THE SCIENCE TEACHER AND FOREIGN LANGUAGES

Why should a science teacher be concerned about the foreign language training of students? The science we teach is supposedly universal. It is the same table of elements that hangs in every chemistry classroom in India or China or Russia. And plants track the sun regardless of a region's culture. But the belief that science is truly international is not supported when scientists themselves turn their skills to analysing the literature they cite in research articles. An inspection of research in several fields (Lewin and Jordan 1981; Turnbull 1977) reveals that authors mainly cite research in their own language, and U.S. scientists were most prominent in ignoring papers in other languages.

This has led foreign scientists to complain in Science: "One concludes that, nowadays, American scientists quote only themselves; the process is dangerous. Languages other than English are discouraged. Young (or not so young) scientists elsewhere in the world publish in English, but sometimes in broken English, missing the opportunity to be clear. This does not help, however, as American scientists do not quote them."

"This kind of parochialism is spreading, and it is leading to a new form of American intellectual colonialism: only Americans do well; American science is exported or good scientists are imported from abroad, where they are transformed into American scientists; foreign science is good only when submitted to American leadership. . . . in the present situation, I see severe threats to the universality of science and to the independence of non-American scientists in their choice of a language, a subject, and a channel for publication." (Pecker 1981)

As science educators, we are partially to blame for the recent generation of mono-lingual researchers. Many university science faculties have made a conscious decision to graduate scientists with research skills in place of traditional foreign language requirements. In elementary and secondary schools, we have allowed foreign languages to be de-emphasized. And we fail to point out to our students the advantages of having a second language in our science work.

The first and most obvious use of another language is in translation of foreign research. In the past, this has been a weak argument because in most fields, the leading edge of research has been in the western world and much of the research was available in English. However, "the next step in the ascent of man" is now being taken by non-western scientists in many fields— an even predicted over a decade ago (Bronowski 1973). With Japanese and Chinese scientists now making some of the breakthroughs in electronics, optics, computers, and nuclear physics, the U.S. House of Representatives has voted one million dollars to begin the translation of some Japanese journals (July 18, 1986 Science). This effort can only begin the translation of the more critical journals, and leaves a backlog of many that will never be converted. Meanwhile, most major countries have more teachers of English than we have students of their language! Indeed, the
number of Chinese studying English exceeds the whole U.S. population!

The world's population that speaks English as a first language is much smaller than most people would guess. If a class of 30 students (Figure 1, below) sat before you, proportioned by native language, how many would speak English? Many U.S. teachers and students would guess 50-60%. Others would trim to only one-third or one-fourth. In reality, less than three in 30, less than one-tenth... would speak English as a first language.

Figure 1. A class of 30 students proportioned according to the 163 different languages spoken by at least one million people in 1982. Data from 1983 World Almanac.
If we were training our students for optimal communication with the world's peoples, then as you sit in a classroom of 30, six of your classmates would be pursuing Chinese; one, French; one, German; two, Russian and two more Russian dialects; over five would study Hindi, Bengali or another Indian dialect; one, Portuguese; two, Spanish; one, Arabic; and one Japanese or Korean. And six would be tackling one of the 114 other languages from Slavic languages to Malay. That is the real world. That of course is not the world our students perceive. A few minutes in class, using an overhead transparency of Figure 1 or partitioning the class by proportional languages, will go far toward portraying our real position in the world.

In addition, the excellent PBS television series, "The Story of English," is currently chronicling the development of our language and the speed with which it is being adopted as a second language overseas, especially as a universal medium in business. In spite of its growing usage among the educated and wealthy, it is desperately important that we maintain a multilingual pool of scientists for scientific reasons.

A second and more important reason to promote science students learning a foreign language lies in the variety of ideas needed to make future breakthroughs in science. Evolutionary biologists recognize the great advantage held by species that maintain the greatest possible diversity. Disasters occur when only one strain of wheat or corn, a "monoculture," is planted everywhere. With no variation, there is no potential to meet changing conditions. In the development of new science concepts, a "monolanguage" holds the same dangers as a monoculture. Because languages partition reality differently, they offer different models of how the world works. There is absolutely no reason why the metaphors provided in English are superior to those of other languages. I will provide two brief examples.

Consider the color "brown." Any western child would recognize the color, and in sorting color crayons, would place brown with the tan and other earth colors. Your shoes are brown, not yellow. Any western child knows yellow, and yellow belongs with orange and red crayons. But in Chinese, "brown" translates as the color hwang (黃). Leather shoes are "dark hwang." What we call "yellow" is "light hwang." Any Chinese child would arrange colored crayons with yellow-to-brown as a series and with yellow totally unrelated to the orange-reds. Westerners have two names China, grading from yellow to dark brown, provide a natural basis for their color spectrum. Jade justifies a similar green-to-black spectrum. This is one of many ways Chinese breaks reality into different "chunks" when compared to English.

In addition, words gain different associations in different cultures, and therefore a word does not carry the same full meaning even when translated with correct one-to-one correspondence. In an English lecture, the word "cobra" not only denotes a poisonous snake, but also (thanks to Saturday morning TV) suggests power, speed, and a degree of "badness." Hence, American carmakers have used the name cobra for a car. In China, the word "cobra" translates with complete one-to-one correctness
into "faahn-chaan tahuh."

Unlike the undescrptive word cobra, this term describes the snake: "faahn chaan" is a ladle-shaped cooking instrument used in a wok; "tahu" is "head." A cobra, with its head raised and its hood spread, resembles such a device. No Chinese carmaker would ever name a car "food-stirrer head." These different ways of breaking apart and representing the real world, and different associations, lead to different ways of perceiving the world and to different metaphors for scientific models. This is demonstrated by one experiment where various flat geometric figures were presented to both western and oriental students with the directive "compare!" The western students pointed out the differences in numbers of edges, angles, points, etc.—the oriental students noted that all the figures were flat, the same texture, the same color, etc. Neither is wrong. Indeed, the mindset that probes for hidden similarities is probably critical in generating future breakthroughs in fields like ecology.

Scientists need the diversity of metaphors found across all languages in order to understand and represent the increasingly complex concepts yet to be unraveled.

As science educators, we can do the following to slow the erosion of multi-lingualism among our students:

1) We can take time to represent the real proportions of languages including English in our classrooms;

2) During science classes, we can call upon those students who speak other languages, to discover the different ways plants, animals and physical phenomena are perceived in other language;

3) We can counsel and encourage our students to pursue a foreign language, and we can promote those programs in our school curricula.

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References Cited


