Do EAP Teachers Require Knowledge of Their Students' Specialist Academic Subjects?

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To what extent do EAP trainers require a specialized knowledge of the academic subjects their students wish to pursue at tertiary level? This paper describes the English Language Training component of the Inter-University Centers project at Bogor Agricultural University and Bandung Institute of Technology in Indonesia in 1995 and 1996. This development project, entitled 'Biodiversity for Biotechnology', was supported by the British Council and Overseas Development Administration. The program consisted of content-based English Language and study skills training in the field of Biotechnology. Analysis of a number of critical incidents that occurred during the training leads to a discussion of the importanceof subject-content knowledge in EAP.

Introduction

The aim of this paper is to explore the issue of how much, if any, subject content knowledge is required for EAP (English for Academic Purposes) teachers to successfully prepare their learners for academic study at tertiary level.It will begin by considering the research evidence for the effectiveness of subject content-based [1] courses, and then proceed to describe two EAP programs given at Universities in Indonesia. Selected aspects of this training will be analyzed, leading to suggested answers to the following two key questions:

1. What level of subject content knowledge is necessary to train students preparing to enter undergraduate (i.e. first degree programs) in Biological Sciences?
2. What level of subject content knowledge is necessary to train students preparing to enter postgraduate (i.e. higher degree programs) in Biological Sciences?

Let us first consider the rationale for asking these questions. In traditional, skill-based [2] EAP courses, it has generally been thought that the trainer does not require specialized academic knowledge of the learners' major subject of study. This is because such training focused on developing language and study skills and not on the academic subject itself. The learners, it is often argued, can deal with complexities of terminology and ambiguities of subject content that may be beyond the trainer's knowledge of the specialist subject. EAP trainers were typically told to exploit queries about subject content, so as to provide opportunities for the students to develop their fluency, produce extended spoken discourse, and effectively share their knowledge of the subject, even if this knowledge goes beyond the trainer's command of the subject. This strategy however, involves a high degree of risk for the trainers, particularly in terms of their credibility with the learners.

The emergence of subject content-based (as opposed to skill-based) EAP courses in the 1980s (c.f. Brinton, Snow & Wesche 1989) raises the issue of which types of skills and knowledge are necessary for EAP trainers to deliver effective and professional courses for ESL/EFL students intending to follow college degree programs in English speaking countries. Krashen (1982:172, 1985:70) identified what he calls a 'transition problem', which refers to a perceived gap in the English Language and study skills abilities of learners who have passed through traditional language classes, and those required for study purposes within universities. He argues that subject content-based courses can impart both subject knowledge and language competence at the same time, and points to evidence from the Canadian immersion programs at the University of Ottawa (Edwards et al, 1984; Wesche 1984).

More recently, the work of Kasper (1994a, 1994b, 1995a, 1995b, 1995c, 1995/96, 1996, 1997) has greatly strengthened the evidence for the effectiveness of content-based courses. She has reported both improved language and content performance among students exposed to content-based EAP programs, higher scores on measures of reading proficiency, and higher pass rates on ESL courses. She also provides quantitative evidence that such students establish and retain a performance advantage over students exposed to non-content based EAP training. Her work also supports the views of Benesch 1988, Guyer & Peterson 1988, and Snow & Brinton 1988, that content-based programs facilitate ESL students' transition to academic mainstream college courses, increasing the likelihood that such students will gain a college degree.

The trend towards content-based EAP training presents a clear challenge to EAP instructors. How much longer will EAP training be done by instructors who may lack specific background knowledge of their learners' specialist academic disciplines? How much longer will the traditional emphasis on training in language and study skills be regarded as adequate in the face of the growing body of persuasive evidence for the effectiveness of subject content-based programs? It may therefore be necessary for EAP trainers to possess a certain level of background knowledge in their students' academic subjects in order to meet this challenge. We shall now examine the delivery of two EAP programs at Indonesian universities to provide evidence for this view.

Biodiversity for Biotechnology: English Language and Study Skills Training

Two distinct EAP programs were provided to students at the Inter-University Centers in Indonesia. The first was held at Bogor Agricultural University in 1995 and the second at Bandung Institute of Technology in 1996. Allstudents were postgraduates at Masters and Doctoral level, courses being divided into classes of twenty participants. A wide range of research interests were represented, covering the following major fields of Biology and Biotechnology:

- Genetic engineering, including gene sequencing
- Microbial facilitation of polymer biosynthesis
- Crop research, including yields and crop storage
- Lipid biosynthesis and related metabolic pathways
- Histology and pathology of the liver
- Microbial action in fermentation
- Enzyme isolation and purification
- Genetic manipulation of bacteria
- Physiology of aquatic mammals
- Plant growth factors

The courses at each of the participating universities involved 160 hours of training (20 hours per week over a two-month period. The participants on each course included Faculty members from the departments of Biotechnology at each institution, and a number of laboratory assistants and technicians also participated. Most of the students were at intermediate level, with a number at pre-intermediate and post-intermediate levels. All were motivated by the desire to learn English for professional and academic purposes.The programs attempted to meet students' expressed needs and interests, which were determined through pre-course needs analysis questionnaires.Two types of program were offered, one directed at the Faculty lecturers and researchers and the other at the laboratory assistants and technicians.

Program for Faculty Lecturers and Researchers

The teaching objectives for the lecturers and researchers included:

- Grammatical and lexical input for biological sciences in specific fields of interest
- Seminar presentation skills to develop students' ability to describe their research
- Listening to lectures and seminars and taking effective notes
- Reading sections of textbooks and published research papers (e.g. abstracts)
- Discussion and interpretation of visual material (graphs, charts, diagrams etc.)
- Writing summaries of texts presented aurally or in written form
- Oral fluency for discussion of themes related to developments in biotechnology
- Self-study component based on individual research completed in the library

The modes of input on the courses varied from lectures, through group work to individual student presentations and self-study assignments based on material selected from Wallace (1980) and Waters & Waters (1995).Language input work utilized concepts common to biological description, such as process, sequence, cause and effect, along with quantity, size, shape and proportion, as detailed in Adamson & Bates (1977). Major blocks of time and attention were devoted to developing participants' reading skills. This work focused on identifying key topics, themes and issues, relating texts to visuals and vice versa, identifying specific content in a text in relation to a pre-set reading purpose, evaluating and criticizing published research, and critical discussion of papers read. The emphasis was firmly on accurate description and interpretation of text and accompanying visual material. Listening skills training focused primarily on listening to, and taking notes on lectures, using a variety of published sources (e.g. Mountford 1977; Pearson 1978; Adkins & Mckean 1983; Yates 1989). Written work concentrated on the writing of scientific abstracts, preparing short summaries of research projects, and editing research papers intended for publication.

Course participants chose research presentation topics early in the course and were given extensive input and practice in the skills required to present their research work orally. Input included how to structure a talk, give an introduction, present methodology, describe results, interpret results and conclude. In the Bogor program in 1995, students gave individual presentations, but because this proved to be very time consuming it was decided to place students in groups for presentation work in the programs held in Bandung. Seminar skills training formed a major component of the courses; students formed groups and presented published research to the whole class. This was followed by discussion and evaluation of the methodology and findings of major researchers working in the students' specific fields of interest. This proved a highly popular component of the training because it engaged students' critical faculties and permitted them to extend their grasp, both of their own fields of interest, and of work going on in related areas. This component was organized around individual and group assignments in the library, followed by open discussion in class.

Program for Laboratory Assistants and Technicians

The courses for laboratory assistants and technicians differed from the above described program because of their different professional and academic needs and their generally lower language proficiency level. These programs had the following objectives:

- Basic oral fluency for speaking with visitors to the laboratories
- Study skills; reading, writing and listening
- Specific lexis for identifying and describing laboratory equipment
- Reading skills for comprehension of laboratory manuals and procedure

These classes received language and skills input sessions in the mornings, followed by laboratory practicals [3] in the afternoons. The innovative laboratory sessions provided students with the opportunity to practice language presented in the input sessions. The 'practicals' involved the learners in realistic everyday activities such as they might perform as a normal part of their jobs as technicians and assistants in the biochemistry, microbiology and genetic engineering laboratories. In these laboratory sessions, course participants were trained to:

- give guided tours of the laboratories for visiting academics
- identify, describe and state the function of pieces of apparatus
- describe specific experiments, their purpose and outcomes
- read, write and interpret laboratory instructions (e.g. for calibrating instruments such as spectrophotometers and ph meters)

The course in English for the Medical Laboratory (Swales & Fanning 1980), proved an invaluable source of lexical and grammatical input for both oral and written description of laboratory equipment and procedure. Course participants appreciated the integration of language and skills work into their professional laboratory practice.

Analysis of Critical Incidents

Let us now return to the central questions established in the introduction to this paper. During the two training programs, students were involved in English Language and study skills work at a range of levels of difficulty. They were also fully engaged in subject content work, both on their chosen fields of interest, and on relevant academic themes selected by the trainer. The programs therefore combined both skill-based and subject content-based paradigms.

1. Dealing With Language Input

The traditional approach to language content and subject content has been to treat them as separate domains, and to advise EAP teachers not to attempt to answer or handle questions arising from clarification of facts related to the learners' academic discipline. The assumption that language input and subject content are separable is, of course, erroneous. While it is true that much of the input is general facilitative language (e.g. basic process verbs such as 'take', 'carry', 'pass', 'transport', 'flow'), even in this genre there are terms which are specifically biological in nature (e.g. 'diffuse', 'digest', 'dilate', 're-combine', 'mutate'). Prepositions may be used to describe biological structures (e.g. 'above', 'below', 'between', 'beside', 'along', etc.), but equally there are similar terms that are specifically biological (e.g. 'anterior to', 'posterior to','inferior to', 'superior to', 'medial to', etc.). The latter group have specific meanings when used to describe the structure of plants and animals. If we accept that general facilitative language (e.g. sequencers, quantifiers, logical connectives etc.) cannot be separated from the more specifically biological terminology (e.g. adjectives for modes of nutrition; 'holozoic', 'holophytic', 'saprophytic'), then it seems that we would also have to accept that some degree of knowledge of the specific terminology is required, if the EAP trainer is going to be able to teach anything valuable to the learners. The above examples all arose during input sessions using Adamson & Bates (op cit.).

Following from the above argument is the question of whether an EAP trainer with a non-relevant academic background can adequately prepare to deal with language points such as those cited above. Moreover, would a trainer with, for example, a degree in music have the confidence to handle such terms and therefore win and hold the respect of the learners? If the trainer is working with undergraduates, it should be possible to anticipate such terminology and prepare adequately using standard biological textbooks. However, even at this level it represents a substantial investment in additional preparation time, and would require an individual with exceptional self-confidence and a willingness to risk loss of face and embarrassment in front of the class. Use of a standard pre-university biology textbook, such as 'Biology: A Functional Approach' (Roberts & King: Nelson, 1987) can significantly reduce the trainer's burden. This text has excellent summaries of the major fields of biological knowledge at the beginning of each chapter, so that even trainers without relevant background knowledge could obtain an adequate grasp of such fields as Genetics, Evolution, Nutrition, Histology and Reproduction.

2. Handling Skills Work

The provision of training in key skills such as selective listening and note-taking requires specific background knowledge of the subject matter, if it is to be successful. Although most of the published comprehension courses referred to previously do have answer keys to the exercises, it is difficult to see how a trainer lacking a relevant background knowledge of the subject could deal with questions arising from a biochemistry lecture on the 'Krebs Cycle', or explain to students how to take notes on the complexities of the endocrine system in mammals, without a grounding in the subject content required. In order to succeed in training scientists to take effective notes, it is necessary for the trainer to advise the student on key words and concepts and in particular to guide the student in identifying key nouns, verbs and adjectives, the content words that carry the central message in scientific discourse. Separating key concepts from redundant language in scientific discourse requires a knowledge of which terms are key and which are not, and this comes from an in-depth study of the subject matter. Without this background knowledge the trainer may be unable to interact effectively with the learners because of unfamiliarity with the discourse that is unfolding in class. This would lead to a serious loss of face for the trainer and to a loss of respect from the course participants. How would a trainer lacking relevant background check a reading or listening comprehension task, or prepare learners to write laboratory reports, or research papers they might wish to publish? Even for training undergraduates then, some relevant knowledge of the subject content is at least desirable. For training postgraduate biotechnologists, as we shall see, it is all the more important.

3. Answering Questions on Terminology

In one particular class dealing with ecology in Bogor, students asked for clarification of the differences between the terms 'symbiosis', 'mutualism', 'predation', 'parasitism' and 'commensalism'. These terms describe different types of relationship between organisms and can only be distinguished by asking such questions as:

- Do the organisms share the same habitat?
- Does one organism harm the other?
- Does one organism benefit from the other?
- Do both organisms benefit?
- Does one organism feed on the other?

It is not really sufficient just to look up these terms in the dictionary; the trainer requires a knowledge of the relevant clarifying questions to ask, and this comes from a background knowledge of the subject. Without this specific background the trainer would be in the same position as the learners, reaching for the dictionary. The use of the questions above enabled the students to critically examine some specific examples and decide precisely which term was being illustrated.

4. Listening to Lectures

In training learners to listen to lectures, again background knowledge is invaluable. It enables the trainer to identify likely sources of difficulty for the students and anticipate problems in understanding key words and concepts, frequently used formulae and cause and effect relationships. A particular example from the training in Bogor involved a lecture on 'Heat Control and the Skin', from Adkins & Mckean (op cit.). The students became confused about the precise mechanism of thermoregulation in mammals. It proved necessary to give a detailed explanation of how a bacterial infection can 'short circuit' the body's internal system of temperature control, which is normally controlled by the hypothalamus, an organ situated at the base of the brain. The trainer's background knowledge of animal physiology enabled a clear picture to emerge of the precise mechanism involved. Without such background, the learners would have remained confused and unable to comprehend the process involved. Another lecture from Yates (1989) provided information and required learners to take notes on five groups of microorganisms. While a trainer lacking background knowledge of microbiology might succeed in making clear some of the differences between bacteria and viruses, algae and protozoa would present a greater challenge, and the fifth group, actinomycetes, would probably confuse both the trainer and the learners. At postgraduate level then, background knowledge of the learners' specialist field would appear to be essential to effective training. There is a risk that without such knowledge, the trainer may be rendered little more than a bystander in the classroom, unable to deal with questions arising or to comprehend the discourse that is unfolding in class.

5. Research Presentations and Seminar Skills Training

The final incident described here concerns the research presentations and seminar training. In order for the trainer to comment meaningfully on the extent to which the students had effectively interpreted the results and findings of their own and others' research studies, a knowledge of the subject matter was required. In Bandung, one class participated in a seminar on a published paper entitled 'Two Australian Species of Dinopid Spider'. Students were divided into groups; one group presented methodology, another the results section, and a third group presented the discussion section. In the discussion that followed, the trainer required a detailed understanding of ecology, of such phenomena as habitat, range, distribution, feeding behavior, competition, adaptation and the like. A lack of background in ecology would have made it almost impossible for the trainer to offer anything more than an opportunity for the students to gain further oral fluency practice.

Conclusion

It is worth recalling that on many pre-departure EAP training programs, students are placed in groups from mixed academic backgrounds, so that a biochemist could be placed in the same class as an engineer or an architect. In such situations it is obviously not possible for the trainer to have an academic background that is relevant to all the students' fields of study. However, in cases like those described in this article, where one academic field is common to all the students (in this case biotechnology), the EAP trainer really does require a background knowledge of a biological subject. Our answer to the first question in the introduction is that trainers without a relevant background should be able to prepare themselves to teach undergraduate biologists, though additional preparation time and a willingness to take risks is required of the trainer. For postgraduates, especially for research students, a relevant background is all but essential for effective training in the complex academic and language skills required.

Notes

1. Subject content-based courses use material drawn from one or more mainstreamacademic disciplines (e.g. biology or chemistry). They are designed to increase language proficiency and to facilitate academic performance (Kasper 1995a).
2. Skill-based EAP courses use materials that are not grounded in any one specific academic discipline, but cover a range of topics (e.g. Òglobal warmingÓ or Òhealth and fitnessÓ).
3. The 'practical' sessions in the laboratories were focused on the language required to describe and demonstrate scientific experiments and procedures. They involved students in carrying out scientific experiments in the microbiology, biochemistry and genetic engineering laboratories.

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