Zest for Living"	The objective
Knowledge, Consideration, Judgment	To understand disasters that are likely to occur in the area, to learn from the past disasters of the area, and to use them in making decisions for taking safe actions
Danger Prediction, Independent Action	To recognize danger at the time of disaster and to be able to secure one's own safety using daily training etc.
The Foundation of Social Contribution	To respects one's own life and those of others, to be able to help the safety of other individuals, To be able to take useful action to help groups and areas during and after disasters that occur in the area.

Existing literature on the development of educational programs for disaster prevention (Ishihara 2013) served as a reference to the perspective of evaluation. Articles such as “interest, motivation and attitude in relation to social events”, “consideration and judgement from a social viewpoint” and “knowledge and understanding of social events” were included in the evaluation criteria. Additionally, this program’s concept of local identity “disaster area considered as an irreplaceable place” (Funami 2016) was also included in the evaluation.

2.3 Development of the Disaster Prevention Educational Program for Reconstruction after Kumamoto Earthquake

The education programs, based on the disaster situation, were planned in cooperation with the locals and the elementary teachers. The education programs were carried out in two Minami-Aso Elementary Schools, and Aso Elementary School a Minami-Aso Junior High School, Aso Elementary School, by scientist, locals and NPO, teachers. As a result, six months after the Kumamoto earthquake, the study implemented a disaster prevention education program aimed at fostering regional identity, rather than dealing with direct grief from disasters.

The disaster prevention education program one year after the Kumamoto earthquake, aimed at understanding the lives of people living in Aso and the wisdom of overcoming natural disasters.

In the disaster education program three years after the Kumamoto earthquake, we conducted a survey to gather information from families and the elderly on the local wisdoms about overcoming natural disasters. In addition to the survey, the children themselves participated in programs preparing emergency food and evacuation action plans during disasters.

The study looked at the effects of the program based on the selected keywords from children’s oral comments, adopting the text-mining approach (Nakamura, 2016) and the interview survey results by children.

3. RESULTS AND DISCUSSION

3.1 The Disaster Prevention Educational Program 6 months after the Kumamoto Earthquake

The education programs were planned in

cooperation with local elementary school teachers and NPOs from May 2016, two months after the Kumamoto earthquake. The conclusion of the advance meeting with local teachers was that the educational program aimed at helping children deal with the damage and trauma of the earthquake was too early. Therefore, this study established three disaster education programs. The first was a program to leverage the local historical experiences, such as the grassland management techniques (controlled burning, fire belt). The aim of the second program was to learn about the attractiveness of living together with volcanoes and grasslands through national parks and geoparks. The third program introduced the interaction between the inside and the outside of the area through the case of Kumamoto’s reconstruction efforts in Tokyo.

The teaching materials used numerous photos of grassland landscapes and local agricultural activities such as controlled burning (Fig. 1), fire belt mowing (Fig. 2) in the Aso area. In addition, this program featured a 3D terrain model to enhance the sensory perception of the volcanic terrain of the Aso area.



Fig.1 Controlled burning



Fig.2 Fire belt mowing

The program was carried out on September 24, 2016 with the participation of 30 children in total from 3rd grade and 4th grade of two elementary schools in Minami-Aso. The instruction method included the presentation of a 3D topography model of Aso with the purpose to enhance the understanding of the volcanic topography and caldera topography of Aso.

The 3D terrain model is 29 cm long, 25 cm wide, has a maximum of 3 cm in height, and was created at the scale of 1 to 100,00. In order to help children grasp the size of the secondary grassland areas of Aso we compared it to “the Yahoo! Dome of Fukuoka” which the local children are familiar with. In addition, when explaining the total distance of the fire belt mowing the idea was to make it easy for children to imagine the total area of the open area and the cut, so it was compared to the distance between Aso and Nagoya.

The second program explained about the purposes of National Parks, Globally Important Agricultural Heritage Systems, and Global Geoparks. In addition, the program explained that the reasons for recognitions as Global Agricultural Heritage Systems and Global Geopark are the livelihood of the people in the grasslands and the volcano of Aso.

The third program introduced a sales promotion event held in Tokyo in order to support the reconstruction after the Kumamoto earthquake.

The educational effect includes the appearance frequency of controlled burning, and the deepened understanding of the maintenance and management of the grassland and its relationship with people's activities. The educational effect was frequent in case of national parks (27times,36.0%). There were many children who did not know that Aso was designated as a National Park, Globally Important Agricultural Heritage System, or Global Geopark. Therefore, it became clear that incorporating national parks and world geoparks into the educational materials would enhance understanding and interest in the area.(table1)

3.2 The Disaster Prevention Educational Program 1 year after the Kumamoto Earthquake

A year has passed since the Kumamoto earthquake, and following meetings with teachers, we planned an educational program that placed stronger emphasis on the perspective of disaster prevention education than the one in 2016.

The objective of the program continued to highlight the attractiveness of Aso through the activities of grassland management such as the fire controlled burning, and through the recognition as national park and geopark, in order to enhance the

appeal of the hometown and to promote place attachment. In addition, learning points from a disaster prevention point of view about the wisdom of Aso that overcame natural disasters and the bond between the community were further included along with traditional land use techniques based on the caldera's topography [12]

The program was carried out for 60 5th grade students of Aso City's Aso Elementary School on December 11, 2017.

The educational methods of the continued program was the same as the previous one. The program featured wisdom gained from overcoming natural disasters, reflected on the bond within the community, incorporated methods for passing on past disasters within the community and introduced traditions related to the natural disasters and the natural phenomena of the Aso region. For example, “Han”(the wooden plate is called, Fig.3) used to alert the neighborhood of impending disasters. It is not used anymore, of course, but it is kept there to remind people of the importance to help each other at times of disasters.

Concerning the local customs, the contents of the program did not investigate the question of scientific validity, but merely aimed at understanding the fact that local ancestors have faced nature by closely observing it.

The program explained about the traditional land use from the walls of the caldera to the floor of the caldera, with the aim to learn about traditional land use(Fig4).

As for the educational effect, considering the high frequency of the appearance of words that refer to the management of the area (e.g. controlled burning), it was possible to confirm the educational effect that children possess an understanding of the management of the grassland and have a raised level of interest toward it. Furthermore, the frequency of appearance of the phrases ‘Local customs’ (71 times,30.1%) and ‘Controlled burning’ (60 times,25.1%) was high. The largest number of comments were about the natural disasters of Aso and its lore and wisdom. It became apparent that children are interested in the area's traditional customs and wisdom. Furthermore, it was also confirmed that the wisdom gained from overcoming natural disasters and the bond within the community helps form a place attachment to the Aso area.(Table1)



Fig. 3 Hann(Past of disaster alarm)



Fig. 4 The land use of Aso area

3.3 The Disaster Prevention Educational Program of Program 2 years after the Kumamoto Earthquake

As one of the educational effects of the program implemented so far, it turned out that the children have a strong interest in the wisdom and customs of reading and understanding nature.

Therefore, in the educational program two years after the Kumamoto earthquake, sixty 6th grade students who participated in the educational program of the previous year were interviewed about the lore and wisdom such as rain, earthquakes, snow, frost, grassland management, firefighting, they acquired from their families and neighbors related to understanding natural disasters in the Aso area. The range of the survey period is from July to December 2018(Fig. 6).

The result is that 'tradition and wisdom about rain' was the most frequent with 43 mentions (36.4%).(tab 1).

There were as many as 18 stories (15.2%) of 'lore and wisdom related to earthquakes'.It was observed from comments that many of the surveyed have heard from family and neighbors about the experiences of the Kumamoto earthquake, such as: "I was helping (being helped by) neighbors or other local people at the time of the Kumamoto earthquake.".Furthermore, there were comments such as "My great grandmother had fled to the rice fields when there was an earthquake in the old days, because there were not many open places." which show that experiences related to past earthquakes are still kept alive.

There were 11 cases (9.3%) of 'lore and wisdom about snow'. "When there was a lot of snow, we shoveled the snow together with the people of the area to clear the road." These comments clearly indicate that children heard tales about living through the severe winters of the Aso area and providing mutual assistance.

There were 4 cases (3.4%) of 'lore and wisdom about frost'. Aso area is an area where early frost and late frost are likely to occur in May and in early autumn around October. As a result, we were able to confirm practices related to frost and agriculture.

There were two cases (1.7%) of 'lore and wisdom on grassland management', which were

about the timing of the controlled burning and the necessity of grassland management.

There were two cases (1.7%) of 'traditions and wisdom concerning firefighting', and those referred to the prevention of fire spreads and related prediction techniques.

The learning points summarized by the children were compiled into a booklet which contain the wisdom of coexisting with nature and Aso, and were shared with families, multigenerational groups, and local communities. Therefore, the program was able to raise awareness of disaster prevention education from school education to regional disaster prevention.



Fig.6The learning about the wisdom and customs

In addition, a public workshop was conducted on September 8, 2018. The topics included the risk characteristics of Aso's natural disasters, forecasting, preparedness and fostering social contribution after disasters. Eleven students ranging from the 5th grade of elementary school to the 1st grade of junior high schools have participated from the local schools of the Aso area.

As part of the learning method, in order to learn about the risk characteristics of Aso, children were explained about the types of landslides (slump, topple, debris flow, rockfall), the differences between landslides that occurred as a result of the Kumamoto earthquake and the landslides that were the results of rain. Subsequently, children enhanced their learning by using confectioneries to simulate the differences of rock topples and slumps.

During the emergency food preparation session, participants used familiar natural resources, eco ovens and bamboo in order to learn the skills to survive natural disasters(Fig.7).

Finally, using elevation maps and 3D topographic models, the children deepened their understanding of the relationship between the topographical characteristics of the Aso area and the disasters. Then, imagining that a disaster occurred while the participants were at home, disaster prevention maps and evacuation action plans were created for each child simulating scenarios of volcanic eruption, landslide disasters and earthquake disasters(Fig8).



Fig.7 The emergency food preparation



Fig.8 The evacuation program

Table 1 Disaster Prevention Educational Program for Reconstruction after Kumamoto Earthquake

Time	Age (Number of students)	School curriculum/ The evaluation criteria on "Zest for Living"	Teaching material of Disaster Prevention Education	The objective of educational program	The word in frequency of oral comments and The word of Impression	Educational effects and issues
2016. September After Kumamoto Earthquake 5 months	9-10 years old 10-11 years old 11-12 years old (36) *Double class	Social studies/ Knowledge and understanding Local identity	【The landscape of Aso】 (Grassland, Volcano, controlled burning, fire belt, seven plants in season) 【3D topography model of Aso】	· Instead of focusing the reality of the recovery from the disaster of Kumamoto Earthquake, it aims to turn children's attention to the values of the local historical experiences, such as the grassland management techniques (controlled burning, fire belt, seven plants in season). · The attractiveness of living together with volcanoes and grasslands through national parks and geoparks. · The interaction between the inside and the outside of the area through the case of Kumamoto's reconstruction efforts in Tokyo.	【The word of Impression (Total words=75) Multiple answers allowed】 Controlled burning (12) 16.0% Volunteers (17) 22.7% Natinadl Park (27) 36.0% Designation of Natinal Park (16) 21.3% Caldera (4) 5.3% Geo-Parkd (2) 2.7% Kind (3) 4.0% Tokyo (1) 1.3% thoughtfulness (1) 1.3% Kumamoto Earthquake (1) 1.3%	It became clear that incorporating national parks and world geoparks into the educational materials would enhance understanding and interest in the area
2017. December After Kumamoto Earthquake 1 year and 8 months	10-11 years old (41)	Life envonetment studies/ Knowledge and understandin Local identity	【The landscape of Aso】 【3D topography model of Aso】 【 Local historical descriptions】	· The objective of the program continued to highlight the attractiveness of Aso through the activities of grassland management. · The wisdom of Aso that overcame natural disasters and the bond between the community along with traditional land use techniques based on the caldera's topography.	【The word of Impression (Total words=239) Multiple answers allowed】 Controlled burning (60) 25.1% Fire belt mowing (27) 11.3% Natinadl Park (41) 17.2% Geo-Parkd (19) 7.9% World Agricultural Heritage (19) 7.9% Local customs (72) 30.1% Hann :Past of disaster alarm (19) 7.9% Tinber forest (1) 0.4%	It was also confirmed that the wisdom gained from overcoming natural disasters and the bond within the community helps form a place attachment to the Aso area.
2018 September 2 years and 5 months	9-10 years old 10-11 years old 11-12 years old 12-13 years old	Social studies/ Science/ Knowledge and understandin Local identity Consideration of judgement Social contribution	【The landscape of Aso】 (Grassland, Volcano) 【3D topography model of Aso】 【 local historical descriptions】 【Simulation model】 experiment, 【Hazard map】	· The types of landslides (slump, topple, debris flow, rockfall) by using confectioneries to simulate the differences of rock topples and slumps. · The emergency food preparation. · It used the Simulation model experiment and hazard map for confirmation of evacuation sites and plan for volcanic eruptions, floods, earthquakes, and landslide disasters that are assumed in the Aso area.	【The oral comments】 "I want to tell about the landslide disaster and the evacuation sites of Aso that I learned about today to my friends and family" "I want to take advantage in my daily life of the many things I learned about, such as the nature of Aso, or making emergency food and disaster prevention plans.	the understanding of the characteristics of disasters that are likely to occur in the area, to the 'knowledge' and 'social contribution' needed to take safe action.
2018 December 2 years and 8 months	11-12 years old	Social studies/ Knowledge and understandin Local identity Consideration of judgement Social contribution	【Local historical descriptions】 【Interview of local their families and neighbors】	· The interview about the wisdom and customs they acquired from their families and neighbors related to understanding natural disasters in the Aso area. · The learning points summarized by the children were compiled into a booklet which contain the wisdom of coexisting with nature and Aso,	【The total number traditions and wisdom =60】 Rain: 43 (36.4%). Earthquakes: 18 (15.2%) Snow: 11 (9.3%) Frost: 4 (3.4%) Grassland management: 2 (1.7%) Firefighting: 2 (1.7%)	It was able to raise awareness of disaster prevention education from school education to regional disaster prevention

There were several comments made by the participating students regarding the educational program's learning points: "I want to tell about the landslide disaster and the evacuation sites of Aso that I learned about today to my friends and family", "I want to take advantage in my daily life of the many things I learned about, such as the nature of Aso, or making emergency food and disaster prevention plans.

As a result of the educational program various learning points have been confirmed from understanding the blessings of nature, the understanding of the characteristics of disasters that are likely to occur in the area, to the 'knowledge' and 'social contribution' needed to take safe action.

There were several comments made by the participating students regarding the educational program's learning points: "I want to tell about the landslide disaster and the evacuation sites of Aso that I learned about today to my friends and family", "I want to take advantage in my daily life of the many things I learned about, such as the nature of Aso, or making emergency food and disaster prevention plans. As a result of the educational program various learning points have been confirmed from understanding the blessings of nature, the understanding of the characteristics of disasters that are likely to occur in the area, to the 'knowledge' and 'social contribution' needed to take safe action(table1).

3.4 Readjustment and future proposals for the educational materials of the Disaster Prevention Education Program for the recovery and reconstruction periods

This study developed a disaster prevention education program for children who continued to live in the Aso area after the Kumamoto earthquake with the aim to enhance their disaster prevention capabilities and to help them take active roles in the reconstruction of the region.

Immediately after the Kumamoto earthquake, the program incorporated 'knowledge' about natural environments, national parks, geoparks, and other local attractions into the educational programs. It became apparent that it is useful to raise children's interest and attachment to the Aso area. Furthermore, it has also become evident that, the knowledge based on the local historical experiences can be a good starting point for the reconstruction after the Kumamoto earthquake.

One year after the Kumamoto earthquake, and local traditions and disasters have been incorporated into the educational programs from the perspective of disaster prevention education. Consequently, 'knowledge' and 'decision' that are necessary for understanding disasters which are likely to occur and past disasters of the area were

obtained as a result. Furthermore, valuable educational effects became evident as the result of deepening interest and awareness by linking past traditional wisdom and modern disaster management approaches.

In the second year after the Kumamoto earthquake, children have become proactive in learning about past regional disasters and their prevention. Then, the educational program provided an opportunity to share knowledge and awareness on disaster prevention among children, local residents and their families. The program successfully shifted from school education to regional disaster prevention.

Furthermore, with the passage of time after the disaster, it has become clear that the programs called 'Prediction of Danger and Taking Independent Action', which aims at recognizing dangers associated with various disasters and 'Contributing to Society and Basics for Disaster Service Workers' can also be implemented.

From the viewpoint of both disaster prevention education and the reconstruction after the Kumamoto Earthquake the development and the continued implementation of the Disaster Prevention Education Program serves an important purpose.

4. CONCLUSION

The study set the evaluation criteria based on the ministry's curriculum guideline called "Zest for Living". It has become evident that, the knowledge based on the local historical experiences can be a good starting point for the reconstruction immediately after the Kumamoto earthquake. One of the educational effects of the program was, as it became clear that the local children are deeply interested in the wisdom and customs of reading and understanding nature. The program successfully raised children's level of awareness from the classroom education of disaster prevention to regional disaster prevention in the three years it has been implemented. Furthermore, with the passage of time after the disaster, it has become apparent that the programs called 'Prediction of Danger and Taking Independent Action', which aims at recognizing dangers associated with various

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