

2016

Studying disciplinary corpora to teach the craft of discussion

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Abstract

Producing publishable quality research articles is a difficult task for novice scholarly writers. Particularly challenging is writing the Discussion/Conclusion section, which requires taking evaluative and interpretive stances on obtained results and substantiating claims regarding the worth of the scholarly contribution of the article to scientific knowledge. Conforming to the expectations of the target disciplinary community adds another dimension to the challenge. Corpus-based genre analysis can foster postgraduate writing instruction by providing insightful descriptions of rhetorical patterns and variation in disciplinary discourse. This paper introduces a pedagogically-oriented cross-disciplinary model of moves and steps devised through top-down corpus analysis. The model was applied to pedagogical materials and tasks designed to enhance genre and corpus-based teaching of Discussion/ Conclusions with an explicit focus on rhetorical conventions.

Keywords

genre, research article, discussion sections, move analysis, corpora, writing pedagogy

Disciplines

Curriculum and Instruction | Educational Assessment, Evaluation, and Research | Educational Methods

Comments

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Abstract

Producing publishable quality research articles is a difficult task for novice scholarly writers. Particularly challenging is writing the Discussion/Conclusion section, which requires taking evaluative and interpretive stances on obtained results and substantiating claims regarding the worth of the scholarly contribution of the article to scientific knowledge. Conforming to the expectations of the target disciplinary community adds another dimension to the challenge. Corpus-based genre analysis can foster postgraduate writing instruction by providing insightful descriptions of rhetorical patterns and variation in disciplinary discourse. This paper introduces a pedagogically-oriented cross-disciplinary model of moves and steps devised through top-down corpus analysis. The model was applied to pedagogical materials and tasks designed to enhance genre and corpus-based teaching of Discussion/Conclusions with an explicit focus on rhetorical conventions.

Keywords: GENRE, RESEARCH ARTICLE, DISCUSSION SECTIONS, MOVE ANALYSIS, CORPORA, WRITING PEDAGOGY

Introduction

Genre studies have been at the forefront of academic writing pedagogy. Teaching the research article (RA) in particular has received much attention given the need to help postgraduate students learn discipline-specific genre conventions and become enculturated to their discourse communities. In the tradition of English for Academic Purposes (EAP), one of the most notable contributions is Swales' (1981) Creating a Research Space (CARS) model for Introductions to RAs, where he conceptualizes the "moves" that writers make to accomplish overarching communicative goals, and the "steps" they take to convey specific aspects of functional meaning. CARS has been translated to a pedagogic approach centering on discourse community, genre, and learning tasks that draw students' attention to both rhetorical actions and the means of accomplishing them structurally and linguistically (Swales, 1990). Currently, this genre-based approach is broadly adopted in advanced academic writing courses, heralding the role of authentic corpora in developing genre knowledge in university students and increasing their awareness of rhetorical structure and metadiscourse (Cheng, 2008; L. Flowerdew, 2015; Hyland, 2006; Paltridge & Starfield, 2007; Swales, 2004; Swales & Feak, 2004).

The move and step concepts have had wide-reaching implications for the analysis and teaching of all RA component sections: Abstracts (Ayers, 2008; Lorés, 2004; Martín, 2003; Samraj, 2005), Methods (Chang & Kuo, 2011; Lim, 2006; Zhang, Kopak, Freund, & Rasmussen, 2011), Results (Brett, 1994; Bruce, 2008; Lim, 2010; Nwogu, 1997; Swales & Feak, 2004; Williams, 1999), and Discussion/Conclusions (Dudley-Evans, 1997; Yang & Allison, 2003). However, unlike the CARS model, demonstrated to be applicable across disciplines, work has stalled on the completion of teaching-oriented models validated with large corpora representative of multiple disciplines. The Discussion/Conclusions (D/C) are of particular pedagogic concern, for

they are highly argumentative in nature (Martinez, 2003; Parkinson, 2011) and present considerable challenges to postgraduate students who, being novices to scholarly writing, struggle to formulate and substantiate claims regarding the worth of their contribution to the knowledge in the field (Peacock, 2002).

This article illustrates how corpus-based move analysis can have direct informative application to genre-based scientific writing pedagogy. Concerned with the dearth of instructional materials suitable for teaching D/C discourse across the disciplines, we first present a cross-disciplinary model, which not only specifies the moves and steps identified in corpora from thirty disciplines, but also describes the rhetorical intent, along with aspects of the content schemata and linguistic realizations, of these discourse elements. Then, we demonstrate how the results of our study were translated to corpus-based materials and tasks that complement a traditional *read about, discuss, and write* approach employed in a postgraduate writing course. Considering insights from classroom implementation, we conclude by reflecting on potential advantages and caveats inherent to such a research-to-pedagogy approach.

Literature review

Corpus-based genre pedagogy

Corpora have been acclaimed as excellent resources for exposing students to authentic discourse and thus beneficial for teaching academic genres (e.g., Cheng, Warren, & Xu, 2003; Coxhead, 2000; Farr, 2003; Flowerdew & Peacock, 2001; Groom, 2005; Hyland, 2006; Lee & Swales, 2006; Turner, 2004). Corpus-based approaches involving the discovery and modeling of moves and steps have emerged as potent means for helping novice research writers examine the rhetorical composition of texts while concurrently raising their awareness to the expectations of target disciplinary communities (Paltridge & Woodrow, 2012; Tribble, 2002). Both bottom-up and top-down techniques have been used to enable corpus analyses at the macro and micro-levels and to foster students' understanding of the relationship between texts and the contexts in which they are created (Boulton, Carter-Thomas, & Rowley-Jolivet, 2012; Gavioli, 2005). For example, concordancing techniques have been offered to students to identify lexico-grammatical features of field-specific discourse, e.g. in Engineering (Lax, 2002), Forestry (Friginal, 2013), and Psychology (Bianchi & Pazzaglia, 2007). Chang and Kuo (2011) involved their students in developing and analyzing word frequency lists derived from a corpus in Computer Science and also in identifying the move structures of texts. In a multidisciplinary writing course, Lee and Swales (2006) tasked the students with compiling corpora of articles written in their fields and conducting comparisons of their own writing with published works. Charles' (2007) students, also from various disciplines, were engaged in corpus exploration tasks with a focus on discourse structures and lexico-grammatical features indicative of rhetorical functions in theses, as well as in class discussions of findings from students' corpus observations. In Cortes' (2007) and Cotos' (2014) learner-oriented courses, the tasks focused on corpus explorations of RA sections one at a time. Guided by move schemas drawn from genre analysis research, students analyzed texts from small corpora they themselves compiled in order to discover discourse tendencies and linguistic patterns in their particular discipline. Students reported on their observations and then applied the insights gained from the corpus when writing a journal manuscript for the final project of the course. Comparing this corpus-based course with a traditional genre-based one, Cortes (2011) found that the former created more beneficial conditions for students' learning of discipline-specific RA conventions.

Undoubtedly, the work on the use of corpus-based approaches accomplished so far sets a solid foundation for postgraduate genre writing instruction. The later editions of *Academic Writing for Graduate Students* books for teachers and students by Swales and Feak (2004, 2012), as well as their volumes in the *Michigan Series in English for Academic and Professional Purposes*, which have gained extensive popularity, provide commendable examples that inspire the use of genre-based corpus findings. Additionally, researcher-practitioners made headway in computer-assisted learning applications (e.g., Anthony & Lashkia, 2003; Birch-Bécaas & Cooke, 2012; Bloch, 2010; Cho & Schunn, 2007; Henry & Rosenberry, 2001). However, the challenge of heterogeneous interests in multi-disciplinary writing classes still stands out. More pedagogically-driven research is needed to provide materials developers and teachers with tangible corpus-based deliverables which could: inform the design of learning tasks for cross-disciplinary research writing courses, mediate students' apprenticeship into established target communities, and scaffold their acquisition of rhetorical, formal-textual, and process domains of genre knowledge (Tardy, 2009).

Discussion/Conclusion move models

The studies of Hopkins and Dudley-Evans (1988) and Dudley-Evans (1994) have been fundamental in the linguistic analysis of D/C discourse, presenting a model of nine moves: (1) *Information*, (2) *Statement of result*, (3) *Finding*, (4) *(Un)Expected outcome*, (5) *Reference to previous research*, (6) *Explanation*, (7) *Claim*, (8) *Limitation*, and (9) *Recommendation*. This work motivated subsequent adaptations for distinct disciplines, for example: Posteguillo (1999) for Computer Science; Graves, Moghaddasi, and Hashim (2013) for Mathematics; Kanoksilapatham (2007) for Biochemistry; and Yang and Allison (2003) for Applied Linguistics. Similar discourse elements were identified by Holmes (1997) in History, Political Science, and Sociology; and by Peacock (2002) in Physics, Biology, Environmental Science, Business, Language and Linguistics, Public and Social Administration, and Law.

Table 1 highlights similarities among representative studies. The first two columns in Table 1 group moves and steps based on shared communicative functions, showing the terms used in their definitions. The third column lists the studies that mention the respective moves and/or steps.

Table 1. Summary of move/step models for Discussion/Conclusions

<i>Moves</i>	<i>Steps</i>	<i>Studies</i>
Contextualizing the study; Background information; Information	Describing established knowledge; Emphasizing the significance of the problem/applications; Gen- eralizing, claiming, deducing previous knowledge	Dudley-Evans (1994), Graves et al. (2013), Holmes (1997), Hopkins & Dudley-Evans (1988), Kanoksi- lapatham (2007), Peacock (2002), Posteguillo (1999), Swales (1990), Yang & Allison (2003)

Consolidating results; Statement of result; Reporting results; Finding; Summarizing results; Reviewing the results	Stating selected findings	Dudley-Evans (1994), Graves et al. (2013), Holmes (1997), Hopkins & Dudley-Evans (1988), Kanoksilapatham (2007), Peacock (2002), Posteguillo (1999), Swales (1990), Yang & Allison (2003)
Commenting on results	Interpreting results; Accounting for results	Graves et al. (2013), Yang & Allison (2003)
(Un)expected outcome		Dudley-Evans (1994), Holmes (1997), Hopkins & Dudley-Evans (1988), Kanoksilapatham (2007), Peacock (2002), Posteguillo (1999), Swales (1990)
Reference to previous research; Reference to previous research (comparison); Reference to previous research (support)	Referring to previous literature; Comparing results with literature	Dudley-Evans (1994), Holmes (1997), Hopkins & Dudley-Evans (1988), Kanoksilapatham (2007), Peacock (2002), Posteguillo (1999), Swales (1990), Yang & Allison (2003)
Explanation; Explanation of unsatisfactory result	Explaining differences in findings	Dudley-Evans (1994), Holmes (1997), Hopkins & Dudley-Evans (1988), Kanoksilapatham (2007), Peacock (2002), Posteguillo (1999), Swales (1990)
Exemplification	Exemplifying	Hopkins & Dudley-Evans (1988), Kanoksilapatham (2007), Posteguillo (1999), Swales (1990)
Summarizing the study	Restating methodology	Yang & Allison (2003), Kanoksilapatham (2007)
Deductions; Deduction and hypothesis	Making suggestions	Hopkins & Dudley-Evans (1988), Posteguillo (1999), Swales (1990), Yang & Allison (2003)
Claim; Generalization	Making overt claims or generalizations	Dudley-Evans (1994), Holmes (1997), Kanoksilapatham (2007), Peacock (2002)
Evaluating the study; Evaluating research	Evaluating methodology; Evaluating results; Indicating significance/advantage; Drawing pedagogic implication	Graves et al. (2013), Yang & Allison (2003)

Stating limitations of the present study; Limitation	Indicating limitations; Limitations about the findings; Limitations about the methodology; Limitations about the claims made	Dudley-Evans (1994), Kanoksilapatham (2007), Peacock (2002), Yang & Allison (2003)
Recommendation for further research; Suggesting further research	Recommending further research	Dudley-Evans (1994), Graves et al. (2013), Holmes (1997), Hopkins & Dudley-Evans (1988), Peacock (2002), Posteguillo (1999), Swales (1990), Yang & Allison (2003)
Outlining parallel subsequent developments		Holmes (1997)
Justification		Hopkins & Dudley-Evans (1988)

Most researchers describe D/C discourse at the level of moves; only Kanoksilapatham (2007) and Yang and Allison (2003) outline the steps. Also note that some of the same concepts were labeled both as moves and as steps (e. g., stating results, referencing previous research, explaining, exemplifying, commenting on limitations, making recommendations). Unlike their fellow researchers, Berkenkotter and Huckin (1995) conceptualized the moves to mirror the metaphorical CARS model: *Occupying the niche*, *(Re)establishing the territory*, and *Establishing additional territory*. In terms of organization, D/C discourse has been characterized as cyclical (Dudley-Evans, 1994; Posteguillo, 1999; Swales & Feak, 1994), often starting with a quasi-obligatory statement of result (Swales, 1990) with or without reference to a graph or table (Peacock, 2002), followed by a comment in the form of either a reference to previous research, a deduction or hypothesis, or a recommendation for further research.

The complexity of argumentation and considerable variation among disciplines may seem to make the task of developing a cross-disciplinary move/step model onerous, if not daunting. However, the studies briefly reviewed above serve as proof-of-concept evidence for such an endeavor. We would argue, however, that this work needs to be taken further in terms of expanding the range of disciplines and, more importantly, in terms of more comprehensively describing the discursual complexity of D/C sections such that it is suitable for direct application to disciplinarily heterogeneous genre-based pedagogy.¹ Although existing move models do hold pedagogical promise, they appear overly simplistic for this purpose. They are either fragmentary, because only the moves are outlined; inconsistent, because they are specific to single or few disciplines; or incomplete, because they are limited to brief definitions and examples. It is worth noting that none of the move analysis studies reviewed above were translated to instructional materials, and few corpus-based pedagogical implementations reported in the literature carry a specific focus on teaching the craft of discussion (e.g., Flowerdew, L., 2015). It is thus not surprising that instructional materials specific to genre-based teaching of D/C writing are lacking.

In what follows, we will build the missing bridge between research and pedagogy by demonstrating: (a) how corpus-based descriptions of D/C discourse units can take into account

the relationship between texts and the authors' role, communicative goals, and purposeful rhetorical choices, and (b) how a cross-disciplinary D/C model can inform the creation and implementation of corpus-based materials and tasks with an explicit focus on rhetorical conventions.

Cross-disciplinary model for Discussion/Conclusions

Corpus-based move analysis

In a large-scale study, we conducted move analysis of all RA sections in a corpus of 900 research articles – 30 articles published in high impact journals in 30 disciplines (see Appendix A for the complete list of disciplines and their acronyms). Faculty consultants from each discipline participated in the compilation of the corpus and holistically evaluated the articles, using a rubric to mark the quality of writing, visual presentation, and overall research as excellent, good, fair, or poor. They were also consulted during the development of move/step models for each section.

We employed top-down corpus analysis following Biber, Connor, and Upton (2007). Our methodology is described in detail in Cotos, Huffman, and Link (2015); here, we summarize it in Figure 1. In short, we first conducted an inductive analysis and pilot annotation of a sample of 150 texts (5 from each discipline), and that resulted in specific move and step descriptors, which were refined based on the feedback provided by the disciplinary consultants. When refining and defining the moves and steps, we also drew on existing formulations, as included in Table 1. The move/step categories were used for annotation, i.e. manual tagging of the corpus. The unit of analysis was the sentenceⁱⁱ. In sentences where writers embedded more than one move or step, the clauses or phrases carrying that secondary function were additionally tagged. When multiple sentences constituted a move or step, a respective tag was assigned to each sentence. Given that our two end-goals for corpus annotation were linguistic inquiry and corpus-based genre pedagogy, the annotation was done using Callisto annotation software (MITRE, 2002), which allows for both a user-driven specification of annotation characteristics and a relatively flexible representation of texts from a pedagogically relevant corpus. We agree with Pérez-Paredes' and Alcaraz-Calero's (2009) belief that the annotation "should meet sound pedagogical presuppositions and foundations" (p. 63).

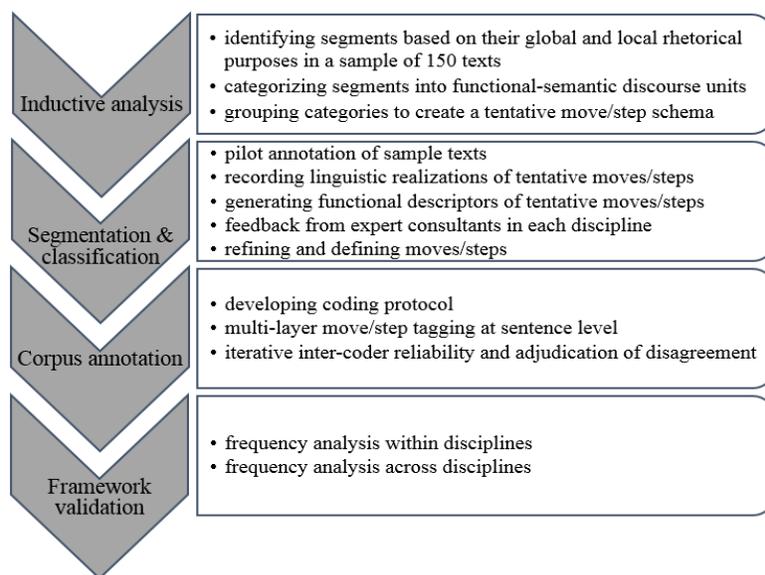


Figure 1. Top-down corpus-based analysis of Discussion/Conclusion discourse

Descriptors of moves and steps

The move/step model for the Discussion/Conclusion sections continues the CARS metaphor, allowing for a degree of parallelism: *Move 1 – Re-establishing the territory*, *Move 2 – Framing the new knowledge*, *Move 3 – Re-shaping the territory*, and *Move 4 – Establishing additional territory*. For teachers, we offer more learner-friendly move names that are placed in square brackets below. The steps presented in Tables 2a, 3a, 4a and 5a are defined in such a way that the definition relates the communicative purpose and function to the expected content, for students often simply do not know what information to include in this section. It is important to clarify here that the descriptors of rhetorical intent and content realizations are not exhaustive; researchers as well as teachers and their students can modify and add to our lists as they explore texts and sociorhetorical situations. Also, the order in which we present the moves and their steps does not suggest a prescriptive sequence. In Tables 2b, 3b, 4b, and 5b, we provide examples from the corpus with underlined language use that helps tie the rhetorical intent and content information into explicit statements.

Move 1: Re-establishing the territory [Grounding the discussion]

This move aims to prepare the reader with a frame of reference needed to contextualize the author's argumentation in the discussion. Authors integrate various details, which have likely been introduced earlier in the paper and are recollected here to help the reader see how important information will be taken further to another level. It also enables a discussion thread that ties back to the Introduction and Methods, bringing out major points regarding what has been accomplished. In separate Conclusion sections, this move summarizes the main points to provide background for conclusive remarks.

Table 2a. Move 1 step descriptors

<i>FUNCTION</i> [Doing what?]	<i>RHETORICAL INTENT</i> [Why?]	<i>CONTENT REALIZATIONS</i> [What content?]
<i>Step 1: Drawing on general background</i> Sets the ground for a broader reflection on the results in view of the existing knowledge territory.	<ul style="list-style-type: none"> - to provide a conceptual frame of reference for the reader - to show how the current study fits in the targeted knowledge/research space 	Information related to ideas that may have motivated the study: <ul style="list-style-type: none"> - a theoretical tenet or debate - an unsolved practical problem or issue - a gap or incongruent/contradictory findings in previous research - high impact facts
<i>Step 2: Drawing on study-specific background</i> Reiterates relevant study specifics.	<ul style="list-style-type: none"> - to remind the reader of study details relevant to further discussed results and/or claims - to re-emphasize the reliability of discussed findings 	Brief summary of study-specific details: <ul style="list-style-type: none"> - purpose of the study and/or research questions or hypotheses - aspects of the methodology (e.g., research design, setting, procedures, data analysis) - rationale for certain methodological choices

<p><i>Step 3: Recounting the principal findings</i> Features important findings.</p>	<ul style="list-style-type: none"> - to highlight noteworthy results - to claim the attainment of research objectives - to show which findings occupy the niche in the targeted knowledge space 	<p>Statements of findings:</p> <ul style="list-style-type: none"> - summary or synthesis of specific results - examples from data - reference to data displays (figures, tables, etc.)
<p><i>Step 4: Previewing the discussion 'road map'</i> Previews section structure.</p>	<ul style="list-style-type: none"> - to guide the reader and clarify expectations 	<p>Statements that specify:</p> <ul style="list-style-type: none"> - general organization and/or sequence of section content.

Table 2b. Move 1 step examples and linguistic realizations

<i>FUNCTION</i> [Doing what?]	<i>LINGUISTIC REALIZATIONS</i> [What language choices?]
<p><i>Step 1: Drawing on general background</i></p>	<ul style="list-style-type: none"> - Forest Transition <u>Theory</u> (Mather, 1992) for example, poses that due to economic development and industrialization, agricultural intensification will be concentrated in the most suitable regions. [FORE] - Body weight <u>is one of the most obvious physical characteristics</u>, and obesity <u>has become a major</u> social and health <u>issue</u>. [BUSS]
<p><i>Step 2: Drawing on study-specific background</i></p>	<ul style="list-style-type: none"> - <u>The aim was to understand the effect of variable processing conditions</u> (that differed between processors) <u>on variability in BC content</u> and true retention under field conditions for two contrasting products. [AGNY] - All animals <u>were treated with</u> a commercial dewormer <u>at the end of</u> the study. [ANSC]
<p><i>Step 3: Recounting the principal findings</i></p>	<ul style="list-style-type: none"> - <u>The findings reported above show that the feedback was no more successful</u> in improving the raters' rating behavior <u>than</u> random variation. [APLI] - When GAPDH was incubated with MG, the formation of fluorescent AGEs - likely argpyrimidine - <u>occurred more rapidly in the presence of</u> isoflurane (Fig. 1). [BIOP]
<p><i>Step 4: Previewing the discussion 'road map'</i></p>	<ul style="list-style-type: none"> - <u>Here, we propose</u> a mechanism for the generation of small internal deletions. <u>We also discuss</u> the implications of our results for the development of transposon-based genome rearrangement tools. [BINF]

Move 2: Framing the new knowledge [Commenting on the results]

This move aims to establish the meaning of the results by presenting the author's understanding of the results and underscoring their soundness with evaluative claims. Authors provide explanations and reasoning that go beyond the 'objective' results and/or beyond the scope of the study, drawing on existing knowledge in the field. They take a stance and seek to position readers to agree with their claims. This move is characteristic of Discussion sections and of combined Discussion/Conclusion sections; it may or may not appear in separate Conclusion sections.

Table 3a. Move 2 step descriptors

<i>FUNCTION</i> <i>[Doing what?]</i>	<i>RHETORICAL INTENT</i> <i>[Why?]</i>	<i>CONTENT REALIZATIONS</i> <i>[What content?]</i>
<i>Step 1: Explicating the results</i> Explains results and/or claims based on the results.	<ul style="list-style-type: none"> - to give meaning to the results - provide logic behind arguments related to principal findings - to take a position and incline the reader to accept it 	Statements that express authors': <ul style="list-style-type: none"> - interpretations of the results - inferences based on the results - deductions from the results - evaluation of the results - hypotheses based on the results
<i>Step 2: Accounting for the results</i> Provides reasons that may have influenced the nature of results.	<ul style="list-style-type: none"> - to justify the nature of the results - to support the reliability of the results - to anticipate questioning by the reader 	Statements that explain results by referring to: <ul style="list-style-type: none"> - experimental conditions - variables - sample size - inability to control or predict certain factors - hypotheses based on theory
<i>Step 3: Clarifying expectations</i> Presents expected or unexpected results.	<ul style="list-style-type: none"> - to draw the reader's attention to noteworthy information - to connect findings to initial hypotheses 	Statements that specify: <ul style="list-style-type: none"> - results that were expected and/or unexpected given the set-up of the study - results that were interesting - results that were satisfactory and/or unsatisfactory.
<i>Step 4: Addressing limitations</i> Acknowledges the limitations of the study.	<ul style="list-style-type: none"> - to anticipate potential criticism and ward off criticism - to avoid over-generalization of findings 	Statements that specify: <ul style="list-style-type: none"> - study-specific weaknesses - conditions that could not be accounted for or controlled - tentative confidence level of results - justifications for soundness of results despite limitations

Table 3b. Move 2 step examples and linguistic realizations

<i>FUNCTION</i> [Doing what?]	<i>LINGUISTIC REALIZATIONS</i> [What language choices?]
<i>Step 1: Explicating the results</i>	<ul style="list-style-type: none"> - <u>The results indicate that</u> incumbents do indeed react preemptively to Southwest's entry threat. [ECON] - <u>The validation results presented suggest that</u> STEMS-Air <u>can be applied to</u> both short-term and long-term modelling of PM10. [ENVE]
<i>Step 2: Accounting for the results</i>	<ul style="list-style-type: none"> - <u>It is unlikely that the</u> adhesion <u>results were simply due to the</u> amount of tropoelastin present. [MECE] - Simultaneous global warming and stratospheric cooling <u>may have also acted together</u> to widen the Hadley cell. [METE]
<i>Step 3: Clarifying expectations</i>	<ul style="list-style-type: none"> - Therefore, <u>our study supports the hypothesis that</u> proteins bound to the actin locally deliver the signal for increased contractility and directed actin assembly. [MCDB] - <u>This result is intriguing since</u> both types of photons likely originate in the same location. [PHAS]
<i>Step 4: Addressing limitations</i>	<ul style="list-style-type: none"> - <u>A major limitation was the lack of</u> waiting-list or healthy control groups. [PSYC] - <u>We must however be cautious in our interpretations.</u> [SOCl]

Move 3: Re-shaping the territory [Referencing literature]

This move aims to redefine and update the knowledge territory by means of positioning the reported findings in the research space established by previous works. Considering how the study procedures, objectives, or assumptions compare with those of previous works, authors evaluate the congruence of their findings with the literature. They also discuss the reliability of findings, claims, or recommendations in the literature in view of the new results. This move is characteristic of Discussion sections and of combined Discussion/Conclusion sections; it may or may not appear in separate Conclusion sections.

Table 4a. Move 3 step descriptors

<i>FUNCTION</i> [Doing what?]	<i>RHETORICAL INTENT</i> [Why?]	<i>CONTENT REALIZATIONS</i> [What content?]
<p><i>Step 1: Supporting with evidence</i></p> <p>Shows congruence of results with previous works.</p>	<ul style="list-style-type: none"> - to demonstrate that the evidence obtained in the study supports and adds to existing knowledge - to strengthen the credibility of new findings - to support claims made based on the new findings 	<p>Statements and citations that show:</p> <ul style="list-style-type: none"> - similarity, agreement, concurrence, and/or conformity of results with previous research - how/which similar or relevant previous research supports the new results - how/which theoretical tenets are reflected in the new results

<p><i>Step 2: Countering with evidence</i> Juxtaposes dissimilar evidence obtained in the study with previous works.</p>	<ul style="list-style-type: none"> - to recognize noteworthy differences - to claim value of results despite differences with previous works - to dismiss questions that are indirectly related to the results 	<p>Statements and citations that show:</p> <ul style="list-style-type: none"> - difference, disagreement, contrast, and/or divergence of results from previous research - how/which new results contradict previous research - how/which new results challenge theoretical tenets
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Table 4b. Move 3 step examples and linguistic realizations

<i>FUNCTION</i> [Doing what?]	<i>LINGUISTIC REALIZATIONS</i> [What language choices?]
<p><i>Step 1: Supporting with evidence</i></p>	<ul style="list-style-type: none"> - <u>Their results may support our data that inhibition of ICAM-1 expression partially explains the decreased HL-60 adhesion.</u> [AGYN] - <u>The result that student writers preferred PE over AWE empirically supported the social constructivism</u> (Vygotsky, 1962, 1978). [CURI]
<p><i>Step 2: Countering with evidence</i></p>	<ul style="list-style-type: none"> - <u>Contrary to what Upchurch (1985) found, our findings show that tissue with larger airspaces is more vulnerable to bruising.</u> [AGBE] - <u>This study, thus, challenges the cognitive-processing model of Flower and Hayes (1981) as well as all studies neglecting the role of development in the construction of text.</u> [APLI]

Move 4: Establishing additional territory [Expanding on comments]

This move aims to expand the discussion beyond the principal findings and promote the study within broader contexts. Authors draw logical conclusions, highlight the significance of the study, and recommend a follow-up course of action. This move may be part of a Discussion section, a combined Discussion/Conclusion section, or of a separate Conclusion section.

Table 5a. Move 4 step descriptors

<i>FUNCTION</i> [Doing what?]	<i>RHETORICAL INTENT</i> [Why?]	<i>CONTENT REALIZATIONS</i> [What content?]
<p><i>Step 1: Generalizing results</i> Presents general claims or conclusions.</p>	<ul style="list-style-type: none"> - to broaden the scope of interpretation of results - to clarify whether the results are applicable or not outside the context of the study 	<p>Statements that specify authors':</p> <ul style="list-style-type: none"> - logical deductions from the results - potential for transferability of results - examples of how the results can be extrapolated - factors that may limit claims to generalizability

<p><i>Step 2: Stating the value</i> Presents specific claims of importance.</p>	<p>- to advocate significance and noteworthiness of the study</p>	<p>Statements that specify:</p> <ul style="list-style-type: none"> - the value of findings - contributions of the study to the field - the strengths of the study that may be significant for future research
<p><i>Step 3: Noting implications</i> Presents specific claims of impact.</p>	<p>- to claim that the results may have impactful ramifications</p>	<p>Statements that specify:</p> <ul style="list-style-type: none"> - how the study and/or particular results may influence research, theory, and/or practice - possible consequences in different contexts
<p><i>Step 4: Proposing directions</i> Presents recommendations for future work.</p>	<p>- to assert the need for future work - to call for continuity of scholarship</p>	<p>Statements that specify:</p> <ul style="list-style-type: none"> - suggestions for focused inquiry - questions or hypotheses that could guide future research - announcements of follow-up or ongoing research by same author/s - justifications for the need for continued research or practical application

Table 5b. Move 4 step examples and linguistic realizations

<i>FUNCTION</i> [Doing what?]	<i>LINGUISTIC REALIZATIONS</i> [What language choices?]
<p><i>Step 1: Generalizing results</i></p>	<p>- <u>Taken as a whole, the results of the study offer some support, albeit modestly, for the notion that</u> personality does explain variability in malevolent creativity. [ARTD] - <u>Consequently, the current work demonstrates that the effects of these markers cannot be extended to</u> all B. taurus breeds. [ANSC]</p>
<p><i>Step 2: Stating the value</i></p>	<p>- <u>Our main contributions include</u> foam type classification using local entropy texture features and the subsequent foam-type-specific bubble segmentation. [CHEE] - <u>This article represents a push toward understanding the actual mechanics of the cable firms' response to the entry of satellite.</u> [ECON]</p>
<p><i>Step 3: Noting implications</i></p>	<p>- The electrical-resistivity <u>technique can be an effective mapping tool for use in</u> reservoir water-quality assessment. [BMSC] - <u>This approach could allow government agencies and industry to evaluate</u> natural contamination of STEC in beef carcass swabs, beef trim, and ground beef more efficiently. [FOOD]</p>

Step 4: Proposing directions

- More work is needed to determine the parameters of this process [IMMU]
- Further analyses should reveal whether this is indeed the case and whether such feature extends to its mammalian orthologue. [MCDB]

Occurrence of moves and steps across disciplines

As previously mentioned, these moves and steps were applied to corpus annotation, which is instrumental for the validation of the new model. However, the annotated corpus also has important pedagogical value. It allows for examining the occurrence of moves and steps within and across disciplines, thus holding notable potential to inform instruction. In multi-disciplinary classrooms, teachers would benefit from such insights when discussing which and why some features of D/C discourse may be more prominent, if not obligatory, and which may be optional. Also, zooming into discipline-specific texts can help them facilitate students' identification of the patterns and variation in their discipline, emphasizing non-linearity in organization as well as creative complexity in content and argumentation. Figures 2-5 help demonstrate how the D/C steps appeared in our corpus. The percentages representing the distribution of steps in the disciplines were calculated based on the number of units of analysis tagged with respective moves and steps in each disciplinary corpus.

The steps of Move 1 shown in Figure 2 illustrate visible patterns across the disciplines. *Recounting the principle findings* step is the most common in general, but some disciplines demonstrate higher frequencies of *Drawing on background information* (ANSC, ARTD, BINF, BUSS, IMMU, MICRO, and VETM) (Appendix A lists the disciplines and their acronyms). This step's distribution is similar to Kanoksilapatham's (2005) move *Contextualizing the study*, which she described as conventional, occurring in 90% of her Biochemistry corpus. Although to a lesser extent, *Drawing on study-specific background* also occurs in all the disciplines; interestingly, this step is a bit more frequent than Step 1 in PHAS. *Previewing the discussion 'road map'* occurs at the lowest frequency and may be optional.

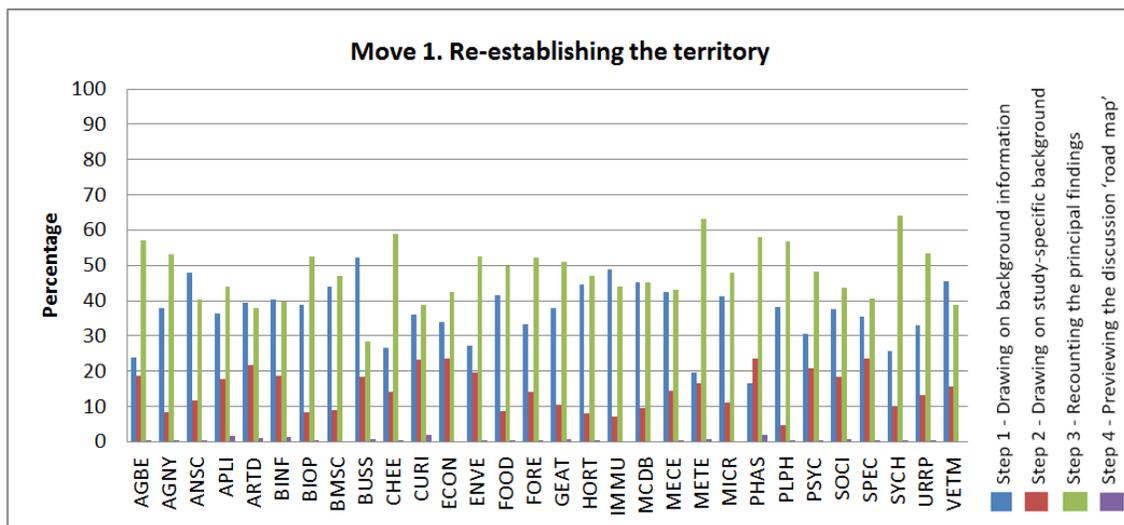


Figure 2. Distribution of steps in Move 1

In Move 2 (Fig. 3), the *Explicating the results* step can be confidently considered conventional. In Yang and Allison (2003), *Commenting on results* by interpreting results, comparing results with literature, accounting for results, and evaluating results, is the most frequent and, and as they claim, obligatory move. *Accounting for the results* and *Addressing limitations* in our corpus are perhaps the most variable across disciplines. Interestingly, six of the eight disciplines in the humanities and social sciences (APLI, BUSS, CURI, PSYC, SOCI, SPEC) seem to address limitations more frequently than to account for results. *Clarifying expectations* may or may not occur; for instance, in ECON this step appears only in .6% of this corpus.

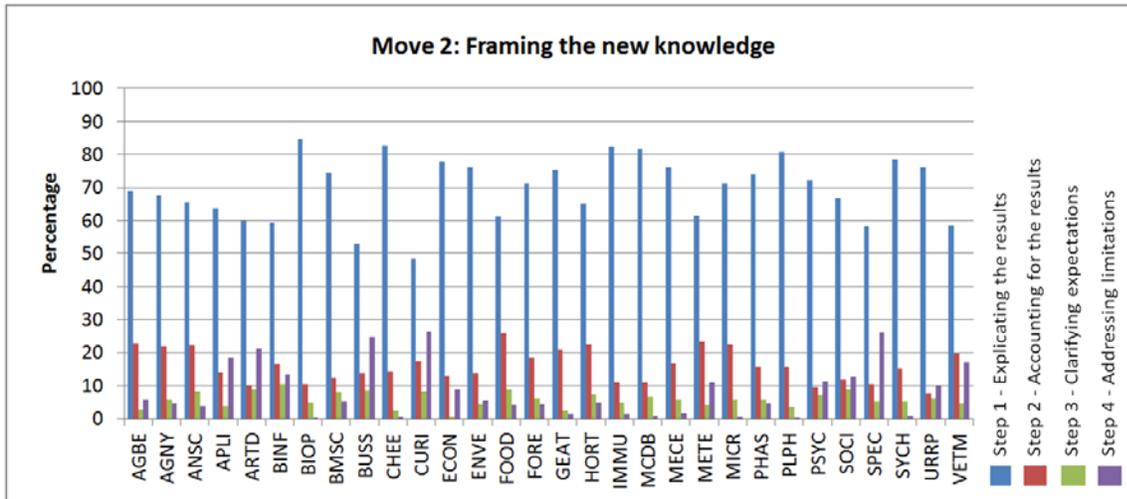


Figure 3. Distribution of steps in Move 2

Both *Supporting with evidence* and *Countering with evidence* in Move 3 can be considered conventional, the former being more common than the latter (Fig. 4). Peacock (2002) also found that *Reference to previous research* seemed to be virtually obligatory, occurring in 73% of all RAs in their corpus.

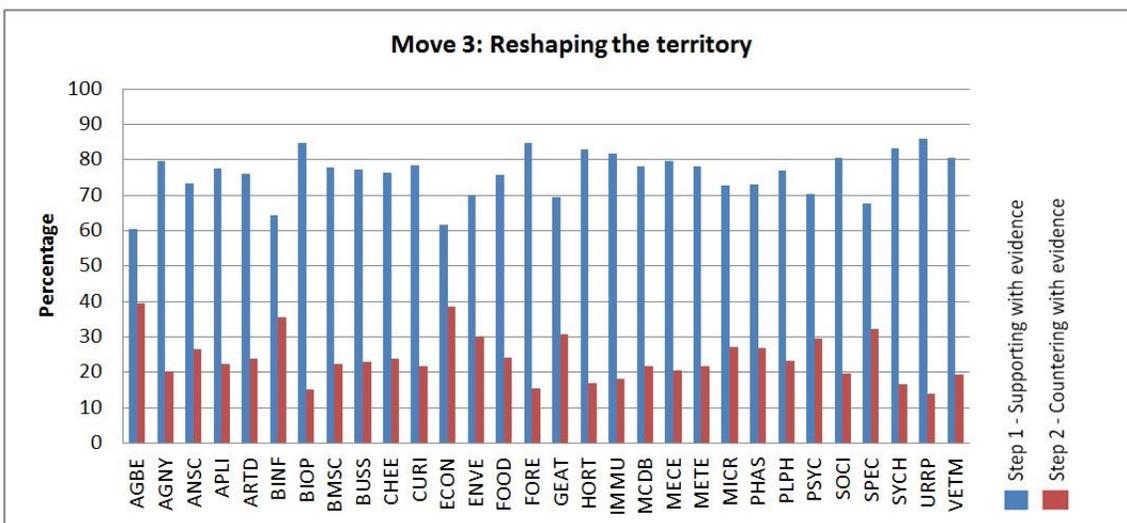


Figure 4. Distribution of steps in Move 3

Move 4 exhibits, perhaps, the most noticeable variation across the disciplinary corpora. While all four steps appear in all the disciplines, *Noting implications* and *Proposing directions* stand out as being predominant (e.g., CURI, FORE and CHEE, SPEC, respectively). These findings are very similar to Peacock (2002) and Posteguillo (1999) who found their *Recommendation* move to be very common.

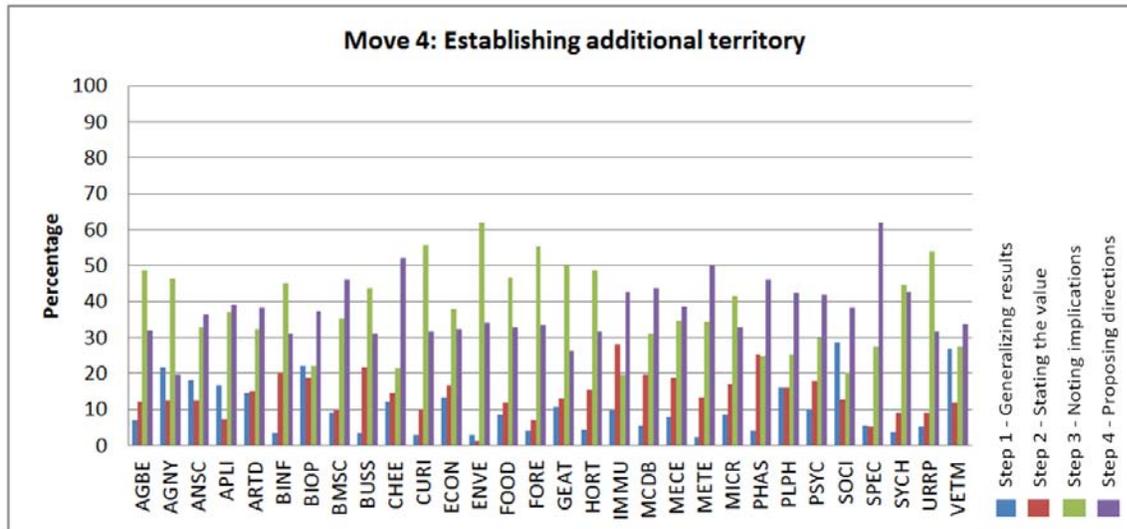


Figure 5. Distribution of steps in Move 4

Pedagogical application

The course

The outcomes of our move analysis found direct application in pedagogic enrichment materials (Braun, 2005) in several credit-bearing, multi-disciplinary graduate writing courses, which are offered by the English Department and the Graduate College at Iowa State University. In this section, we refer to the pedagogy in the “Advanced Academic Writing Workshop: Writing Empirical Research” course. Traditionally, it employs a genre approach informed by rhetoric and composition/writing studies and academic literacies (Lea & Street, 1998; Miller, 1984), centering on the processes and practices of producing academic discourse. Students read articles that address different facets of academic writing and current trends in academic discourse, and discuss the expectations of publishing in academic journals, including the referee process and editorial decision-making. Specifically targeting the RA genre, we have complemented this approach with corpus-based descriptions, which highlight rhetorical conventions applicable across disciplines, and with hands-on analysis of authentic corpora, which can reveal patterns and variation in discipline-specific discourse. The course is open to both L1 and L2 speakers of English; both student populations tend to be equally represented.

Corpus-based materials and tasks

The course materials and tasks were made available to students on the web via the Moodleⁱⁱⁱ course management system. The move/step model served to equip students with tangible guide-

lines for analyzing and producing research discourse. The model also informed the reading materials, which were composed to provide a comprehensive narrative description of each move and respective steps. The readings were accompanied by short video-lectures for each move, in which an instructor explained the genre concepts using excerpts from the corpus and exemplified a reflective process for how to interpret the functional meaning and language use in D/C discourse. Additionally, a set of exercises was designed for knowledge consolidation discussion in pairs or small groups. The guidelines for D/C peer review also integrated the rhetorical concepts explored in class to encourage constructive feedback based on the reviewer's interpretation of what the author does, whether s/he is explicit enough in conveying rhetorical intent, whether the content is sufficient and appropriate, and whether the argumentation is clearly and effectively developed. Similar to Charles (2007), Flowerdew (2008), and Gavioli and Aston (2001), peer-to-peer interaction was employed as a means of pedagogic processing (Widdowson, 2004) to carry out discourse-based tasks focused on description and awareness-raising, also enabling students to relate the corpus data to their own contextual writing goals.

Swales (1990) maintains that the tasks should be designed as “a set of differentiated, sequenceable, goal-directed activities drawing upon a range of cognitive and communicative procedures relatable to the acquisition of pre-genre and genre skills appropriate to a foreseen or emerging socio-rhetorical situation” (p. 76). In view of this recommendation, the materials and tasks outlined in Table 6 integrate corpus work by means of analysis, application, evaluation, and practice in the traditional instructional process of reading about, discussing, and doing research writing. Combining discursive tasks with authentic corpus explorations aimed to lessen the caveat of adopting a prescriptive formulaic approach.

Table 6. Materials and tasks in D/C Unit

<i>MATERIALS</i>	<i>TASKS</i>
	Writing of D/C draft
Self-compiled corpus	Global features analysis and discussion
Video lectures, readings	Study of D/C moves/steps
Corpus-based exercises, move/step model hand-out	Group work and discussion
Annotated corpus, Callisto	Rhetorical composition analysis; online discussion forum
Annotated corpus, Callisto or concordancer	Language use analysis; online discussion forum
Self-compiled corpus, Callisto	Annotation of rhetorical features
Student D/C draft, Callisto	Annotation of first draft
	Revision of D/C draft
Move/step model-based guidelines	Peer review
	Revision of D/C draft

The corpus-based tasks integrated pedagogical techniques advocated in the literature, including the use of specialized corpora – both published and compiled by students (Cortes, 2007, 2011; Lee & Swales, 2006), and annotated corpus data (Chang & Kuo, 2011; Pérez-Paredes & Alcaraz-Calero, 2009). A feature distinct from previous applications is the use of functional annotation of corpus texts suitable for pedagogical delivery as well as for students' own analysis of texts. Specifically, the corpus annotated in the study and the Callisto software were used as key resources for students' corpus-based explorations. The tasks described below built on corpus exploration and text analysis. Similar to Cortes (2007, 2011), the students recorded their observations as individual forum posts in Moodle, which fostered class discussions of patterns and variation and informed students' evaluation of D/C discourse produced by published authors, their peers, and themselves.

Global features analysis task (self-compiled corpus)

Students' first exposure to corpora occurred prior to the introduction of the move/step model. At the beginning of the course, the students compiled a small corpus of no less than 15 research articles in their particular field of study. The articles had to be recently published, written by different authors, and selected from three reputable journals, one of which was the journal that they intended to submit their own article to. Students were then asked to examine and take notes about global D/C characteristics in their self-compiled corpus (e.g., organization into sections and subsections, naming conventions, noticeable transitions from the preceding section, etc.). This task set the scene for group discussion of similarities and differences among RAs in different journals, what may be conventionalized by the disciplinary community, and how authors may choose to develop their discourse in creative ways.

Rhetorical composition analysis task (annotated corpus)

After having been familiarized with the move/step functions and their purposes in D/C sections, the students were directed to the annotated corpora in order to explore the rhetorical composition of annotated texts in a corpus representative of their field. A few students whose discipline was not represented in the corpus analyzed texts from disciplines similar to theirs; for example, a student in Human Development and Family Studies worked with texts from Sociology. Guided by a set of questions (Appendix B1), the students opened annotated D/C files in Callisto one by one and examined the color-coded moves and their annotation for steps (Appendix B2). This task drew their attention to the presence or absence of the moves, their distribution and sequencing, the occurrence of steps within a move and their frequency, and the overlap of move colors reflecting multifunctionality of discourse. The students also used hand-outs based on the descriptions presented in Tables 2-5 and took notes reflecting on why they thought authors in their discipline use particular moves/steps in a particular way (rhetorical intent) and what kind of information or ideas they include (content realization) to achieve their purposes.

Language use analysis task (annotated corpus)

To complete this task, students also used the annotated corpus in Callisto – this time focusing on the bottom section of the screen displaying move tabs with text excerpts and their corresponding steps.^{iv} They were asked to identify the linguistic means indicative of certain step functions and compile a list of such means, which they could use when they revise their own

D/C drafts. Students were also asked to pay attention to grammatical features (e.g., verb tenses in *Recounting principal findings* versus *Generalizing results*, adverbials and modals expressing tentative claims in *Explicating results* or *Noting implications*).

Annotation of rhetorical features tasks (self-compiled corpus and personal draft)

To consolidate and apply their knowledge, the students were tasked with annotating a text from their self-compiled corpus in Callisto (after a demonstration explanation by the teacher). They used course materials as well as their corpus exploration notes as scaffolding. Working collaboratively on this task, students verbalized their hypotheses regarding the author's communicative intent and justified their interpretations by identifying language use that may signal the identified functions. Then, they annotated their own D/C drafts independently, engaging in the same thought processes as in the corpus exploration and annotation.

While it is beyond the scope of this article to present an evaluation of the corpus-based materials and tasks designed using our research results, based on our experience we would recommend this approach for a number of reasons. First, teachers would have the tools to orchestrate situated individual and group work and the simulation of a real-world communicative (research) activity (J. Flowerdew, 2015) in a way that helps students transition from “knowledge that” to “knowledge how” (DeKeyser, 2007, p. 98). Additionally, the corpus-based tasks are likely to not only generate rich awareness-raising discussions and critical evaluations (which might be inconceivable otherwise), but to also lead to specific learner actions in the writing process, as the students attempt revisions of their drafts. For example, after initial considerations of global features, the students may reconsider the backbone structural outline of their draft. Their analysis of rhetorical composition can result in corpus-based and self-generated guidelines, which can help them intertwine functional steps common in their discipline. Particularly valuable in this task would be the emphasis on rhetorical intent and content realizations, so that the students acquire a deeper understanding of why and how argumentation works by confirming and adding to the list of ideas suggested in the instructional material accompanying the task (based on the descriptors in Tables 2a-5a). Furthermore, the analysis of language use can result in a self-compiled functional thesaurus containing a wide range of linguistic means that students could operate with to improve the effectiveness and clarity of their rhetorical intent in working drafts, and that they could gradually internalize for future writing projects. Finally, the hands-on annotation is, perhaps, the most cognitively-engaging and fun task, unique for enhancing students' ability to evaluate why writing, theirs and others', may be perceived as more or less effective by the target audience.

As we advocate these tasks, however, we do acknowledge that the approach we took in our course may not be feasible in other educational environments. Teachers may not be able to afford enough class time for corpus-based and interactive activities, so a practical compromise would need to be made. We found online forums to be a great platform for learning interactions. Also, if the course is organized into section-specific RA units, then after the first unit the students could be assigned the corpus explorations tasks as homework, and more class time could be devoted to their discussions of corpus findings and writing increments. Another problem is supplying annotated discipline-specific corpora to all the students. Although it is helpful for students to observe structural complexity in color-coded D/C discourse in general, not being able to

draw conclusions about disciplinary patterns is a limitation (especially to the rhetorical composition analysis). With time, however, corpus representativeness can grow if teachers collect the texts annotated by their students.

Closing remarks

Our genre-driven agenda adheres to Swales' (1990) seminal work, which John Flowerdew (2015) justifiably assesses as highly valuable for teaching writing in academic and research settings, for it enhances key constructs of the Vygotskian, genre, corpus, and English as a Lingua Franca strands of pedagogic theory. Swales (1990) argues that "It is communicative purpose that drives the language activities of the discourse community; it is communicative purpose that is the prototypical criterion for genre identity, and it is communicative purpose that operates as the primary determinant of task" (p. 10). We would add – it is communicative purpose that should underlie writing instruction and gear the learning of student apprentices to genre.

In this paper, we presented a research-to-pedagogy thread that realizes the potential of RA communicative purposes through multi-disciplinary corpus analysis and direct transfer of research results to the classroom. In our illustration of this connection, we intend to provide teachers with "something to contribute over and above methodology" (Swales, 1990, p. 215) – a cross-disciplinary model and a rhetorically annotated corpus. We do recognize that such a theoretically grounded, research-informed, and corpus-based approach requires enormous efforts that call for ambitious future work. Advanced methods in corpus and computational linguistics offer great promise for potential interdisciplinary collaborations with applied linguists and writing scholars, which could result in automated annotation of disciplinary corpora as well as in new methods and materials for teachers and students.

ⁱ In post-graduate contexts where genre-based teaching is discipline-specific at earlier levels of education, acquainting students with a cross-disciplinary model is also advisable, for it can help novices, especially L2 writers, disentangle genre complexity and become conscious of the implicit relationship between structural, rhetorical, and lexico-grammatical aspects of genre writing (see Hyland, 2007; Johns, 2011). Additionally, in our epoch of interdisciplinary research, it can help them acquire formal knowledge of the genre (Tardy, 2009) and thus foster their communication when co-authoring publications with scholars in other fields.

ⁱⁱ The appropriateness of the sentence as the unit of analysis is well explained by Crookes (1986) and Holmes (1997).

ⁱⁱⁱ Moodle, or Modular Object-Oriented Dynamic Learning Environments, is an open-source course management system that offers customizable features to tailor online learning environments (<https://moodle.org>).

^{iv} In a subsequent version of the course, the students have been using a move/step concordancer, which is built in an online AWE application for research writing based on our annotated corpus data (Cotos, 2015).

Appendix A. Disciplines included in the RA corpus

<ul style="list-style-type: none"><input type="checkbox"/> Agricultural & Bio-Systems Engineering (AGBE)<input type="checkbox"/> Agronomy (AGNY)<input type="checkbox"/> Animal Science (ANSC)<input type="checkbox"/> Applied Linguistics (APLI)<input type="checkbox"/> Art and Design (ARTD)<input type="checkbox"/> Bioinformatics (BINF)<input type="checkbox"/> Biomedical Sciences (BMSC)<input type="checkbox"/> Biophysics (BIOP)<input type="checkbox"/> Business (BUSS)<input type="checkbox"/> Chemical Engineering (CHEE)<input type="checkbox"/> Curriculum & Instruction (CURI)<input type="checkbox"/> Economics (ECON)<input type="checkbox"/> Environmental Engineering (ENVE)<input type="checkbox"/> Food Science (FOOD)<input type="checkbox"/> Forestry (FORE) Geological & Atmospheric Sciences (GEAT)<input type="checkbox"/> Horticulture (HORT)	<ul style="list-style-type: none"><input type="checkbox"/> Immunobiology (IMMU)<input type="checkbox"/> Mechanical Engineering (MECE)<input type="checkbox"/> Meteorology (METE)<input type="checkbox"/> Microbiology (MICR)<input type="checkbox"/> Molecular, Cellular & Developmental Biology (MCDB)<input type="checkbox"/> Physics & Astronomy (PHAS)<input type="checkbox"/> Plant Physiology (PLPH)<input type="checkbox"/> Psychology (PSYC)<input type="checkbox"/> Sociology (SOCI)<input type="checkbox"/> Special Education (SPED)<input type="checkbox"/> Synthetic Chemistry (SYCH)<input type="checkbox"/> Urban & Regional Planning (URRP)<input type="checkbox"/> Veterinary Medicine (VETM)
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Appendix B1. Rhetorical composition analysis task: Directions

Using Callisto, open annotated Discussion/Conclusion sections in your discipline (or a discipline related to your field) one by one. Begin with a focus on with Move 1 (the blue text) and take detailed reflective notes of your observations. Use the following questions as guidelines:

- How is Move 1 distributed?
- Do all the steps appear in Move 1? If yes, is there a particular sequence?
- Do you think the order in the occurrence of the steps in Move 1 matters? Why?
- Are there steps in Move 1 that appear more often than others? Why?
- Is there any rhetorical overlap - that is, are there segments that represent more than one step in Move 1? Why do you think authors may choose to do that?
- Are there any steps that are not used or rare? Why do you think they might not be common in your discipline?
- Is the rhetorical intent similar or different in excerpts showing the same step in the same text and in other texts? How?
- What ideas/content do authors use to realize each step?

Appendix B2. Rhetorical composition analysis task: Example of annotated text in Callisto

The screenshot shows the Callisto software interface. At the top is a menu bar with 'File', 'Edit', 'Format', 'Tools', and 'Help'. Below the menu bar is a text window containing two paragraphs of text. The first paragraph is annotated with red highlights, and the second paragraph is annotated with yellow highlights. Below the text window is a table with four columns: 'disc_concl_m1_reestablishing_territory', 'disc_concl_m2_framing_principal_findings', 'heading_subheading', and 'disc_concl_m3_reshaping_the_territory'. Below the table is a table with two columns: 'Text' and 'step'. The table contains several rows of text and corresponding steps.

Text	step
From our data, we cannot rule out a similar origin for the Metz and Nancy varieties, but it appears that mirabelle plums arise from c...	explicating_results
Interestingly, the two analyses did not reveal the same pattern of genotype clustering.	relating_to_expectations
Accordingly, the genetic analysis clearly separated damsons from greengages, which are two groups of medium-sized plums that...	relating_to_expectations
In other words, since microsatellites are neutral, they do not reveal groups of varieties that differ morphologically within the same s...	accounting_for_results
This latter result can be attributed to the low resolution in our study.	accounting_for_results
Based on Reales et al. (2010) and our own results, plum appears to derive from <i>P. cerasifera</i> , at least in its maternal lineage.	explicating_results
The results obtained with SSR loci may support a hybrid origin of plum because <i>P. domestica</i> and <i>P. spinosa</i> shared alleles and t...	explicating_results
Nevertheless, secondary introgression with <i>P. spinosa</i> , as proposed by Zohary and Hopf (2000), could also explain this observati...	accounting_for_results

Move 1 is colored in blue, move 2 in red, move 3 in green, and move 4 in yellow. By scrolling over or by clicking on a sentence, students can see the step that the sentence represents and the multiple layers of steps when there are such. This information is organized by move and step below the text window.

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