Applying linguistics to writing in disciplines: a reflection

Simon Milligan[1]

Language Center of UZH and ETH Zurich
8006 Zurich, Switzerland

Abstract

Writing about research is of critical importance both to science as a whole and to the careers of individual scientists. However, acquiring the skills required to write effectively takes a great deal of time. This reflection paper discusses how writing courses delivered to groups that share a single disciplinary background can enable the development of discipline-specific writing skills faster than broad-spectrum courses for participants from a wide range of disciplines.

Two courses are considered: one a broad-spectrum course, the other a more specific one. Both courses are aimed at doctoral students producing their first (or early) research articles. The particular element examined is the presentation, practice, and production of a schema for structuring introductions called *creating a research space* (CARS). In both courses, the CARS schema was first presented and then demonstrated with two examples taken from authentic texts. The examples used in the broad-spectrum course differed more than those used in the specific course, and the heterogeneity of example texts under consideration was then increased by asking participants in both courses to examine model texts that they had selected from their target journals.

Subsequent plenary discussion in the broad-spectrum course tended to focus on differences between examples more than did discussion in the specific course. Introductions produced as assignments for the broad-spectrum course were more heterogeneous than those produced for the specific course, but this does not indicate that any of the broad-spectrum assignments was less successful in reproducing the stylistic specificities of research article introductions in that participant's discipline. Comparison of quantitative feedback for the courses as a whole indicates somewhat higher satisfaction with the specific approach, exemplified here with introductions, than with the broad-spectrum course, although this will have been affected by many factors. Some qualitative feedback for the specific course explicitly mentions the discipline-specific approach as a positive aspect.

The instances examined here are not themselves conclusive evidence of the superiority of either course, but they are congruent with a growing body of research indicating that participants benefit most directly from learning to write particular genres within their specific disciplines. However, discipline-specific courses can only be provided under a particular set of circumstances, do not necessarily provide a strong foundation for broader long-term writing skills development or a clear awareness of the diversity of writing styles across the academy, and are not necessarily better suited to supporting writers of diverse, nonstandard, or nonacademic genres.

1 Introduction

Writing up and publishing research are central to the practice of science, and doctoral students and others often spend substantial time acquiring writing skills. One fundamental question that arises when developing writing support is whether such skills are more rapidly acquired in general

[1] smilligan@ethz.ch

courses for a broad spectrum of fields or in courses for groups within specific disciplines. Ample evidence exists that the kinds of writing required of students varies widely between disciplines (Hyland 2006, Nesi & Gardner 2012) and that students benefit most directly from learning to write particular genres within their specific disciplines (Shing, Sim & Bahrani 2013, Abdoulrezapour & Tavakoli 2013, Flowerdew & Costley 2017). Consequently, a body of research literature and practice known as English for Specific Academic Purposes (ESAP) has developed in recent years (Basturkmen 2012). While discipline-specific writing courses by no means eliminate heterogeneity – and some disciplines can be very diverse in their textual concerns and conventions – the grouping of writing learners by discipline can be readily and intuitively understood as an extension of the basic principle that reducing heterogeneity within a learning cohort is likely to improve learning outcomes.

However, ESAP writing courses can only take place in particular circumstances. For instance, the Language Center's academic writing for specific purposes (AWSP) courses require a department, institute, or chair to commission a course for its students or staff. For such a course to be effective, a sometimes-extensive needs analysis is required. The course is also likely to be most effective when all the participants are writing or preparing to write texts of the same genre, such as research articles (RAs). Unless these conditions are in place, and suitably qualified and experienced instructors can provide the courses, then more generic writing support may be the best option available (Flowerdew 2016).

A second nontrivial question is how to gauge the success of learning writing skills. Readily quantifiable aspects of texts do not capture many critical features of successful writing and are therefore usually poor indicators of the outcomes of learning about writing. Although a quantitative approach to textual analysis, corpus linguistics, has advanced considerably in recent years, its best results come from large corpora of millions, or at least several hundreds of thousands, of words; it provides no direct measure of individual learning outcomes.

Instead, studies examining successful learning about writing typically rely on genre analysis of student writing and on other human judgements gathered through questionnaires and interviews (e.g. Samraj 2008, Shing, Sim & Bahrani 2013). Although these bring with them all the potential confounders usually associated with human cognitive biases, they do allow researchers to take account of the basic fact that what constitutes 'good' writing in one discipline may be considered suboptimal or even unsuitable in another.

This reflection article does not present new empirical research. Instead, it demonstrates how a broad-spectrum writing course compares with an ESAP writing course. It shows how one illustrative example of scientific writing, the introduction of a research article, is learned in a broad-spectrum course delivered at the ETH's Hoenggerberg campus to doctoral students from any natural science and engineering discipline[2] and in an ESAP writing course for clinical researchers at the University Children's Hospital Zurich[3]. It also presents an overview of assignments and participant feedback from these two courses; however, the information presented here cannot be treated as direct evidence for the superiority of one approach over another; rather, it demonstrates an instance of the ESAP approach to writing, which a growing body of studies indicates can enable the development of writing skills for specific target genres more effectively than broad-spectrum courses.

Materials designed to scaffold learning the structure of RA introductions have been chosen to exemplify the distinction between courses for three reasons. Firstly, the sections are closely comparable; unlike much of the materials used with these courses, both presented introductions in a very similar way, differing substantially only in the choice of authentic examples. Secondly, the schema used to present and discuss introductions lends itself to quick and clear presentation in a reflection paper such as this; this is not the case with other elements, such as discussions.

[2] MA.2.76 Writing Research Papers for Publication
[3] Writing for Publication at the University Children's Hospital Zurich

Thirdly, the schema is very broadly used, so although readers of this paper may not readily recognize specific aspects of the examples presented here, they will likely be familiar with the form that the introduction schema takes in their own disciplines.

2 Teaching concept

Within applied linguistics, the structure and sequence of introductions are most often presented as the creating a research space (CARS) schema (Swales 1990). The schema has been found to be applicable to describing RA introductions across a wide range of empirical and nonempirical disciplines and involves a sequence of three rhetorical moves: creating a territory, creating a niche, and occupying the niche. However, each of these steps can be performed in many ways, and disciplines vary widely in their conventions for each step.

The schema has been used to analyse research article introductions in such diverse disciplines as engineering (Anthony 1999, Kanoksilapatham 2012), forestry (Joseph, Lim & Nor 2014), and linguistics (Ozturk 2007). It has also been used to compare intercultural differences in academic writing (Hirano 2009) and to compare introductions in research articles with those in MSc theses in specific disciplines (Samraj 2008, Maher & Milligan 2019).

The CARS schema is also widely known in applied linguistics because it can easily be integrated into a range of pedagogical techniques. In both the courses discussed here, the CARS schema was used in class to structure an analysis of introductions in a similar way. First, the CARS schema was introduced in plenary in a condensed form, much like that given in Table 1 (based on Swales 1990, Samraj 2008). In the next phase, participants formed pairs. In each pair, one participant read one example introduction (Example A) and the other read a second (Example B), and each was instructed to look for the moves and steps detailed in the CARS schema. When both had finished reading, the participants compared notes pairwise; they were instructed to identify similarities and differences between the examples.

In both courses, this was followed by one further phase in which each participant analysed the structure and language of the introduction of a model text selected by the participant from his or her target journal. This analysis was scaffolded by a checklist of points to look for, and participants were encouraged to record key elements of vocabulary and grammatical choices. In both courses, each participant was asked to write an introduction as an assignment. This was submitted to the instructor for commentary, and the participant produced a second draft as part of the portfolio of assignments used as the basis of assessment.

The CARS schema moves and steps	Explanation and commentary on moves and steps.
Move 1: “establishing a territory”	This move’s overall purpose is to provide the context of the study to the target readership. The broader and more heterogeneous the readership is, the more fundamental is the point from which the introduction must start.
1a: claim to centrality—either relevance to real world or to research field	The purpose of this step is to signal the key relevance of the topic whose investigation the RA reports. The two most common approaches are either to signal the relevance of the topic to some real-world problem or to indicate the degree of research interest in the topic. This step does not always appear, especially in narrow-scope ‘niche’ journals, but some other journals will accept relatively unobjective persuasive language here.
1b: topic generalizations	These may be few and simple or quite detailed, depending on the knowledge expected of the readership and on disciplinary convention. Typically, the broadest generalizations appear first and become more specific as the text progresses so that the introduction ‘zooms in’ on the particular area to which the RA contributes new knowledge.
1c: reference to items of previous research	These may vary greatly in number; disciplines such as mechanical engineering tend to require few citations here, whereas others such as molecular biology tend to use more.
Move 2: “establishing a niche”	This move’s purpose is to make explicit the need for the work reported in the RA. This move is typically the shortest of the three, and in some cases does not appear at all.
expression of a research gap, real-world problem, opportunity to extend current knowledge	It may specify some knowledge that the research community or a community of practice (e.g., medical practitioners) does not yet have, it may indicate some shortcomings in existing methods or technologies, or it may identify the value of extending current knowledge in some way or other.
Move 3: “occupying the niche”	This is where the RA first introduces the authors’ own research. In some fields, this may occupy up to 90% of the whole introduction, but in others it may be limited to a single sentence.
3a: outline of research or purposes of research	Some RAs present such outlines prominently; others combine this step with step 3b or even 3c, and others omit this step.
3b: summary of major steps in method and key results	Most RAs include at least brief mention of their methods and key findings here.
3c: preview of research article organization	Some disciplines, such as economics, treat such a preview as practically obligatory, but many natural science disciplines do not use any such preview in RA introductions, though they may appear in the natural sciences in theses and other genres.

Table 1: Overview and brief description of the moves and steps of the creating a research space (CARS) schema (based on Swales 1990, Samraj 2008).

3 Analysis of student learning

Similarities and differences can of course be found between the two examples in both courses (see Tables A2 and A3 in the Appendix). However, differences were more frequently observed by participants of the broad-spectrum course than by those of the specific course. Moreover, differences tended to become more salient when the participants had examined the model texts from their target journals. This is in line with experience in many previous courses; plenary discussion following the text analyses tends more often to focus on differences between texts in broad-spectrum courses than it does in specific courses. Discussion in specific courses tends to deal more frequently with making particular lexical and grammatical choices than with selecting overall strategies.

For example, participants in a broad-spectrum course may face a range of options for the opening sentence of an introduction. It may simply present a fact about the topic under consideration, it may refer to interest generated by the topic (e.g., Table A2, step 1a, Example A), or it might involve an eye-catching if rather unobjective broad generalization (e.g., Table A2, step 1a, Example B). In contrast, participants in the specific course discussed here observed that clinical research articles usually begin with a reference to how widespread or severe a disease or condition is (Table A3, step 1a, Examples A and B). They were thus able to move directly to considering, for instance, whether World Health Organization figures should be cited, or whether other statistics would serve their particular ends better.

Naturally, this does not prevent participants on broad-spectrum courses from learning from their model texts how their own disciplines typically manage such elements. However, their lack of familiarity with disciplines other than their own may result in their experiencing more difficulty in reading authentic examples from such fields, and the time devoted to considering how diverse the forms of academic writing can be, while potentially fascinating, may well not contribute directly to their discipline-specific writing skills or the production of their first publication.

The assignments produced by these two courses' participants are not available for direct analysis in this reflection paper. However, the instructor's post hoc reflection on these assignments produced three main observations. Firstly, the introductions produced as assignments and assessed in the specific course followed the pattern of the examples quite closely: with one exception, they began with reference to the severity, prevalence, or incidence of a disease or condition supported by citation to statistical sources, then moved on to generalize about the disease or condition before explicitly identifying a gap in current clinical knowledge. Secondly, while the introductions produced for the broad-spectrum course were of course more heterogeneous, this cannot be taken as a sign that any participant's individual assignment was less successful in reproducing the stylistic specificities of research article introductions in his or her discipline. Finally, these first two observations are in line with the relative heterogeneity of other assignments produced on these courses and with recollection of assignments produced on other broad-spectrum and specific courses.

It is far from conclusive whether the closer focus of the specific course contributed to the generally higher feedback given for that course than for the broad-spectrum course, but it is feasible to suggest that it might have (Table A4). Course participants at high levels of language proficiency such as are required of the authors of RAs are typically capable of assessing their own learning progress quite accurately, so this response supports instructors' perceptions of the differences between these types of courses.

The participants also specified aspects of the specific course as particularly helpful, and some of these comments are consistent with the materials on introductions contributing to the positive overall feedback for this course: 'For me, the introduction and discussion part was the most helpful since it's where I have most trouble'. Other comments evaluated the adaptation of the course to

the participants' specific purposes more generally: 'Really adapted the course to our needs'; 'Materials were well structured and adapted to participants' needs'.

4 Lessons learnt

The main lesson is scarcely counterintuitive: Discipline-specific courses seem able to develop participants' writing of specific target genres more effectively than broad-spectrum courses. This is in line with the basic principle that reducing heterogeneity within a learning cohort can enable improved learning outcomes. However, such a conclusion cannot be derived directly from this reflection paper. Instead, the materials and feedback presented here can be seen as congruent with the growing body of evidence (Shing, Sim & Bahrani 2013, Abdoulrezapour & Tavakoli 2013, Flowerdew & Costley 2017) demonstrating ESAP writing courses' capacity to deliver optimal outcomes for participants.

As mentioned toward the end of the introduction to this reflection, the example of introductions has been used here to illustrate variation between disciplines in part because of their relatively close comparability. This makes them suitable for illustrating variation within a single well-known structure, but other sections of RAs and MSc theses can vary far more greatly. For example, the closing sections of an RA are often a discussion section followed by a conclusion. However, some fields, such as chemistry, prefer to integrate results and discussions in one single section, whereas others, such as ecology, maintain a rigorous separation of data from interpretation largely by ensuring that results and discussion occupy separate sections. Moreover, some fields integrate the conclusions within the discussion section, others prefer a brief summary conclusion, and still others use long conclusion sections that incorporate elements relating limitations and research outlook. Although such sections are less readily comparable, and thus are less suited to succinctly illustrating interdisciplinary variation, participants of courses may be argued to benefit more from an ESAP approach when studying such sections, since this approach reduces the potential for them to be distracted by widely varying and for them perhaps inappropriate disciplinary conventions.

Conventions in both disciplines and interdisciplinary fields govern a host of textual features other than macrostructure. For instance, many RAs may incorporate quite lengthy consideration of research outlook and/or practical implications of the research reported, and the explicit unpacking of potential consequences may be considered essential, especially for broad and varied readerships for whom such entailments may not be self-evident. In contrast, other fields, such as many branches of engineering, avoid such speculative discussion almost completely. Discipline-specific writing courses also help focus participants' learning by ensuring that materials incorporate discipline-appropriate examples, ideally from participants' target journals or conferences. Much of such learning has been suggested to occur alongside the explicit aims and objectives of a course through incidental language learning (Hutchinson and Waters 1987), so many of the advantages of the ESAP approach may not be readily observable to participants or instructors.

The particular set of circumstances required for an ESAP writing course to be effectively delivered restricts the numbers of students who can benefit from such courses. All the participants need to seek to produce the same genre, such as a research article, in the same discipline or at least in related fields, at roughly the same time. This in turn demands coordination at institutional level. Successful examples of such coordination at the ETH have taken place at departmental level (D-INFK: Writing for Publication in Computer Science; D-MAVT: Scientific Writing for Publication in Engineering) and within individual laboratories (Laboratory of Food Biochemistry: Writing for Publication in Food Biochemistry; Neural Control of Movement Lab: Writing for Publication in Movement Neuroscience).

For many students for whom no discipline-specific writing course is arranged, however, the best option available is a broad-spectrum course such as that discussed in this reflection. A broad-spectrum course can be designed to encourage as much discipline specificity as its circumstances allow; in the example discussed here, the participants' disciplinary background is at least restricted to some extent, to the natural sciences and engineering, and participants examine model texts from their own target journals so as to produce texts as close as possible to those successfully published in their field. By exposing their participants to a broader range of textual examples, such broad-spectrum courses may also provide a more helpful foundation for broader long-term writing skills development and a greater awareness of the diversity of writing styles across the academy.

Indeed, ESAP writing courses may well best be complemented by access to very general writing support, which need not even be delivered through a course. Instead, it could be accessible on demand to students and researchers without the opportunity to attend a course, or those writing non-standard, perhaps even nonacademic genres. Many universities in Anglophone countries have instituted writing centres to provide such broad-spectrum on-demand writing support.

Acknowledgments

The author wishes to thank the participants of the courses discussed here and participants of all the courses he has taught; there is no teaching without learning. The author also wishes to thank two anonymous reviewers for their many and helpful suggestions for improvement and the editors of this journal for their perseverance with the issue's publication in these uniquely trying times.

References

Abdoulrezapour, Parisa, and Mansoor Tavakoli (2013) University Teachers and Students' Perceptions of EAP Methodologies and Their Effectiveness *The Social Sciences* 8(1): 49-54.

Anthony, L. (1999). Writing Research Article Introductions in Software Engineering: How Accurate is a Standard Model? *IEEE Transactions on Professional Communication*, *42*(1), 38-46.

Basturkmen, Helen (2012) Languages for Specific Purposes Curriculum Creation and Implementation in Australasia and Europe *The Modern Language Journal* 96: 59-70.

Flowerdew, John (2016) English for Specific Academic Purposes (ESAP) Writing: Making the case. *Writing & Pedagogy*. 8. 5-32.

Flowerdew, John, and Tracey Costley (ed.s) (2017) *Discipline-Specific Writing: Theory into Practice* Routledge.

Hirano, E. (2009). Research article introductions in English for Specific Purposes: A comparison between Brazilian Portuguese and English. *English for Specific Purposes*, *28*(, 240-250.

Hutchinson T., and A. Waters (1987) *English for Specific Purposes: a learning centred approach* Cambridge University Press, Cambridge.

Hyland, Ken (2006) *English for Academic Purposes an advanced resource book* Routledge: London.

Joseph, R., Lim, J. M. H. & Nor, N. A. M. (2014) Communicative Moves in Forestry Research Introductions: Implications for the Design of Learning Materials. *Procedia: Social and Behavioral Sciences*, *134*, 53-69.

Kanoksilapatham, B. (2012) Structure of Research Article Introductions in Three Engineering Subdisciplines. *IEEE Transactions on Professional Communication*, *55*(4), 294-309.

Kee , Jun Wei, Che Chang Chong, Chun Keong Toh, Yuan Yi Chong, Wai Yip Fan (2013) Stoichiometric H2 production from H2O upon Mn2(CO)10 photolysis *Journal of Organometallic Chemistry* 724 1-6

Nakamura et al., Evolutionary changes of multiple visual pigment genes in the complete genome of Pacific bluefin tuna (2013) *PNAS* 110 (27): 11061-11066 www.pnas.org/cgi/doi/10.1073/pnas.1302051110

Maher, Paschal and Simon Milligan (2019) Teaching master thesis writing to engineers: Insights from corpus and genre analysis of introductions *English for Specific Purposes*, Vol 55.

Nesi, Hilary, and Sheena Gardner (2012) *Genres across the Disciplines Student writing in higher education* Cambrige: Cambridge University Press.

Ozturk, I. (2007). The Textual Organization of Research Article Introductions in Applied Linguistics: Variability within a Single Discipline. *English for Specific Purposes*, *26*(1), 25-38.

Quinn et al. (2018) Association of Mental Health Conditions and Treatments With Long-term Opioid Analgesic Receipt Among Adolescents *JAMA Pediatr*. 2018;172(5):423-430. doi:10.1001/jamapediatrics.2017.5641

Schams et al. (2017) Diagnosing developmental dysplasia of the hip using the Graf ultrasound method: risk and protective factor analysis in 11,820 universally screened newborns *Eur J Pediatr* (2017) 176:1193–1200 DOI 10.1007/s00431-017-2959-z

Shing, Soo Ruey, Tam Shu Sim, and Taher Bahrani (2013) EGAP or ESAP? Towards Meeting the Academic English Language Needs of Undergraduates *The International Journal of Language Learning and Applied Linguistics World (IJLLALW)* 2(1): 31-44.

Swales, J. (1990) *Genre Analysis* Cambridge: Cambridge University Press.

Appendix

	Example A, from *Journal of Organometallic Chemistry* (Kee et al, 2013): summary description and example phrases	**Example B, from *Proceedings of the National Academy of Science (PNAS)* (Nakamura et al. 2013): summary description and example phrases**
Move 1: "establishing a territory"	Quite briefly sketched over ca. 150 words.	Delivered in rather more detail over ca. 250 words.
1a: claim to centrality—either relevance to real world or to research field	A relatively objective expression: the RA's topic 'has generated considerable interest as a cleaner source of energy'	A rather unobjective claim to centrality: 'Tunas are considered "the ultimate fish," because they are top predators in ocean ecosystems'.
1b: topic generalizations	Some, becoming slightly more specific	Several, becoming increasingly specific
1c: reference to items of previous research	15 citations before Move 3, one citation repeated in introduction in Move 3.	16 citations before Move 3, no citations in introduction in Move 3.
Move 2: "establishing a niche"	An explicit statement of a knowledge gap preceded by 'However'.	An explicit statement of a knowledge gap preceded by 'However'
expression of a research gap, real-world problem, opportunity to extend current knowledge	'However, more examples and extensive studies are still required to understand . . .'	'However, little is known about the genetic basis and evolutionary history of tuna's optic adaptation to an open-ocean predatory lifestyle.'
Move 3: "occupying the niche"	'In this paper, we report . . .'	'In this study, we have sequenced the draft genome of Pacific bluefin tuna . . .'
3a: outline of research or purposes of research	absent	some mention of purposes combined with 3b
3b: summary of major steps in method and key results	Briefly summarized in ca. 70 words, with a strong focus on results and findings rather than methods	Briefly summarized in ca. 70 words.
3c: preview of research article organization	absent	absent

Table A2: Overview of example introductions presented in the broad-spectrum course materials.

	Example A, from *JAMA Pediatrics* (Quinn et al. 2018) summary description and example phrases	**Example B, from *European Journal of Pediatrics* (Schams et al. 2018) summary description and example phrases**
Move 1: "establishing a territory"		
1a: claim to centrality—either relevance to real world or to research field	An objective expression of the incidence of a medical condition supported by citations of statistics	An objective expression of the incidence of a medical condition supported by citations of statistics
1b: topic generalizations	Several generalizations about the clinical problem, becoming increasingly specific	Several generalizations about the clinical problem, becoming increasingly specific
1c: reference to items of previous research	18 citations before Move 3, no citations in introduction in Move 3.	20 citations before Move 3, no citations in introduction in Move 3.
Move 2: "establishing a niche"	An explicit statement of a gap in knowledge arising from a lack of statistical power in previous studies using 'however' immediately before subject and verb.	An explicit statement of gaps in practical knowledge preceded by 'However'.
expression of a research gap, real-world problem, opportunity to extend current knowledge	'Given the rarity of LTOT[4] among youths, however, few studies have had sufficient sample sizes to examine associations between LTOT and specific mental health conditions during adolescence in particular.'	'However, numerous new questions regarding the survey and treatment constellations arose from the usage of the Graf ultrasound method.'
Move 3: "occupying the niche"	absent	absent
3a: outline of research or purposes of research	absent	Combined with step 3b
3b: summary of major steps in method and key results	Briefly summarized in ca. 80 words, with broadly equal focus on methods and results	Very briefly summarized in ca. 40 words, with greater focus on methods than on results
3c: preview of research article organization	absent	absent

Table A3: Overview of example introductions presented in the specific course materials.

elements that participants were asked to rate	**average response on a 6-point scale**	
	broad spectrum (7 responses)	**specific (10 responses)**
Please rate the **course content**, including structure, range and relevance of topics, amount of detail, etc. (1 = unsatisfactory, 6 = excellent).	5.1	5.6
Please rate the **course materials**, in particular whether the exercises were clear and straightforward, interesting, varied, and motivating (1 = unsatisfactory, 6 = excellent).	5.3	5.6
Please rate the **schedule, duration, and timing** (1 = unsatisfactory, 6 = excellent).	5.0	5.4
Please rate the **lecturer** (1 = unsatisfactory, 6 = excellent).	5.3	6.0

Table A4: Summary of feedback given by the participants of the two courses.

[4] long-term opioid therapy