

Elevating Written English Environmental Communication Skills in Japanese University Science Majors

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Abstract

It goes without saying that the world is presently witnessing severe problems with the environment that seem difficult to curb, perhaps impossible to cure in the future. Global warming, deforestation, sea level rise, and strengthening storms are but a few of these problems. One important aspect of the ensuing global and environment problematic scenario is the communication associated with learning about and teaching aspects of environmental problems, environmental sustainability, and the SDGs (sustainable development goals). Because Japanese university students have slightly less communicative competence in written environmental English communication along this type, they have a shortcoming when compared to the global community. To fill this gap, in a class called Science English the author conducted a study that contained test scores of environmental vocabulary and a short writing that used environmentally-related words and phrases. Pearson's correlation test result of total words written with total environmental words and phrases used was a positive value of 0.48. In addition, Likert scale results showed 79% strongly agreed that the class helped with environmental learning and 69% strongly agreed that the vocabulary learning was helpful for learning how to write environmental English aspects effectively.

Keywords: Environmental education; English learning; environmental communication; SDGs; written English communication

Introduction

The underlying meaning of environmental communication, both written and spoken, is the ability to learn about, teach, and use pertinent information to coordinate efforts to act positively for the environment. Having originated in the 1980s, the field of environmental communication arose from other academically related fields such as interpersonal communication, environmental science studies, public speaking, sociology, and ecological studies.

Along with the emergence of activism and grassroots efforts to elevate environmental action, environmental communication has taken on a new ideal that is to motivate people to act for sustainability (Meisner, 2015).

While the meaning of environmental communication is easy to understand, the entire environmental movement still has its skeptics; as of 2020, Russia, Poland, France, and Japan held the most climate-change deniers, while countries such as Denmark, Sweden, and Chile were at that time some of the most climate-pro countries (Sustainability for All, 2019). Undoubtedly, the climate-change problem is evident in every country on earth as of late. In 2018, the Ministry of Environment in Japan reported that temperatures there are on the increase faster than the global average. Precipitation there annually has risen more than 50% since the 1970s, and 2020 witnessed rising of floods in Kyushu, causing landslides, environmental destruction, and community displacement. According to the G20 climate risk analysis, rising sea levels and coastal erosion due to climate change in Japan alone could have up to four million people prone to becoming victims of flooding. In addition, millions living in cities such as Tokyo could face enormous heatwaves causing infrastructure collapse and economic hardships. By 2050, The climate in Japan could see temperatures increasing by 2.4 degrees Celsius (Japan Ministry of Environment). Most South Pacific-based countries, such as Vanuatu, Fiji, Kiribati, the Marshall Islands, and the Solomon Islands are on the brink of facing massive problems such as sea level rise. Most other countries face plastic pollution problems, as well as deforestation that causes vegetation to become dry, leading to land fires. The Western United States, like many European countries, is seeing droughts and destructive fires.

According to the website, Sustainability for All, the top five most polluting countries in the world are China, the US, India, Russia, and Japan (2019). Japan is at the top of the worlds' most developed countries and provides billions of yen in aid to developing countries to combat climate change. However, Japan continues to have serious problems with its own climate change and faces its own environmental challenges. It is curious how this gap is possible given Japan's global importance.

The author posits that one of the largest reasons for this problem in the lack of complex English communication skills in Japan and gap in English education. This may be due to the need for the country to retain its traditional culture and language, so it is not lost to the commonality of the other countries who are English-friendly. There are many reasons why English is not readily learned. First, English and Japanese are fundamen-

tally different language systems, requiring a large amount of study; indeed, memorizing thousands of Chinese characters, learning the other writing systems of Japan (along with English and other languages), and internalizing all the societal procedures and norms found in Japan takes an exorbitant amount of time and effort. Second, Japan perhaps has adopted an idealistic viewpoint of global communication over a practical one; that is, Japan likes the idea of being able to communicate on the world stage but has trouble reaching the final goal, and this is perhaps easy to see. These points notwithstanding, there is clearly a gap between Japan's ultimate goals and the ability to reach those goals. In order to fill this gap, the author decided to conduct a study on elevating English ability for effective written environmental communication in Japanese university science majors.

Method and Material

This study employed the outcomes of 32 semester-end examinations of junior-year environmental science students in their first semester of a course called Science English at a midsize public university in Southwest Japan. The examinations were based on a textbook that the author created entitled *The Environment Project* (Morrow, 2021). The book is used in the Science English course where the author teaches; the university is a mid-size public university in Southwestern Japan. The textbook contains twelve units based on science topics found to be useful and interesting in a pre-course design investigation done by the author. Each unit contains a science related topic reading, a vocabulary cloze activity, a listening exercise with a mind-mapping activity, a section for discussion, role-play, or agree-disagree, and, most pertinent to this study, sentence writing activities using the unit keywords, a paragraph writing activity relating to the unit topic, and an explanation for a design activity tied to each unit. Each unit is taught for two weeks before moving on the subsequent topic; this gives students time to internalize the material fully.

In order to evaluate the material for use in this study, the vocabulary definition writing task was checked for meaning and accuracy. A total of two points was given for each definition for a total of twenty points. Next, sentences using provided key words given in the test from words students had learned previously were examined for grammatical usage, meaning, and appropriate usage of the keywords. In addition, the paragraph writings were analyzed for word-count, and the total number of environmentally related vocabulary words tied to each unit were counted and tabulated.

Pre-test, or before the test was administered, the students were told that they would

be randomly given ten words to write the meanings of, that were studied during the semester, and which would be taken directly from the textbook. They were also required to write a short paragraph responding to a broad question: “Why do you save energy and how can people be encouraged to do so,” and to aim for a word count of 100. They were also told to use as many environmentally related words and/or phrases as possible in their writings from the vocabulary that they had learned throughout the semester in the class. They were given no specific count for the environmental words and phrases. The vocabulary used stemmed from words such as “recycling,” to phrases such as “alternative energy.” The words and phrases were tabulated as one unit; that is, a word was tabulated as 1, and phrases were also tabulated as one unit.

Post-test, after completion of the test and in the subsequent class, a questionnaire was administered to all the students enrolled in the class to evaluate the students’ understanding of the material taught. The questionnaire contained items such as: “the Science English class helped me learn about science topics in English and about the environment;” “the vocabulary was helpful and useful for my learning about the environment;” “I was able to consider SDGs more during the class;” “the textbook in all was helpful and useful to learn about the SDGs.” A complete questionnaire can be found in the appendix.

The first seven questions were asked using a five-point Likert style system, that included these points: 5) strongly agree, 4) agree, 3) neither agree nor disagree, 2) disagree, and 1) strongly disagree. The final three questions were open-ended and required students to write their answers to questions in full sentences. Those questions were: “What do you think would be more useful or helpful activities to learn about SDGs and the environment?” “What would you like to do more of in class to learn about the environment?” “What was the best activity in class to learn about the environment and the SDGs?”

Statistical Results of Test Outcomes

The author used simple statistics to analyze the outcome of this study on vocabulary cloze exercises, and environmental words and phrase usage in long writing.

Calculated were the average, median, mode, standard deviation to observe the outcomes of these measures from the tests in order to obtain a clear picture of students’ knowledge of, and skill in, environmental writing. Also calculated were the total number of correct answers in the test, the total of words in the long writing section with the total number of environmental words/phrases used. The mean, median, mode and standard deviation

were calculated for each variable. This was done to ensure that the answers were close to mean and therefore were true answers. Finally, Pearson’s R correlation was calculated on the number of correct answers with the total number of words written, the total words written with the total environmental words used, and the number of correct answers with the total number of environmental words and phrases used.

Table 1. Statistical Results of the Test Outcomes

Measure	Total number of correct vocab answers/20	Total words used in the long writing	Total environmental words/phrases used
Mean	11.35	61.19	9.06
Median	11	57	9
Mode	13	50	8
SD	2.93	17.26	3.30

Source: Calculated from test data, 2023.

As can be seen in Table 1, the mean value of test scores from a total of 20 was 11; the median was 11 and mode was 13. The SD value was 3. Of the total words used, a mean value of 61 was found out of a possible top word count of 100; the median value was 57 and mode 50. The SD value was 17. The total environmental words and/or phrases had a mean score of 9, while the median was 9 and the mode 8. The SD value was slightly over 3.

The Pearson’s R correlation test was run for two variables, three times: 1) the total number of correct answers on the vocabulary section and the total words written on the short writing; 2) the total words written in the short writing section and the total number of environmental words and phrases used; and 3) the total number of correct answers on the vocabulary test and the total number of environmental words and phrases used.

Table 2. Pearson’s R Correlation Results

Item	Value
Ttl # of crct answers/ttl # words	0.24
Ttl # wds/ttl # env. words&phrases	0.48
Ttl # of crct vocab. answers/ttl#env words	0.40

Source: Calculated from test data, 2023.

As the data show, the highest Pearson’s R value was the total number of words written with the total number of environmental words and phrases used: 0.48. The second

strongest correlation was the total number of correct answers on the vocabulary test with the total number of environmental words and phrases used, which resulted in a value of 0.40. Finally, the correlation value of total number of correct answers on the vocabulary section with the total number of words used was 0.24.

Qualitative Results

Post-test, a ten-item qualitative questionnaire was administered to the students that employed in the first seven questions containing a five-point Likert scale response system to seven questions. The five points in the Likert scale were as follows: 5) strongly agree; 4) agree; 3) neither agree nor disagree; 2) disagree; 1) strongly disagree. The questions included: The science English class helped me learn about basic Science topics in English; “I could elevate my presentation skills in English;” “the vocabulary was helpful in my learning to write about the environment,” “the design and explanation were helpful in my learning about the environment;” and “the textbook all in all was helpful for my learning about the environment;” among others.

The final three questions (questions 8-10) in the qualitative questionnaire contained open-ended questions in which the students were to freely write their own answers based on their own feelings in their experience from the course. Again, as stated above, those questions were: 8) “What do you think would more useful or helpful activities to learn about SDGs and the environment?” 9) “What would you like to do more of in class to learn about the environment?” 10) “What was the best activity in class to learn about the environment and the SDGs?”

Table 3. Likert Scale Responses to Environment Questions

Q. #	1) Science Eng. helped me learn about basic science in Engl.	2) I could elevate my present. skills in English	3) I was able to consider SDGs more	4)The vocab was helpful to learn to write about Env	5) The listening was helpful for my environ. learning	6) The dsgn & expl. were helpful for my environ. learning	7) The textbook in all was helpful for my environ. learning
5	6 (21%)	3 (11%)	9 (31%)	5 (17%)	2 (7%)	3 (11%)	9 (31%)
4	23 (79%)	14 (48%)	11 (38%)	20 (69%)	19 (66%)	21 (72%)	8 (28%)
3	0	12 (42%)	8 (28%)	4 (14%)	8 (28%)	5 (17%)	12 (41%)
2	0	0	1 (4%)	0	0	0	0
1	0	0	0	0	0	0	0
Total	29	29	29	29	29	29	29

Source: Compiled from questionnaire data, 2023.

As Table 3 shows, the majority of students (79%) agreed that the Science English class helped them learn about basic science topics in English; and 21% strongly agreed. Of the total, 11% strongly agreed that they could elevate their presentations skills in English, 48% agreed with this, while 42% neither agreed nor disagreed. As for the question, “I was able to consider SDGs more,” 38% agreed, 17% strongly agreed, 14% neither agreed nor disagreed and 4% disagreed. Totally, 69% agreed that the vocabulary was “helpful for my environmental learning,” and 17% strongly agreed; 14% neither agreed nor disagreed. Concerning the question, “the listening section was helpful in my learning about the environment,” 66% agreed, 28% neither agreed nor disagreed, and 7% strongly agreed. In the design and explanation question, 72% agreed that design and explanation was helpful, 17% neither agreed nor disagreed, and 11% strongly agreed. Finally, as for the textbook as a whole helping in environmental learning, 41% neither agreed nor disagreed, 31% strongly agreed, and 28% agreed.

Table 4. Answers to Open-Ended Questions

8) What do you think would be more useful or helpful activities to learn about SDGs and the environment?	<ul style="list-style-type: none"> To see more other exciting designs. To hear about overseas information more. To read more related literature in English To listen to more lectures about SDGs. To go directly to places to learn about SDGs. To study SDGs more. To watch more videos on each issue. To use the Internet more. To learn more deeply about one SDG. To watch general videos more.
9) What would you like to do more of in class to learn about the environment?	<ul style="list-style-type: none"> To go to an environmental location or museum. To learn more about living things. To think about environmental designs in groups. To do more communication activities. To learn more about microplastics. To learn about PET recycling. To work on water issues more. To learn more environmentally related vocabulary. To research on the Internet and come up with solutions. To increase group activities.
10) What was the best activity in class to learn about the environment and the SDGs?	<ul style="list-style-type: none"> Learning about pollution because I could learn new things. Understanding problems with the items that we are currently using. Learning vocabulary was the best thing. Thinking for ourselves and trying new designs. Thinking about alternative energy. Participating in discussions. Creating mind maps were the best thing. Making and giving presentations. Designing and presenting was the best thing for me. Thinking and presenting our own designs in English.

Source: Compiled from questionnaire data, 2023.

In the last three open-ended questions, multiple answers were allowed for each question. As Table 4 shows, various answers were given for each question. Question 8 (What do you think would be more useful activities to learn about the SDGs and the environment?) included such answers as: to go directly to places to learn about SDGs; to watch videos on each SDG issue; and to use the Internet more. Answers to question 9 (What would you like to do more of in the class to learn about the environment?) included: go to an environmental location or museum; think about environmental designs in groups more; and learn more environmentally related vocabulary. Question 10 (What was the best activity in class to learn about the environment and the SDGs?) included such answers as: understanding

problems with items we are currently using; learning environmental vocabulary; and creating and giving presentations.

Discussion

The overall results show that there is some value to teaching vocabulary related to the environment, and to have students internalize this vocabulary on tests to help them solve pending environmental problems. Table 1 exemplifies that the mean test score from a possible score of 20 was 11, slightly over half. This shows that while students are not perfect in their internalizing vocabulary, they were able to achieve half for vocabulary that was quite complicated and unfamiliar.

The total word count in the writing section as 100, and as the data show, the mean word count was 61, while the median was 57. These values again were more than half; however, the standard deviation is quite high (17.2) showing that the word count varied greatly. There was no word limit for the environmental words/phrases used; data show that the mean number of environmental words/phrases used was 9.06 with a median of 9 and a mode of 8. Out of a possible word-count of 100, the fact that second language learners who are science majors could remember 9 environmentally related words on a test was quite impressive. Again, some words were quite long and unfamiliar.

Pearson's R correlation tests were conducted three times. First, the number of correct words was correlated with the total number of words written. Here, results show a positive a value at 0.24. Even though it is not high, this value still shows that students were focused on writing environment topics effectively. Secondly, upon conducting correlation test with the total number of words written with the total number of environmental words/phrases used, a higher correlation value emerged (0.48). This value, too, while not close to +1, was far from negative, and could show that students were trying to include as many environmental words and phrases as they could. In the correlation of total number of correct answers with total number of environmental words and phrases used, a positive correlation (0.40) was found. Again, this value is not incredibly high, but it is positive nonetheless, and could display the students' efforts to answer vocabulary correctly as well as positively internalize environmentally related words and phrases.

In the Likert questionnaire (Table 2), 21% of students strongly agreed that the science English class helped them learn about basic science topics in English, 11% strongly agreed that they could elevate their presentation skills in English, and 31% strongly agreed

that they could consider SDGs more. Of the total, 69% agreed that the vocabulary was helpful for environmental writing and 72% agreed that design and explanation activity was useful. Totally, 31% strongly agreed that the textbook as a whole was useful for practicing environmental learning aspects such as writing.

Results of the open-ended questions show that many students feel that listening to more lectures on SDGs, visiting environmental locations directly to learn about SDGs, reading more English literature on SDGs, and watching more videos on each issue would be useful activities to help students internalize the meanings of SDGs more fully. In addition, students related that they want to think about environmental designs in group, do more communication activities, to learn more environmentally related vocabulary, and to research on the Internet and come up with solutions as classroom activities. For these students, the best way to learn about the SDGs and the environment in this class was to understand problems with the items that we are currently using, to learn vocabulary, to think for themselves and try new designs, to think about alternative energy, to participate in discussions, to create mind maps were the best thing, to make and give presentations were among the best things students participated in during the class. This illustrates that in-class activities geared towards environmental vocabulary, creating solutions to existing problems, and presenting these solutions in English was profoundly encouraging to them to broaden their insights and begin to take the problem of environment degradation seriously.

Conclusion

This study showed that young students are indeed interested in learning environmental aspects and about the SDGs more deeply in English. Some students even want to go to the extent of visiting locations physically in order to learn more about solving environmental problems and to gain knowledge. While some statistical values were quite low, the results were positive and exhibit students' interests in, and concern for, environmental issues, even in their second language. Not only should environmental science programs offer classroom instruction in English, but so should general-English courses that run the gamut of holistic language learning and teaching. This would help students learn English, and at the same time, they will be learning about ways to solve the environment issues so close at hand today.

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Appendix

Science English Environmental Learning Questionnaire

Please circle the answer according to your feeling.

1) The Science English class helped me learn about basic science topics and the environment in English well.

5. Strongly agree 4. Agree 3. Neither agree nor disagree 2. Disagree 1. Strongly Disagree

2) I could elevate my presentation skills in the Science English class.

5. Strongly agree 4. Agree 3. Neither agree nor disagree 2. Disagree 1. Strongly Disagree

3) I was able to consider SDGs more during the class.

5. Strongly agree 4. Agree 3. Neither agree nor disagree 2. Disagree 1. Strongly Disagree

4) The vocabulary was helpful and useful for my learning about the environment.

5. Strongly agree 4. Agree 3. Neither agree nor disagree 2. Disagree 1. Strongly Disagree

5) The listening was helpful and useful for my learning about the environment.

5. Strongly agree 4. Agree 3. Neither agree nor disagree 2. Disagree 1. Strongly Disagree

6) The design and explanation presentation were helpful and useful for my learning about the environment.

5. Strongly agree 4. Agree 3. Neither agree nor disagree 2. Disagree 1. Strongly Disagree

7) The textbook in all was helpful and useful to learn about the SDGs.

5. Strongly agree 4. Agree 3. Neither agree nor disagree 2. Disagree 1. Strongly Disagree

8) What do you think would be more useful or helpful activities to learn about the SDGs?

9) What would you like to do more of in the class to learn about the environment?

10) What in the class and textbook was the best thing for your learning?
