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The role of English in scientific communication: *lingua franca* or *Tyrannosaurus rex?*

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Abstract

The use of English as an international language of science (EILS) is by now well documented; depending on one's orientation, English may be seen as a neutral *lingua franca* or it may be seen more insidiously as a dominating and overpowering force. This paper explores these co-existing roles of EILS through various perspectives. It begins by outlining conversations regarding EILS found in the literature of applied linguistics and the scientific community. The paper then turns to the perspective of international graduate students studying at an American university through a small-scale questionnaire and focus group interview study that attempts to understand these students' attitudes toward English and its role in scientific communication. Findings from the study are discussed in light of published conversations of EILS and implications for an EAP classroom that aims to recognize the dual roles of English in scientific communication.

Keywords: English in science; English for academic purposes; World Englishes

1. English as an international language of science (EILS)

In today's "Information Age," the volume of scientific information is somewhat astounding: one old estimate is that about 7000 scientific journal articles are published *every day* (Naisbett, 1982); the *ISI Web of Knowledge* alone currently contains in its databases over 8600 journal titles (ISI Web of Knowledge, n.d.). With this immense volume, information management and access becomes crucial at individual, institutional, and national levels. Such international, cross-cultural communication may be facilitated by use of a common language. Due to historical

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circumstances, concerted planning and promotion, chance, and/or accident (see Benesch, 2001; Crystal, 1997; Grabe & Kaplan, 1986; Kaplan, 1993, 2001; Pennycook, 1994; Phillipson, 1992; and Salager-Meyer, 1997 for various explanations), English has increasingly dominated international communication and information access. However, the use of English as a common language is not uncontroversial. Rather than giving everyone equal access, English as an international language of science (EILS) has led some users to enjoy preferred treatment and status; authors based in the Inner Circle (Kachru, 1985) in general, and those based in the United States in particular, enjoy a disproportionately large percentage of publications and are more likely to be the "gatekeepers" of published works (Gibbs, 1995; Canagarajah, 1996, 2002).

This backdrop thus suggests two primary roles of English in science. One is that of a common language, a *lingua franca*, which allows for ease of information storage and retrieval that may be more efficient than translation (Grabe, 1988) and provides a means for knowledge advancement (Wood, 2001). At the same time, English may be seen more nefariously, acting as something of a *Tyrannosaurus rex* (Swales, 1997)—"a powerful carnivore gobbling up the other denizens of the academic linguistic grazing grounds" (p. 374). It is the goal of this paper to bring together the ways in which applied linguists and the scientific community have discussed issues surrounding these co-existing roles of English, and to understand how these issues are discussed by "next generation" scientists. I begin by outlining major issues discussed in the literature in applied linguistics and the scientific commmunity. I then turn to describe a survey and interview study of non-Inner Circle graduate students studying in the United States, focusing on their experiences with and attitudes EILS; connections are drawn between their responses and the issues described in the reviewed literature. The paper concludes with a consideration of the EAP classroom and possible ways in which instructors may address the multiple roles of English.

2. Disciplinary views of EILS

Because of differing subject-matter focuses and differing epistemological paradigms, one would expect at least some disparity between conversations regarding EILS by applied linguists and those in "hard science" fields. These—largely separate—discussions nonetheless share many concerns and often touch on parallel issues. Based on a review of the literature in applied linguistics, scientific journals, and popular science magazines (such as *Nature* and *Scientific American*), I have categorized these issues into five main topic areas, each discussed below.[1]

[1] One key drawback to this review of the literature is that, with regrettable irony, it relies almost exclusively on English-language publications. The difficulty of accessing non-English-language resources that may offer alternative viewpoints reflects some of the same issues described in this paper.

2.1. Why English?

Historical circumstances and issues of information access and economic development have been cited by applied linguists as major factors in the global spread of English (Kaplan, 1993, 2001; Grabe, 1988; Grabe & Kaplan, 1986). An additional and separate argument is that English's "pluricentric" nature has allowed its varieties flourish, in turn leading to its success as a global language (Kaplan, 2001). Other applied linguists have discussed the use of English in specific scientific domains, finding it to be more dominant in natural sciences than social sciences, in theoretical than applied sciences (Ammon, 1994), and in the hard sciences than the humanities (Medgyes & Kaplan, 1992). Indeed, de Oliveira et al. (2001: 440) cite a coordinator of a leading Brazilian science journal project who stated that "to publish in Portuguese would be a kind of provincialism".

The need for a common language is not often discussed explicitly in scientific literature, but is instead presumed. Statements marking English as the language of science or medicine are commonplace (e.g., Brambrink, Ehrler, & Dick, 2000; Glaze, 2000); as early as 1967, an essay in *Current Contents* referred to English as the current language of international science and called for scientists to accelerate the process of making English more prevalent (The Information Scientist, 1967). Scientists face a great deal of pressure to publish in visible (usually international) journals, most of which are now English language, leading to a self-perpetuating cycle in which English becomes increasingly important.

2.2. Publication and citation practices

While the use of EILS has roots in the past, current circumstances have often been inculcated by applied linguists in maintaining the dominance of English. There may, for instance, be a tendency for researchers to cite their own English-language research more frequently than their mother-tongue publications (Grabe, 1988). As English-language articles are cited more frequently, they will in turn take on increasing prestige and importance. Canagarajah (1996) describes more specifically how these practices may affect periphery scholars, who face a double-bind: They may lack access to a large body of English-language resources and are thus unable to cite these sources; however, manuscripts which lack the "key" (English-language) references are more likely to be turned down. Ironically, periphery scholars may be marginalized even when writing about their local communities, while their central scholar counterparts achieve recognition for writing on the same topic (Canagarajah, 2002). Wood (2001), however, provides an alternative perspective. Through his study of articles published in *Science* and *Nature* over a one-year period, he concludes that non-native-English-speakers (NNESs) are well published and that "the linguistic barriers for NNSs to be published in even the most prestigious journals do not seem high" (p. 80).

While most studies have taken a wide-lens perspective on language of publication bias, Petersen and Shaw (2002) adopt a more local perspective in their study of English in a Danish business school. They find the practices to be much more

complex than is often suggested with great variation among fields of study. Their robust model of publication practices accounts for these differences by considering factors like discipline, individual preferences, and institutional pressure.

Scientific literature is replete with quantitative measurements of the extent to which English dominates the publication industry. In 1995, for example, English made up over 95% of publications in the *Science Citation Index*; the remaining percentage was made up of French, German, Russian, and—at about 0.5–0.7%—all other languages (van Leeuwen, Moed, Tussen, Visser & van Raan, 2001). Within specific fields, this trend reoccurs: English dominates publications in, for example, medical science (Egger et al., 1997), social science (Tijssen, van Leeuwen, Verspagen & Hollanders, 1998, cited in van Dalen & Henkens, 2001), paediatric anaestheisa clinical practice (Brambrink, Ehrler & Dick, 2000), and freshwater ecology (Wishart & Davies, 1998). Furthermore, non-Inner Circle scientists are increasingly less likely to publish in their mother tongue, and their English-language publications are cited more often (Butler, 2000; Egger et al., 1997; Garcia-Guinea & Ruis, 1998; van Leeuwen et al., 2001). References to English-language publications in French science papers, for example, has steadily increased to 85% in 1995 (Navarro, 1995).

Not only does the English language appear to dominate published work, but research that is based in Inner Circle countries seems to hold a clear advantage in the international arena (Bambrink et al., 2000; van Dalen & Henkens, 2001). For example, a study of freshwater ecology articles published over a ten-year period found that 60.4% of the papers came from only five countries—all Inner Circle countries (Wishart & Davies, 1998).

2.3. *Anglophone gatekeeping and discursive norms*

Gatekeeping, through editorial boards and referees, provides yet another mechanism for an English stranglehold on scientific scholarship. Applied linguists have pointed out that the roles of gatekeepers are most often filled by Anglophone scholars (Canagarajah, 1996; Clyne, 1991). Medgyes and Kaplan (1992: 68) state their views quite unequivocally: "the English-speaking nations control an information cartel that makes OPEC's energy control seem trivial." When a small number of (Anglophone) gatekeepers hold such control, deviations from a perceived standard may be easily excluded in a variety of ways. Scholars may be disadvantaged through the "nondiscursive" elements of the publication process, such as, paper and printing quality, postal and procedural expectations, and author-editor interactions (Canagarajah, 1996; Flowerdew, 2000). Discursive elements are also likely to play an important role in gatekeeping. Kaplan (2001), for example, suggests that common methods and measurement standards have coupled with cumulative and self-referential knowledge-making to result in an increased standardization of scientific discourse. Therefore, when genre or discourse patterns do not follow the expectations of the gatekeepers, they are more likely to be viewed as non-standard and to be excluded from publication (Bhatia, 1997; Kaplan, 2001).

In many cases, non-Inner Circle scholars may feel more comfortable *reading* than *producing* English-language texts. As a result, these scholars are often excluded from participation as central members of the international academic community (Duszak, 1997). Canagarajah (1996) describes such scholars or communities as primarily "consumers" of central scholars' knowledge. Indeed, much has been written about the extent to which periphery academic communities may be "off-networked" (Swales, 1990) from central communities (Canagarajah, 1996; Duszak, 1997; Flowerdew, 2000; Kaplan, 1993). Surveys of Scandinavian (Jernudd & Baldauf, 1987), Danish (Phillipson & Skutnabb-Kangas, 2000), Hungarian (Medgyes & Kaplan, 1992), and Hong Kong (Flowerdew, 1999a,b, 2000) scholars have all found that these scholars felt disadvantaged vis-à-vis their NES colleagues.

Discussion in scientific literature regarding exclusionary gatekeeping practices are most often found in editorials and letters to the editor. Gibbs (1995) details the gatekeeping and publishing practices that serve to exclude periphery scholars, and a series of letters to the editor in *Nature* (Carter-Sigglow, 1997; Clayton, 1997; Fewer, 1997; Nathan, 1997; Terenzi, 1997; Umakantha, 1997) provide first-hand anecdotes of these practices.

2.4. The need for diversity

An additional result of the dominance of English in science concerns the issue of diversity; within applied linguistics, this concern focuses on linguistic diversity. As English has taken over the "key registers" of science (Kaplan, 2001), it has become an example of *linguicism* (Skutnabb-Kangas, 1988), "through both unequal resource allocation and legitimate processes that validate 'big' languages at the expense of 'small' ones" (Phillipson & Skutnabb-Kangas, 2000: 22). Swales, 1997, 1998) is concerned about such loss of specialized registers and genres in "otherwise healthy languages," citing Ongstaad's (1992) argument that losing genres or registers is a step toward language death. Others have also argued for the importance of linguistic and rhetorical diversity within the scientific community (Mauranen, 1994; Salager-Meyer, 1997). According to this view, "the extinction of small languages is even more catastrophic than the extinction of biological species...[because it] narrows the human condition" (Kaplan, 2001: 19).

The scientific community too has expressed concern with linguistic diversity, primarily in its effects on science. Because so many top-tier journals publish in English, meta-analyses and research reviews often exclude non-English language publications from their studies; these language-biased exclusions may have important implications. For instance, significant results may be more likely to be published in English (Egger et al., 1997) and some meta-analyses of research articles could obtain different results by including non-English papers (Gregoire, Derderian & Le Lorier, 1995). Gibbs (1995) notes that important work situated in Third World countries is essentially becoming "lost science." Biases in fields like demography and freshwater ecology have led the research of U.S. and European countries to dominate, giving a distorted view of research in these fields (van Dalen

& Henkens, 2001; Wishart & Davies, 1998). Garcia-Guinea and Ruis (1998) argue for the protection of local and regional scientific work through increased recognition of Spanish-language science, which provides an important network for those scholars who research local topics.

2.5. Calls for action

Both applied linguists and scientists concerned with the effects of EILS have outlined possible moves toward change. Applied linguists have recommended awareness-raising of these issues among language teachers and their students (Clyne, 1991; Swales, 1997, 1998), increased mentoring between Inner Circle advisors and their students who return to periphery countries (Flowerdew, 2000), and concrete changes to be made by academic policy-makers and gatekeepers (Canagarajah, 1996; Phillipson & Skutnabb-Kangas, 1999; Salager-Meyer, 1997).

Within the scientific community, van Dalen and Henkens (2001) have concluded that overlooked science may become more visible if national journals publish in English. Glaze (2000:369A) urges graduate advisors to have their students write often in English, and Wishart and Davies (1998) recommend increased collaboration between scholars in developed and developing countries and more research focusing on the contexts of developing countries. More cynical views are found in letters like that by Fewer (1997: 764), which warns against monolingual publication practices that result in "academic imperialism".

2.6. Summary

In sum, applied linguists and scientists have explored somewhat similar issues regarding EILS, yet through different lenses. Applied linguists have focused primarily on the historical origins of EILS, the publishing difficulties that NNES scholars may face, the dominance of native-speaker norms enforced by gatekeepers, the dangers of linguicism, and calls for changes that may lead to a more equitable situation for languages and their users. Scientists, on the other hand, have tended to focus primarily on the pragmatic justifications of EILS, the publication and citation practices related to English-language research and researchers based outside of the U.S. or U.K., difficulties in publishing faced by periphery scholars, and the dangerous effects on science of a language bias in publication. In both cases, the co-existing roles of English are evident: English is a necessary tool, but one that has potential for quite negative consequences.

3. The international graduate student community

Previous work in applied linguistics has surveyed practicing scientists and other scholars about their uses of and attitudes toward EILS, providing useful insights into the experiences of those in the Outer and Expanding Circles (e.g., Jernudd &

Baldauf, 1987; Flowerdew, 1999a, 1999b, 2000; Medgyes & Kaplan, 1992; Phillipson & Skutnabb-Kangas, 1999). However, almost no work has focused on "next generation" scientists and professionals, such as graduate students.

International graduate students studying in the U.S. provide a useful perspective into the issues of EILS for several reasons. First, these students represent two understudied populations of EILS users: that of future professionals and that of Outer and Expanding Circle scholars currently situated in the Inner Circle. Whether they remain in academe or move into the private sector, these students are likely to be engaged in the writing and/or reading of scientific research. As the numbers of these populations continue to expand (Institute of International Education, 2002), their views are of increasing importance. Second, if the use of EILS continues to increase (as appears likely), users from the Outer and Expanding Circles will eventually outnumber those from the Inner Circle (if they have not already). As Widdowson (1994) and Graddol (1999) point out, such a demographic will lead to language changes over time; therefore, international graduate students represent future influential users of scientific English. A third reason for surveying international graduate students in the U.S. is that this population "may play key roles in the spread of English worldwide and in attitude changes toward its role as a world language" (Munro, 1996: 338). Finally, international graduate students, particularly those currently enrolled in English-language support courses, represent a group that may have heightened awareness of the role of language in scientific communication. Because these students are often faced with linguistic challenges that affect their educational circumstances (e.g., obtaining and maintaining teaching assistantships, communicating with advisors and peers), they may have unique insights into the role that language is playing and will play in their professional development.

The next part of this paper reports on a study carried out with graduate students from non-Inner Circle countries enrolled in English-support courses at a large American research university. The goal of the study was to understand better this population's experiences with and attitudes toward EILS and to situate these views within the dominant (published) conversations in applied linguistics and scientific communities.

3.1. Methodologies and research context

A questionnaire was created to collect general demographic information about participants, including their educational experiences with English, the extent to which they felt English was important within their research area, self-assessment of their own English proficiency in professional situations, and attitudes toward the use of English in science and their positions as NNES scholars (see Appendix A). The focus group interviews (FGIs) were used to probe specific questions in more detail within a small-group setting (see Appendix B). While one-on-one interviews may have allowed for a more in-depth understanding of individuals' views, FGIs have the advantage of allowing multiple discussants to hear one another's ideas and therefore build upon those ideas.

The questionnaire was completed voluntarily by 45 international graduate students. Twenty-two of these students were enrolled in three sections of a class teaching oral English for international teaching assistants. This course was required for potential international teaching assistants (ITAs) who had not passed an oral English proficiency exam required by the university. The other 23 students were enrolled in 3 sections of a class teaching written English for ESL graduate students (see Table 1). Students were generally recommended or required by their academic advisors to take this course. The length of time that the students had been in the U.S. varied from eight months to seven years, with an average of two years. The numbers of master's and doctoral students were nearly equal. Although one would expect these two sub-populations to differ in their experiences and responses, such differences were rarely evident; places where the populations' responses were distinct are noted in the subsequent discussion. After being piloted by a small group of respondents, the questionnaires were distributed at the end each of the classes; students were provided information about the study and asked to complete the questionnaire voluntarily. All students who were present completed and submitted the questionnaire.

The FGIs were conducted with one group of participants enrolled in an oral English course and one group of participants enrolled in a written English course. These participants were familiar with one another as they had been classmates for 12 to 15 weeks at the time of the FGI. Details regarding the focus group participants are found in Table 2. At the beginning of the FGI, the purpose of the study was described to participants and they were given a written copy of the questions that would be discussed.

Table 1
Demographic information for questionnaire respondents

	#	%		#	%
Home country			*Age*[a]		
South Korea	19	42.2%	21–25	11	24.4%
China	14	31.1	26–30	16	35.6
Taiwan	4	8.9	31–35	11	24.2
Turkey	2	4.4	36–40	2	4.4
Brazil	1	2.2	41–45	2	4.4
Ecuador	1	2.2	*Field of study*		
Germany	1	2.2	Engineering	32	71.1%
India	1	2.2	Science	10	22.2
Japan	1	2.2	Management	1	2.2
Thailand	1	2.2	Interior Design	1	2.2
English class enrolled in			Unknown	1	2.2
Writing	23	51.1%	*Degree program*		
Speaking	22	48.9	Doctorate	25	55.6%
Sex			Masters	19	42.2
Male	35	78%	Unknown	1	2.2
Female	10	22			

[a] Because some respondents chose not to answer this question, $n = 43$ in this category.

Table 2
Demographic information for focus group discussants

Discussant	Home Country	First Language	Field	Degree	Age	Sex
FGI #1						
1	P. R. China	Chinese	Mathematics	PhD	?	male
2	P. R. China	Chinese	Biology	PhD	?	female
3	South Korea	Korean	Engineering	PhD	25	male
4	South Korea	Korea	Science	PhD	26	female
5	South Korea	Korea	Engineering	PhD	29	male
6	South Korea	Korea	Engineering	PhD	35	male
FGI #2						
1	P. R. China	Chinese	Engineering	MS	27	female
2	Germany	German	Technology	MS	31	male
3	India	English	Engineering	PhD	25	male
4	South Korea	Korean	Engineering	MS	33	male
5	South Korea	Korean	Engineering	PhD	41	male
6	Thailand	Thai	Engineering	MS	25	male

This study also aimed to respond to at least three of Pennycook's (2001) four criteria for engaged research in critical applied linguistics: the inclusion of participants' interests, desires, and lives; a focus on the workings of power; and an orientation toward transformative goals. At the same time, I faced an uneasy critical research paradox that Pennycook (1999) has referred to:

> A first step in critical work may therefore be to develop an awareness of the issues...But it is important to consider very carefully what awareness might mean...Work that aims to make people more aware of their own oppression can often be pessimistic and patronizing, especially if it is only a top-down attempt to get people to see how they are oppressed (p. 336).

This research therefore attempted to allow participants the opportunity for self-reflection and information exchange rather than to encourage a type of social transformation that I (and not necessarily they) may favor. I reminded participants that the research audience would be other language professionals and asked for them to consider what they would like this audience to know about their views. When reading and interpreting the participants' responses, I ask readers to keep in mind this context, as well as the positionings created between an American native-English speaking researcher and international graduate students enrolled in an English language course. Finally, in an attempt to create a two-way exchange between these participants and myself, participants and their instructors were all provided with a compilation of the study's data and were invited to provide any additional comments or suggestions.

4. Findings

4.1. Professional activities in English

Questionnaire respondents were asked to compare the number of professional activities they have conducted in English versus other languages. Overall, the questionnaire respondents reported relatively little experience writing in English. Although 37 students had written a bachelor's or master's degree thesis, only 7 of these were written in English. Respondents were also asked to report the number of scientific papers they had written in English or other languages. Doctoral students reported writing slightly more in their first language (L1), while master's students reported writing slightly more in English.

One possible explanation for the difference between the master's and doctoral students' experiences may be that the master's students had relatively little professional experience in general; most of that experience was likely to be conducted in the U.S., in English. On the other hand, nearly all of the doctoral students had received their master's degrees in their home countries before going to the U.S. For many, this meant that much of their previous professional experience had been conducted in their L1. In fact, out of the 25 doctoral students who had written a thesis for a prior degree, only 6 had done so in English. Students' country of origin is also likely to impact their experience writing in English, as illustrated in Fig. 1. While the numbers here are too small to be considered representative, they hint at potential geographical influences on students' uses of and experiences with writing in English.

Respondents were also asked to compare the language of communication at professional conferences they had attended. Twenty-seven respondents reported that they had attended professional conferences; most ($n = 19$) had attended more conferences in non-English languages, and a small number ($n = 3$) had attended the same number of conferences in English and another language. Only six respondents reported having attended more conferences held in English than other languages. Interestingly, all six of these respondents had written English-language master's theses, suggesting that (1) the doctoral students were more likely to have

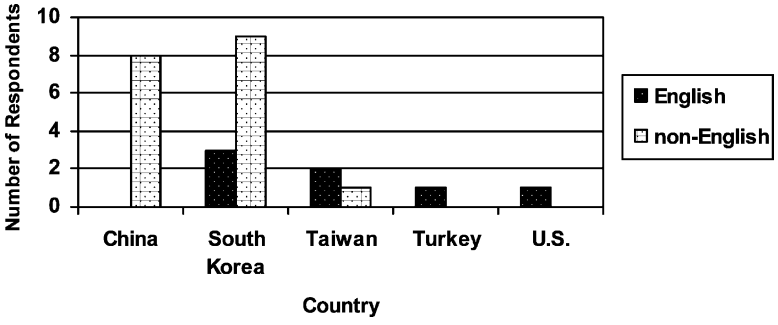

Fig. 1. Language of theses written by doctoral students, by country where thesis was written.

attended English-language conferences, and (2) some students had more overall use of English for professional purposes, and this use may depend to some extent on their country of origin.

4.2. Perceived importance and competence

Questionnaire respondents were asked to rate their perception of the importance of English in their field of study and to rate their own competence of English for professional purposes. The self-assessment rating was not intended to measure linguistic proficiency, but to indicate how respondents assess their English level for others (in this case, for a NES researcher), perhaps providing insight into these respondents' confidence in English.

There was an inverse relationship between the averages for self-assessed level of English competence and importance of English in the respondents' field, as seen in Fig. 2. That is, self- assessment of English tended to be relatively low, but the need for English was relatively high.

Perceived importance of English did not differ between master's students and doctoral students, but did vary somewhat in relation to field of study. Importance of English was rated as *very high* or *essential* for all fields except for students in Statistics ($n = 1$), Electrical Engineering ($n = 1$), Mechanical Engineering ($n = 1$), and Agricultural Engineering ($n = 1$), who rated English as *somewhat important*.

The majority of respondents in engineering fields rated English as *very important*, while the majority of those in science fields rated English as *essential* (see Fig. 3). Their responses suggest a perceived higher importance of English in the theoretical sciences over the applied sciences, in line with Ammon's (1994) claim that English is more dominant in theoretical fields than applied fields.

Overall, 82% of respondents' rated their English as either *weak* or *adequate*. Although respondents came from different populations—those in a required speaking versus writing courses and those master's versus doctoral programs—the self-assessment trends of these groups were very similar. Some difference between male and female respondents, however, is evident in the sample. That is, none of the female respondents rated their English as *strong* or *fluent*, as compared with nearly

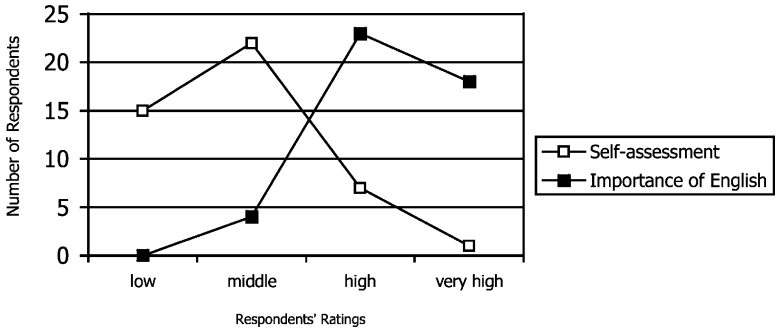

Fig. 2. Self-assessment of English skills and perceived importance of English.

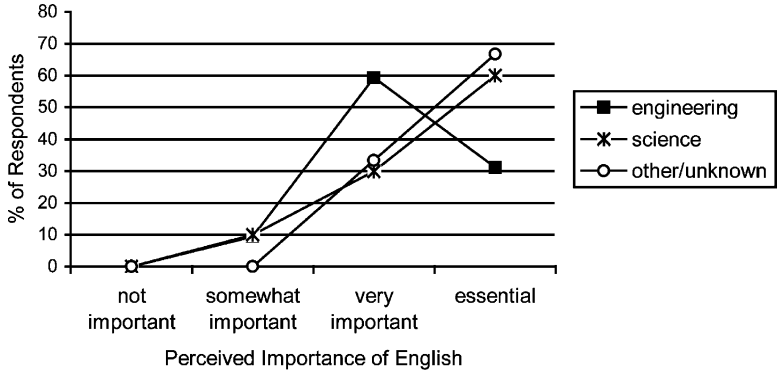

Fig. 3. Perceived importance of English, by field of study.

one-fourth of the male respondents who assessed their English at these levels. Though it is beyond the scope of this study, the trend suggests a need for further research into the positionings of NNES female scholars in scientific fields.

4.3. EILS benefits and drawbacks

Both the questionnaires and FGIs elicited participants' beliefs about the benefits and drawbacks of the predominance of English in scientific communication. Forty-three questionnaire respondents felt that there were benefits to the use of English as a language of science. By far, the most frequently-cited benefits focused on two issues: (1) ease of information sharing and access worldwide, and (2) ease of communication among professionals worldwide. Several respondents added that having a shared language can facilitate scientific progress.

Generally, respondents saw a common language as important, whether or not that language was English; however, a few respondents saw the use of English as particularly beneficial. One respondent wrote that English was a good choice because its grammatical structure is "explicit and objective," and another wrote that English is effective for inputting information into a computer. Others wrote that English was a good choice for a common language in science because it is already widely used.

While nearly all respondents saw benefits in the use of EILS, 36 respondents also felt that there were some negative aspects to EILS. The most commonly-cited drawbacks were (1) the great deal of time spent learning English for non-native speakers, and (2) the difficulties that NNES researchers might face in communication. Many respondents also wrote that research not published in English may be overlooked, that NESs are at an unfair advantage, that professionals who do not speak English are at a great disadvantage, and that miscommunication among researchers can occur. Several respondents referred to a lack of diversity resulting from the use of EILS. Specifically, they referred to the death of other languages, a dominance of English culture, and a reduction in the number of journals. One

respondent wrote that science has become English oriented, giving the U.S. and EU countries more benefits, and another referred to the difficulty in non-Inner Circle countries of finding support for writing and proofreading English documents.

Focus group participants were asked about the geographical aspect of EILS, including the benefits of working in the U.S. or in their home countries after completing their degrees. Both groups repeatedly cited facilities and salaries as primary benefits of remaining in the U.S. (see Table 3).

Participants in FGI #1 tended to focus on personal aspects of returning to their home countries, mentioning the benefits of living in a familiar environment and being closer to family. FGI #2 participants emphasized the benefits of remaining in the U.S. where they would have access to better facilities, resources, and networking with other researchers. Both groups cited more benefits for remaining in the U.S. than returning to their home countries. An exception to this included the views expressed by a participant of German origin, who felt advantaged as a German speaker in Europe. His views suggest a potentially important difference between the experiences and attitudes of European scientists vis-à-vis Asian scientists that warrants further investigation.

4.4. Personal experiences

Both the questionnaire and FGIs asked participants to consider their own personal experiences as EILS users and the ways in which they had felt advantaged and disadvantaged as non-Inner Circle researchers. In the questionnaires, two separate items asked respondents about their personal experiences as researchers from non-English speaking countries (see Appendix A, Section III, questions c and d). One question asked if they had ever felt advantaged when participating in professional activities, and the second asked if they had felt disadvantaged. It was therefore possible for respondents to answer "yes" (or "no") to both questions.

Most respondents ($n = 29$) said that they had "not felt advantaged," and a large number ($n = 24$) also said that they "had felt disadvantaged." Frequently-cited explanations for these two responses included finding it difficult to participate as actively as NESs and being frequently misunderstood by others. Several referred to the frustrations of having good ideas but not knowing how to express them clearly.

Table 3
Benefits of working in the U.S. versus home country

Benefits of remaining in the U.S.	Benefits of returning to home country
Access to facilities and diverse resources	More freedom as a researcher (Germany)
Better funding opportunities	Can expose students to research through English medium (Thailand)
Higher salaries	Personal comfort (Korea, China, Taiwan)
Good opportunities for working with well-known researchers and for networking with researchers worldwide	
Better opportunities for find a job in home country after having worked in the U.S.	

As one respondent wrote, "I already have strong field background and work experiences, but for seminar or group discussion I can't express ideas as good as others who have less knowledge." Spoken interactions—such as discussions, conferences, jokes, or colloquial situations—were commonly-cited areas of difficulty, and many referred to the speed of conversation as posing a particular challenge. Other disadvantages mentioned included writing in English and obtaining teaching assistantships at an American university.

A smaller number of respondents ($n = 13$) felt that they "had felt advantaged" as a researcher from a non-English speaking country, and several ($n = 10$) said that they did "had not felt disadvantaged" professionally. The most commonly-cited advantage of being a NNES researcher was having access to diverse languages and cultures work when reading, using technical terminology, problem-solving, and considering "cultural dimensions". One respondent felt advantaged because "Other people forgive you easily since you have language problem when you didn't express your idea clearly".

Out of the 10 respondents who said that they had "not felt disadvantaged", only 4 supplied explanations. These explanations mostly explained that English did not pose great difficulty for these students. Interestingly, these 10 respondents did not self-assess their English to be particularly high: 2 rated themselves as *strong,* 6 as *adequate*, and 2 as *weak*. One respondent explained that most of the field-specific terminology was already in English, and another explained that ideas were more important than language.

Participants in FGI #2 were given a breakdown of the proportion of different languages found in the *Science Citation Index* in 1998 (~96% English) and were asked how they felt this breakdown influenced them personally and professionally. Several participants saw the positive side of the situation: knowing English meant that they were able to access the vast proportion of scientific articles, and NNES researchers had to learn only one additional language to access most scientific information. Others noted negative aspects EILS's dominance: learning English requires years of study before one can read or study in English, and expressing oneself may be more difficult in a second language. One participant explained the impact of this on his peers in his home country, where access to English-language journals is often difficult. Two participants explained that the overall dominance of English does not accurately reflect the language breakdowns in specific fields. They noted that in their research areas, other languages, such as Korean, Japanese, or German share a significant portion of the published work.

In addition, focus group participants were given four ideological perspectives on EILS and asked where they personally stood in relation to those views. Most of the participants commented on more than one view, in addition to explaining which view(s) they most agreed with. Each perspective—ranging from the most pragmatic view of EILS to a more pluricentric view of multilingualism—was agreed with by at least one participant. Most participants felt disadvantaged compared with NESs, but also felt there was a need for a common language. Although several agreed with a need for change, they cited the difficulties of instituting such a change. Their comments are summarized in Table 4.

Table 4
Participants' comments on four ideological perspectives of EILS

View #1: English provides a common language that allows everyone in scientific fields to communicate equally	• This is the current trend and is the most productive • This is the most effective because if a paper is in Japanese, I can't read it • This allows equal participation for everyone • This is fine at conferences • This has value, but if too much focus is on language, good ideas may be lost • This makes sense because science stems from Europe
View #2: The use of English in science benefits native English speakers, but disadvantages non-native English speakers.	• It's difficult to publish as a non-native speaker; but, we need to learn English • If common language were [my L1], I would have more confidence • Participating in conferences in English is difficult • The situation is unfair, but too hard to change • People are disadvantaged not because of language, but because they are foreigners
View #3: The dominance of English in science has caused a serious power imbalance among scholars, and this imbalance should be changed.	• I agree this situation should change • This is like the situation in France, but it has caused problems • I agree because NNESs are often judged by their linguistic ability and their research is devalued
View #4: Multilingualism should be promoted in science. For example, native English-speaking scientists should speak at least one other language, and journals should publish articles in multiple languages.	• This is the best for non-native English speakers • Because some scientist may not have the opportunity to learn English; learning English takes a lot of time • I agree, but the situation would be difficult for journals • All scientists, especially English-speaking scientists, should speak more than one language; it gives one a better view of what is going on in the world • Every scientist should learn one other language

4.5. Language choice

Finally, the questionnaire respondents were asked what language they would prefer for three professional activities (reading research, writing up research, and attending conferences), given a situation in which any language would be equally used and valued. Respondents were fairly evenly divided between selecting English and their L1 (see Fig. 4); however, there is a slight preference for the L1 when participating in professional conferences. A small number of respondents selected two or more languages for the activities, explaining that they felt equally comfortable in the different languages.

The most frequent reason for selecting English for professional communication was because it is already the most widely used, suggesting that the multilingual scenario of the question was too far out of plausibility for many respondents. Some other, less frequent, reasons for selecting English as the preferred language were that terminology is already in English and that English was the language in

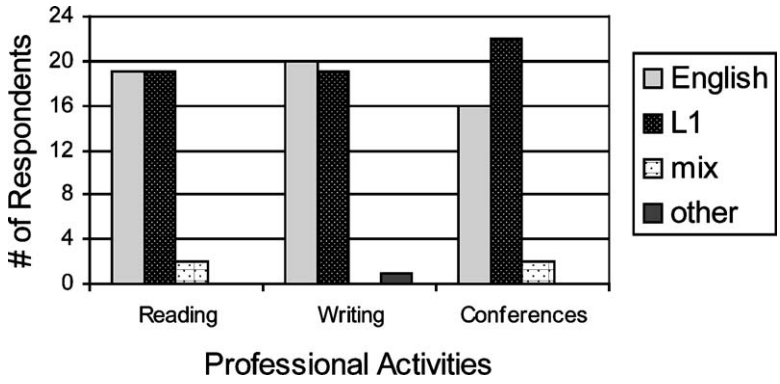

Fig. 4. Preferred language in professional activities.

which the respondent learned the subject matter. The most common reasons for selecting one's L1 were ease of communication and comfort level. Several respondents also noted clarity and accuracy as being reasons for preferring to use their mother tongue. As noted above, there was a slight preference for the first language in conference participation. The reasons given for this choice were having better fluency and comprehension in the L1.

While most respondents preferred the same language for reading, writing, and participating in conferences, 10 of the respondents favored different languages for different activities; these 10 cases provide interesting insights. For example, many of these respondents preferred to read research in English because they felt it was "objective", less ambiguous than their native language, and more accurate than translation. One respondent selected Chinese for reading because it "saves space". Several of these respondents preferred English for writing up research because of its perceived conciseness, clarity, and "strict grammar", and one participant preferred English for its ease in computer entry. One Korean participant preferred Japanese for writing up research because "Japanese researchers are strong in my field".

5. Discussion

The results of this study suggest several ways in which the views of these junior scientists echo the published perspectives described at the start of this paper. First, their greater confidence in reading versus writing or speaking in English parallels published claims that periphery scholars often become primarily consumers of knowledge (Canagarajah, 1996; Duszak, 1997; Kaplan, 1993; cf. Petersen & Shaw, 2002). It seems likely that if these respondents return to their home countries, they may face some of the publishing difficulties of off-networked scholars described in the literature (e.g., Canagarajah, 2002; Flowerdew, 1999a,b, 2000; Gibbs, 1995).

Like respondents in surveys of more senior-level scholars (Jernudd & Baldauf, 1987; Flowerdew, 1999a,b; Medgyes & Kaplan, 1992; Phillipson & Skutnabb-Kangas, 2000), the majority of these respondents shared frustrations related to time spent learning and mastering a second language and the difficulty of communicating clearly in English. The respondents were also aware of the problems of overlooking non-English-language research and of a publication bias that may go beyond language, a claim corroborated by published literature (e.g., Egger et al., 1997; Gregoire, Derderian, & Le Lorier, 1995). In addition, calls for linguistic diversity (e.g., Phillipson & Skutnabb-Kangas, 2000) were echoed by respondents who cited their own multilingualism as an advantage, allowing them to draw on multiple languages in their work and thought processes.

An important disconnect between the respondents' views and those found in published literature concern the views toward change in EILS. While many FGI participants felt that the inequities resulting from EILS should be addressed, they were largely unable to describe specific means for change. Part of this feeling of relative disempowerment may stem from the participants' positions as novices rather than central scholars, who are likely more familiar with mechanisms for change. It may also be that this study provided one of the first fora in which the participants had the opportunity to consider the issue of EILS in terms of change.

It should be noted that this study has attempted only to understand the views of a local population in order to situate those views within larger public discussions of EILS and to provide this population with a space for discussing language-related issues in their professional lives. Several participants did express interest in the issue, especially during and after the FGIs. Future work may conduct similar projects in local contexts in Outer and Expanding Circle countries as well as the Inner Circle. More longitudinal work would also allow for a better understanding of how graduate students' views may change over time as they become more confident in their language and professional abilities and as they increasingly participate more centrally in their professional communities.

6. Pedagogical implications

I began this study wanting to know whether these students viewed English primarily as a neutral *lingua franca* or as a more sinister *Tyrannosaurus rex*. The answer is, of course, not so clear-cut. While the majority see the value of having a *lingua franca* in science, their experiences and attitudes suggest that English is not as neutral for them as such a term would suggest. Most of these students recognized the ways in which the use of English can serve (or has served) to disadvantage certain scholars and their scholarship, and many recognized the danger of English behaving as a linguistic carnivore. As an EAP instructor, I find myself facing one of the "moral dilemmas" about which Johnston (2003) writes: on the one had, I want to recognize the *Tyrannosaurus rex* side of English and do not want to be complicit in maintaining its status quo, but at the same time I want to help my students succeed—in English—within the institutions of academe and industry.

Benesch (2001) outlines one pedagogical approach for addressing this dilemma. Through critical EAP, she addresses the notion of *limit-situations*, a term used by Freire to describe obstacles that people perceive to limit their freedom or ability to achieve their goals. Benesch describes several examples of how critical EAP can offer students opportunities to affect change in their own limit-situations. What I find most persuasive is her insistence that EAP teachers take a continued focus on "needs" (in the traditional EAP sense), but "reserve a second eye for changes that might bring about better conditions in academic life, in workplaces, and in the societies in which they teach and live" (Benesch, 2001: 137).

While Benesch offers several examples of this approach in undergraduate classes, few models have been described at the graduate level. Swales and Feak's (2000) textbook *English in Today's Research World* broaches the issue by presenting some graphs illustrating publication bias, but these statistics rarely surprise most international students. Beyond confronting students with facts about English's dominance, classroom tasks can involve students in learning more about the sociopolitics of their disciplinary/professional communities in terms of the production, reception, and distribution of scholarship, as well as mechanisms for change.

EAP classrooms can address the social and political factors that influence the way texts are produced and received in an international community. One's language status may, for example, lead instructors and peers to respond to them differently or may inhibit their participation in group discussions (Prior, 1991; Shaw, 1991), thereby reducing their social contact with professional communities and impeding academic success (Dong, 1996; Johns & Swales, 2002). Students in speaking-focused EAP classes can monitor their social interactions over the space of a week or month, recording the types of interactions in which they are engaged, with whom, and through what language. More importantly, they may consider the types of interactions they find themselves *avoiding*, exploring the implications of such avoidance. Beginning a writing class by reading short autobiographies of NNES scholars (such as those in Belcher & Connor, 2001) can offer a foundation for discussing some of the social and political influences on writers and readers. Students can also be encouraged to reflect on the ways in which their multilingualism benefits them in scholarly endeavors, considering the different sources of information and perspectives to which they have access. Focusing on students' multilingual resources can serve to counter the common perception of deficit that EAP classrooms may be prone to.

Classrooms may also include space for considering the social and political factors that influence the distribution of texts, such as the gatekeeping practices that surround different academic and professional genres. They can consider the implications of a non-blind review process, or identify the demographic make-up of a well-known journal's editorial board or its authors. In addition, activities may address the mechanisms for change within different professional domains. Some students, for example, may be interested in the power structures of workplace institutions, such as the hiring and training practices of large companies with regards to language. A classroom assignment such as a résumé could be paired with an inves-

tigation of a target company's language policies, including who implements them and how; students may also locate information about the ethnic or linguistic backgrounds of the company's workforce at various levels in the hierarchy, building knowledge of the sociopolitical nature of a seemingly neutral writing activity.

Through activities like these, instructors can allow space for students to consider the impact of EILS on scientific work and on their individual lives, and they can encourage students to take advantage of their multilingualism, viewing it as an asset rather than a liability. None of the ideas here aim to directly challenge institutional and linguistic power structures, but instead offer a small attempt at countering a "vulgar pragmatism" of EAP instruction that overlooks (and reinforces) the inequities that learners face. Classes which provide such opportunities offer students an additional "service" because they overtly address the multiple roles of English and the often invisible influences that greatly impact individuals' participation and success in their scientific pursuits.

Appendix A. Questionnaire

I. Demographic Information
Home country
Other countries lived in
First language
Other languages
Age
Sex
Years of formal English instruction:
Length of time in the U.S.
Length of time at University X

II. Professional Background
Field of study
Degree (circle one): master's doctorateother
Approximately how many scientific papers* have you written in English? in another language? (**include any work written in school, the workplace, or professional activities*)
Have you written a thesis for your bachelor's degree or master's degree? If Yes, in what language? In what country?
How important is English within your field? Circle the most appropriate answer. (NOT IMPORTANT, SOMEWHAT IMPORTANT, VERY IMPORTANT, ESSENTIAL)
In general, how would you describe your English competence for professional activities*? Circle the most appropriate answer. (WEAK, ADEQUATE, STRONG, FLUENT) (**Professional activities* are those activities that are related to your professional work. This may include, for example, coursework, research, reading research, writing professional papers, communicating with

others in your field, attending professional conferences, etc.)
How many professional conferences have you attended conducted mainly in English? in another language?

III. Language and Scientific Communication
English has become the primary language of communication in scientific fields. In your own view, what are the *benefits* of this situation, if any?
What are the *negative aspects* of this situation, if any?
As a researcher from a non-English speaking country, do you ever feel that you are at a *disadvantage* when participating in professional activities? Explain and/or give an example.
As a researcher from a non-English speaking country, do you ever feel that you are at an *advantage* when participating in professional activities? Explain and/or give an example.
Imagine that all languages were equally valued and used in international scientific communication. If you were given a choice, in what language would you prefer to conduct the following professional activities?
Activity Preferred Language Why?
Reading research
Writing up research
Attending conferences

Appendix B. Focus group interview questions

Questions

- When you complete your degree, some of you may stay in the U.S. and others may return to your home country. Professionally, what are some benefits to remaining in the U.S.? to returning home?
- According to a recent study, about 95.5% of the articles listed in the *1998 Science Citation Index* were written in English. The other 4.5% were written in French (~1%), German (~1%), Russian (~1%), or all other languages (~1%). How does this situation influence you and your scholarship?
- The following viewpoints have all been expressed by scholars in language policy and planning. Which of them do you most agree with and why? (If you disagree with all of them, explain your view).

a. English provides a common language that allows everyone in scientific fields to communicate equally.
b. The use of English in science benefits native English speakers, but disadvantages non-native English speakers.
c. The dominance of English in science has caused a serious power imbalance among scholars, and this imbalance should be changed.
d. Multilingualism should be promoted in science. For example, native English-

speaking scientists should speak at least one other language, and journals should publish articles in multiple languages.

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