

Educational Effects and Changes in Children's Appreciation of Nature through Community-based Education: A Case Study of *Satoumi* Learning in Japan

Kyoko MATSUMOTO^{1,2,*}, Kimihito TAKENO³, Tomoya KISHIOKA⁴, Makoto URATA^{1,2},
Michio MATSUBARA⁵, Takahiro KATO⁵, Nobuo SUZUKI², Kazuichi HAYAKAWA²

¹Institute of Noto SATOUMI Education and Studies, Ishikawa, Japan

²Institute of Nature and Environmental Technology, Kanazawa University, Ishikawa, Japan

³Faculty of Education, Shiga University, Shiga, Japan

⁴Organization of Frontier Science and Innovation, Kanazawa University, Ishikawa, Japan

⁵Professional School for Teacher Education, College of Human and Social Sciences, Kanazawa University, Ishikawa, Japan

*Corresponding author: matsumoto@notosatoumi.com

Received April 05, 2022; Revised May 09, 2022; Accepted May 19, 2022

Abstract This study investigates the educational effects and changes in children's appreciation of nature through community-based education, namely, *satoumi* learning in elementary and junior high schools in the Noto Peninsula, Japan. This study considers ocean education as a community-based education that uses natural resources and compares changes in children's appreciation of nature before and after receiving ocean education as an educational effect. A structured questionnaire was administered to every elementary school (grades 4-6) and junior high school student (years 1 and 2) in Noto town in 2016 and 2017 (n = 420). The survey was distributed to the same students through the Noto Town Board of Education in 2016 and 2017. Using paired and unpaired t-tests, we found a significant educational effect on students' relationships with the community, particularly for students in the first year of ocean education. The educational effect in the second year was comparatively lower, though the students' appreciation of nature significantly increased in the second year. In particular, the students' relationship with the ocean and settlement intention decreased in the higher grades of elementary and junior high school. However, the findings suggest that continuing ocean education can not only enhance students' relationships with the community but also foster their appreciation of nature. Regarding gender differences, girls had a lower frequency of visiting the ocean after one year of *satoumi* learning, though overall, they tended to hold positive attitudes toward local nature. In addition, the student responses to many questionnaire items differed significantly according to whether the school was located in an inland or coastal area. Finally, after the second year, the benefits of ocean education were limited. Therefore, it is recommended to develop more effective learning programs for higher grades and inland schools.

Keywords: *satoumi*, community-based education, ocean education, appreciation of nature, educational effect, elementary and junior high school students

Cite This Article: Kyoko MATSUMOTO, Kimihito TAKENO, Tomoya KISHIOKA, Makoto URATA, Michio MATSUBARA, Takahiro KATO, Nobuo SUZUKI, and Kazuichi HAYAKAWA, "Educational Effects and Changes in Children's Appreciation of Nature through Community-based Education: A Case Study of *Satoumi* Learning in Japan." *American Journal of Educational Research*, vol. 10, no. 5 (2022): 323-331. doi: 10.12691/education-10-5-8.

1. Introduction

Japan seeks to maintain a positive living environment for local community members and to promote settlement intention, especially given the decreasing birthrate and aging population in rural areas. To this end, the Ministry of Education, Culture, Sports, Science and Technology advocates for establishing a community identity where every community member feels pride and is attached to

the community and the adults cooperate to foster an environment for children's education. [1] Hence, it is necessary to help children develop place attachment to the community through education. This, in turn, is expected to influence their future settlement intention. For instance, the comprehensive strategy and plan of local governments includes aims to increase settlement intention and encourage U-turns through education. *U-turn* is a Japanese term for a person born in a rural area, who moved to a city for school or employment, and has returned to live in his or her hometown.

In this circumstance, community-based education, for example, related to experiences of community life and local nature, has been offered in various regions of Japan. [2] Children can benefit from active learning opportunities using natural resources, including the ocean and mountains. [3]

Previous research on place and community-based education in the context of environmental and outdoor education has suggested that students learn with enthusiasm and improve their grades when place-based education is incorporated into the curriculum. When school education is integrated with the local community, students can cultivate ties with the community and develop knowledge, skills, and experience to contribute as community members. As a result, they have more options for staying in the community as constructive residents. [4,5]

At the same time, the Japanese government has emphasized the need for ocean education. In 2007, the Basic Act on Ocean Policy was enacted to promote the “enhancement of citizens’ understanding of the oceans” (Article 28). [6] Then, the revised plan in 2013 recommended “to improve marine-related education at elementary schools, junior high schools, and high schools.” [7] The Third Basic Plan on Ocean Policy, formulated in 2018, aims to promote ocean education, enhance opportunities for people to come into contact with the ocean such as through recreation, tourism, etc., and implement ocean education in every municipality by 2025. [8] However, the learning contents, teaching methods, and measurement of the effectiveness of ocean education remain open research problems. [9]

In this study, *ocean education* is community-based education that uses natural resources and compares the changes in children’s appreciation of nature before and after they receive ocean education as an educational effect. Since one goal of ocean education is to foster pride and attachment to the community, focus is placed on the children’s appreciation of nature related to the local community.

2. Materials and Methods

2.1. Study Area

This research targets ocean education as a curriculum that incorporates place and community-based life experience as well as experience with nature in Noto town, Ishikawa prefecture, Japan. The core industries of Noto town are the primary industries such as agriculture, forestry, and fishery. The Noto region includes four cities and five towns, including Noto town, and is known for its traditional agriculture, forestry and fishing methods and activities to conserve the use of *Satoyama Satoumi*. In 2011, the Food and Agriculture Organization of the United Nations certified “Noto’s Satoyama and Satoumi” as the Globally Important Agricultural Heritage Systems. [10]

However, the aging of industrial workers and shortage of replacement workers have become major problems. The aging rate exceeded 21% in 1995, and the proportion of the young population fell below 10% in 2010 in Noto town. [11] Furthermore, there is no higher education institution in Noto town, and the outflow of young people when they go on to high school or find a job after graduation is one of the major factors accelerating the declining birthrate and aging population. As of 2015, there were about 650 students at five elementary schools and about 400 students at four junior high schools in Noto town. The number of children is decreasing each year. Also, the number of elementary schools has decreased from ten to five, while the number of junior high schools has decreased from six to four compared to when Noto town was born in 2005 due to a merger (Figure 1). [11]

In 2015, Noto Town’s Regional Strategy [12] was created with a goal of “enhancing ocean education at elementary and junior high schools as practical education to deepen love for and pride in our hometown and to promote local activities in the community, such as local festivals to foster local pride and community attachment.” Accordingly, all elementary and junior high schools in Noto town have introduced ocean education.

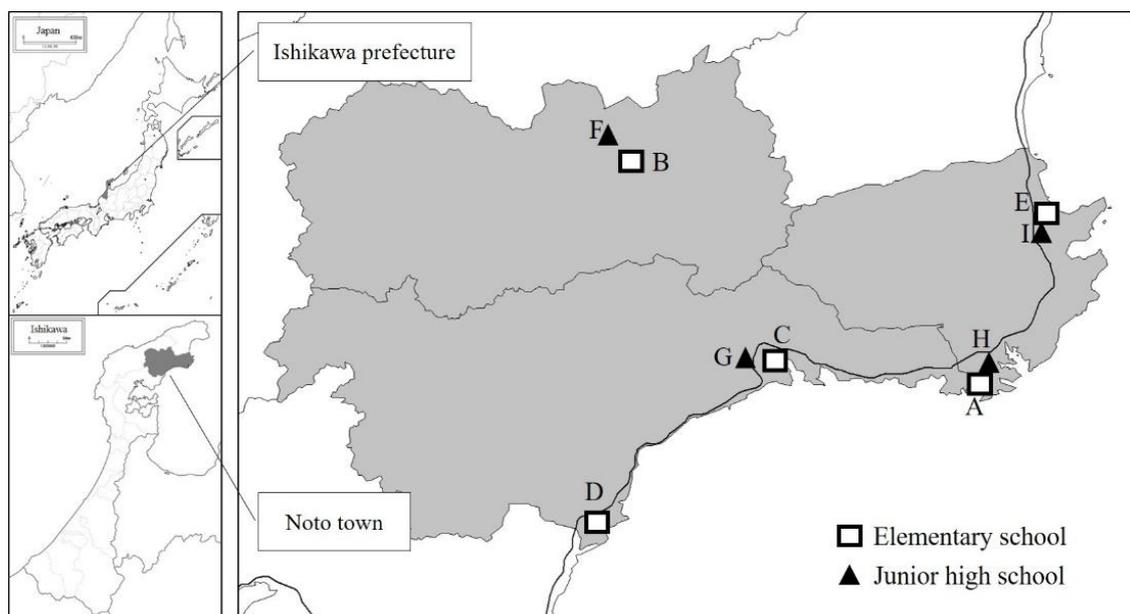


Figure 1. Location of study area: Noto town, Ishikawa prefecture, Japan

2.2. Satoumi Learning

As of April 2015, the Ministry of Education, Culture, Sports, Science and Technology designated one elementary school in Noto town as a pilot school for a *satoumi* course. At the pilot school, 5th and 6th grade students to receive 35 hours of instruction a year in the *satoumi* course, while other elementary and junior high schools carry out *satoumi* learning around 5 hours a year (Table 1). In this paper, the term “*satoumi* course” refers to this program, and “*satoumi* learning” is used for the forms of ocean education at other schools. In Japanese, *sato* means the area where people live, and *umi* means the sea. Thus, *satoumi* is an important sea area that supports culture and cultural exchanges, for example, through fisheries and the distribution of products. The area includes both nature and human residents, as well as high biological productivity and biodiversity. [13]

Ocean education, including the *satoumi* course, is “practical education to deepen local love and pride in your hometown through ocean experimental learning toward implementing rich locality and active school education.” [14] The learning contents are classified into four categories: becoming familiar with the ocean, getting to know the ocean, protecting the ocean, and utilizing the

ocean. Activities include beach observations, community festival studies, beach cleanups, and cooking squid. [15]

In Figure 2, the upper left shows 1st and 2nd grade elementary school students observing the ocean as an activity of “becoming familiar with the ocean.” The upper right shows 3rd grade students studying a community festival related to the ocean as a “getting to know the ocean” activity. Then, the lower left depicts 5th and 6th grade elementary school students doing a joint cleanup with junior high school students at the beach as an example of “protecting the ocean.” Finally, the lower right shows 6th grade students cooking squid as an activity of “utilizing the ocean.”

The purpose of “becoming familiar with the ocean” is to cultivate interest in the sea through experiential learning, while “getting to know the ocean” aims to develop further interest in the nature and resources of the sea, as well as their deep relationships with people. The “protecting the ocean” curriculum component teaches students to take part in the conservation of the ocean environment through activities such as independent investigations, and “utilizing the ocean” shows students the importance of sustainable use of ocean products and resources, the transportation of people and goods by ship, and the connections with people around the world through the sea. [9,16]

Table 1. Pilot school’s implementation status of *satoumi* learning [16]

Year/grade	Subjects for <i>satoumi</i> learning	Learning contents	Hours
1 st	Living environment studies	- Seasonal changes in the sea	16
2 nd	Living environment studies	- Breeding of sea creatures	19
3 rd	Science, social studies, the period for integrated studies, and so on	- Festival of the sea - Environmental beautification	51
4 th	Science, social studies, the period for integrated studies, and so on	- PR for local squid products	50
5 th	Science, social studies, the period for integrated studies, and so on	- Birth of fish - Survey and presentation of the fisheries industry	35
6 th	Science, the period for integrated studies, and home economics	- Fisherman’s work-study - Cooking using seafood	35



Figure 2. Activities in the *satoumi* course

Table 2. Implementation status of ocean education at elementary and junior high schools [17,18]

Elementary school	Learning contents		Hours
	5 th grade	6 th grade	
A	- Noto Town's fisheries industry - Birth of fish - Change of marine environment and creatures' lives - Agriculture, forestry, and fishery industries	- A fisher's work - Life and environment - Nutritious diet	35 hours each
B	- Making seaweed salt and experiencing being on a canoe - Making sticky rice-stuffed squid - Breeding masu trout	- Beach observation - Making sticky rice-stuffed squid	5 hours each
C	- Cooking seafood such as squid, yellowtail, and seaweed - Experiencing fishing and making seaweed salt	- Ocean-related jobs - Whaling history - History and present of Oshiki net fishing and traditional fixed-net fishing - Cooking practice with squid	5 hours each
D	- Experiencing fishing	- Experiences of fisherfolk - Ocean-based local dishes - A fisher's life	5 hours each
E	- Experience of being on a canoe - Experience of lightly dried cuttlefish	- Experience being on of a canoe - Experience of lightly dried cuttlefish	5 hours each
Junior high school	Learning contents		Hours
	1 st grade	2 nd grade	
F	- Beach observation and combing - Flotsam investigation - Beach observation, life collection - People and festivals at <i>satoumi</i>	- Knowing <i>satoyama</i> , connection between mountains and the ocean - People and festivals at <i>satoumi</i>	5 hours each
G	- Tsunami disaster prevention - Cooking practice using fishery resources	- Tsunami disaster prevention - Study group on sea creatures - Making a lampshade	5 hours each
H	- Beach observation, life collection	- Making seaweed salt, dissecting a squid, and making lightly dried cuttlefish	5 hours each
I	- Making seaweed salt - Cooking practice using crabs and local products	- Beach observation, collecting seaweed, and making a seaweed specimen - Cooking practice using yellowtail and local products	5 hours each

The *satoumi* course at the pilot school is positioned as “practical education that aims to realize a school education that is rich in locality and vibrant through experiential learning of the sea, deepening love of the hometown, and making the hometown proud.” It includes a special curriculum that draws on local teaching resources such as the coastline where diverse creatures live, the distinctive fishery industry, and the history, culture, and facilities related to the ocean. The aim is to make children be proud of their hometown and foster place attachment to the community (Table 2). [11,16]

Specifically, the educational goals of the *satoumi* course are to “cultivate a rich sensitivity to the ocean and along with raising interest in the ocean,” “help people understand the relationship between the ocean and humans

and the connection with the people of the world through the ocean, and to cultivate the qualities, abilities, and attitudes of forming a sustainable society” through “activities to get close to the rich nature of the ocean and experience activities to feel a connection with the ocean in the familiar society.” [17,18]

2.3. Survey and Analysis

This study employed a questionnaire survey targeting all 4th, 5th, and 6th grade elementary school students and 1st, 2nd and 3rd grade junior high school students in Noto town (Table 3). The survey was distributed to the same students through the Noto Town Board of Education in 2016 and 2017.

Table 3. Survey participants¹

School	School in an inland area	4th, 2015 5th, 2016	5th, 2015 6th, 2016	6th, 2015 1st, 2016 ¹	1st, 2015 2nd, 2016	Total	
Elementary school	A	-	14	12	(17) → H	-	26
	B	○	23	27	(24) → F	-	50
	C	-	31	39	(37) → G	-	70
	D	-	13	13	(6) → G	-	26
	E	-	12	27	(21) → I	-	39
Junior high school	F	○	-	-	24	23	47
	G	-	-	-	43	42	85
	H	-	-	-	17	14	31
	I	-	-	-	21	25	46

¹ The arrow indicates which junior high school the students in 6th grade elementary school attended in 2016.

Table 4. Research outline

Topic	Questionnaire items	Scale
Attribute	School name, grade, and gender	-
Relationship with the ocean	Frequency of playing at the ocean in March, April, and May	4 scales
	Frequency of playing at the ocean in June, July, and August	
	Frequency of playing at the ocean in September, October, and November	
	Frequency of playing at the ocean in December, January, and February	
<i>Satoumi</i> learning	Motivation to learn about the ocean	5 scales
Relationship with community	Participation in community festivals	5 scales
	Participation in community events other than festivals	
	Knowledge about community traditions and culture	
	Pride in local nature	
	Pride in community traditions and culture	
	Pride in local specialties	
	Settlement intention	
Appreciation of nature	The air is fresh.	5 scales
	The natural scenery is beautiful.	
	The vegetables and edible wild plants are delicious.	
	The fish is delicious.	

As shown in Table 4, the students were asked about their school, grade, and gender as personal attributes and seasonal frequency of playing at the ocean as an item representing their relationship with the ocean. The items indicating their relationship with the community asked about the students' motivation to learn about the ocean, participation in community festivals and other events, knowledge about community traditions and culture, pride in local nature, pride in community traditions and culture, pride in local specialties, and settlement intention. Finally, the items related to the students' relationship with nature were "The air is fresh," "The natural scenery is beautiful," "The vegetables and edible wild plants are delicious," and "The fish is delicious."

After collecting the questionnaire responses, we calculated the mean values and standard deviations and conducted a paired t-test to identify the children's changes in appreciation of nature by school, school location, and gender. We then compared the survey results from 2016 and 2017.

3. Results

Table 5 shows that the children's mean value for each topic by a paired t-test for each elementary and junior high school and the overall results. School A, the pilot school, was in its first year of ocean education in 2015 and its second year in 2016. The other elementary and junior high schools had a pre-implementation status of ocean education as of 2015, and their first year of implementation was 2016. The "School" column shows the school to which the children belonged in 2015, and the bold font indicates $p < .05$. The same applies hereafter to the following tables.

Statistically significant differences between the average values before and after the students received ocean education at all elementary and junior high school students, including the pilot school, were observed for the following: frequency of playing at the ocean in June, July, and August; participation in community events other than festivals; knowledge about community traditions and culture; pride in local nature; pride in community traditions and culture; pride in local specialties; settlement intention; and freshness of air. We would like to emphasize that the average values of the two topics frequency of playing at the ocean in June, July, and August and settlement intention fell after the students received ocean education.

As shown in Table 6, three items (i.e., motivation to learn about the ocean, participation in community festivals, and settlement intention) were significantly higher for the pilot school than for the other elementary and junior high schools. These three items are more likely to increase with study time.

Table 7 shows the differences in educational effect between the second and first years of ocean education. At the pilot school where ocean education was conducted for two years, the results were significantly higher for all eight items in comparison to the other elementary and junior high schools, which were in their first year.

On the other hand, as shown in Table 8, two items of appreciation of nature showed significant increases at the pilot school. However, at the other elementary and junior high schools, high effects were seen mainly in the items representing relationship with community. The items frequency of playing at the ocean in June, July, and August and settlement intention were significantly lower. Similar to the overall results shown in Table 5, as the grade level went up, the relationship with the ocean and settlement intention tended to decrease.

Table 5. Children’s mean value for each topic by paired t-test at each elementary and junior high school

School ³		Elementary school					Junior high school				Overall
		A	B	C	D	E	F	G	H	I	
Pilot school		○	-	-	-	-	-	-	-	-	
School in an inland area		-	○	-	-	-	○	-	-	-	
Frequency of playing at the ocean in March, April, and May	2015	1.26	1.06	1.10	1.25	1.30	1.05	1.29	1.36	1.20	1.18
	2016	1.45	1.02	1.18	1.29	1.15	1.14	1.13	1.07	1.00	1.16
Frequency of playing at the ocean in June, July, and August	2015	2.10	1.67*	1.92	2.27	2.27*	1.55	2.12	3.00	2.28	2.03*
	2016	2.12	1.51*	2.01	2.03	2.02*	1.55	1.93	3.00	2.16	1.94*
Frequency of playing at the ocean in September, October, and November	2015	1.40	1.06	1.19	1.30	1.38	1.20	1.24	1.50	1.24	1.24
	2016	1.58	1.05	1.30	1.35	1.28	1.20	1.16	1.57	1.12	1.26
Frequency of playing at the ocean in December, January, and February	2015	1.23	1.02	1.05	1.13	1.02	1.10 ^a	1.05	1.07	1.00	1.06
	2016	1.10	1.02	1.08	1.17	1.06	1.10 ^a	1.08	1.00	1.00	1.07
Motivation to learn about the ocean	2015	4.36	3.76	3.66	4.25	4.30	3.73	3.62**	4.00	3.60	3.90
	2016	4.38	3.81	3.85	4.38	4.25	3.50	3.07**	3.60	3.64	3.88
Participation in community festivals	2015	4.77	3.86	4.49	4.57	4.73	4.14	4.65	4.79	4.28	4.45
	2016	4.67	3.99	4.54	4.70	4.70	4.41	4.53	4.64	4.64	4.49
Participation in community events other than festivals	2015	3.86	3.47	3.48	3.58*	3.83	3.35	3.51	3.46	3.04	3.55*
	2016	4.26	3.49	3.57	4.23*	4.10	3.61	3.23	3.77	3.08	3.70*
Knowledge about community traditions and culture	2015	3.58	3.08*	2.86**	3.59*	3.48*	3.00	3.26	3.31	2.60*	3.17***
	2016	3.91	3.44*	3.35**	4.21*	3.83*	3.30	3.36	3.54	2.92*	3.54***
Pride in local nature	2015	4.19	3.83	3.70**	4.33	4.18*	3.83	3.85	3.79	3.48	3.90***
	2016	4.43	4.08	4.08**	4.47	4.53*	3.83	3.68	4.21	3.56	4.13***
Pride in community traditions and culture	2015	4.44	3.72	4.09**	4.00**	4.38	3.87	4.31	4.54	3.76	4.10***
	2016	4.70	3.90	4.41**	4.70**	4.53	3.70	4.36	4.31	4.00	4.32***
Pride in local specialties	2015	4.35	3.57	3.72*	3.97*	4.15	3.87	3.63	4.36	3.68	3.86**
	2016	4.57	3.76	4.02*	4.53*	4.25	3.78	3.58	4.07	3.80	4.03**
Settlement intention	2015	4.16	3.79***	3.96*	4.33	4.05	3.74**	3.85	4.14*	3.68	3.96***
	2016	3.83	3.21***	3.62*	4.30	4.02	3.22**	3.33	3.43*	3.52	3.61***
The air is fresh. (Freshness of air)	2015	4.00**	3.97	3.82	4.03*	4.46	4.35	3.90	4.07	3.84	4.02**
	2016	4.31**	4.22	4.01	4.57*	4.39	4.39	3.60	4.29	4.00	4.16**
The natural scenery is beautiful.	2015	4.29	4.07	4.02	4.37	4.37	4.26	4.15***	4.14	4.00	4.16
	2016	4.45	4.32	4.14	4.53	4.38	4.35	3.63***	4.29	3.92	4.22
The vegetables and edible wild plants are delicious.	2015	4.35**	4.27	4.11	4.48	4.62	4.09	4.13*	4.21	3.96	4.26
	2016	4.58**	4.37	4.21	4.52	4.67	4.09	3.75*	4.57	4.08	4.32
The fish is delicious.	2015	4.48	4.27	4.42	4.47	4.72	4.35	4.30	4.36	4.32	4.42
	2016	4.71	4.41	4.46	4.53	4.80	4.30	4.23	4.71	4.36	4.50

*p < .05** p < .01*** p < .001.

Table 6. Children’s mean values and standard deviations for each topic by unpaired t-test in the first year of ocean education at the pilot school in 2015 and other elementary and junior high schools in 2016

Marine education level (according to year)	Pilot school	Other elementary and junior high schools	t
	1 st year in 2015	1 st year in 2016	
Motivation to learn about the ocean	4.36 ± 0.685	3.83 ± 1.099	4.531***
Participation in community festivals	4.77 ± 0.642	4.48 ± 0.982	2.703**
Settlement intention	4.16 ± 1.090	3.60 ± 1.226	3.177**

*p < .05 **p < .01 ***p < .001.

Table 7. Children’s mean values and standard deviations for each topic by unpaired t-test at the pilot school and other elementary and junior high schools in 2016

	Pilot school	Other elementary and junior high schools	<i>t</i>
Marine education level (according to year)	2 nd year in 2016	1 st year in 2016	
Frequency of playing at the ocean in March, April, and May	1.45 ± 0.643	1.12 ± 0.405	4.304***
Frequency of playing at the ocean in September, October, and November	1.58 ± 0.747	1.22 ± 0.586	2.793**
Motivation to learn about the ocean	4.38 ± 0.764	3.83 ± 1.101	3.164*
Knowledge about community traditions and culture	3.91 ± 1.042	3.49 ± 1.123	2.310*
Pride in community traditions and culture	4.70 ± 0.773	4.27 ± 0.970	2.775**
Pride in local specialties	4.57 ± 0.677	3.98 ± 1.025	3.645*
The vegetables and edible wild plants are delicious.	4.58 ± 0.106	4.29 ± 0.927	2.014*
The fish is delicious.	4.71 ± 0.636	4.48 ± 0.847	1.783**

*p < .05 **p < .01 ***p < .001.

Table 8. Children’s mean values and standard deviations for each topic by paired t-test at the pilot school and other elementary and junior high schools

Topic	Pilot school			Other elementary and junior high schools		
	1 st year	2 nd year	<i>t</i>	Before leaning	After learning	<i>t</i>
Frequency of playing at the ocean in June, July, and August	2.10 ± 0.958	2.12 ± 0.832	-0.154	2.02 ± 0.856 ↘	1.92 ± 0.825	2.473*
Knowledge about community traditions and culture	3.58 ± 1.029	3.91 ± 1.042	-1.685	3.12 ± 1.198 ↗	3.49 ± 1.123	-5.754***
Pride in local nature	4.19 ± 0.969	4.43 ± 0.831	-1.349	3.87 ± 1.048 ↗	4.09 ± 0.966	-3.756***
Pride in community traditions and culture	4.44 ± 0.854	4.70 ± 0.773	-1.566	4.06 ± 1.108 ↗	4.27 ± 0.970	-3.550***
Pride in local specialties	4.35 ± 0.921	4.57 ± 0.677	-1.669	3.81 ± 1.128 ↗	3.98 ± 1.025	-2.568*
Settlement intention	4.16 ± 1.048	3.83 ± 1.267	1.747	3.93 ± 1.181 ↘	3.59 ± 1.227	5.621***
The air is fresh. (Freshness of air)	4.00 ± 0.937 ↗	4.31 ± 0.749	-2.949**	4.02 ± 0.989 ↗	4.15 ± 0.967	-2.241*
The vegetables and edible wild plants are delicious.	4.35 ± 0.813 ↗	4.58 ± 0.106	-2.12*	4.25 ± 0.902	4.29 ± 0.927	-0.725

*p < .05** p < .01*** p < .001.

Analysis by gender showed that for boys, participation in community events other than festivals was significantly higher after ocean education. For girls, pride in local specialties and freshness of air were significantly higher. On the other hand, for girls, frequency of playing at the ocean in June, July, and August was significantly low. Common findings for the two genders are that knowledge about community traditions and culture, pride in local nature, and pride in community traditions and culture were significantly higher after ocean education, whereas settlement intention was low (Table 9).

Additionally, we analyzed the differences between

students at the schools located in inland versus coastal areas. For students attending inland schools, knowledge about community traditions and culture rose significantly after ocean education. In contrast, the frequency of playing at the ocean in June, July, and August and settlement intention were significantly low. Meanwhile, for students attending coast schools, participation in community events other than festivals, knowledge about community traditions and culture, pride in local nature, pride in community traditions and culture, pride in local specialties, and freshness of air were significantly high (Table 10).

Table 9. Children’s mean values and standard deviations for each topic by paired t-test by gender

Topic	Boys			Girls		
	Before learning	After learning	<i>t</i>	Before learning	After learning	<i>t</i>
Frequency of playing at the ocean in June, July, and August	2.13 ± 0.927	2.10 ± 0.918	0.565	1.91 ± 0.778	1.77 ± 0.671	2.884**
Participation in community events other than festivals	3.49 ± 1.321	3.69 ± 1.162	-2.076*	3.60 ± 1.280	3.70 ± 1.159	-1.126
Knowledge about community traditions and culture	3.14 ± 1.281	3.51 ± 1.137	-4.149***	3.17 ± 1.067	3.55 ± 1.101	-4.371***
Pride in local nature	3.79 ± 1.107	4.08 ± 0.994	-3.562***	4.02 ± 0.954	4.17 ± 0.915	-1.976**
Pride in community traditions and culture	4.01 ± 1.220	4.22 ± 1.041	-2.451*	4.19 ± 0.914	4.43 ± 0.850	-3.152**
Pride in local specialties	3.83 ± 1.192	3.97 ± 1.041	-1.504	3.88 ± 1.035	4.10 ± 0.974	-2.769**
Settlement intention	3.90 ± 1.196	3.57 ± 1.241	3.694***	4.03 ± 1.142	3.67 ± 1.218	4.803***
Freshness of air	3.99 ± 1.025	4.11 ± 0.973	-1.744	4.05 ± 0.932	4.21 ± 0.918	-2.280*

*p < .05 **p < .01 ***p < .001.

Table 10. Children's mean values and standard deviations for each topic by paired t-test by school location (inland vs. coastal)

Topic	Inland area			Coastal area		
	Before learning	After learning	<i>t</i>	Before learning	After learning	<i>t</i>
Frequency of playing at the ocean in June, July, and August	1.65 ± 0.632	1.52 ± 0.580	2.236*	2.14 ± 0.891	2.07 ± 0.846	1.507
Participation in community events other than festivals	3.48 ± 1.358	3.55 ± 1.250	-0.485	3.59 ± 1.311	3.77 ± 1.156	-2.442*
Knowledge about community traditions and culture	3.11 ± 1.289	3.46 ± 1.196	-2.463*	3.21 ± 1.216	3.59 ± 1.150	-5.521***
Pride in local nature	3.88 ± 1.166	4.07 ± 1.094	-1.459	3.94 ± 1.081	4.18 ± 0.989	-3.785***
Pride in community traditions and culture	3.82 ± 1.288	3.92 ± 1.288	-0.785	4.22 ± 1.107	4.48 ± 0.928	-4.005***
Pride in local specialties	3.72 ± 1.331	3.84 ± 1.378	-0.821	3.95 ± 1.188	4.13 ± 1.023	-2.854**
Settlement intention	3.86 ± 1.484	3.30 ± 1.509	5.329***	4.04 ± 1.230	3.76 ± 1.296	4.040***
Freshness of air	4.16 ± 1.332	4.35 ± 1.289	-1.676	4.03 ± 1.106	4.16 ± 1.071	-2.258*

*p < .05 **p < .01 ***p < .001.

At elementary and junior high schools in coastal areas, excluding the pilot school, pride in local nature, pride in community traditions and culture, and pride in local specialties were significantly higher after ocean education. For the two items participation in community events other than festivals and knowledge about community traditions and culture, there was no significant difference before and after the implementation of ocean education at the pilot school. However, the scores for these two items at the pilot school were higher than the scores at other elementary and junior high schools and contributed to the significant difference found after the implementation of ocean education on the whole for elementary and junior high schools in coastal areas (Table 10). A common finding for inland and coastal schools is that settlement intention was significantly low.

4. Discussion

This research verified the changes in children's appreciation of nature achieved through community-based education on the relationship between the local community and surrounding nature. In particular, educational effects concerning the relationship between the ocean and the community were notable in the first year of ocean education. The educational effect was lower in the second year, though the items of appreciation of nature significantly increased in the second year. Overall, it seems that continuing ocean education will lead not only to enhancing students' relationships with the community but also to increasing their appreciation of nature.

Regarding the differences between boys and girls, girls visited the ocean less frequently after the first year of ocean education. However, their scores on the items pride in local specialties and freshness of air were significantly high, indicating that girls generally held positive attitudes toward local nature. No particular gender differences were seen in the other items.

In addition, regarding the difference in the location of schools, there were many items that were significantly higher in schools along the coast. Therefore, it is necessary to develop an effective learning program for higher grades and inland schools. A *satoumi* learning program includes content about not only the ocean itself but also the ocean's relationship with the community, and it is conceivable that developing a learning program on

culture based on the community's relation with the ocean will increase interest in the community and nature.

After the second year of ocean education, the educational effects tended to be restrictive; therefore, it is recommended to develop new learning programs for higher grades and inland schools. If ocean education continues to be offered for the same target students, a distinct program should be created for each grade.

5. Conclusion

As of 2022, all elementary and junior high schools in Noto town have continued *satoumi* learning. Further studies are needed to clarify the contents of ocean education at each school as well as the changes in students' appreciation of nature before and after ocean education, toward improving educational practices in order to increase students' curiosity and improve their scholastic ability.

Acknowledgments

This research was supported by The Nippon Foundation. We are deeply grateful to the elementary and junior high school students and teachers in Noto town, Ishikawa prefecture, Japan, and the Noto Town Board of Education that cooperated with our questionnaire research. We express our appreciation for their participation.

References

- [1] Central Council for Education, The Third Chapter, The Role of Education in Japan, Ministry of Education, Culture, Sports, Science and Technology-Japan (ed.), *The Role of Education in Japan for 21st Century (First Recommendations, Central Education Council)*, 1996. [published in Japanese]
Available: http://www.mext.go.jp/b_menu/shingi/chuuou/toushin/960701j.htm. [Accessed May 2, 2022].
- [2] Regional Self-Support Promotion Division, Local Administration Bureau, Ministry of Internal Affairs and Communications, *Case Study for Community Development Using School as a Base of Local Revitalization*, Ministry of Internal Affairs and Communications, 2013. [published in Japanese].
Available: http://www.soumu.go.jp/main_content/000222444.pdf. [Accessed May 2, 2022].

- [3] Tamaki Baba, "A Study Regarding the Learning Support for the Consolidated School in Depopulated Areas-Through Surveys on the "Hometown Education" in Ajigasawa Town-," *Research reports of Shokei Gakuin College*, 68. 1-11. 2014. [published in Japanese]
- [4] Takano, Takako, *Bonding with the Land: Outdoor and Environmental Education Programmes and Their Cultural Contexts*. GeoSciences PhD thesis and dissertation collection, University of Edinburgh, Edinburgh, 2004. Available: <http://hdl.handle.net/1842/30814>. [Accessed May 2, 2022].
- [5] Takako Takano, "An Overview and an Inquiry into Place-Based Education-As a Joining Territory of Environmental and Outdoor Education," *Japanese Society of Environmental Education*, 23-2. 27-37. 2013. [published in Japanese]
- [6] The House of Representatives, Japan, *Basis Act on Ocean Policy*, 2007. [published in Japanese]
Available:
https://www.shugiin.go.jp/internet/itdb_housei.nsf/html/housei/16620070427033.htm. [Accessed May 2, 2022].
- [7] Cabinet Office, *Basic Plan on Ocean Policy*, 2013.
Available:
https://www8.cao.go.jp/ocean/english/plan/pdf/plan02_e.pdf. [Accessed May 2, 2022].
- [8] Cabinet Office, *The Basic Plan on Ocean Policy*, 2018.
Available:
https://www8.cao.go.jp/ocean/english/plan/pdf/plan03_e.pdf. [Accessed May 2, 2022].
- [9] Ocean Policy Research Foundation, *Grand Design for Ocean Education in the 21st Century (for Elementary School), Ocean Education Curriculum and Unit Plans*, Ocean Policy Research Institute, 2015. [published in Japanese]
- [10] Food and Agriculture Organization of the United Nations Website, *Noto's Satoyama and Satoumi, Japan*, 2011.
Available:
<http://www.fao.org/giahs/giahsaroundtheworld/designated-sites/asia-and-the-pacific/notos-satoyama-and-satoumi/en/>. [Accessed May 2, 2022].
- [11] Noto town's website, *Basic Noto town Plan for the Promotion of Education*, 2015. [published in Japanese]
- [12] Noto Town's Website, *Noto Town's Revitalization Comprehensive Strategy*, 2015. [published in Japanese]
- [13] Sato-umi Net: *Definition of Sato-umi*.
Available:
https://www.env.go.jp/water/heisa/satoumi/en/01_e.html. [Accessed May 2, 2022]
- [14] Noto Town's Website, *Basic Noto-cho Plan for the Promotion of Education*, 2015.
Available:
<https://www.town.noto.lg.jp/open/info/0000009480.pdf>. [Accessed May 2, 2022].
- [15] Kyoko Matsumoto, Kimihito Takeno, Makoto Urata, Michio Matsubara, Takahiro Kato, Nobuo Suzuki, and Kazuichi Hayakawa, "Evaluation of Marine Education's Effect in Elementary and Junior High Schools-Analysis of the Value Consciousness Using Text Mining-," *American Journal of Educational Research*, 5, 1. 76-81. 2017.
- [16] Noto Town Ogi Elementary School Reference Material, *Research Presentation of Ocean Education Promotion Program "Satoumi Learning" Designated by Board of Education in 2016 School Year*, 2016. [published in Japanese].
- [17] Noto town elementary and junior high school, *Report on Implementation Status of Ocean Education in 2016 School Year*, 2016. [published in Japanese].
- [18] Noto Town Ogi Elementary School, *Research Presentation of Promotion Program "Satoumi Learning" Designated by Board of Education in 2016 School Year*, 2016. [published in Japanese].

