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The Creation of Learning Scales for Environmental Education Based on Existing Conceptions of Learning

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Abstract: So far, evaluation of environmental learning has evaluated only single points in time; however, accumulated learning experiences should have greater effect on learning and on environmental problems. We investigate conceptions of learning and the accumulated educational experiences they reflect in the context of environmental education, which has a unique position in education systems. We developed and conducted a systematic survey in order to create a learning scale for environmental education conceptions; participants were Japanese high school students (N = 771). Analysis found that students' conceptions of learning consist of six orientations: (1) Environmental Recognition/Conservation Responsibility Orientation, (2) Thought Expansion/Fulfillment, (3) Certainty/Applicability Orientation, (4) Teacher-Dependent Orientation, (5) Experience-Based Physical Activity Orientation, and (6) Duty-Adjusted Orientation. Factors (1), (2), and (5), above, are considered unique to environmental learning. Factor (1) reflects the societal content of environmental conservation, which is a criterion for evaluating environmental learning. In contrast, Factors (3), (4), and (6) are general educational factors mediated by elements such as academic achievement. The scale obtained from this research will help determine learners' views of and degree of interest in environmental learning.

Keywords: conception of learning; school education; environmental learning

1. Introduction

Environmentally conscious behavior can exert a great effect on environmental problems and sustainability, including those caused by human activities [1,2]. In other words, such behavior refers to actions to realize sustainability. As typified by Burn [1] and Everett and Peirce [2], these actions are strategic actions to sustain the present human life considering sustainability of the global environment for the next generation in order to respond to the dramatic change in the global environment in recent years [3]. Promoting environmentally conscious actions is an effective measure to realize sustainable environmental conservation in situations such as everyday purchasing/consumption behavior, energy consumption, and participation as environmental volunteers [4,5].

To encourage environmentally conscious action, it is effective to encourage people to think critically about what it means to take such action [6], that is, to think critically about one's actions, with consideration to their environment and sustainability [7–9]. The process of environmental learning—"learning *in* the environment", "learning *about* the environment", and "learning *for* the environment"—is one way to encourage this kind of thinking [10,11]. In terms of dealing with environmental problems, the role of environmental learning is fulfilled when the stage of "working for the environment", that is, of commitment to dealing with environmental problems, is reached [12,13].

Various verifications on environmental learning have been conducted in school education, which have entailed evaluation according to the specific goals of environmental school education and the overall goals of school education. Evaluation methods used have included questionnaires measuring attitudes toward environmental problems as well as methods such as free description and interviews [14–17].

However, Raid and Scott [18] point out that many evaluation studies have targeted specific school practices at a certain point in time, while conversely few have looked at the accumulation of generalizable knowledge through serial learning experiences. It is very difficult to judge whether an evaluation of learning captures learning a certain point in time or over time. Lave and Wenger [19] stated that learning occurs based on the accumulation of experiences of learning conducted in the community. In environmental learning, some studies focus on whether the accumulation of opportunities to interact with the surrounding environment affects attitudes toward environmental problems [20–23]. However, Lave and Wenger [19] also noted that participants are likely to pay attention to aspects of their unique experiences, such as personal growth and personal preferences, and that it is thus necessary for those concerned with evaluation of learning to pay attention to individual experiences of environmental learning within the education system as a community. At present; however, there is no research on how experiences of environmental learning in the education system are accumulated—and thus we will examine this topic by looking at learners' conceptions of environmental learning.

Therefore, in this research, we will deal with conceptions of learning in order to examine how environmental learning experiences have been accumulated. "Conception of learning", here, means a person's beliefs and values surrounding "what learning is and how one grasps learning"; it emerges from learning experiences over time and involves perspective on factors that influence one's learning attitudes, motivation, and strategy, and the relation of learning to one's goals [24–28]. Conceptions of learning have strong implications for learners' preferences [24] and thus for how learning should be devised [27]. Understanding learners' conceptions of learning and their effects on actual learning should contribute to reflection and updating of teaching practices.

A basis for understanding conceptions of learning is presented in Marton et al. [29] and Säljö [30], and more detailed findings are presented in Purdie et al. [31,32]. Peterson et al. [33] presented a questionnaire meant to measure the content and extent of conception of learning; it covered the following aspects of learning: (i) learning as a quantitative increase in knowledge; (ii) learning as memorization and regeneration; (iii) learning as acquiring facts, skills, and methods that can be retained and used; (iv) learning as making sense or abstracting meaning; (v) learning as interpreting and understanding reality in a different way; (vi) learning contributing to human growth; (vii) learning as a duty; (viii) learning as the development of commonsense skills which can be used in society; (ix) learning as something that can happen anywhere; and (x) learning as something done for a purpose. It should be noted here that the contents of (i) to (x) have been generally regarded as influencing factors in strategies for creating motivation to achieving goals and attitudes for self-realization. The contents of conception of learning are said to handle influencing factors for attitudes attributable to self that leads to the extension of an individual's ability to act and think for themselves, based on the learner's future goals and academic achievements.

On the other hand, environmental learning factors are largely influenced by the wish to fulfill societal responsibilities as sustainable society. Existing research indicates that sustainability training requires attention to qualities different from self-capability such as knowledge and skills [34,35]. Among them, Wick et al. [36] argued that it is necessary to know that there are various values without confining oneself, as well as to incorporate the ability to think about whether the environment will be preserved for future generations and the ability to build interpersonal relationships into learning for sustainability. When verifying the conception of learning on environmental education based on these findings, environmental conceptions of learning are meaningless without a strong focus on societal responsibilities compared with existing conceptions. If the experience of environmental learning

cannot be differentiated from other experiences of academic achievement and attitudes attributable to self, it will be unclear whether environmental learning is serving its unique purpose in education.

No current case study on environmental learning focused on conceptions of learning in the context given above could be found in the literature. Thus, through quantitative surveys of environmental learning in schools, this research aims to grasp conceptions of environmental learning and validate a scale for this purpose.

2. Materials and Methods

2.1. Preparation of Provisional Scale by Preliminary Survey

We gathered data on conceptions of environmental learning through a free-form questionnaire. To select questionnaire items, we made reference to surveys used in past research [29,37,38], and adopted five questions.

1. What kind of things do you find enjoyable or fun when it comes to environmental learning, and why?
2. When you are engaged in environmental learning, what do you find boring, and why?
3. What kind of things do you think about when you hear the term "environmental learning"?
4. Why are you studying environmental learning?
5. Why do you think it is important for you to study environmental learning? Do you think environmental learning in important?

A preliminary survey was conducted on two groups: all Kyoto Prefectural High School students participating in the environmental learning program GLOBE—Global Learning and Observations to Benefit the Environment [39] (2nd grade (16–17 years old): 42 students; 3rd grade (17–18 years old): 40 students; total: 82 students; 14 May 2015), and university students attending lectures in "Environmental Education and Teaching Materials Development" at universities in Tokyo (2nd year: 25 students; 3rd year: 12 students; 4th year: 2 students; total: 39 students; 21 April 2015). Before participants answered the survey questions, it was explained that their answers would not affect their school marks, that they could leave questions blank if they did not want to answer them, and that individuals would not be identifiable by their responses. The university students were also told that they should answer regarding their accumulated educational experiences over time, including before entering university.

Using all descriptions obtained from this preliminary survey, we attempted to replace each description with questionnaire items through discussion with two people with experience of teaching at school level. These two people were asked to discuss whether the questionnaire items reflect high school and university students' opinions. Furthermore, we discussed the redundancy and relevance of the questionnaire items as a measurement scale with five other experts who were researchers or graduate students. We created the questionnaire items through such interactive procedure which included excluding duplicate items and confirming their validity. Subsequently, seven university students taking lectures in environmental learning were also asked to answer the survey, and we gathered their opinions regarding whether the questions were appropriate and clear. We noted that the expressions of the questionnaire items made students answer clearly regarding whether the questions were consistent with their experiences when deciding the items. In addition, we used strong expressions such as "should" and "necessary" to create the questionnaire items so that there would be differences in respondents' answers.

Based on the above, we decided a provisional scale to ask about students' conceptions of learning with regards to environmental learning, which items were answered on a 5-point Likert-type scale ("1. Not at All Applicable", to "5. Very Applicable").

2.2. Survey Participant Selection

Survey respondents needed to have some experience of environmental learning, basic knowledge of the concept, and (among them) a range of experiences with different implementation modes. Purdie et al. [31] noted that the ratio of Japanese students whose conception of learning was "learning as a duty" was notably larger than that in Australia, and it has also been noted that a school-dependent conception of learning is strongly represented in Japan [37]. Given the high proportion of Japanese learners who view learning as a duty, it was anticipated that a contrast between conceptions of learning based on academic achievement and those based on environmental learning would be easily discovered.

To that end, three schools in Japan were selected: the first, a high school with its own dedicated environmental learning program (from here on, referred to as "High School A"), one that conducts specialized education in industry and industrial systems, including learning about environmental problems, ("High School B"), and one dealing with issues relating to the natural environment and environmental problems as part of science and social studies classes, without a separate program ("High School C"). We chose to conduct the survey in high schools because Otsuka and Saito [40] found that high school students' conceptions of learning were more diverse than those of university students. By surveying high school students, it was determined that the data related to conception of learning could be more comprehensively confirmed.

2.3. Survey Flow

High School A, in Yokohama, promotes self-study and taking an active part in one's own learning; this includes environmental learning efforts such as periodic learning experiences conducted outside of the classroom. High School B, in Sagamihara, has been designated a SSH (Super Science High-school) in the past and includes specialized education classes which include the "environmental system" among its available subjects. High School C, in Tokyo's Chiyoda Ward, is a private joint middle and high school focused on science and mathematics education. Broadly speaking, Schools A and B are characterized by school-organized original or special learning content and by learners who are generally familiar with "environmental learning" content, while School C does not deliver special learning content but is rather more familiar with environmental learning as it applies to other subjects of study, such as science and social studies; as a group, learners are not strongly familiar with the term "environmental learning". To investigate whether this difference in "environmental learning" consciousness could affect the students' conceptions of learning, the number of surveys distributed was weighted (540 to Schools A and B combined and 600 to School C).

The schools were asked to distribute and collect surveys between September and December 2016, whenever possible to all students engaged in environmental learning in the school. Additionally, an implementation guide was prepared, explaining the flow of the survey to teachers and requesting they distribute and collect surveys accordingly; in addition, it asked teachers to encourage student to respond to the survey but also to explain that answers to this survey had nothing to do with their school marks, that they could leave questions blank if they did not want to answer them, and that individuals would not be identifiable by their responses. Permission to conduct the survey under these conditions was granted by principals and teachers in charge.

2.4. Analysis Methods

We compiled answers from items related to conception of learning and confirmed the overall response tendency. To confirm the validity of the intention of choosing three high schools, we confirmed the difference in tendency of the answers between School A and School B, and between School C and Schools A and B combined using Mann-Whitney's *U* test.

We conducted an exploratory categorical factor analysis (minimum residual method, Promax rotation) of the entire results and of the results for each high school through examining

an appropriate number of factors according to MAP (Minimum Average Partial) analysis and parallel analysis using polychoric correlation matrix of the answers. According to the factor load amount and commonality indicated for each item, items with little influence on factor composition were excluded, and a similar factor analysis was again performed. Cronbach's alpha was used to calculate the final factor, and the internal consistency of the answers was confirmed. For these quantitative analyses, R 3.1.3 was used.

3. Results

Selecting Questionnaire Items and Exploratory Factor Analysis

We confirmed 121 valid responses obtained by preliminary survey and on their basis finalized wording for all questionnaire items. After consultation with two schoolteachers and five experts, duplicate content was excluded, and 80 final questionnaire items were adopted. A provisional scale was set, with a rating system of 1 to 5 as discussed above.

Valid responses to this survey were 199 (76.5%) from High School A, 206 (88.8%) from High School B, and 366 (79.9%) from High School C, for a total of 771 valid responses. Results were tabulated, and the number of people answering each option was confirmed. Table A1 summarizes the questionnaire items in the provisional scale and provides the summary results of this survey. Significant differences were found in 26 questionnaire items in the tendency of the answers between School A and School B, and 41 items in the tendency of the answers between School C and Schools A and B combined. The fact that the majority of the items had significant differences in the tendency between School C and Schools A and B combined was consistent with the assumption made in the design of this research. However, there were also somewhat significant differences between School A and School B for which we had assumed homogeneity. Therefore, further analysis was conducted considering the possibility that this unexpected difference affects the results of the categorical factor analysis.

An exploratory factor analysis was conducted using the responses to the 80 items. MAP analysis presented five factors and parallel factor analysis presented eight factors as the appropriate number of factors. A factor analysis based on this result presented stable results with six factors in School A, five in School B, six in School C, and six in the combined results for all schools, which did not include factors with very few items. Although School B had one less factor compared with the others, there was no difference in the contents of the classified questionnaire items. In each school and in the overall comparison, the content classified into each factor consisted of items largely held in common among the 6 factors. Items that showed high factor load were classified into multiple factors, while items with extremely low commonality were deleted.

Repeated similar-factor analysis using the remaining 41 answers yielded an overall factor analysis for the first factor of 16 items; the second factor, 9 items; the third factor, 6 items; the fourth factor, 4 items; the fifth factor, 3 items; and the sixth factor, 3 items (Table 1).

Table 1. Results of exploratory factor analysis on conceptions of environmental learning.

	No.	Question Items	Factor Loading [Minimum Residual Method, Promax Rotation]						
			1	2	3	4	5	6	Commonality
1	57	It is important to learn about the current situation of the world through environmental learning	**0.511**	−0.035	0.234	−0.037	−0.031	0.008	0.410
	62	We need environmental learning because human beings must improve the environment that we have polluted	**0.696**	−0.228	0.010	0.141	0.174	−0.093	0.458
	63	The things I learn in environmental learning are relevant to my life	**0.600**	−0.097	0.169	0.027	0.022	−0.054	0.434
	64	Environmental learning is important to the future of the human being	**0.709**	−0.107	0.031	0.082	0.077	−0.042	0.482
	66	I feel responsible or guilty for the things I learn in environmental learning	**0.541**	−0.015	−0.113	0.056	0.146	−0.014	0.287
	67	It is necessary to engage in environmental learning sincerely	**0.654**	0.120	−0.113	−0.050	0.021	0.049	0.469
	68	I can be aware of changes occurring in the environment with environmental learning	**0.658**	−0.056	0.193	−0.046	−0.068	0.016	0.536
	69	I take environmental learning because I think the Earth is important	**0.802**	−0.191	−0.020	0.106	0.047	−0.078	0.513
	70	Environmental learning helps me understand the current state of nature	**0.698**	−0.077	0.139	−0.073	−0.084	0.050	0.525
	71	I can consider what I can do for the environment with environmental learning	**0.601**	0.191	−0.014	−0.066	−0.165	0.024	0.495
	72	In environmental learning it is necessary for me to feel familiar with nature	**0.586**	0.268	−0.083	−0.065	−0.140	0.110	0.505
	73	It is necessary for me to ask "Why?" in environmental learning	**0.488**	0.279	−0.031	−0.103	−0.107	0.123	0.446
	74	Engaging in environmental learning will lead to less pollution in the environment	**0.581**	0.046	−0.023	0.106	0.023	0.016	0.360
	75	Through environmental learning, we need to [learn how to] tell others about nature and environmental problems	**0.521**	0.201	−0.047	0.019	0.006	0.109	0.400
	76	Through environmental learning, it is important to disseminate information regarding environmental problems to as many people as possible	**0.631**	0.090	−0.073	0.041	−0.023	0.051	0.406
	79	Environmental learning is something we should work on as members of society	**0.642**	0.058	−0.002	−0.028	−0.025	0.003	0.454
2	8	It is important to be self−motivated in environmental learning	−0.103	**0.441**	0.132	0.137	0.152	0.014	0.270
	14	With environmental learning, I can think about ways to deal with environmental problems	−0.044	**0.498**	0.129	−0.137	0.093	0.082	0.361
	15	I have a lot of flexibility in environmental learning	−0.191	**0.553**	0.090	0.010	0.009	0.116	0.261
	25	I feel a sense of accomplishment in environmental learning	0.077	**0.595**	−0.074	0.016	0.187	−0.033	0.448
	28	In environmental learning, I can learn about things that interest me	−0.077	**0.608**	0.081	0.063	0.053	−0.304	0.490
	32	I enjoy going to environmental learning class	0.082	**0.589**	−0.088	−0.063	0.054	−0.205	0.473
	33	I can get some ideas from others in environmental learning	0.108	**0.527**	−0.027	0.076	−0.096	0.030	0.310
	36	I can have my own opinions and thoughts in environmental learning	0.257	**0.414**	0.120	−0.034	−0.058	0.009	0.447
	39	It was my decision to learn about environmental learning	0.085	**0.510**	−0.109	0.108	0.044	−0.115	0.287
3	4	By studying environmental learning, nature can be objectively evaluated through data, etc.	−0.080	0.113	**0.616**	0.121	−0.157	−0.013	0.392
	5	Environmental learning is not only a subject in Japan	0.062	−0.112	**0.697**	−0.079	−0.039	0.094	0.466
	6	Environmental learning covers a variety of topics	0.126	0.240	**0.468**	−0.065	−0.057	−0.024	0.490
	9	In environmental learning, it is important to have accurate information and applicable skills in advance	−0.020	0.141	**0.507**	0.140	0.044	0.020	0.376
	12	Environmental learning takes a lot of time	0.163	0.070	**0.494**	−0.029	0.103	−0.014	0.460
	13	Environmental learning makes use of the knowledge I received in science and social studies	0.297	−0.110	**0.485**	−0.008	0.174	−0.086	0.496

Table 1. *Cont.*

	No.	Question Items	Factor Loading [Minimum Residual Method, Promax Rotation]						
			1	**2**	**3**	**4**	**5**	**6**	**Commonality**
4	52	Environmental learning is taught by a teacher	0.110	0.056	0.040	**0.815**	−0.143	−0.044	0.629
	53	Environmental learning cannot be conducted without a teacher	−0.026	0.146	0.030	**0.765**	−0.066	−0.089	0.541
	54	I do not have a reason to attend environmental learning classes	−0.238	−0.091	−0.029	**0.410**	0.077	0.221	0.414
	55	It is important to have a good teacher who teaches environmental learning	0.144	0.004	0.031	**0.404**	0.000	0.075	0.200
5	20	Environmental learning is an ongoing effort	0.158	0.070	0.094	−0.165	**0.569**	0.046	0.515
	21	Experiencing nature in real life is essential to environmental learning	0.224	0.183	−0.123	−0.065	**0.625**	0.044	0.576
	26	My body and clothing get dirty in environmental learning	−0.133	0.081	−0.054	−0.023	**0.574**	0.205	0.370
6	29	In environmental learning, there are topics I am not interested in	−0.123	−0.079	0.108	−0.096	0.175	**0.653**	0.502
	30	In environmental learning, it is also important to work on topics which do not interest me	0.143	−0.001	−0.034	−0.024	0.098	**0.408**	0.195
	51	I study environmental learning because it is a required course	0.030	−0.059	0.015	0.263	−0.034	**0.485**	0.379
		contribution rate	17.5	8.3	5.9	4.5	3.6	3.0	
		α	0.90	0.78	0.76	0.64	0.65	0.50	
		factor correlation	1 —	0.586	0.538	−0.114	0.292	−0.064	
			2	—	0.490	−0.179	0.189	−0.116	
			3		—	0.069	0.274	0.088	
			4			—	0.104	0.268	
			5				—	0.136	
			6					—	

Factors were representative interpreted and characterized based on the questionnaire items included in each factor. The first factor was represented by contents such as "I feel a personal responsibility to carry out environmental conservation" and "As a member of society, it is important to value the earth", as well as contents that mean "I deepen recognition to the environment". This result suggests that the participants believe that they can learn more about the environment and that they are aware of the necessity of and their responsibility toward environmental conservation. Therefore, the first factor was called "Environmental Recognition/Conservation Responsibility Orientation".

The second factor involved contents that mean "to acquire satisfactory learning from highly flexible learning" and "to expand thinking related to self-directed learning". This can be interpreted as a conception of learning that considers that environmental learning is conducted according to one's own interests, in which one's thinking expands and is satisfied based on exchanges with other people. Therefore, the second factor was called "Thought Expansion/Fulfillment Orientation".

The third factor was represented by contents focusing on appropriate knowledge and skills, and on the utilization of this knowledge in procedures such as experiments and surveys. These items suggest that when learners tackle environmental learning, they can utilize their newly acquired knowledge in such procedures, and they consider it necessary to obtain reliable results after performing sufficient procedures. Therefore, the third factor was called "Certainty/Certainty Orientation".

The fourth factor was represented by questionnaire items reflecting acute awareness of the presence of a "teacher" when engaged in learning. Learners engaged in this learning orientation emphasized the importance of teachers in environmental learning. Therefore, the fourth factor was called "Teacher-Dependent Orientation".

The fifth factor was represented by contents that emphasize experience. In particular, the questionnaire item "My body and clothing get dirty in environmental learning" belongs to this factor, which represents a conception of learning that is particularly conscious of physical experiences in environmental learning. Therefore, the fifth factor was called "Experience-Based Physical Activity Orientation".

The sixth factor was represented by passive contents against environmental learning. It shows a conception of learning that considers that participants understand environmental learning as an obligation imposed by schools and that they are in fact not interested in it. From the questionnaire item included in this factor, "In environmental learning, it is also important to work on topics which do not interest me", consciously adapting to duty is also recognized. Therefore, the sixth factor was called "Duty-Adjusted Orientation".

The cumulative contribution rate of all 6 factors was 42.8%. In this final detection of items for the six factors, Cronbach's alpha was calculated for each factor: the coefficient of the first factor was 0.90, that of the second factor 0.78, that of the third factor 0.76, that of the fourth factor 0.64, that of the fifth factor 0.65, that of the sixth factor 0.50. Although the alpha of the sixth factor showed a low value, the above interpretability of the factor was considered. For this reason, it was eventually decided to include only the first six factors as aspects of conception of environmental learning.

4. Discussion

Conceptions of learning including each of the six factors were obtained as a result of factor analysis. In light of the possible problems that could emerge in this research, the nature of each of these categories will be examined and compared with established conceptions of learning.

Considering these six factors based on the process of environmental learning [10,11], the factors that reflect learners' experiences of environmental learning well are "Environmental Recognition/Conservation Responsibility Orientation", "Thought Expansion/Fulfillment Orientation", and "Experience-Based Physical Activity Orientation". We found that "Experience-Based Physical Activity Orientation" corresponds to "learning in the environment", "Thought Expansion/Fulfillment Orientation" corresponds to "learning about the environment", and "Environmental Recognition/Conservation Responsibility Orientation" corresponds to "learning for the environment".

The conceptions of learning identified in this study seem to reveal these factors that relate to the process of environmental learning (Table 2). In environmental learning practice, "learning *for* the environment" is considered the most important process [41,42]. However, in order to reach the process of "Learning *for* the Environment", it is necessary to go through the process of "learning *in* the environment" and "learning *about* the environment" [11,43].

Table 2. Comparison between the process of environmental learning and the existing conception of learning, based on the conception of environmental learning.

		Conception of Environmental Learning					
		Environmental Recognition/ Conservation Responsibility Orientation	**Thought Expansion/ Fulfillment Orientation**	**Certainty/ Applicability Orientation**	**Teacher-Dependent Orientation**	**Experience-Based Physical Activity Orientation**	**Duty-Adjusted Orientation**
Process of Environmental Learning [10,11,41–43]	Learning *in* the environment					Experience of environmental education as a format [1]	
	Learning *about* the environment		Necessity to think about the environment [2]				
	Learning *for* the environment	Social awareness of environmental conservation [3]					
Existing Conception of Learning [31–33]	(i) Learning as a quantitative increase in knowledge		Identified as same content				
	(ii) Learning as memorization and regeneration						
	(iii) Learning as acquiring facts, skills, and methods that can be retained and used			Focus on procedures in the learning process			
	(iv) Learning as making sense or abstracting meaning	Understanding while thinking endogenously [4]	Understanding of complex events				
	(v) Learning as interpreting and understanding reality in a different way						
	(vi) Learning contributing to human growth		Identified as same content				
	(vii) Learning as a duty				External intervention, such as school or teacher [5]		Identified as same content
	(viii) Learning as the development of commonsense skills which can be used in society						
	(ix) Learning as something that can happen anywhere					Request for experiential scenes	
	(x) Learning as something done for a purpose	Social purpose consciousness of environmental conservation [6]					Negative consciousness that no purpose is found [7]

[1] It is considered desirable for learners to experience learning with physical activity at the very first stage of environmental education. [2] This factor represents the widespread notion of recognizing the environment as a complicated concept that requires a comprehensive approach. [3] This factor includes contents addressing the purpose of environmental conservation; it involves the development of the skill to spontaneously think about the environment. [4] This finding overlaps with the behavioral influences research of Petty and Cacioppo [6]. [5] Moreover, in the figure, (vii) refers to the obligation to "learn what must be learned" [32] and it entails the premise that external intervention, such as that by a school or a teacher, has a strong influence. [6] Therefore, "Conservation Responsibility Orientation" can be distinguished from attitudes that are attributable to self; [7] it is the opposite of "Environmental Recognition/Conservation Responsibility Orientation" [41].

It is possible to obtain a deeper understanding of these three factors by comparing them with the existing conception of learning. Learning shifts to a deeper and clearer motivation as the process moves from "Experience-based Physical Activity Orientation" to "Thought Expansion/Fulfillment Orientation", and from "Thought Expansion/Fulfillment Orientation" to "Environmental Recognition/Conservation Responsibility Orientation." It can be said that "(ix) learning as something that can happen anywhere" [31–33] corresponds to "Experience-Based Physical Activity Orientation", which is a conception of learning that considers that learners recognize learning only from the its format. Learners are unaware of the significance and purpose of environmental learning, because it is taught only through physical experiences.

The significance of receiving environmental learning is included in "Thought Expansion/Fulfillment Orientation", which is the next process. The existing conception of learning that corresponds to "Thought Expansion/Fulfillment Orientation" is "(iv) learning as making sense or abstracting meaning" and "(vi) learning contributing to human growth" [31–33]. Learners aim towards human growth on their own by learning more about the environment. Therefore, this seems to indicate that learners find meaning of environmental learning. However, even at this process, the contents related to social context of environmental conservation consciousness, which is assumed in this research, are not sufficiently included in the questionnaire items of this factor (Table 1). The pursuit of self-growth is the significance of this process for learners. In that sense, it cannot be considered an effective environmental learning stage according to the findings of Fien [41] and Greenall Gough [42].

The next process, "Environmental Recognition/Conservation Responsibility Orientation", corresponds to "(iv) learning as making sense or abstracting meaning" [31–33], which is the same as "Thought Expansion/Fulfillment Orientation". However, "Environmental Recognition/Conservation Responsibility Orientation" is unique in that it also corresponds to "(x) learning as something done for a purpose" [31–33]. In other words, it is thought that learners perceive environmental learning in different ways; they shift from being conscious of its significance in "Thought Expansion/Fulfillment Orientation" to being conscious of its purpose in "Environmental Recognition/Conservation Responsibility Orientation". In addition, the contents of the questionnaire item of "Environmental Recognition/Conservation Responsibility Orientation" (Table 1) do not represent a consciousness of purpose related to oneself, such as an existing conception of learning, but a social context of environmental conservation consciousness. It is thought that this process is different from "Thought Expansion/Fulfillment Orientation" in that a clear objective consciousness to fulfill the responsibility of environmental conservation motivates learners. This process can be considered a stage of effective environmental learning that related to a sociable attitude of environmental conservation.

From the conception of environmental learning in this study, the three factors that correspond to the process of environmental learning give us a deeper understanding of it. Learners gain motivation that is accompanied by consciousness of purpose through consciousness of significance from a formal way of thinking. Furthermore, there are existing findings that support the importance of these three factors. Kopnina and Cocis [44] showed that the "choice of environmental issues" conducted by learners does not necessarily agree with the "purpose consciousness of environmental conservation". Compared with the results of this study, learners' choice of issues may occur not only in "Environmental Recognition/Conservation Responsibility Orientation" but also in "Thought Expansion/Fulfillment Orientation" as the stage of finding significance and in "Experience-Based Physical Activity Orientation" as the stage of formally understanding it. In addition, Uyanık [45], who proposed an effective educational method for raising awareness about environmental problems, showed that it is effective to develop ideas that are not restricted within the classroom and to clarify students' opinions. Such practical research also supports the necessity of "Thought Expansion/Fulfillment Orientation" and "Experience-Based Physical Activity Orientation" along with "Environmental Recognition/Conservation Responsibility Orientation".

However, although we conducted this survey on the assumption that it is essentially different from existing conceptions of learning, it must be kept in mind that only the

"Environmental Recognition/Conservation Responsibility Orientation" factor strongly indicated societal responsibility of environmental conservation, and that the "Certainty/Applicability Orientation", "Teacher-Dependent Orientation", and "Duty-Adjusted Orientation" factors did not. In particular, "Duty-Adjusted Orientation" is a negative factor, indicating that learners think that learning that is not related to themselves is not significant [46]. It is said that if a learner has a negative experience, it will be difficult to engage positively from then on, even after the accumulation of subsequent experiences [47]. Therefore, this factor can serve as an indicator of difficulty meaningfully proceeding even after environmental learning is over. In addition, "Teacher-Dependent Orientation" is also common to "(vii) learning as a duty premised on the existence of schools and teachers". These two factors are thought to be clearly taken out by conducting a survey to Japanese learners. This finding supports those of Purdie et al. [31] and Suzuki [37]. It seems that the results that are in accordance with the design of this study were obtained by comparatively detecting factors specific to environmental learning and those that relate to "(vii) learning as a duty". These two factors almost overlap with the existing conception of learning (Table 2). However, it cannot be concluded that "Teacher-Dependent Orientation" is necessarily undesirable. In environmental learning, it is expected that the extent of intervention by teachers will differ depending on the content of learning addressed in each practice and the competence of the teachers. For example, Agnes and Abd Rahim [48] suggested that teachers should improve the learning environment in environmental learning and receive sufficient environmental learning training to increase the effectiveness of environmental learning for learners. "Teacher-Dependent Orientation" means that learners expect appropriate teaching from the teacher in practice. In other words, this factor seems to reflect the fact that the existence of a teacher plays a major role in learners' accumulation of environmental learning experiences. Therefore, it is necessary to confirm whether "Teacher-Dependent Orientation" can be established along with "Environmental Recognition/Conservation Responsibility Orientation", "Thought Expansion/Fulfillment Orientation", and "Experience-Based Physical Activity Orientation" in order to confirm learners' environmental learning experience. By confirming this, learners' conception of learning can be understood, which can provide an opportunity to consider the subsequent practice of environmental learning.

5. Conclusions

The purpose of this research was to grasp how experiences of environmental learning were received, based on the results of the application of a conception of learning scale. We were able to outline an environmental learning conception consisting of six common factors across groups: "Environmental Recognition/Conservation Responsibility Orientation", "Thought Expansion/Fulfillment Orientation", "Experience-Based Physical Activity Orientation", "Certainty/Applicability Orientation", "Teacher-Dependent Orientation", and "Duty-Adjusted Orientation". Furthermore, when compared with existing conceptions of learning, "Environmental Recognition/Conservation Responsibility Orientation", "Thought Expansion/Fulfillment Orientation", and "Experience-Based Physical Activity Orientation" were found to be unique to environmental learning conceptions of learning. In particular, "Environmental Recognition/Conservation Responsibility Orientation" and "Duty-adjusted Orientation" were thought to include content which could serve as a basis for evaluating the success or failure of environmental learning. These two factors were considered clues about related societal responsibility of environmental conservation [41,42,47].

To conclude, suggestions will be made for how the results of this research can be put into practice. The conceptions of environmental learning scale redeveloped makes it possible to compare learners' experiences of environmental learning. By confirming the respective degrees of "Environmental Recognition/Conservation Responsibility Orientation", "Thought Expansion/Fulfillment Orientation", and "Experience-Based Physical Activity Orientation", we can confirm which stage of learning—*in*, *about*, or *for* the environment—the learner is in. For example, when a learner's motivation for environmental learning cannot be judged only by environmental conservation consciousness [44], the knowledge provided by this scale can offer a more detailed understanding of the learner's

motivation. Through such detailed surveys, if learners have only reached the *about* stage, the scale may be used as material to devise learning measures related to "learning *for* the environment". This scale should thus be useful to help devise practical methods and curriculum that respond to learners' environmental learning experiences.

However, it has not been confirmed whether the environmental learning conceptions of learning obtained in this research will actually affect environmentally conscious behavior, which is ultimately the primary environmental learning goal. The scale should be utilized further so that it can be tested in this regard. The findings of this research have revealed conceptions of learning corresponding to the stages of environmental learning, paving the way for future research to determine whether conception of learning affects environmental consciousness in practice.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Number of questionnaire responses to the provisional scale.

No.	Questionnaire Items		Number of Questionnaire Responses										*U*-Test (A-B [3])	*U*-Test (A&B-C [4])
			Answer: 1	(%)	Answer: 2	(%)	Answer: 3	(%)	Answer: 4	(%)	Answer: 5	(%)		
1	I have learned things I did not know before in environmental learning	All school [1]	19	(2)	36	(5)	193	(25)	352	(46)	171	(22)	*	**
		A [2]	3	(2)	4	(2)	58	(29)	93	(47)	41	(21)		
		B [2]	0	(0)	7	(3)	33	(16)	117	(57)	49	(24)		
		C [2]	16	(4)	25	(7)	102	(28)	142	(39)	81	(22)		
2	In environmental learning, I can learn how humans and nature interact	All school [1]	20	(3)	52	(7)	175	(23)	373	(48)	151	(20)		**
		A [2]	3	(2)	8	(4)	42	(21)	110	(55)	36	(18)		
		B [2]	2	(1)	6	(3)	40	(19)	109	(53)	49	(24)		
		C [2]	15	(4)	38	(10)	93	(25)	154	(42)	66	(18)		
3	By studying environmental learning, I can better understand my local environment	All school [1]	30	(4)	78	(10)	225	(29)	316	(41)	122	(16)		**
		A [2]	4	(2)	15	(8)	52	(26)	90	(45)	38	(19)		
		B [2]	3	(1)	14	(7)	60	(29)	92	(45)	37	(18)		
		C [2]	23	(6)	49	(13)	113	(31)	134	(37)	47	(13)		
4	By studying environmental learning, nature can be objectively evaluated through data, etc.	All school [1]	33	(4)	128	(17)	296	(38)	225	(29)	89	(12)		
		A [2]	12	(6)	31	(16)	75	(38)	57	(29)	24	(12)		
		B [2]	0	(0)	29	(14)	83	(40)	71	(34)	23	(11)		
		C [2]	21	(6)	68	(19)	138	(38)	97	(27)	42	(11)		
5	Environmental learning is not only a subject in Japan	All school [1]	34	(4)	59	(8)	192	(25)	238	(31)	248	(32)		*
		A [2]	7	(4)	13	(7)	49	(25)	63	(32)	67	(34)		
		B [2]	3	(1)	8	(4)	59	(29)	65	(32)	71	(34)		
		C [2]	24	(7)	38	(10)	84	(23)	110	(30)	110	(30)		
6	Environmental learning covers a variety of topics	All school [1]	24	(3)	36	(5)	151	(20)	340	(44)	220	(29)		
		A [2]	6	(3)	5	(3)	43	(22)	90	(45)	55	(28)		
		B [2]	4	(2)	10	(5)	30	(15)	102	(50)	60	(29)		
		C [2]	14	(4)	21	(6)	78	(21)	148	(40)	105	(29)		

Table A1. *Cont.*

No.	Questionnaire Items		Number of Questionnaire Responses										*U*-Test (A-B [3])	*U*-Test (A&B-C [4])
			Answer: 1	(%)	Answer: 2	(%)	Answer: 3	(%)	Answer: 4	(%)	Answer: 5	(%)		
7	Through environmental learning, I have been able to deepen my understanding	All school [1]	22	(3)	28	(4)	142	(18)	320	(42)	259	(34)		**
		A [2]	5	(3)	4	(2)	35	(18)	91	(46)	64	(32)		
		B [2]	2	(1)	4	(2)	29	(14)	93	(45)	78	(38)		
		C [2]	15	(4)	20	(5)	78	(21)	136	(37)	117	(32)		
8	It is important to be self-motivated in environmental learning	All school [1]	46	(6)	107	(14)	270	(35)	245	(32)	103	(13)		*
		A [2]	9	(5)	21	(11)	73	(37)	72	(36)	24	(12)		
		B [2]	8	(4)	20	(10)	77	(37)	80	(39)	21	(10)		
		C [2]	29	(8)	66	(18)	120	(33)	93	(25)	58	(16)		
9	In environmental learning, it is important to have accurate information and applicable skills in advance	All school [1]	33	(4)	92	(12)	268	(35)	260	(34)	118	(15)		**
		A [2]	5	(3)	13	(7)	78	(39)	70	(35)	33	(17)		
		B [2]	3	(1)	10	(5)	69	(33)	86	(42)	38	(18)		
		C [2]	25	(7)	69	(19)	121	(33)	104	(28)	47	(13)		
10	In environmental learning, I can collect accurate data through experimentation and investigation	All school [1]	57	(7)	115	(15)	319	(41)	187	(24)	93	(12)		**
		A [2]	11	(6)	18	(9)	94	(47)	48	(24)	28	(14)		
		B [2]	6	(3)	19	(9)	94	(46)	65	(32)	22	(11)		
		C [2]	40	(11)	78	(21)	131	(36)	74	(20)	43	(12)		
11	In environmental learning, I have to perform the same task over and over again	All school [1]	20	(3)	66	(9)	224	(29)	287	(37)	174	(23)		**
		A [2]	4	(2)	11	(6)	55	(28)	82	(41)	47	(24)		
		B [2]	3	(1)	14	(7)	51	(25)	86	(42)	52	(25)		
		C [2]	13	(4)	41	(11)	118	(32)	119	(33)	75	(20)		
12	Environmental learning takes a lot of time	All school [1]	24	(3)	61	(8)	179	(23)	317	(41)	190	(25)		
		A [2]	5	(3)	13	(7)	50	(25)	86	(43)	45	(23)		
		B [2]	3	(1)	13	(6)	45	(22)	92	(45)	53	(26)		
		C [2]	16	(4)	35	(10)	84	(23)	139	(38)	92	(25)		
13	Environmental learning makes use of the knowledge I received in science and social studies	All school [1]	20	(3)	55	(7)	234	(30)	284	(37)	178	(23)		**
		A [2]	4	(2)	5	(3)	70	(35)	74	(37)	46	(23)		
		B [2]	2	(1)	11	(5)	56	(27)	82	(40)	55	(27)		
		C [2]	14	(4)	39	(11)	108	(30)	128	(35)	77	(21)		
14	With environmental learning, I can think about ways to deal with environmental problems	All school [1]	43	(6)	90	(12)	243	(32)	235	(30)	160	(21)		
		A [2]	9	(5)	20	(10)	63	(32)	71	(36)	36	(18)		
		B [2]	11	(5)	20	(10)	84	(41)	58	(28)	33	(16)		
		C [2]	23	(6)	50	(14)	96	(26)	106	(29)	91	(25)		
15	I have a lot of flexibility in environmental learning	All school [1]	30	(4)	103	(13)	324	(42)	231	(30)	83	(11)		*
		A [2]	8	(4)	27	(14)	95	(48)	55	(28)	14	(7)		
		B [2]	7	(3)	22	(11)	98	(48)	68	(33)	11	(5)		
		C [2]	15	(4)	54	(15)	131	(36)	108	(30)	58	(16)		
16	I do most of the activities and study for environmental learning on my own initiative	All school [1]	28	(4)	65	(8)	192	(25)	287	(37)	199	(26)		
		A [2]	8	(4)	19	(10)	61	(31)	69	(35)	42	(21)	**	**
		B [2]	2	(1)	5	(2)	32	(16)	104	(50)	63	(31)		
		C [2]	18	(5)	41	(11)	99	(27)	114	(31)	94	(26)		
17	In environmental learning, there are tasks that summarize what I studied, such as reports and presentations	All school [1]	15	(2)	53	(7)	220	(29)	317	(41)	166	(22)		
		A [2]	6	(3)	11	(6)	63	(32)	80	(40)	39	(20)	**	**
		B [2]	0	(0)	8	(4)	42	(20)	102	(50)	54	(26)		
		C [2]	9	(2)	34	(9)	115	(31)	135	(37)	73	(20)		
18	I need time to carefully consider things in environmental learning	All school [1]	22	(3)	53	(7)	230	(30)	275	(36)	191	(25)		
		A [2]	4	(2)	9	(5)	54	(27)	71	(36)	61	(31)		**
		B [2]	2	(1)	6	(3)	56	(27)	79	(38)	63	(31)		
		C [2]	16	(4)	38	(10)	120	(33)	125	(34)	67	(18)		

Table A1. *Cont.*

No.	Questionnaire Items	Number of Questionnaire Responses										*U*-Test (A-B [3])	*U*-Test (A&B-C [4])
			Answer: 1	(%)	Answer: 2	(%)	Answer: 3	(%)	Answer: 4	(%)	Answer: 5	(%)		
19	In Environmetal learning, it cannot be helped if I do not produce the expected results	All school [1]	28	(4)	49	(6)	232	(30)	293	(38)	169	(22)		**
		A [2]	6	(3)	7	(4)	45	(23)	95	(48)	46	(23)		
		B [2]	2	(1)	4	(2)	62	(30)	84	(41)	54	(26)		
		C [2]	20	(5)	38	(10)	125	(34)	114	(31)	69	(19)		
20	Environmental learning is an ongoing effort	All school [1]	19	(2)	56	(7)	215	(28)	284	(37)	197	(26)		
		A [2]	5	(3)	10	(5)	47	(24)	76	(38)	61	(31)		
		B [2]	2	(1)	10	(5)	63	(31)	88	(43)	43	(21)		
		C [2]	12	(3)	36	(10)	105	(29)	120	(33)	93	(25)		
21	Experiencing nature in real life is essential to environmental learning	All school [1]	28	(4)	58	(8)	220	(29)	292	(38)	173	(22)	**	**
		A [2]	6	(3)	8	(4)	49	(25)	75	(38)	61	(31)		
		B [2]	4	(2)	11	(5)	58	(28)	96	(47)	37	(18)		
		C [2]	18	(5)	39	(11)	113	(31)	121	(33)	75	(20)		
22	Real environmental learning is conducted outdoors	All school [1]	13	(2)	33	(4)	213	(28)	344	(45)	168	(22)	**	**
		A [2]	3	(2)	3	(2)	57	(29)	99	(50)	37	(19)		
		B [2]	0	(0)	4	(2)	46	(22)	103	(50)	53	(26)		
		C [2]	10	(3)	26	(7)	110	(30)	142	(39)	78	(21)		
23	It is possible to study environmental learning indoors	All school [1]	36	(5)	100	(13)	270	(35)	256	(33)	109	(14)		
		A [2]	12	(6)	19	(10)	76	(38)	60	(30)	32	(16)		
		B [2]	2	(1)	22	(11)	80	(39)	73	(35)	29	(14)		
		C [2]	22	(6)	59	(16)	114	(31)	123	(34)	48	(13)		
24	You must experience things firsthand in environmental learning	All school [1]	17	(2)	51	(7)	188	(24)	282	(37)	233	(30)		**
		A [2]	3	(2)	5	(3)	49	(25)	71	(36)	71	(36)		
		B [2]	1	(0)	9	(4)	42	(20)	95	(46)	59	(29)		
		C [2]	13	(4)	37	(10)	97	(27)	116	(32)	103	(28)		
25	I feel a sense of accomplishment in environmental learning	All school [1]	45	(6)	92	(12)	266	(35)	236	(31)	132	(17)		
		A [2]	7	(4)	26	(13)	65	(33)	65	(33)	36	(18)		
		B [2]	10	(5)	22	(11)	80	(39)	66	(32)	28	(14)		
		C [2]	28	(8)	44	(12)	121	(33)	105	(29)	68	(19)		
26	My body and clothing get dirty in environmental learning	All school [1]	35	(5)	80	(10)	264	(34)	246	(32)	146	(19)	**	**
		A [2]	4	(2)	6	(3)	56	(28)	80	(40)	53	(27)		
		B [2]	6	(3)	19	(9)	90	(44)	64	(31)	27	(13)		
		C [2]	25	(7)	55	(15)	118	(32)	102	(28)	66	(18)		
27	I get tired in environmental learning	All school [1]	24	(3)	74	(10)	232	(30)	237	(31)	204	(26)	**	
		A [2]	1	(1)	3	(2)	44	(22)	74	(37)	77	(39)		
		B [2]	9	(4)	26	(13)	85	(41)	54	(26)	32	(16)		
		C [2]	14	(4)	45	(12)	103	(28)	109	(30)	95	(26)		
28	In environmental learning, I can learn about things that interest me	All school [1]	60	(8)	111	(14)	316	(41)	182	(24)	102	(13)		
		A [2]	17	(9)	32	(16)	84	(42)	43	(22)	23	(12)		
		B [2]	14	(7)	28	(14)	89	(43)	54	(26)	21	(10)		
		C [2]	29	(8)	51	(14)	143	(39)	85	(23)	58	(16)		
29	In environmental learning, there are topics I am not interested in	All school [1]	13	(2)	71	(9)	246	(32)	292	(38)	149	(19)	*	**
		A [2]	0	(0)	9	(5)	57	(29)	86	(43)	47	(24)		
		B [2]	2	(1)	18	(9)	72	(35)	74	(36)	40	(19)		
		C [2]	11	(3)	44	(12)	117	(32)	132	(36)	62	(17)		
30	In environmental learning, it is also important to work on topics which do not interest me	All school [1]	23	(3)	49	(6)	232	(30)	299	(39)	168	(22)		*
		A [2]	5	(3)	5	(3)	65	(33)	75	(38)	49	(25)		
		B [2]	2	(1)	8	(4)	69	(33)	79	(38)	48	(23)		
		C [2]	16	(4)	36	(10)	98	(27)	145	(40)	71	(19)		

Table A1. *Cont.*

No.	Questionnaire Items	Number of Questionnaire Responses										*U*-Test (A-B [3])	*U*-Test (A&B-C [4])
			Answer: 1	(%)	Answer: 2	(%)	Answer: 3	(%)	Answer: 4	(%)	Answer: 5	(%)		
31	I am not interested in environmental learning	All school [1]	78	(10)	152	(20)	281	(36)	137	(18)	123	(16)		
		A [2]	11	(6)	34	(17)	76	(38)	38	(19)	40	(20)	**	
		B [2]	33	(16)	33	(16)	80	(39)	33	(16)	27	(13)		
		C [2]	34	(9)	85	(23)	125	(34)	66	(18)	56	(15)		
32	I enjoy going to environmental learning class	All school [1]	44	(6)	75	(10)	325	(42)	230	(30)	97	(13)		
		A [2]	12	(6)	22	(11)	86	(43)	61	(31)	18	(9)		
		B [2]	11	(5)	15	(7)	100	(49)	51	(25)	29	(14)		
		C [2]	21	(6)	38	(10)	139	(38)	118	(32)	50	(14)		
33	I can get some ideas from others in environmental learning	All school [1]	36	(5)	82	(11)	316	(41)	267	(35)	70	(9)		
		A [2]	12	(6)	18	(9)	96	(48)	59	(30)	14	(7)	*	
		B [2]	9	(4)	13	(6)	83	(40)	80	(39)	21	(10)		
		C [2]	15	(4)	51	(14)	137	(37)	128	(35)	35	(10)		
34	It is hard to deal with other people's different opinions and ideas in environmental learning if force to believe	All school [1]	22	(3)	77	(10)	267	(35)	247	(32)	158	(20)		
		A [2]	5	(3)	16	(8)	74	(37)	65	(33)	39	(20)		
		B [2]	1	(0)	18	(9)	72	(35)	71	(34)	44	(21)		
		C [2]	16	(4)	43	(12)	121	(33)	111	(30)	75	(20)		
35	People can share opinions and work together in environmental learning	All school [1]	19	(2)	57	(7)	217	(28)	328	(43)	150	(19)		
		A [2]	5	(3)	8	(4)	72	(36)	85	(43)	29	(15)	**	
		B [2]	1	(0)	12	(6)	47	(23)	98	(48)	48	(23)		
		C [2]	13	(4)	37	(10)	98	(27)	145	(40)	73	(20)		
36	I can have my own opinions and thoughts in environmental learning	All school [1]	21	(3)	47	(6)	227	(29)	307	(40)	169	(22)		
		A [2]	6	(3)	14	(7)	69	(35)	77	(39)	33	(17)	**	
		B [2]	1	(0)	8	(4)	52	(25)	92	(45)	53	(26)		
		C [2]	14	(4)	25	(7)	106	(29)	138	(38)	83	(23)		
37	It is necessary to have a variety of perspectives in environmental learning	All school [1]	11	(1)	33	(4)	162	(21)	335	(43)	230	(30)		
		A [2]	3	(2)	2	(1)	52	(26)	90	(45)	52	(26)	**	*
		B [2]	0	(0)	1	(0)	32	(16)	103	(50)	70	(34)		
		C [2]	8	(2)	30	(8)	78	(21)	142	(39)	108	(30)		
38	You must listen to other people's opinions in environmental learning	All school [1]	12	(2)	32	(4)	181	(23)	361	(47)	185	(24)		
		A [2]	4	(2)	4	(2)	49	(25)	105	(53)	37	(19)		
		B [2]	1	(0)	3	(1)	42	(20)	111	(54)	49	(24)		
		C [2]	7	(2)	25	(7)	90	(25)	145	(40)	99	(27)		
39	It was my decision to learn about environmental learning	All school [1]	40	(5)	74	(10)	301	(39)	265	(34)	91	(12)		
		A [2]	11	(6)	21	(11)	98	(49)	54	(27)	15	(8)	**	
		B [2]	4	(2)	8	(4)	97	(47)	81	(39)	16	(8)		
		C [2]	25	(7)	45	(12)	106	(29)	130	(36)	60	(16)		
40	According to environmental learning, a self-centered worldview leads to environmental destruction	All school [1]	61	(8)	104	(13)	313	(41)	198	(26)	95	(12)		
		A [2]	17	(9)	16	(8)	88	(44)	47	(24)	31	(16)		*
		B [2]	10	(5)	27	(13)	86	(42)	62	(30)	21	(10)		
		C [2]	34	(9)	61	(17)	139	(38)	89	(24)	43	(12)		
41	I feel that my opinions are different from other people's opinions in environmental learning	All school [1]	24	(3)	71	(9)	351	(46)	251	(33)	74	(10)		
		A [2]	7	(4)	16	(8)	103	(52)	55	(28)	18	(9)		
		B [2]	1	(0)	12	(6)	106	(51)	65	(32)	22	(11)		
		C [2]	16	(4)	43	(12)	142	(39)	131	(36)	34	(9)		
42	I do not get along with others in environmental learning	All school [1]	82	(11)	166	(22)	359	(47)	128	(17)	36	(5)		
		A [2]	18	(9)	43	(22)	103	(52)	26	(13)	9	(5)		
		B [2]	17	(8)	33	(16)	111	(54)	37	(18)	8	(4)		
		C [2]	47	(13)	90	(25)	145	(40)	65	(18)	19	(5)		

Table A1. *Cont.*

No.	Questionnaire Items		Number of Questionnaire Responses										*U*-Test (A-B [3])	*U*-Test (A&B-C [4])
			Answer: 1	(%)	Answer: 2	(%)	Answer: 3	(%)	Answer: 4	(%)	Answer: 5	(%)		
43	It is each person's decisions when it comes to environmental learning	All school [1]	14	(2)	26	(3)	178	(23)	316	(41)	237	(31)	**	**
		A [2]	3	(2)	2	(1)	52	(26)	84	(42)	58	(29)		
		B [2]	0	(0)	1	(0)	35	(17)	92	(45)	78	(38)		
		C [2]	11	(3)	23	(6)	91	(25)	140	(38)	101	(28)		
44	Environmental learning is different from other subjects (Japanese, mathematics, science, social studies, English)	All school [1]	19	(2)	66	(9)	263	(34)	248	(32)	175	(23)		
		A [2]	3	(2)	8	(4)	72	(36)	71	(36)	45	(23)		
		B [2]	2	(1)	19	(9)	78	(38)	65	(32)	42	(20)		
		C [2]	14	(4)	39	(11)	113	(31)	112	(31)	88	(24)		
45	I think environmental learning is easier than other subjects	All school [1]	33	(4)	95	(12)	315	(41)	203	(26)	125	(16)		
		A [2]	5	(3)	16	(8)	83	(42)	62	(31)	33	(17)	*	
		B [2]	5	(2)	26	(13)	102	(50)	47	(23)	26	(13)		
		C [2]	23	(6)	53	(14)	130	(36)	94	(26)	66	(18)		
46	I think environmental learning classroom lectures are boring	All school [1]	34	(4)	89	(12)	299	(39)	204	(26)	145	(19)		
		A [2]	10	(5)	16	(8)	72	(36)	59	(30)	42	(21)		**
		B [2]	2	(1)	19	(9)	87	(42)	64	(31)	34	(17)		
		C [2]	22	(6)	54	(15)	140	(38)	81	(22)	69	(19)		
47	There are no definitive answers in environmental learning	All school [1]	10	(1)	37	(5)	190	(25)	295	(38)	239	(31)		
		A [2]	6	(3)	4	(2)	45	(23)	85	(43)	59	(30)		
		B [2]	0	(0)	3	(1)	60	(29)	82	(40)	61	(30)		
		C [2]	4	(1)	30	(8)	85	(23)	128	(35)	119	(33)		
48	In environmental learning, I am able to handle objects and tools I do not handle in my day -to-day life	All school [1]	29	(4)	70	(9)	242	(31)	279	(36)	151	(20)		
		A [2]	6	(3)	9	(5)	69	(35)	76	(38)	39	(20)		**
		B [2]	1	(0)	10	(5)	64	(31)	89	(43)	42	(20)		
		C [2]	22	(6)	51	(14)	109	(30)	114	(31)	70	(19)		
49	Environmental learning is useful for my future	All school [1]	39	(5)	72	(9)	272	(35)	273	(35)	115	(15)		
		A [2]	12	(6)	12	(6)	86	(43)	68	(34)	21	(11)		
		B [2]	6	(3)	19	(9)	76	(37)	81	(39)	24	(12)		
		C [2]	21	(6)	41	(11)	110	(30)	124	(34)	70	(19)		
50	In environmental learning, I learned professional skills or knowledge	All school [1]	31	(4)	73	(9)	243	(32)	297	(39)	127	(16)		
		A [2]	6	(3)	15	(8)	76	(38)	73	(37)	29	(15)	**	**
		B [2]	2	(1)	10	(5)	47	(23)	101	(49)	46	(22)		
		C [2]	23	(6)	48	(13)	120	(33)	123	(34)	52	(14)		
51	I study environmental learning because it is a required course	All school [1]	28	(4)	82	(11)	281	(36)	259	(34)	121	(16)		
		A [2]	4	(2)	11	(6)	65	(33)	81	(41)	38	(19)	**	*
		B [2]	7	(3)	21	(10)	85	(41)	68	(33)	25	(12)		
		C [2]	17	(5)	50	(14)	131	(36)	110	(30)	58	(16)		
52	Environmental learning is taught by a teacher	All school [1]	73	(9)	135	(18)	364	(47)	151	(20)	48	(6)		
		A [2]	20	(10)	35	(18)	104	(52)	30	(15)	10	(5)	**	
		B [2]	7	(3)	25	(12)	119	(58)	45	(22)	10	(5)		
		C [2]	46	(13)	75	(20)	141	(39)	76	(21)	28	(8)		
53	Environmental learning cannot be conducted without a teacher	All school [1]	91	(12)	179	(23)	315	(41)	134	(17)	52	(7)		
		A [2]	27	(14)	48	(24)	85	(43)	32	(16)	7	(4)	**	
		B [2]	11	(5)	33	(16)	114	(55)	35	(17)	13	(6)		
		C [2]	53	(14)	98	(27)	116	(32)	67	(18)	32	(9)		
54	I do not have a reason to attend environmental learning classes	All school [1]	91	(12)	191	(25)	287	(37)	119	(15)	83	(11)		
		A [2]	13	(7)	45	(23)	79	(40)	35	(18)	27	(14)	**	
		B [2]	28	(14)	50	(24)	91	(44)	27	(13)	10	(5)		
		C [2]	50	(14)	96	(26)	117	(32)	57	(16)	46	(13)		

Table A1. *Cont.*

No.	Questionnaire Items		Number of Questionnaire Responses										*U*-Test (A-B [3])	*U*-Test (A&B-C [4])
			Answer: 1	(%)	Answer: 2	(%)	Answer: 3	(%)	Answer: 4	(%)	Answer: 5	(%)		
55	It is important to have a good teacher who teaches environmental learning	All school [1]	46	(6)	101	(13)	336	(44)	185	(24)	103	(13)		*
		A [2]	12	(6)	23	(12)	91	(46)	45	(23)	28	(14)		
		B [2]	5	(2)	17	(8)	105	(51)	48	(23)	31	(15)		
		C [2]	29	(8)	61	(17)	140	(38)	92	(25)	44	(12)		
56	I take environmental learning because a teacher I like teaches the class	All school [1]	136	(18)	185	(24)	340	(44)	79	(10)	31	(4)		
		A [2]	33	(17)	42	(21)	97	(49)	17	(9)	10	(5)		
		B [2]	35	(17)	49	(24)	109	(53)	10	(5)	3	(1)		
		C [2]	68	(19)	94	(26)	134	(37)	52	(14)	18	(5)		
57	It is important to learn about the current situation of the world through environmental learning	All school [1]	23	(3)	58	(8)	254	(33)	284	(37)	152	(20)		
		A [2]	8	(4)	12	(6)	76	(38)	75	(38)	28	(14)	**	
		B [2]	0	(0)	10	(5)	68	(33)	77	(37)	51	(25)		
		C [2]	15	(4)	36	(10)	110	(30)	132	(36)	73	(20)		
58	Environmental learning broadens your horizons	All school [1]	28	(4)	38	(5)	209	(27)	342	(44)	154	(20)		
		A [2]	8	(4)	6	(3)	61	(31)	97	(49)	27	(14)		
		B [2]	1	(0)	9	(4)	58	(28)	95	(46)	43	(21)		
		C [2]	19	(5)	23	(6)	90	(25)	150	(41)	84	(23)		
59	I gained applicable knowledge and life skills through environmental learning	All school [1]	21	(3)	53	(7)	276	(36)	304	(39)	117	(15)		
		A [2]	6	(3)	7	(4)	88	(44)	79	(40)	19	(10)	*	
		B [2]	0	(0)	11	(5)	73	(35)	93	(45)	29	(14)		
		C [2]	15	(4)	35	(10)	115	(31)	132	(36)	69	(19)		
60	What I learn in environmental learning can be applied to many different aspects of my life	All school [1]	28	(4)	86	(11)	280	(36)	274	(36)	103	(13)		
		A [2]	5	(3)	15	(8)	87	(44)	74	(37)	18	(9)		
		B [2]	2	(1)	17	(8)	73	(35)	88	(43)	26	(13)		
		C [2]	21	(6)	54	(15)	120	(33)	112	(31)	59	(16)		
61	Environmental learning is important because we get the blessing of nature (to show our gratitude)	All school [1]	36	(5)	101	(13)	327	(42)	202	(26)	105	(14)		
		A [2]	7	(4)	17	(9)	98	(49)	47	(24)	30	(15)		
		B [2]	6	(3)	24	(12)	89	(43)	62	(30)	25	(12)		
		C [2]	23	(6)	60	(16)	140	(38)	93	(25)	50	(14)		
62	We need environmental learning because human beings must improve the environment that we have polluted	All school [1]	41	(5)	78	(10)	266	(35)	241	(31)	145	(19)		**
		A [2]	8	(4)	13	(7)	81	(41)	60	(30)	37	(19)		
		B [2]	6	(3)	15	(7)	65	(32)	72	(35)	48	(23)		
		C [2]	27	(7)	50	(14)	120	(33)	109	(30)	60	(16)		
63	The things I learn in environmental learning are relevant to my life	All school [1]	15	(2)	55	(7)	230	(30)	325	(42)	146	(19)		
		A [2]	2	(1)	15	(8)	57	(29)	88	(44)	37	(19)		
		B [2]	1	(0)	11	(5)	62	(30)	90	(44)	42	(20)		
		C [2]	12	(3)	29	(8)	111	(30)	147	(40)	67	(18)		
64	Environmental learning is important to the future of the human being	All school [1]	16	(2)	66	(9)	278	(36)	290	(38)	121	(16)		
		A [2]	3	(2)	12	(6)	65	(33)	91	(46)	28	(14)		**
		B [2]	2	(1)	11	(5)	71	(34)	82	(40)	40	(19)		
		C [2]	11	(3)	43	(12)	142	(39)	117	(32)	53	(14)		
65	I think it is impossible for human beings to live on their own	All school [1]	20	(3)	45	(6)	133	(17)	269	(35)	304	(39)		
		A [2]	6	(3)	8	(4)	37	(19)	65	(33)	83	(42)		**
		B [2]	3	(1)	1	(0)	30	(15)	76	(37)	96	(47)		
		C [2]	11	(3)	36	(10)	66	(18)	128	(35)	125	(34)		
66	I feel responsible or guilty for the things I learn in environmental learning	All school [1]	37	(5)	87	(11)	256	(33)	257	(33)	134	(17)		
		A [2]	9	(5)	15	(8)	74	(37)	72	(36)	29	(15)		
		B [2]	8	(4)	19	(9)	73	(35)	65	(32)	41	(20)		
		C [2]	20	(5)	53	(14)	109	(30)	120	(33)	64	(17)		

Table A1. *Cont.*

No.	Questionnaire Items	Number of Questionnaire Responses										*U*-Test (A-B [3])	*U*-Test (A&B-C [4])
			Answer: 1	(%)	Answer: 2	(%)	Answer: 3	(%)	Answer: 4	(%)	Answer: 5	(%)		
67	It is necessary to engage in environmental learning sincerely	All school [1]	18	(2)	41	(5)	238	(31)	312	(40)	162	(21)	*	
		A [2]	3	(2)	5	(3)	79	(40)	78	(39)	34	(17)		
		B [2]	2	(1)	7	(3)	60	(29)	90	(44)	47	(23)		
		C [2]	13	(4)	29	(8)	99	(27)	144	(39)	81	(22)		
68	I can be aware of changes occurring in the environment with environmental learning	All school [1]	23	(3)	50	(6)	225	(29)	324	(42)	149	(19)	**	**
		A [2]	9	(5)	13	(7)	63	(32)	82	(41)	32	(16)		
		B [2]	0	(0)	5	(2)	49	(24)	101	(49)	51	(25)		
		C [2]	14	(4)	32	(9)	113	(31)	141	(39)	66	(18)		
69	I take environmental learning because I think the Earth is important	All school [1]	32	(4)	85	(11)	221	(29)	269	(35)	164	(21)		**
		A [2]	8	(4)	15	(8)	56	(28)	82	(41)	38	(19)		
		B [2]	5	(2)	17	(8)	53	(26)	72	(35)	59	(29)		
		C [2]	19	(5)	53	(14)	112	(31)	115	(31)	67	(18)		
70	Environmental learning helps me understand the current state of nature	All school [1]	18	(2)	39	(5)	188	(24)	338	(44)	188	(24)	**	**
		A [2]	8	(4)	9	(5)	48	(24)	90	(45)	44	(22)		
		B [2]	0	(0)	3	(1)	42	(20)	96	(47)	65	(32)		
		C [2]	10	(3)	27	(7)	98	(27)	152	(42)	79	(22)		
71	I can consider what I can do for the environment with environmental learning	All school [1]	36	(5)	72	(9)	253	(33)	284	(37)	126	(16)		
		A [2]	8	(4)	17	(9)	72	(36)	72	(36)	30	(15)		
		B [2]	8	(4)	10	(5)	70	(34)	83	(40)	35	(17)		
		C [2]	20	(5)	45	(12)	111	(30)	129	(35)	61	(17)		
72	In environmental learning it is necessary for me to feel familiar with nature	All school [1]	27	(4)	54	(7)	247	(32)	296	(38)	147	(19)		**
		A [2]	5	(3)	11	(6)	66	(33)	82	(41)	35	(18)		
		B [2]	5	(2)	2	(1)	64	(31)	91	(44)	44	(21)		
		C [2]	17	(5)	41	(11)	117	(32)	123	(34)	68	(19)		
73	It is necessary for me to ask "Why?" in environmental learning	All school [1]	24	(3)	59	(8)	191	(25)	291	(38)	206	(27)		*
		A [2]	4	(2)	10	(5)	56	(28)	78	(39)	51	(26)		
		B [2]	6	(3)	10	(5)	42	(20)	87	(42)	61	(30)		
		C [2]	14	(4)	39	(11)	93	(25)	126	(34)	94	(26)		
74	Engaging in environmental learning will lead to less pollution in the environment	All school [1]	34	(4)	71	(9)	262	(34)	255	(33)	149	(19)		**
		A [2]	9	(5)	10	(5)	64	(32)	71	(36)	45	(23)		
		B [2]	7	(3)	10	(5)	77	(37)	73	(35)	39	(19)		
		C [2]	18	(5)	51	(14)	121	(33)	111	(30)	65	(18)		
75	Through environmental learning, we need to [learn how to] tell others about nature and environmental problems	All school [1]	32	(4)	74	(10)	282	(37)	263	(34)	120	(16)		**
		A [2]	5	(3)	15	(8)	78	(39)	71	(36)	30	(15)		
		B [2]	5	(2)	11	(5)	75	(36)	80	(39)	35	(17)		
		C [2]	22	(6)	48	(13)	129	(35)	112	(31)	55	(15)		
76	Through environmental learning, it is important to disseminate information regarding environmental problems to as many people as possible	All school [1]	29	(4)	77	(10)	261	(34)	277	(36)	127	(16)		**
		A [2]	4	(2)	10	(5)	67	(34)	84	(42)	34	(17)		
		B [2]	4	(2)	10	(5)	70	(34)	75	(36)	47	(23)		
		C [2]	21	(6)	57	(16)	124	(34)	118	(32)	46	(13)		
77	It is not good to have a passive stance/attitude in environmental learning	All school [1]	31	(4)	81	(11)	335	(43)	199	(26)	124	(16)		
		A [2]	8	(4)	14	(7)	102	(51)	47	(24)	28	(14)		
		B [2]	7	(3)	18	(9)	96	(47)	56	(27)	28	(14)		
		C [2]	16	(4)	49	(13)	137	(37)	96	(26)	68	(19)		

Table A1. *Cont.*

No.	Questionnaire Items		Number of Questionnaire Responses										*U*-Test (A-B [3])	*U*-Test (A&B-C [4])
			Answer: 1	(%)	Answer: 2	(%)	Answer: 3	(%)	Answer: 4	(%)	Answer: 5	(%)		
78	I have the ability to express my opinions or thoughts to others when it comes to environmental learning	All school [1]	27	(4)	86	(11)	298	(39)	249	(32)	111	(14)		
		A [2]	7	(4)	14	(7)	90	(45)	68	(34)	20	(10)		
		B [2]	5	(2)	19	(9)	84	(41)	71	(34)	27	(13)		
		C [2]	15	(4)	53	(14)	124	(34)	110	(30)	64	(17)		
79	Environmental learning is something we should work on as members of society	All school [1]	28	(4)	53	(7)	281	(36)	285	(37)	124	(16)		*
		A [2]	4	(2)	6	(3)	78	(39)	86	(43)	25	(13)		
		B [2]	4	(2)	8	(4)	79	(38)	80	(39)	35	(17)		
		C [2]	20	(5)	39	(11)	124	(34)	119	(33)	64	(17)		
80	Environmental learning has the potential to change an individual's awareness	All school [1]	30	(4)	67	(9)	285	(37)	252	(33)	137	(18)		
		A [2]	5	(3)	14	(7)	85	(43)	70	(35)	25	(13)		
		B [2]	7	(3)	8	(4)	90	(44)	67	(33)	34	(17)		
		C [2]	18	(5)	45	(12)	110	(30)	115	(31)	78	(21)		

[1] Calculated utilizing valid responses from all three schools' students (N = 771). [2] Calculated utilizing valid responses from each school's students (High School A: N = 199, High School B: N = 206, High School C: N = 366). [3] The U-test showed a significance difference between School A students and School B students (* $p < 0.05$, ** $p < 0.01$). [4] The U-test showed a significance difference between School C students and the other school students (* $p < 0.05$, ** $p < 0.01$).

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