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TEACHING LIFE SCIENCE IN ENGLISH TO SECOND YEAR ENGLISH MAJORS AT HOKUSEI GAKUEN WOMEN'S JUNIOR COLLEGE

北星学園女子短期大学英文学科２年生への英語による生命科学教育法

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要　約

本研究は、北星学園女子短期大学における２年目の英語専攻学生を対象とした生命科学授業について報告するものである。この選択科目は、授業内容を英語で授業することを基本としている。４つの英語学習能力の中でも以下に示すようなの３つの内容が強調される。これらをその重要性の順に示すと、読解力、聞き取り能力、記述する能力である。
この授業の主眼とするところは、学生に生命科学における種々の論題を提供することである。学生には英語を用いることと同時に、与えられた論題を通じて各自の英語の能力を高めることが要求される。この授業は２年間行われてきた。ここでは、初年度から今年度までの２年間で遂行されたいくつかの変更点について報告する。

キーワード：生命科学

ABSTRACT

This paper describes the Life Science course for second year English majors at Hokusei Junior College. It is a content-based course which is taught in English. Of the four skills, three are emphasized in the following weighted order: reading, listening, and writing. The focus of the course is to expose the students to various topics in the life sciences. The students are required to use and improve their English skills through the topics covered. The course has been taught for two years, and some of the changes made from the first to the second year are reported.

INTRODUCTION

Life Science was first offered as a content-based one year, two semester, course at Hokusei Junior College in 1995. At the time of writing this paper, a little less than two years of Life Science classes have been taught. Classes consist of about 40 students, meet once a week for

90 minutes and meet about 13 times a semester for a total of about 26 classes for the whole course. Content-based courses have been offered at Hokusei Junior College for many years (Allison et al., 1995) with Life Science and Geography being the latest additions.

Life Science is a very broad subject that is mainly biology with some biochemistry and chemistry too. I tend to think that anything dealing with living organisms is suitable for discussion in Life Science. This breadth of scope gives the instructor a huge amount of material from which to choose. The majority of students taking this course have had minimal exposure to the hard sciences (i.e., physics, chemistry, and biology), which when combined with teaching in the students' second language, provides ample challenge for the students and instructor alike.

My background is in molecular biology and protein chemistry. I generated and investigated genetically engineered proteins (Maune, 1991), and assisted in teaching some undergraduate biochemistry classes. Upon coming to Japan I taught English at an English conversation school for about two years. I then started teaching at Hokusei Junior College part-time before teaching both Oral English and Life Science full-time.

OBJECTIVES

The teaching challenge for me has been to find out the students' point of view based on their scientific and English understanding, and what concepts they can effectively assimilate - though this would seem to reflect just about any teaching experience. Also, most lecturers of science courses at American universities basically disseminate information and provide relatively little motivation for the students. In this case the grade provides the motivation. For conversational English, in my experience, the instructor does try to provide motivation to assist the students in overcoming their English language inhibitions. In my case, just about everything that I have studied in the life sciences has been interesting to me, and lead to a better understanding of other scientific subjects; I was a science major. The motivation was the continued expansion of my scientific knowledge base to be used in a career in science.

However, for this Life Science course, there are two goals: 1) introducing the students to scientific thinking and various life science topics, and 2) improving the students' English; preparation for a career in science is not a goal. The first goal is the medium through which to attempt the second. Based on my own experiences with two college professors who showed their enthusiasm for the subjects they taught, biochemistry and molecular biology in this case, I try to present the material in a stimulating fashion which results in more attentive students who can thus improve their English.

I want to expose the students to various concepts that are relevant in their everyday lives. Other goals of mine are: to try to get the students to think beyond what facts they know (i.e., to extrapolate), to try to infuse them with excitement for some of the advances in scientific knowledge that have happened recently and in the past, to make them question what they are told and what they know, and to do this in a relaxed and lively, as opposed to dry, atmosphere.

THE COURSE

An overview

In the first year, the course was taught almost exclusively as a lecture-style course with various readings and a number of written assignments. There was no textbook assigned - instead materials from many sources were used. Tests were based on the notes and readings, and grades were based mostly on the tests and also on the written assignments.

In 1996, the second year of the course, many changes were made: a text was used, there were more written assignments, poster presentations, and the students also watched a video. Again, tests were based on the readings and notes, but for grades, tests comprised less of the grade than in the first year.

Opening material

For both the first and second years, the opening lectures were on defining science, the scientific method, defining life, and the needs of living organisms. Redi's classic experiment disproving that flies spontaneously generate from rotting meat was used to illustrate the scientific method. The students were asked to relate the scientific method's steps to Redi's experiment and to expand on Redi's conclusion that flies do not develop from rotting meat - the answer being that the flies are attracted to the smell of the rotting meat with the meat serving as a food source for the larvae. This lesson contrasts today's paradigm with Redi's, when the idea that life could come from non-living matter was held to be true. The use of experimental variables in Redi's experiment was discussed. This introduction will be continued with few changes as the material was grasped well by the students, and the scientific method, though not mentioned or detailed, is present in lots of material covered in the course.

In the first year, the following was then discussed: rain forest depletion and ozone depletion relating to oxygen levels on the planet, homeostasis asitrelates to various cycles in the earths atmosphere, and an introduction to chemistry. The introduction to chemistry did not work well. The concepts were not grasped by the students (the test scores were very low) and this early difficulty frustrated them. The object of the course is not only to increase the scientific understanding of the students in specifically defined areas.Therefore, the exact topics covered can be altered at will within the broad subject of Life Science. I received lots of unhappy feedback from the students about the chemistry section.

Thus, the material mentioned in the preceding paragraph was not taught in the second year course. Instead, global warming was discussed and the students then had group projects. There were four to five students in each group, constructing posters on various chapters in the text relating to living things in their environment(e.g., *How are materials cycled in nature?* and *What are habitats and niches?*). Each student had to contribute one A4 sized piece of paper for the final poster. A glossary of any difficult vocabulary using both the English definition as well as

the Japanese translation was required with no less than four words per poster. I also explained some ideas about poster layout that I had learned working with my meticulous advisor making posters for presenting at scientific conferences. Students were given some class time to work on the posters during which I answered any questions and made suggestions. The students were given time to review the posters and had to list good and bad points for each poster as well as ideas for improvement. They also graded the posters - they could only give one ten, one nine, etc. After the students had read all the posters, I told them the grades that I had given each poster and the rational behind those grades. These first posters had many layout problems which I expounded on. The students evidently listened or did not like having their posters criticized in detail in front of their classmates as, whatever the motivation, the next batch of posters, on topics concerned with food and energy, were dramatically improved. I plan to continue these poster presentations but will require the students to formulate some questions for each poster and have the questions answered by the students who made the particular poster (suggested by T. Christensen). I am also thinking about incorporating a mini oral presentation for each poster, but have not thought yet about specifics.

An idea that did not work

In the teaching of classification in the first year, I came across an idea to have the students make a classification system for their shoes. The students would then get hands on experience with the rigors of developing a functioning system. However, at this school the students all wear the same white sandals or white sneakers. Thus, their shoes could not be used to design a classification system around. I decided to use my own shoes for this and required that the students use at least a three tiered system (the binomial nomenclature system used today has seven tiers). There were almost 30 right shoes including: dress shoes, sneakers, hiking boots, ski boots, bicycle shoes, slippers, sandals, and other footwear. The difficulty was creating initial categories (*Kingdoms*) based on physical characteristics so that the shoes were rationally grouped (i.e., all hiking boots together and all sneakers together, etc.) with each shoe having a place in only one *Kingdom*. Students worked in groups of two, and had to show me their definitions of their *Kingdoms* before they could further classify the shoes. This, like the chemistry introduction before, was another frustrating time for the first year class. I wanted them to get into the detail necessary to properly classify the shoes while the students wanted to have nothing to do with my shoes (in my own defense I did have each shoe on its side so they would not have to handle any shoes, and I did handle shoes when students requested it). I explained the ideas behind the task at least three times using students' incorrect *Kingdoms*. At this point some students did comprehend, but many could not understand the connection between my shoes and organisms. This, like the chemistry, was another frustrating time for the first year class. For the second year class, I only briefly touched upon classification with some notes and a few pages of reading.

Some simple experiments

This is only a lecture course, but I wanted the students to get a little exposure to experimental methods. The simple experiments relate to the nervous system, were done in class, and require only: some pieces of paper about the size of a 1,000 yen bill, some 35 cm paper rulers with five cm gradations, one yen coins, paper, and pencils. I will illustrate only three of the five experiments.

The first is something that I did as a kid, but does not seem to be common here in Japan. One student has her arms at her side and tries vigorously to push her arms out while her partner restrains her from moving her arms out. After 30 seconds, the partner releases the students arms, the student relaxes, and her arms should go out to the side if done properly. When I did this for the first time, with the first year class, I was surprised that almost none of the students had ever done this. I was more surprised at the reactions; most students quickly pulled their arms to their sides and said that they did not like the feeling of letting their arms go up on their own.

Another experiment involves a partner dropping a one yen coin from a defined height above a student's hand with the student trying to move her hand so the coin does not strike it. Hits and misses are recorded for 10 tries, then the height is either increased or decreased.

Another experiment has the students write their names 10 times. This is done for three sets of 10, and the time taken for each set is recorded. This is followed by writing your name backwards for three sets of 10. The backwards written names are all covered immediately after written so that the students cannot just copy, but must actually learn. The first year, the students did not cover the backwards written names, which greatly affected the results.

These simple experiments were well received by the students as the experiments were a change of pace. Whether or not the class learned anything is the question. Reproducibility, error, and other experimental considerations are addressed as well as this year I had the students graph the results of two of the experiments. From their graphs I got the impression that many of them had not been exposed to simple graphing. Thus, I am thinking about cutting the number of experiments and spending some time on graphing. The students had to write their ideas about the results, but few of the students' answers were written using nervous system concepts discussed in class. When I explained the results though, they were attentive and really were interested in the answers.

Reading in Japanese

The Man Who Mistook His Wife For A Hat by Oliver Sacks was used this year during lectures concerned with the nervous system. One chapter of the Japanese translation (the book was written in English) was read by each student, and that chapter summary and their personal impressions were written. This is the first time I had the students read something in Japanese and to then write about it in English. I feel that this book does a great job of bringing to light how

contrived our perceptions of reality are (the book details some patients bizarre mental occurrences). The students had to write their ideas in English and, for the most part, wrote very interesting reflections. Is this valid in a content-based course? I think so. I am developing the impression that variation keeps interest up, which enables learning. As this book was well received, I am thinking about utilizing some Japanese translations of Stephen J. Gould books to use during the discussion of evolution.

Paper Chase

Paper Chase is a simple game that can elucidate natural selection. Again, as above, it is also a variation that gets the class lively. Small square pieces of white, green, and newspaper are spread out on newspapers. The students form teams and have to take the pieces off the newspaper one at a time. From this, relating to the famous peppered moth story, students see how some traits of the small paper pieces are advantageous for survival with the student as predator and the paper pieces as prey. I motivate real natural selection by showing some cookies that the team with the most paper pieces wins. Of course the white and green pieces are taken much more frequently than the newspaper pieces.

After the game, students had to answer questions about various aspects of the game. Again though, when asked what the game related to, most did not say natural selection or evolution, but said speed or eyesight. When I explained the game's relationship to natural selection they understood, but prior to the explanation, few made the connection (the question asked is *What does this relate to from the reading?*).

New plans

This year I did use a video in class, which was well received by the students, though they said that the English was too fast for them (they were also provided with a transcript and audio cassette tape). Next year I plan on incorporating a few more videos dealing with natural selection, endangered species, and the human brain. Videos provide images that books cannot, and also offer many possible uses for language instruction. On those lines I also hope to use some CD-ROM programs too. This year I purchased 10 CD-ROM titles, but only a few were applicable to the students. These titles were tested by a few students. I watched the students use the programs and asked them for their impressions. Programs utilizing more text were easier to follow for the students and kept them interested in the program while programs with lots of audio and little text were not at all well received but were more frustrating. More programs will be examined and possibly used next year.

Closing thoughts

Teaching this course for two years has given me a better understanding of how to teach it. The first year tests were much too difficult and some concepts were better left unexamined. I

know that the second year course was taught better than the first, and that next year's course will be better again. This just underscores the value of experience (not the saying, *Those who can do. Those who can't teach.*). The challenge will be to continue to improve and adjust the course, without becoming complacent - to try new things. I also want to make sure that in my lectures I continue to convey to the students some of the excitement that I feel for the subject matter, and that I can instill in them such excitement.

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