

# Development of Climate Change and Disaster Mitigation Education in Elementary Schools Based on Scientific Knowledge

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## 1 Background to practical implementation

Marine education at this school has been promoted in conjunction with the curriculum for the four marine education promotional schools in Omuta City with instruction from teachers from the Center for Ocean Literacy and Education in the Graduate School of Education at The University of Tokyo.

One of the issues of marine education being engaged in by these four schools is “the lack of scientific knowledge regarding oceans in order to promote behavioral change.” When taking a marine education standpoint, educational content is divided between subjects such as social studies and science, and the content itself is further divided into different areas within each subject. This makes the knowledge required for the promotion of marine education either partial or one-sided (for example, from the viewpoint of the “water cycle,” weather variation is studied in year three, the flow of water is studied in year four, and the operations such as erosion, conveyance, and accumulation are studied in year five). For that reason, a practical issue is the difficulty that children have in gaining a comprehensive understanding of the water cycle, which leads to some children having only partial or one-sided knowledge when devising studies for the promotion of behavioral change in marine education.

In the floods in July 2020, this school district was heavily damaged, with flooding of 1.5m in the school area. The flooding was caused by linear rainbands, which raised the level of interest in climate change and disaster preparedness among the children.

For these reasons, at this school, there is a desire to expand marine education by improving the curriculum to learn about the current situation and reasons for climate change and to consider the actions that should be taken based on scientific knowledge. Therefore, what we have devised in order for the children to acquire scientific knowledge is the “formation of marine literacy educational targets” and “textbook production” with learning in the elementary school curriculum being reorganized from the perspective of marine education to supplement the areas that are lacking. The formation of these educational targets and textbooks was based on the seven principles of “Ocean Literacy for All (1st edition),” the translation of which was provided by the Marine Education Center. First, based on the seven principles, the required competencies in marine literacy were clarified with reference to the three competencies in the curriculum guidelines, and these competencies were set as educational targets across the nine years of compulsory education. Then, with reference to those educational targets, a textbook was produced that reorganizes or supplements the knowledge to be gained through the curriculum.

The practical examples shown here are based on the policies in connection to these issues and solutions.

## 2 Practical examples from the 5th grade

### (1) Motivation to practice

Due to the flooding (2020 Kyushu Floods) that occurred on July 6, 2020, this school district was heavily damaged. The homes of many children were flooded, as was the first storey of the school building and the

gymnasium (Fig. 1). This damage caused the children to ask, “Why was the rain heavier than ever before?” and “Why has Kyushu been repeatedly damaged by flooding in recent years?” Therefore, we devised a learning plan so that the children would take appropriate action during disasters based on a correct understanding of flooding mechanisms and responses (Fig. 2).



Fig. 1 School Flooding in 2020 Kyushu Floods

ぼくは、今までは海はつながっていると思  
 っていたけど、でも川から水が流れ、はなし  
 た。海の水はあふれているので、はと不思議  
 だ。たけど、学習を通して、雨が降って山  
 から川へ流れて、海へ行き、海の水が蒸発  
 して、雲かできてまた雨になって、くり返しになっ  
 ると言ったことがあった。

I used to think that the ocean was connected.  
 However, I have always wondered if the water in the  
 ocean is overflowing when the water from the river is  
 constantly flowing into the ocean. Through this study,  
 I learned that when it rains, water flows from the  
 mountains to the rivers and then to the ocean, where it  
 evaporates, clouds form, and it rains again, and so on.

Fig. 2 Description of School children①

## (2) The Stage of Perceiving the Issues

First, invitations were given to people from the Omuta City Disaster Preparedness Management Office as well as weather forecasters, who were asked about the mechanisms of the flooding that occurred (Fig. 3). The children were taught that heavy rain is caused by linear rainbands of cumulonimbus clouds, and that the atmospheric instability that causes cumulonimbus clouds is exacerbated by the rising ocean temperatures in recent years. The children were surprised that flooding damage is connected to the problems with the ocean that they had already studied, which deepened their awareness of the issues, and, because flooding may occur in the future due to rising ocean temperatures, they asked why the temperature is increasing and how to prepare in case a flood occurs in the future (Fig. 4).



Fig. 3 Interviews with the disaster preparedness management office, etc.

・ぼくは学習を通して自分の命を守ることにそのた  
 めにせんに防災バックなどをしるべし  
 て行動力の任方むな人を言周べておくことが  
 大切なことだと思ひました。なせなら  
 人の命を守るためには自分の命を守らなければ  
 いけない自分の命を守るためにはせんに  
 防災バックや行動力の任方むな人を言周べ  
 ておかなければいけないと思ひたからです。

Through my study, I realized that it is important  
 to protect our own lives, and to prepare disaster  
 prevention bags, etc., and to research how to act  
 and evacuation centers in advance. This is  
 because in order to protect people's lives, we  
 must protect our own lives, and in order to  
 protect our own lives, we must prepare disaster  
 prevention bags and research how to act and  
 evacuation centers in advance.

Fig. 4 Description of School children②

### (3) The Stage of Acquiring a Deeper Understanding

Based on the children's awareness of the issues, first, they studied Principle 1 and Principle 3 of the Marine Literacy Textbook with a focus on the causes of rising ocean temperatures (See Principles 1 and 3 in the Appendix). Based on the text that summarizes "water circulation systems (Principle 1)" and "the relationship between the climate and oceans (Principle 3)," the children learned that the amount of water vapor being emitted from the sea is increasing due to rising ocean temperatures, that global warming is related to the rising ocean temperatures and that even ocean currents may be affected by this increase in ocean temperature. This gave the children a correct understanding of the fact that complex factors are involved in the causes of flooding, which widened their perspectives on global environmental issues from the standpoint of regional communities, and raised their awareness of the issues with regard to environmental problems.

Therefore, the children considered and discussed what they can do in their own lives in order to limit global warming even by a little. The children conducted various investigations into the causes of global warming and initiatives that would limit warming while also considering everyday activities such as "not wasting goods or foods" from the standpoint of SDG 12, "Responsible Production and Consumption," with a focus not only on the greenhouse gases emitted in daily life but also on current social systems of mass production for mass consumption.

Next, focussing on preparing for coming disasters, the children studied self-help and mutual help. The children looked back on their disaster experiences from that time, including power outages and a shortage of goods, and considered various topics such as "arranging a disaster preparation bag," and "confirming escape routes." Then, they were divided into several groups for study through collaboration. Regarding these studies, reference was made to the "disaster preparedness learning sheet" issued by the Kesenuma Board of Education.

As for the contents of the disaster preparation bag, a guest teacher provided support in order to study the usefulness of tools, including how to use torches not only for light during power outages but also to signal a call for help when stranded during a vertical evacuation. Regarding points of danger and evacuation routes, because the water becomes muddy during floods, making it impossible to see through, fieldwork in the school area was conducted to check for points that could be dangerous during evacuation, including the location of manholes and gutters, and this information was added to hazard maps issued by Omuta City. Through these studies, the children were able to consider the specific actions that should be taken while imagining various situations during disasters (Fig. 5,6).



Fig. 5 Flood status survey



Fig. 6 school district dangerous location plan

#### (4) The Stage of Taking Action

Finally, everything that had been understood and considered so far was compiled onto a leaflet, which was exhibited in local public institutions and stores, etc., and which visitors were asked to distribute. This leaflet was so well received that the 300 copies prepared in advance had all been distributed within one month (Fig. 7).



Fig. 7 Leaflet distribution request

### 3 Transformations in the children through practice

After seeing the impressions made on the children through this learning program, the transformation in their awareness can be split into three categories.

First, the children made a correct reassessment of the connection between oceans and the climate. It was found that the children made connections and accurate reassessments of the partial knowledge they had gained from subject studies, such as “rain falls into the sea, that evaporates and turns into rain clouds,” and “ocean currents transport marine products but they are being impacted by human activity.”

Second, they reconsidered the actions that they should take from wider perspectives in specific terms. It was found that the children used marine education as a starting point for considering the various targets of the SDGs, such as “don’t use things wastefully,” and “don’t leave food half-eaten” and that they considered global-scale issues in connection to their own lives.

Third, they felt the necessity of cooperation in the locality. This study gave them a real feeling that there is a limit to what individuals can do on their own with regard to controlling global warming and also with regard to taking action during disasters. It was also found that the children believed that problems should be resolved through cooperation with others, including the fact that “it is important for everyone to take action because the issue was overlooked, which caused the problem to increase in scale.”