A Two-way Mirror: Reflections of Learners and Teachers on Language Skills for Science Undergraduates

Fong Yoke Sim, Ho Poh Wai, & Judith Lindley

This paper reports a needs analysis conducted by three CELC lecturers to investigate the language skills Science Faculty staff and students consider essential and to explore the question of collaboration between Science and Language staff to teach subject-specific language skills. Science academic staff members reflected their views on a questionnaire designed for this needs assessment while students responded on a slightly adapted one. The results indicate that both teachers and learners are more concerned that undergraduates acquire general language skills and a sound foundation in grammar and vocabulary than master the subject-specific skills of reading scientific literature and using scientific writing conventions. Collaboration between Language and Science teachers is seen as desirable by about half the staff and student respondents, but this aspect requires further research for more conclusive results. The authors recommend that similar needs analyses be conducted in other NUS faculties to enhance both syllabus design and pedagogy of our language modules.

INTRODUCTION

Background

Among the many challenges facing the language teacher, the issue of students' needs is one of the most important. What kind of language skills do the students need? Do students reading specialised disciplines at tertiary level, such as the undergraduates at the National University of Singapore, require subject-specific language skills and materials to manage their majors more effectively? In terms of perception, do lecturers and students concur in what they consider essential language skills and relevant materials? Is collaboration between subject and language lecturers necessary and desirable to meet students' language needs?

The Centre for English Language Communication (CELC) offers over 20 modules to almost all the faculties and schools in NUS. Over the years, a number of needs analyses have been conducted by lecturers at CELC, and its predecessor, the English Language Proficiency Unit. Three are cited below.

Hurley (1990) surveyed 47 Faculty of Arts and Social Sciences academic staff and interviewed 18 of them on what Arts students need to do in their majors and what areas should be focused on in a Level One English Proficiency (EP) course. Course materials were also collected for analysis. The results indicated that the Arts EP course "should emphasise skills which assure that students can demonstrate their mastery of course content effectively in writing, as well as manipulating that content in different ways, as called for in different types of tasks" (Hurley, 1990: 19). Furthermore, course materials and assignments should teach students to respond appropriately to prompts and intelligently to texts and arguments. When assessing student writing, the respondents ranked clarity, relevance, essay organisation and coherence higher than grammar, vocabulary and getting the interest of the reader.

A survey of practising engineers registered in the 1988 *Gazette of Professional Engineers* was carried out by Estad and Ferryman, who taught a technical communication course in the Faculty of Engineering. The 359 respondents gave extensive feedback on the adequacy of the English and communication skills of local engineering graduates to the tasks they performed in professional settings. The findings pointed to the need for more oral and written communication training for local engineering students. The need to communicate clearly in speaking and writing, with a full awareness of the audience and to use accepted formats was also emphasised. In contrast, grammatical accuracy was not a primary concern (Estad & Ferryman 1990).

More recently, a needs assessment was also conducted at the Faculty of Science by Lindley (1993) and the team teaching the Level Two EP course. This analysis reported the responses of Science Faculty academic staff on the essential language skills for their students. The Science lecturers considered it most important for students to be able to read lecturers' prepared notes after the

lectures. On the other hand, being able to read scientific literature did not rank as very important until undergraduates become candidates for the honours degree. The ability to take good notes of lectures was rated more highly than the ability to submit good written work. As for oral skills, asking questions after lectures and asking lecture-related questions in tutorials were rated as important strategies for lecture comprehension. During tutorials, it appeared that students engaged in vigorous exchange with tutors but were seldom called upon to display oral skills necessary for giving a talk or presenting a paper (Lindley, 1993).

Rationale and objectives

These findings of the 1993 Assessment reflecting staff perceptions have since contributed to the design and teaching of language proficiency modules to meet the needs of Science Faculty students. However, in recent years, with the steady increase in the number of international students admitted to NUS and hence the development of a multi-cultural ESL/EFL setting in the institution, as well as the offer of cross-faculty modules, it is postulated that the language needs of the Science student population have shifted.

Thus, to obtain a clearer profile of current Science Faculty language requirements, the authors of this paper deem it necessary to gather Science students' responses on the subject as well as those of academic staff in a new needs analysis.

The objectives of this present paper are to identify the language skills and requirements for Science Faculty, and to explore how the teaching of science and the teaching of language could be made more compatible. It is hoped that the findings of this paper would also be useful for the design and teaching of language modules in NUS.

Needs analysis

The importance of needs analysis in curriculum design and language teaching has been emphasised by many authors (Yalden, 1987; Graves, 2000; Richards, 2001). Richards states that "one of the basic assumptions of curriculum development is that a sound educational programme should be based on an analysis of learners'

needs" (Richards, 2001: 51). What exactly is needs analysis? What are some related issues? This section will give a brief overview of needs analysis to provide a perspective to the present study.

For a comprehensive yet succinct definition of needs analysis, also known as needs assessment, the following one by Graves (2000: 98) is adopted for this paper. "Essentially, needs assessment is a systematic and ongoing process of gathering information about students' needs and preferences, interpreting the information, and then making course decisions based on the interpretation in order to meet the needs."

Historically, needs analysis, as a distinct and essential step in the systems approach to curriculum development, was introduced into language teaching via the English for Specific Purposes (ESP) movement in the 1960s. An ESP approach begins with an analysis of the learner's needs (Richards, 2001). By the 1980s, "a needs-based philosophy" became prevalent in language teaching, particularly in ESP and vocationally oriented programme design (Brindley, 1984, cited in Richards, 2001).

During its early days, "the most sophisticated application of needs analysis to language syllabus design is to be found in the work of John Munby (1978)" (Nunan, 1988: 19). Munby's model "was welcomed as a systematic and objective set of processes for arriving at a specification of student needs and selecting language to match them" (Richards, 2001: 35). However, the Munby approach has since been criticised for being too mechanistic, narrow and arbitrary (Nunan, 1988; Richards, 2001). As a result of such criticisms of early needs analysis work, there has been a movement towards greater emphasis on obtaining and applying more subjective information in syllabus design (Nunan, 1988).

So what "more subjective" information do we gather? Yalden (1987) mentions *background information* on educational level, language learning experience, and current proficiency in the target language; *language needs* with reference to purpose of the course, situations of use and a breakdown of topics and language skills; *learning styles and preferences*. Graves (2000: 102) lists both present and future information:

The present:

1. Who the learners are
2. The learners' level of language proficiency
3. The learners' level of intercultural competence
4. Their interests
5. Their learning preferences
6. Their attitudes

The future:

7. The learners' [or others involved] goals and expectations
8. The target contexts: situations, roles, topics, and content
9. Types of communicative skills they will need and tasks they will perform
10. Language modalities they will use

When does one conduct needs analysis? The timing of needs analysis can vary from one course to another. It can take place before, during or after a language programme (Richards, 2001). The methodology of needs analysis includes many instruments for obtaining data: observation, interviews, questionnaires, discussion and negotiation (Yalden, 1987). Questionnaires are among the most commonly employed instruments due to their ease of administration. However, the information obtained "may be fairly superficial or imprecise and will often need follow-up to gain a fuller understanding of what respondents intend" (Richards, 2001: 60).

What are some problems relating to needs analysis? An important consideration is the different interpretations of *needs* by the different *stakeholders* (learners, teachers, parents, employers, etc.) who have different interests and values (Richards, 2001). Graves (2000) indicates that the process of needs analysis involves the reconciliation of competing views among learners, teachers, institutions and even the community, on what needs to be learned. Brindley (1989, cited in Richards, 2001) discusses the divergence between learners' and teachers' views of needs and proposes that the two groups negotiate with each other to satisfy and clarify assumptions.

Finally, after the data has been analysed and tabulated, how do we apply the results? Richards claims that "there is no direct application of the information obtained from needs analysis" (Richards, 2001: 65). Citing a study by Gravett, Richards and Lewis

(1997) on language difficulties faced by ESL students at the University of Auckland, Richards (2001) shows the results: a list of difficulties which respondents experienced with speaking and listening skills (Gravett, Richards & Lewis, 1997: 36, cited in Richards, 2001: 65):

1. large-group discussions
2. class discussions
3. interactions with native speakers
4. out-of-class projects
5. small-group work
6. demonstrator interactions
7. class participation

Richards argues that the above results give little direct information about the exact type of difficulties faced by the learners in each event. The information obtained "has to be subjected to a great deal of interpretation before it can be usefully applied in programme planning" (Richards, 2001: 65). However, though there is no direct route from needs analysis to application, after interpretation, the results can be helpful in the following ways (Richards, 2001: 67):

- It may provide the basis for the evaluation of an existing programme or a component of a programme.
- It may provide the basis for planning goals and objectives for a future programme.
- It may assist with developing tests and other assessment procedures.
- It can help with the selection of appropriate teaching methods in a programme.
- It may provide the basis for developing a syllabus and teaching materials for a course.
- It may provide information that can be used as part of a course or programme report to an external body or organisation.

However, some authors have reported at least partial application of needs analysis results. One recent example, Patterson (2001), conducted a needs analysis of the target situation of a functioning English for Academic Purposes (EAP) programme and concluded that note-taking was a low-frequency and low-problem skill. Lecture notes were made available prior to a lecture so that

students did not have to take down copious notes. On the other hand, it was observed that speaking presented problems for students during tutorials. As a result of these findings, the EAP course has been adapted, among other things, to give more curriculum time to the aural-oral component and none to note-taking.

METHODOLOGY

A questionnaire was designed to collect data from Science Faculty academic staff and then adapted for students (see Appendix 1). The two surveys were conducted in Academic Year 1999/2000. This is in line with the "triangular approach" advocated by authors like Richards (2001) and Graves (2000) "since any one source of information is likely to be incomplete or partial" (Richards, 2001: 59).

In all, a sample of 120 Science undergraduates reading 20 different majors took part while 60 faculty members, who taught one or more levels (from first year to postgraduate classes), responded. The student respondents comprised both local and international students but, for the purposes of this study, no distinction was made in the analysis of the data obtained.

RESULTS

Language skills required

Table 1 shows a comparison of the responses of Science lecturers and students to the question of what language skills are required by students.

In order to have a yardstick for comparison of the results, it was decided arbitrarily that skills with a majority of 50% or more for the responses "regularly" and "often" are interpreted as the "most important". Those with 40 - 49% are classified as "important". The definitions for "regularly" and "often" are extracted from the *Longman Dictionary of Contemporary English.* The former carries the meaning of "happening every time or at (more or less) same-length intervals" while the latter means "many times though not necessarily at regular intervals". Table 1 indicates that there are different perceptions between Science lecturers and

students as to which language skills are most important or important for Science undergraduates.

Table 1. Comparison between lecturers' and students' perceptions of language skills required

Language Skills Required	1 regularly		2 often	
	staff	students	staff	students
1. Listen for and identify main and supplementary points	75%	33%	13%	41%
2. Explain or discuss answers	52%	19%	27%	58%
3. Present or defend viewpoints	40%	14%	22%	38%
4. Present findings of projects	32%	14%	20%	37%
5. Participate in seminars	23%	3%	10%	13%
6. Take notes of oral explanations	58%	23%	23%	29%
7. Take notes from OHT or screen	47%	30%	23%	33%
8. Write essay answers to tutorial or examination questions	32%	22%	20%	29%
9. Write laboratory or other reports	45%	36%	20%	23%
10. Write abstracts/references	13%	36%	12%	21%
11. Write other documents (specify): (a) international papers (b) IA final report	10%	2%	2%	8%
12. Verbally interpret data presented in graphic form			22%	34%
13. Other language skills (specify)? (a) lab reports and tutorial discussion are crucial (b) write proper English	2%	3%	0%	3%

For the lecturers, they are, in descending order:

Most important

- Listen for and identify main and supplementary points
- Take notes of oral explanations
- Explain or discuss answers

Important

- Take notes from OHT or screen
- Write laboratory or other reports
- Present or defend viewpoints

For the students, they are, in descending order:

Most important

- Explain or discuss answers

Important

- Listen for and identify main and supplementary points

The results indicate that the lecturers expect students to possess many more language skills than the students themselves think are necessary or important. The majority of students see themselves as requiring only two aural-oral skills. From informal interviews with the students, it was learnt that many lecturers gave handouts, so students did not feel it was necessary to take notes.

In their individual comments on the survey forms, a small number of students included various requests that reflect their perceived present and future language needs:

- Have more interactive sessions.
- More presentations relevant to the working world.
- Maybe more should be touched on business communication skill.
- Point out students' Grammar Errors more frequently in the class!
- Reduce the no. of students in each class (less than 10).
- The module should do more on grammar and vocabulary.

Lecturers' comments, on the other hand, reflected their opinion that students need to develop a better grasp of general reading, writing, speaking skills, as well as grammar and vocabulary:

- Students have a narrow vocabulary and comprehension skills are not well developed. They need more time to read an article before comprehending it. Speed reading will be useful to students as well as widening of their vocabulary.
- Examination answers show that some students have problems communicating concepts in written form -- some thoughts not clearly organised or fleshed out.
- Many students have trouble putting together a grammatically complete sentence. However, it's

probably too late to do much about this; it should have been done earlier. The train has left without them.

- The main problem I have is that they can't write projects (Honours projects, UROPS projects, etc). I don't care about whether they can write grammatically correct English, but the problem is that they can't present things (both orally and in written form) that makes it easy for their peers.
- Inability to express oneself is a common problem.
- The majority of our Science students speak and/or write very bad English.

Subject-specific skills and materials

To determine how important subject-specific language skills are to Science students and whether it is necessary to develop subject-specific language learning materials for them, both groups of respondents were asked questions relating to the reading of scientific journals and instruction in scientific writing.

Most students do not think they are required or encouraged to read scientific journals (53% answered "No"). Lecturers' responses also indicate that reading of scientific literature is meant for students in Honours year and above (30% indicated it is for Level 4 and 28% for postgraduate students).

When asked to cite journals that students are required or encouraged to read, students listed 30 journals while lecturers named 90. Only seven titles in the two lists matched:

- *Journal of Organic Chemistry*
- *Semiconductor*
- *Nature*
- *Science*
- *Cell*
- *Chemical and Engineering News*
- *Journal of Physical Chemistry*

The ability to read scientific literature, therefore, does not seem to be emphasised. There was, however, one proponent for students to be taught the reading of scientific literature:

- Students should be encouraged to overcome the fear of reading literature. They can be taught and guided by examples in a lecture or tutorial. Staff (either Lecturer or TA) should give the students a list of reading materials e.g., journals, and allow students time to procure them, read through, and come for discussions. Very importantly, staff should introduce websites to students to give them new avenues of literature search and updates. Also, importantly, follow up must be given to students so that they can become encouraged to independent search and learning through such initiatives. Students can be encouraged to give feedback to staff, on any new web searches that they may have come up with, and therefore, strike a two-way teaching-learning for both staff and students.

On the teaching of scientific writing, only a few lecturers put forward suggestions:

- A module on scientific writing for all science students to be designed jointly by language specialists and science specialists and taught thereafter by science staff.
- A series of workshops on scientific writing for students team-taught by science and language staff.
- Perhaps students can be given scientific papers to discuss to enhance their language skills in science. These papers depend on their specialisation. What needs to be done now is to teach them the conventions of scientific writing.

There is one dissenting voice, however:

- Teaching the student to read and refer to scientific literature is not the problem. We have been doing this for since the last at least 10 years. Our students are so pampered and spoon-fed that most of them do not even refer to their textbooks!

As to who should be responsible for teaching students to read and refer in writing to scientific literature, there is concurrence here between students (60%) and lecturers (53%) that both Science and Language lecturers should be responsible.

PEDAGOGICAL AND RESEARCH IMPLICATIONS

Language skills required

The results suggest that NUS Science lecturers think that undergraduates do not as yet possess the necessary language skills to manage their majors while the students themselves think that they do not need many language skills. This finding of divergence between learners and teachers' views on students' language needs concurs with those of Nunan (1988); Brindley (1989, cited in Richards, 2001) and Graves (2000).

According to Nunan, the gap can be bridged by learners and teachers exchanging information "so that the agendas of the teacher and the learner may be more closely aligned." The advantages of such a dialogue are two-fold. "In the first place, information provided by learners can be used to guide the selection of content and learning activities. Secondly, by providing learners with detailed information on goals, objectives, and learning activities, learners may come to have a greater appreciation and acceptance of the learning experience they are undertaking or about to undertake. It may be that learners...have not been informed in any meaningful way what the teacher's goals are" (Nunan, 1988: 80).

Thus, it would be useful, at the beginning of a tertiary level course, for the lecturer and students to discuss the language skills each side considers necessary to follow the course effectively. Both the subject and language lecturers can thus help students realise the inadequacy of depending on a few language skills and the need to be proactive in acquiring a bigger repertoire.

Furthermore, an element of "formative assessment" may be added to the discussion. In its simplest form, a formative assessment by students and teachers would allow negotiation of writing/reading topics. In other words, there would be a range of topic choices, or alternatively, there might be broadly defined topics which students would then be expected to limit and refine together with peers and teachers. The syllabus and materials would need to be structured in such a way that students can set their own language agendas within a framework which meets the objectives determined by the staff. Realistic planning would also consider those students

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whose main or only agenda item is minimal engagement with their language course.

Based on the academic staff's feedback on the gap between the students' standard of English and what is expected of them, as well as the students' comments, Science EP and EAP course materials should aim to develop students' language skills, particularly in:

- grammar
- vocabulary
- reading comprehension
- writing skills
- presentation skills
- organisation and development of examination answers
- business communication skills

In addition, some undergraduates also expressed their preference for certain pedagogical approaches which language lecturers can take into consideration in lesson planning:

- small groups
- interactive lessons
- grammar correction by teacher

Subject-specific skills and materials

The findings of this study suggest that the majority of both faculty and student respondents do not see the ability to read scientific literature as essential for Science undergraduates. Nonetheless, the Science lecturers who deem the skill important can introduce the relevant journals and websites to students at the beginning of their modules and communicate their recommendations to Language lecturers who, in turn, can give follow-up attention in their EP and EAP modules. For example, after the authors had analysed the results of this study, students were assigned to select an article from a scientific journal for a vocabulary presentation task. Students learnt to summarise the contents before presenting new vocabulary from the article. This kind of support is aimed at helping students acquire the skills of reading scientific literature.

Research on the topic of collaboration between English teachers and subject teachers points to both advantages and disadvantages. Selinker believes that Language teachers "must seriously deal with procedures for talking to colleagues in subject disciplines" to achieve "an enviable two-way interaction between subject matter/content courses and language courses" (Selinker, 1988: 35). However, he acknowledges that the actual procedure of working with an informant is "tricky" (1988: 37). First, there is the problem of how to approach a Subject Specialist Informant (SSI) after identifying a good one. Selinker advocates that "the best approach" is through "a mutually respected third party who knows what Language for Specific Purposes (LSP) people are doing and its potential importance to the informant" (Selinker, 1988: 38). Secondly, the Language teacher has to prepare carefully for informant sessions so as to gain the desired information while minimising the possibility of SSI or question-type bias. Lastly, the Language researcher-teacher must establish a long-term relationship with the SSI as the information gathering can go on for months (Selinker, 1988).

Also in favour of collaboration is Balarbar (1995) who reported on her consultations with the engineering faculty members of De La Salle University in Manila in the process of writing and revising an ESP text for engineering students. At the outset, Balarbar and Carreon-Houlahan "decided to confine the consultations to a minimum, i.e., to the needs analysis stage of syllabus design" through interviews (1995: 151). One faculty member also provided samples of students' technical reports. The first edition of the text proved too technical and specialised, for both students and language teachers. Balarbar postulated that the weakness could have resulted from how teamwork with the subject specialists was managed. Subsequently, her team solicited feedback from other teachers who had used their text. They then decided to consult the subject specialists more closely such that the latter were involved in designing some activities and suggesting skill areas to be included. In conclusion, Balarbar reiterated that in such collaboration, the language teacher should define the degree of involvement and types of contributions of the subject specialists as "successful ESP materials should be language-based rather than content-based and created by language teachers in close consultation with subject teachers" (1995: 156).

A less sanguine view on collaboration is given by Spack (1998) who details the problems as follows. First, it is difficult for a writing programme to have a carefully planned pedagogical or rhetorical rationale when it depends on another content course. Secondly, English teachers, even when they collaborate with content teachers, often find themselves in the awkward position of knowing less about the subject than their students. Students, on the other hand, may resent a situation in which their English tutors cannot fully explain or answer questions about the content of the assignment (Spack, 1998).

These difficulties are compounded when we consider the fact that every discipline has its own subdisciplines, each with its own conventions. Furthermore, no discipline is static and the principles of reasoning in a discipline may evolve over time (Spack, 1998). Spack further argues that,

> Even studying a finished product – whether well-written or not – cannot prepare English teachers to teach students how writers in other disciplines write. A written product such as a scientific report is merely a representation of a research process, which is finally summarised for peers; it is not a representation of a writing process....To learn to write in any discipline, students must become immersed in the subject matter; this is accomplished through reading, lectures, seminars, and so on....They will learn most efficiently from teachers who have a solid grounding in the subject matter and who have been through the process themselves.
>
> (Spack, 1998: 95)

More research on collaboration in teaching discipline-specific writing skills may have to be conducted before further conclusions can be drawn. However, where collaboration is deemed necessary or desirable in any institution, a modest beginning can be made with the following conditions:

- interested staff from both sides willing and able to work together
- long-term planning based on concrete and achievable objectives
- input from both students and teachers via needs analyses

- piloting by the working committee members themselves

However, in practical terms, collaboration between Science and Language lecturers to teach undergraduates the conventions of scientific writing will have to be worked out within the considerations of teaching and administrative demands on both sides and timetabling constraints.

Meanwhile, Language teachers can give informal help when their students bring discipline-specific writing to them for vetting from time to time. Such instances provide opportunities to communicate with the subject teachers through the medium of the students' work, for example, a project report. The Language teachers can forward their comments to the subject teachers supervising the project as a courtesy and as an assurance that coherent direction will be given to the students.

On the topic of subject-specific materials, it may be impractical to develop EP and EAP materials based on scientific literature *alone* for NUS Science students as they come from a wide spectrum of specialties. The 120 students in this study read 20 different majors. The literature for each discipline will also have its own unique style and emphasis.

However, a possible way of making the inclusion of *some* scientific literature in the EP and EAP modules meaningful is for Science lecturers to recommend journals which are central and interdisciplinary. These should be accessible scientific literature that carries over across diverse science cultures. Possible candidates include *Science, Nature, The Sciences* and *Discover*. In addition, students could be asked to bring forward specific material for study and discussion if the students are to be helped with the difficulties they actually face.

Finally, a word on methodology. This needs analysis employed two questionnaires in order to gather data from two fairly large samples of respondents but could not confirm the results with the use of other instruments due to time constraints. For future studies, it will be ideal to follow up questionnaire surveys with interviews and/or observations so as to obtain richer and more accurate information.

CONCLUSION

This study sets out to investigate the language skills NUS Science Faculty undergraduates need and the possibility of collaboration between Science and Language staff to help these students acquire the skills. The results indicate that most Science staff and students see the undergraduates as needing the more general skills of listening, reading, speaking and writing, as well as a grounding in grammar and vocabulary, rather than subject-specific skills. Collaboration is considered desirable but needs to be further studied as a preliminary search of the literature points to many drawbacks.

Though this paper reports the findings for students in a specific faculty of a specific institution, the authors believe that the study can be replicated in similar settings in other faculties or institutions. Future research can also focus on the language needs of postgraduates or compare those between local and international students. It is hoped that such studies would serve to enhance the planning and teaching of language modules in NUS and other tertiary institutions.

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Appendix 1. The questionnaire

LANGUAGE SKILLS FOR SCIENCE FACULTY STUDENTS SURVEY

STAFF QUESTIONNAIRE

I. Please circle the level(s) of the modules you teach:

1000 2000 3000 4000 Post-grad

How often are specific language skills required of students reading your modules? The grid below lists such skills. Please fill it according to the descriptive scale below. A tick ✔ in the cell under the numbers below means that the skill is:

1 – regularly
2 – often
3 – occasionally
4 – rarely
5 – the skill is not relevant

You may make as many copies of the grid as you need (one extra copy is attached.). Mark the grid with the module number or modular level (1000, 2000, etc.) it describes. MODULE/LEVEL_____

Please put a tick √ in the appropriate cell: **Language Skills Required**	**1**	**2**	**3**	**4**	**5**
1. Listen for and identify main and supplementary points					
2. Explain or discuss answers					
3. Present or defend viewpoints					
4. Present findings of projects					
5. Participate in seminars					
6. Take notes of oral explanations					
7. Take notes from OHT or screen					
8. Write essay answers to tutorial or examination questions					
9. Write laboratory or other reports					
10. Write abstracts/reference lists					

Please put a tick √ in the appropriate cell: Language Skills Required	1	2	3	4	5
11. Write other documents. Please specify: (a) (b)					
12. Verbally interpret data presented in graphic form.					
13. Other language skills? Please specify: (a) (b)					

II. At what levels are students required or encouraged to read professional scientific literature? Please tick all the levels that apply:

1000 _____ 2000 _____ 3000 _____ 4000 _____

Post-grad _____

III. Please name the major scientific journals that students are required or encouraged to read.

1. _____

2. _____

3. _____

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IV. Who do you think is responsible to teach science students how to read and refer appropriately in writing to scientific literature? Please tick only one choice:

1. The lecturer/tutor specialising in the discipline ___
2. The lecturer/tutor specialising in language and communication ___
3. Both of the above. ___

V. Do you have any suggestions to enhance the current language and communication programme for Science undergraduates/postgraduates? (You may also wish simply to point out problems relating to the students' language skills.) Please write your comments in the space below, or feel free to call one of us for discussion. **Our names, email addresses and contact numbers are given below.**

Thank you very much for your time and contribution.

Fong Yoke Sim ext 3883 elcfys@nus.edu.sg
Ho Poh Wai ext 3349 elchopw@nus.edu.sg
Judith Lindley ext 3875 elclindl@nus.edu.sg