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**Teaching ERPP to undergraduate STEM students in Chinese universities?
Addressing contextual realities in an EFL academic environment**

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Teaching ERPP to undergraduate STEM students in Chinese Universities? Addressing contextual realities in an EFL academic environment

Margaret Cargill

Abstract

As interest in developing effective ERPP pedagogy grows internationally, instructors encounter a range of constraints dictated by the teaching contexts they inhabit. This perspective piece addresses the context of universities in PR China, and some of the constraints facing English teachers interested in introducing ERPP perspectives into their teaching. These constraints may also be relevant in other contexts where English is used and taught as a foreign language. English for Academic Purposes (EAP), the 'parent' discipline of ERPP in some senses, is a relatively new focus in many Chinese universities, and the demand for professional development and teacher training in both EAP and ERPP is growing. This article discusses the use of published research articles (RAs) as teaching materials in English classes taught to students not yet conducting their own research, to enhance motivation for learning EAP. It discusses techniques for developing skills in reading and analysing RAs using genre analysis and concordancing software with student-constructed mini-corpora. The aim is to enhance students' confidence in their ability to handle the challenges they face in their major discipline classes when they are asked to read RAs published in English.

Introduction and context

One of the defining characteristics of English for Research Publication Purposes (ERPP) as a developing field could be said to be its importance in and for contexts traditionally labelled EFL (English as a Foreign Language), given the high level of externally imposed pressure to publish in English that operates in many locations where English is used and taught as a language largely outside the linguistic mainstream – a foreign language. ERPP was listed among the themes to be addressed at the 5th China English for Academic Purposes Association (CEAPA) Conference in Shanghai, China, and this invited perspective piece has been developed from a presentation I gave there. Nevertheless, the main interest of those attending was not specifically ERPP but the broader EAP – English for Academic Purposes. The title of my presentation was 'English for What Academic Purposes? Using research publication to motivate student engagement in EAP learning', and I will aim in what follows to explain my choice of topic and content and connect it in a useful way to the pedagogical concerns of ERPP as a field.

As is becoming well known, EAP is a burgeoning field in China at present; many Foreign Language Departments and individual teachers are considering or actioning changes in their programs for non-English majors, moving from teaching general English to EAP (Li & Ma, 2018). This has led to a growing demand for professional development for English Language Teaching (ELT) academics to help them meet the new challenges they face, particularly those related to the limited extent to which English is required to be used by students within the courses in their non-English major disciplines. If students do not need to write academic assignments in English in their major courses, many well-developed and well known EAP approaches (e.g. Swales & Feak, 2012) become less relevant. In parallel, and not unconnected, the pressure continues to grow on academic staff and doctoral and Master students, in disciplines beyond English and especially in STEM fields (Science,

Technology, Engineering and Medicine), to publish their research in indexed international journals, early in their careers and in English. In high-ranking universities there is a graduation requirement in many disciplines for students to first-author at least one paper in an SCI (Science Citation Index) or equivalent level journal (Li, 2006, 2015). Much has been written about facilitating achievement of this goal at the end-point, but my concern here is to consider ways that could be considered to strengthen the earlier teaching of the English-related skills that will support scientists in their publication efforts throughout their careers. My driving motivation throughout my working life has been to support the effective communication of science research internationally, so that the many serious challenges facing the world can be tackled in the most effective ways (Cargill, 2011). Hence my interest in pedagogy, under the banners of both EAP and ERPP.

A second foundational interest for me is the role and importance of context in the teaching of English. I have always tried to remain sensitive to what might or might not be practical or achievable in the specific teaching contexts in which I or colleagues find myself/themselves, and to ways in which ELT can address authentic needs for English as experienced by the students we teach. To quote from the abstract of the CEAPA conference keynote address:

In this talk I will present my ideas on using ‘research publication’ in its many facets as a means of creating authenticity in EAP teaching contexts. I hope to show that this approach is relevant not only for graduate students required to publish their own research in order to graduate. It can also be used in undergraduate contexts. Key foundations for the approach involve collaboration with academic colleagues from discipline fields beyond English, and an emphasis on teaching strategies for life-long language learning, including those emerging from genre analysis and corpus linguistics. (Cargill, 2019)

So – in a conference context, what follows represents my proposals to those in attendance – at the last session of the conference, immediately before the closing ceremony.

The role of students’ major disciplines in enhancing motivation for EAP learning

A question to begin: What characterises EAP? As Campion (2016) points out, definitions are contested – and yet some commonalities can be seen. Two that are important for me are these: an abiding concern for learners and learner needs; and the fact that EAP is “[r]elated in content to particular disciplines, occupations and activities” (Strevens, 1988, cited in Flowerdew & Peacock, 2001, p. 13). In this light, the rise of EAP in China actively invites us as EAP teachers to collaboration with other disciplines .

Disciplines have previously been described as academic ‘tribes’ (Becher & Trowler, 2001) which utilise and rely on different research paradigms and methodologies – and importantly for us and our students, markedly different discourse and language conventions. These can appear on the page in differences in their “appeals to background knowledge, different means of establishing truth, and different ways of engaging with readers” (Hyland, 2002b, p. 391). We are fortunate that Applied Linguistics (AL) provides a rigorous research base to critique and engage with this situation across discipline contexts, and this base forms a vital contribution in the face of actions in the management macro-context by stakeholders with little understanding of the role of language in the construction of new knowledge. Discipline specificity is well-recognised as an important feature of effective EAP teaching (Hyland, 2002a), and many ERPP and EAP practitioners would agree that generic English

instruction often has limited efficacy and can struggle to motivate students who are already immersed in their own disciplinary homes.

For many students, learning needs to be connected to a real need or recognisable use for the material to be learned – instrumental motivation (Gardner & Lambert, 1972). For English reading/writing in EFL contexts, it may be a challenge to present ‘real needs’ in real time for EAP. In ESL (English as a Second Language) contexts, students must write in English in their content courses – their majors – so EAP instruction can target the genres they need to succeed: essays, exam answers, laboratory reports – authentic writing tasks. But what about EFL contexts such as China?

There are several policy-driven opportunities that could be taken advantage of, including bilingual teaching initiatives in the disciplines and English as a medium of instruction (EMI)/ foreign expertise in the classroom programs (the latter term is used in some Chinese universities to describe programs where L1 English experts in a discipline field are invited to lecture to students on discipline course content in English). However the extent to which ELT professionals are involved in delivery or support of these initiatives is highly variable and often non-existent, perhaps due to the deep separation that exists between English teaching and other disciplines in the Chinese context (Cargill, O'Connor, & Li, 2012). How then could we as EAP teachers with an eye to future needs for ERPP take advantage of these collaboration potentials for creating authentic EAP learning tasks? For me – this can happen when we teach strategies and techniques for managing the English challenges students meet in their disciplines, and when we develop students’ confidence that they can indeed learn to use English for their own academic purposes, by giving hands-on practice with authentic tasks. The one I wish to focus on here is reading/analysing journal articles written in English, with a view to writing one later. Thus, the focus is not just on reading for comprehension of content to be used in Chinese assignments or exams, but also on reading for learning of discipline-specific English language elements that can be re-used in writing tasks later, the most relevant of which is writing students’ own research articles for publication. So an important part of the ‘value-adding’ that is provided by EAP input is the teaching of strategies for learning language use – how to unpack and re-use discourse as well as vocabulary – for broader application.

Ideally, inclusion of this focus provides opportunities for collaborating with experts in other disciplines, to add value to our teaching and theirs – but it can be begun by ELT practitioners working alone. Seeking to move towards this kind of collaboration, I have found it useful to adopt an attitude of ‘respectful humility’ towards the language conventions and practices of my academic colleagues in students’ home disciplines – aiming to build learning communities and take advantage of expert informants. While doing so, I also foreground our AL expertise in the analysis of target texts and contexts, and in the design of teaching for language learning – working to design teaching to help meet their goals for their students as well as my own. A guiding principle is this one from Flowerdew (2016),:

[W]hichever model of writing is chosen ..., if at all possible, students need to be exposed to the understandings, language and communicative activities of their target disciplines, with students themselves also contributing to this enterprise.

Adapting ERPP workshop-based teaching to classroom-based EAP

My major experience base lies not with EAP more broadly, but within ERPP: English for Research Publication Purposes (Cargill & Burgess, 2008), delivering workshop-based training for science and

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technology research students (PhD and Master by Research) with their own analysed data ready to write as a paper. This reflects the teaching context for these students in Australia, where no coursework is included in the degree programs. This type of workshop was found to be successful in institutes of the Chinese Academy of Sciences (CAS) (Cargill & O'Connor, 2012) - but significant adaptation was required for pre- or during-research courses for university students in China. Preliminary research on the needed adaptations took place at the (Graduate) University of the Chinese Academy of Sciences ([G]UCAS, Beijing (2006-9), with full implementation at Northwest Agriculture & Forestry University, Shaanxi, in 2016 (Cargill, Gao, Wang, & O'Connor, 2018). In whatever context the courses are taught, the underlying theoretical and pedagogical frameworks lie within genre analysis (Swales, 1990) and genre pedagogy (Cope & Kalantzis, 1993) and corpus linguistics, especially hands-on concordancing with self-made mini-corpora (Charles, 2012).

The genre pedagogy 'wheel' as a teaching framework

The definition of genre I use with students is this one: "a class of communicative events, the members of which share some set of communicative purposes which are recognized by the expert members of the parent discourse community" (Swales, 1990, p. 58). Genre analysis identifies features which define genres (e.g. research articles, RAs) and sub-genres (e.g. RAs in molecular biology or applied economics). These features inform genre pedagogy (see Figure 1 – the 'wheel'). For our purposes here, note especially the outside rim with its emphasis on the role of context and setting, underlining the importance of our collaboration with discipline academics to help us understand the students' needs for English and what are the most salient items of vocabulary and discourse structures for the students' stage and goals. Next, focus on the top segment of the first internal layer, Deconstruction (of example texts), with its arrows leading 'towards control of' and 'critical orientation to' genre and text. This is the first teaching action, where texts of the target genre are de-constructed or analysed – see below for details.

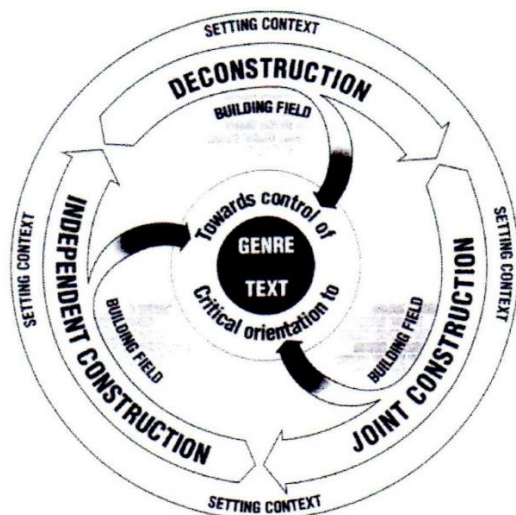


Figure 1. The genre pedagogy 'wheel' (Rothery, 1994)

For me, this general approach leads to a method for developing international publication skills for our students, one which can begin with small steps. We aim to use our students' existing research skills on the problem of getting articles published, initially by analysing successful articles – and the journals they come from. In doing this we use results of AL research to highlight key points for focus.

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Beginning with context and setting, I like to encourage my students to do some analysis of every communication event they are involved with, beginning with the following four aspects: audience (who will read or listen to it?); purpose (what is your goal in communicating?); format (what constraints do you face because of required structures or rules?); and assessment (who will judge if the communication is successful, and what criteria will they use?) (Olsen & Huckin, 1991). These questions work well for beginning to think about published journal articles in the disciplines.

Three levels of genre analysis are relevant for ERPP: 1. structure of whole documents (e.g. article structures such as IMRD (Introduction, Methods, Results and Discussion) and its variants (Cargill & O'Connor, 2013); 2. structure of text sections (e.g. argument 'stages' or moves and steps of an article introduction); and 3. language usage at paragraph and sentence level.

But even to begin working with authentic texts such as RAs in a mixed-discipline class involves us in the challenge of unknown vocabulary and students' default response of 'switching off'. To illustrate the problem, here is an extract from one article used in the Cargill and O'Connor (2013) textbook, giving its title and the headings of its internal sections (Figure 2).

The soybean NRAMP homologue, GmDMT1, is a symbiotic divalent metal transporter capable of ferrous iron transport. (Kaiser et al., 2003, *The Plant Journal*.)

Summary

Keywords

Introduction

Results

Cloning of GmDmt1;1

Gene expression

Protein localisation

Functional analysis in yeast

Discussion

GmDmt1;1 can transport ferrous iron

Specificity of GmDmt1;1

Localisation and function of GmDmt1;1

Regulation of GmDmt1;1 expression

Conclusion

Experimental procedures

Plant growth

Isolation of GmDmt1;1

Northern analysis

Antibody generation and Western immunoblot analysis

Symbiosome isolation and nodule membrane purification

Functional expression in yeast

Acknowledgements

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Figure 2. Title and section headings of an example paper, demonstrating vocabulary challenges for mixed-discipline classes

This RA represents an article structure we name AIRDaM (Abstract, Introduction, Results, Discussion and Method), which is commonly used in molecular biology and chemistry-type journals. An

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important first step in deconstructing or analysing articles from students' own disciplines involves identifying the macro-structures (Cargill & O'Connor, 2013), and in particular whether and if so how the RAs differ from the IMRD structure often taught as an invariable norm (Level 1 above).

However, working with authentic RA examples necessarily introduces challenges with unfamiliar vocabulary. In introducing this or similar articles in a class, I work with the idea of 'How to read text from a discipline that is new to you'. I ask students to use the concept of the 'noun phrase' (NP), also called a 'nominal group'. These are chunks of language that refer to a thing or idea – they do not contain a finite verb. Examples are *football boots*, *ferrous iron transport*, and *the presence of soil micro-organisms*. Using this concept, a reader can 'skip over' the NPs and still learn from the structure of the phrases or sentences in the examples. The desired learning here is not the meaning of specific discipline-specific vocabulary items, but rather structure and discursal features. Let's take as an example the title of the Kaiser (2003) paper: *The soybean NRAMP homologue, GmDMT1, is a symbiotic divalent metal transporter capable of ferrous iron transport*.

Which words do you/your students know? Perhaps these: soybean? metal? transporter? capable? iron? transport? Using the NP idea, the title could look like this:

The soybean NP, (name), is a NP capable of NP

OR – The soybean NP, (name), is a (... transporter) capable of (... iron transport)

In either case, students can identify that the title structure is a complete sentence, a statement.

Now let's move on to the second level of genre analysis for ERPP, structure of text sections – here, writing about Results. Here is the full, original version of a results paragraph; the students' task is to identify which of three information elements are present in which sentences: L=locate, i.e. where to find the data being referred to; H=highlight, i.e. what is the important result readers should pay attention to; and C=comment, i.e. extra explanation about the meaning of the numbers given.

¹A total of 53 samples were examined. ²Direct microscopic examination of the samples showed 20 different fungal strains, which were isolated by culture and identified to the level of genus and/or species (Table 1). ³These findings show that fungi can tolerate adverse environmental changes in the vegetative form. ⁴Table 2 shows the results of the tests applied to the isolates. ⁵None of the fungi strains was able to grow in culture media with 500 to 5000 mg L⁻¹ of anionic surfactant. ⁶An inhibitory effect on fungal growth and activity might be expected from the anionic surfactant level found in the ponds. (cited in Weissberg and Buker (1990))

Using the NP concept, we can rewrite the paragraph like this:

¹A total of 53 samples were examined. ²Direct microscopic examination of the samples showed 20 different NP, which were isolated by NP and identified to the level of NP (Table 1). ³These findings show that NP can tolerate NP. ⁴Table 2 shows the results of the tests applied to NP. ⁵None of the NP was able to grow in NP. ⁶NP might be expected from NP.

Revised to demonstrate improved conciseness, and improved grammatical accuracy as well (the first sentence uses seven words but contains little information of interest except for the number, and the verb is plural with a singular subject *total*), the paragraph will read like this:

²Direct microscopic examination of the 53 samples showed 20 different NP, which were isolated by NP and identified to the level of NP (Table 1). ³These findings show that NP can

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tolerate NP. ⁴Table 2 shows the results of the tests applied to NP. ⁵None of the NP was able to grow in NP. ⁶NP might be expected from NP.

Guided analysis¹ will enable students to note two different ways in which locate elements are presented – in a bracket within a sentence that also highlights a main finding (in Sentence 2), and in a stand-alone sentence (Sentence 4). Students can then be asked to check which of these is most common in their own discipline articles. Further analysis will identify important differences in tense usage in this and similar paragraphs, even within a single sentence.

Advantages of the technique include the following: it

- shows students the importance of sentence structure and verb forms/ tenses for understanding (and creating) meaning;
- demonstrates that not all vocabulary is equal in value;
- promotes strategic guess-work about types of meaning – improves dictionary use because irrelevant meanings can be more easily discarded; and
- highlights the importance of discipline-specific noun phrases.

A contribution from corpus linguistics

The third level of analysis mentioned above, after deconstruction of macro-structure and argument stages or moves and steps in article sections, is language usage at paragraph and sentence level. If not all vocabulary is equal in value, as suggested in the enumeration of advantages, then identifying valuable vocabulary for learning is an important goal, both for reading purposes and later writing. A next step can thus be combining a 'linguistic approach' with the 'genre approach' (Xu, 2019). Xu (2019) feels that the genre approach "does not seem to highlight language acquisition" (p. 125) and "does not overcome the last mile problem" (p. 124) in writing for publication. She advocates inclusion of language learning methods informed by 'idiom/memory based view of language' (p.126) – identifying/ learning multi-word sequences and bundles. One way for students to learn to identify these effectively in their own contexts beyond the English classroom is through practising hands-on concordancing with self-made, discipline-specific corpora of research articles from the students' own disciplines (Charles, 2012; Lee & Swales, 2005). This technique was not familiar to my conference audience, so a brief introduction is included here.

To help students identify NPs to learn, I introduce a very simple freeware concordancing program: AdTAT (Adelaide Text Analysis Tool, <https://www.adelaide.edu.au/graduatecentre/career-development/online-training/resources-tools/adtat-the-adelaide-text-analysis-tool>), or you might prefer to use AntConc, at <https://www.laurenceanthony.net/software/antconc/>, which is also freeware and very well supported for use with students. I demonstrate use of these programs with student-made collections (mini-corpora) of published research articles from their own disciplines. Instructions for making these are available in the Corpora section of this website: http://www.writeresearch.com.au/html/concordancing_help.html. Techniques include constructing a Word frequency list to find commonly used words in the discipline, and conducting a Basic search for frequently occurring words, to identify extended NPs or multi-word sequences to learn.

¹ Suggested answers to the student task: Sentence 2 = H+L; Sentence 3 = C; Sentence 4 = L; Sentence 5 = H; Sentence 6 = C

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The Word Frequency command will list all individual words appearing in the total corpus, in order of frequency (how many times the word appears). The first (most common) words are always 'grammar' words like *the*, *of*, *and* and *to*. Students need to scroll down to find content words and list the ones they do not know for later learning. Then they can investigate how the frequently used words they identify are used by expert writers of English in their disciplines. They do this by doing a Basic Search or KWIC (keyword in context) search. It is possible to see the extended context of an individual result by clicking on the line – the full text will appear with the search term highlighted. In this way students can identify patterns of usage and copy down phrases and language patterns – multi-word sequences – to learn. For more information on this approach, see Cargill et al. (2018). Students can also use concordancing software and their discipline-specific corpus to check aspects of usage, grammar and collocation (which words are used together in English) – and build on their corpora by adding more papers as their interests develop over their academic careers.

There are a number of potential issues with this approach which need to be considered carefully. These include the time required to teach corpus preparation and concordancer use in courses with limited hours available. Adopting this approach certainly requires a 'learning community' attitude where everyone, teacher and students, is learning together how to use the new vocabulary that is identified.

Concluding remarks

In my experience, advantages of an approach that combines genre analysis with the use of self-made mini-corpora include the following. Students learn techniques and strategies for investigating and learning the English of their own disciplines, providing additional motivation for engaging in EAP learning. They can apply genre analysis to new genres and build on their individual self-made corpora throughout their academic careers. Teachers no longer need to 'know all the answers' – consulting a corpus becomes the method of choice for answering language queries that arise. The approach can be used in single-discipline or mixed-discipline EAP/ERPP classes. It also represents a valuable contribution English teachers can make to collaboration with other discipline colleagues.

To sum up, the ability to read discipline-specific research articles written in English is a genuine need for STEM students in many EFL contexts from undergraduate days, particularly where bilingual teaching or foreign expertise in the classroom approaches have been adopted, as is the case in many Chinese universities. My experience in China over the past 18 years has demonstrated a genuine need for teaching and learning strategies and approaches that can build bridges between the expertise sets of STEM academics and those of the English language professionals who can open up access for students to STEM content written in English. When EAP instruction taps into helping students develop the ability to read RAs in their own major fields, the students' motivation for engagement in EAP learning is likely to be enhanced. Important scaffolding for the process of reading these high-stakes texts is provided when genre analysis is taught at the level of article structure and moves or stages within article sections. As a further layer of possibility, corpus linguistics /concordancing combined with self-made corpora of discipline specific research articles can provide access to learnable language 'chunks' or multi-word sequences as used by expert writers in the relevant discipline. Taken together, these components can form a solid basis or foundation on which later teaching that focuses more specifically on ERPP writing can build.

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