

Integrating Authentic Materials and Language Skills in English for Science and Technology Instruction

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Integrating the use of a variety of authentic materials with the four language skills of reading, writing, speaking, and listening is useful in most English for Science and Technology (EST) instruction. This article discusses a semester-long elective course in scientific English for third-year students in the Department of Earth Science at a university in Japan. The course meets for between 12 and 15 ninety-minute sessions and has between 15 and 25 low to mid-intermediate level students. The instructional focus is on the rhetorical functions of scientific discourse in English, such as cause and effect, hypothesizing, definition, description, and classification (see Trimble 1985). The goal is developing reading skills for comprehending research published in the students' field of study.

The following is an explanation of how a unit in this course integrated three learning materials on volcanoes: a research article from a scientific journal, an article from *The Economist* magazine that reports on the scientific journal article, and an instructional video with its script.

Video: reading, speaking, listening

The video, *Inside Volcanoes*, was produced by BBC-TV for the Open University in the United Kingdom and runs about 25 minutes. Scientists present basic geological and geophysical information on volcanoes with magnificent footage from a number of volcanic sites in various parts of the world. The Open University videos approximate short scientific lectures and can be used effectively to advance students' listening comprehension, reading, and speaking skills through integrated activities with the instructional materials. Some of the video content was already familiar to the students from their Earth Science courses.

A few weeks before studying this integrated unit on volcanoes, students are given the video script and asked to read it. Then they complete a worksheet in which they identify the prominent rhetorical functions in the script. In particular, the worksheet requires students to recognize definition, description, classification, comparison, and cause and effect. These rhetorical functions organize and frame the content of the presentation, and understanding them is essential for comprehension of the video. Before starting this unit, the students have already completed exercises on the rhetoric of scientific discourse and received a list of the important scientific vocabulary from the script.

In the first of the class sessions for this unit on volcanoes, students work in small groups comparing and commenting on their responses to the worksheet items. This discussion is entirely in English. It is important that lessons include meaningful student-centered, interactive oral activities because EST-related speaking opportunities may be rare for students. The group work is followed by a class review of the prominent rhetorical functions in the script.

Then the video is shown in segments of a few minutes each, with pauses for the teacher to briefly highlight both the scientific content and the rhetorical forms in each segment. Students watch and listen without the script. To reinforce the students' listening comprehension skills, during the next week the video is played once again with longer stretches of viewing and fewer pauses.

***The Economist* article: reading, speaking, writing**

Following work with the video and its script, the students are asked to read the article from the Science and Technology section of *The Economist* and complete an accompanying worksheet. *The Economist* article reports on a research article from the scientific journal *Geophysical Research Letters* that compares seismic and acoustic monitoring of a volcano in southern Japan. The rationale for using the article from *The Economist* magazine prior to the original, authentic research article it reports on is two-fold. First, the latter piece is at a level of English well beyond that of most intermediate, third-year students. Second, students often do not know a considerable amount of the scientific vocabulary and the geological or geophysical concepts the original research deals with, nor do they understand much of the advanced mathematical data presented. *The Economist* Science and Technology articles digest the original research articles to shorter and more manageable lengths and are not loaded with scientific vocabulary and mathematical formulations.

At the same time—and this is very important—*The Economist* articles generally parallel the schematic structure of the scientific journal articles (see Porcaro 2000). The particular article used, "Now, Listen Carefully" (1999), contains statements of the scientific problem and propositions for its solution, explanations with comparison and cause-and-effect, and an outline of the experimental procedures.

In class, using only English, students work in pairs or small groups on recognizing and understanding these rhetorical functions to improve their comprehension of scientific discourse. Students are also assigned to small groups to write a short paragraph together that synthesizes the seven or so points of comparison between seismic and acoustic monitoring presented in the article. This written work is then reviewed with the entire class.

Scientific research journal article: reading, speaking

In the last class meeting on this unit, we go to the authentic research article (Garces et al. 1999) from the scientific journal *Geophysical Research Letters*. There are two reasons for including this type of article. First, needs analysis clearly reveals that some of the students already are assigned, or at least attempt, research with English language journal articles for their Earth Science courses. Second, proficiency to read such articles is a recognized necessity for those who continue on to graduate studies and seek professional employment in this field. This course is

their only opportunity to study these articles systematically and learn appropriate reading strategies.

Judiciously-selected scientific journal articles that are current, relevant, interesting, and of manageable length (3 to 5 pages), used in conjunction with companion digest articles from *The Economist*, can therefore orient students to the forms and patterns of written scientific discourse in English. They also help students begin the practical application of reading strategies.

With guidance from worksheets and through class work with the teacher and interactive group work, students focus on the form and content of the articles. Starting with the abstract of the article, students analyze the organization and pattern of presentation, including descriptions of research design and experiments, reports of observations and findings, statements of hypotheses, discussions of implications and conclusions, and directions for further research. They are able to apply content comprehension strategies that focus on the rhetorical features of English scientific discourse to parts of the articles, working from both structure to meaning and meaning to structure in a "purposeful interaction with the text" (Hudson 1991:79).

A survey of students' opinions was conducted at the end of the course. They responded that the scientific journal articles were very difficult and they generally could follow only the main flow of the presentation of the research. But they considered the exercise worthwhile and useful and recommended its continued inclusion in the course.

Conclusion

For such a course, then, I try to maintain a cautious balance. Students should apply skills and gain confidence, yet not become overwhelmed, frustrated, and discouraged by the arduous challenge of comprehending scientific journal articles. The integrated use of various authentic materials and the four language skills in this EST course provides students with an interesting, manageable, and effective program of study. Other language teachers with similar courses, as well as those in more intensive programs, may find in this article some useful ideas for their particular fields of EST instruction.

References

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Note: Articles from the Science and Technology section of *The Economist* are available on the
Web site <http://www.economist.com>.