

Building genre knowledge through peer review: L2 doctoral students' provision of feedback in the natural sciences

Karyn Humphries Sandstrom

Umeå University | Sweden

Abstract: Doctoral students in the natural sciences who are writing research for the first time and also writing in an additional language (L2) need to acquire knowledge of the genre of the research article (RA). This knowledge can be elusive. One instructional activity that can mediate genre knowledge is students acting as reviewers to peers' RA texts. However, mediation of genre knowledge is contingent on reviewers' focusing on genre features of peers' texts. To explore the focus of L2 doctoral students' peer review, this study examined online feedback provided by 24 L2 doctoral reviewers on 73 texts written by their L2 peers. To determine the potential relevance of the feedback to the scientific research article, review comments were thematically coded, and the categories of comments were then compared with descriptions of text features of RAs in the natural sciences. Findings showed that review comments focused on precision, organization, cohesion, voice and stance, and research knowledge, categories that reflect key aspects of scientific RAs.

Keywords: L2 peer review, doctoral students, genre knowledge, research articles, natural sciences



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Contact: Karyn Sandström, Department of Language Studies, Umeå Universitet, 90187 Umeå, | Sweden – Karyn.sandstrom@umu.se

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1. Introduction

Doctoral students who are researching for the first time, writing for publication for the first time, and writing in a language that is non-native can feel overwhelmed. As novice researchers, they will be expected to produce texts that attend to their respective discipline's debates and assumptions (Lea & Street, 1998), to rhetorical knowledge that may be hard to perceive (Tardy, 2005), and to linguistic and discourse conventions that are in a state of flux (Bazerman, 1988; Li & Ge, 2009). Understandably, doctoral students have found the immensity of writing their theses to be emotionally laden (Aitchison et al., 2012; Wellington, 2010) and often highly stressful (Russell-Pinson & Harris, 2019). A critical component of learning to write research articles (RAs) is the acquisition of genre knowledge, understood here to be "the abstract, socially recognized ways of using language to achieve particular purposes" (Hyland, 2019, p.18). In the natural sciences, genre knowledge includes the lexico-grammatical conventions and the structural moves of the text sections of RAs that reflect the practices of their distinct research communities. The primary mediating activity serving to develop doctoral students' genre knowledge is supervisory tutelage in the form of feedback, described here as information about a writer's performance or understanding (Hattie & Timperley, 2007).

Writing pedagogy via doctoral supervision is not without its problems. Supervisors and doctoral students may have incongruent goals about writing (Belcher, 1994), and faculty members may evaluate the importance of writing skills differently from their graduate students (Link, 2018). There can also be disagreements over amounts of supervision that should be provided (Cotterall, 2011; Manathunga, 2005). Supervisors may struggle themselves with writing in the L2 (Hanauer et al., 2019), they may not have the meta-language to communicate the features of the genre to their doctoral students (Paré, 2011), and they may have insufficient time to provide feedback (Carter & Kumar, 2017). Further complicating doctoral supervision in the sciences are findings that indicate a survival-of-the-fittest writer mentality among some supervisors, where the competitive publishing world is mimicked by the supervisor as text gatekeeper rather than supervisor as mentor for writing skill development (Aitchison et al., 2012). Challenges for doctoral students learning writing via supervision are further exacerbated when pairs do not share the same language and/or culture. In such situations supervisors are found to be more tentative with their feedback (Guerin et al., 2017), and doctoral students can feel resentful over feedback due to misunderstandings in supervisory sessions (Wang & Li, 2011). Such misunderstandings can even lead to contact avoidance between supervisor and doctoral student (Russell-Pinson & Harris, 2019). These complications can hinder doctoral students' acquisition of genre knowledge through supervisory scaffolding.

If L2 doctoral students need more scaffolding to learn the RA genre than what they receive via supervisory tutelage, what alternative activities might scaffold such genre knowledge? Acting as peer reviewers to colleagues in similar disciplines may be such an activity. This study is a response to L2 doctoral students' need to learn the genre of their communities' RA and the possibility that providing peer review (PR) can mediate genre knowledge. The aim is to explore the written feedback provided by L2 doctoral students to their peers in an unsupervised feedback forum to ascertain what they notice and remark upon. The study responds to the call for expanded research on L2 writing that is tied to FL writing populations (Manchón, 2009), and for research on the collaborative nature of developing novice scholars' research texts (Curry & Lillis, 2019).

1.1 Relevance and mediation of genre knowledge

A key assumption in this study is that doctoral students must develop the abstract, socially recognized ways of using language as fits their discourse communities. According to Tardy (2009), these recognized ways include the domains of text moves, cohesion, purpose, context, and positioning of the writer. That learners might acquire such domains of knowledge through interaction with peers is based on a sociocognitive model whereby genre is mediated when reviewers and writers analyze, discuss, evaluate and practice features of the RA genre (Han & Hyland, 2019). These central tasks of genre mediation are present when students first write an RA text section of their own based on their understandings of genre expectations, and then evaluate a peer's RA text section, initiating discussion through feedback comments. If the feedback that they provide focusses on features of the RA, then the reviewers are seen here to be participating in the fundamental tasks described in genre-pedagogy. Mediation of genre would be seen to occur first through the writer attempting to conform to the genre requirements of a text section through her/his own writing, then through acting as a reviewer whose task it is to notice genre features in the peer's text, and then through putting their thoughts into words when constructing the comment. Such noticing of features and languaging of the comment are understood in and of themselves to mediate an individual's cognition (Schmidt, 2001; Swain, 2009). The articulation of the disciplinary concepts is understood to promote the internalization of such concepts (Bazerman, 2012). This languaging, or articulation, occurs in the composing of the review comment. It is possible, though not assumed, that such genre-focused feedback can eventually serve as a prompt for the receiver of the feedback, a first gesture in dialogic interaction. Therefore, the relevance of the feedback comments to the RA genre serves as indicator for PR's potential for mediating genre knowledge.

To examine the extent to which doctoral students' feedback addresses genre, a description of such genre features of scientific RAs is needed. A primary source of

such genre features comes from studies that examine the RAs of various discourse communities in the sciences, for example, investigations of epistemic modality (Yang et al., 2015), move sequences in introductions (Samraj, 2002), strategic hedging (Koutsantoni, 2006), and macro-structure and metadiscoursal features (Del Saz Rubio, 2011). Another source of genre description is found in explorations of historical changes that occur in the scientific RA (Bazerman, 1988; Li & Ge, 2009). These descriptions identify evolutionary shifts of genre features within disciplines. Also contributing to genre descriptions are prescriptivist texts produced by academic journals, professional organizations, style guides, and writing textbooks. Though a generic description of scientific RAs will be imprecise due to the diversity of genre features within the natural science texts, it is possible to find some uniformity in the RA descriptions regarding text moves, cohesion devices, positioning of the writer and the critical nature of concepts.

1.2 Peer Review in L2 Settings

Assuming that genre of the RA is an important focus in the learning of RA writing, and assuming that it is possible for us to identify review comments about the RA genre when such comments occur, what review comment types might ~~can~~ we anticipate that these L2 doctoral students will provide? What do we know about L2 peer reviewers from earlier research?

Activities of L2 peer feedback at the university level have been explored in research for decades. Studies that explore the foci of peer feedback is of particular interest for the current study. Some early findings depicted L2 peer feedback as a constrained activity, where students focused on small details and text mistakes (Leki, 1990; Nelson & Carson, 1998), and focused on correct forms from a prescriptive stance (Mangelsdorf & Schlumberger, 1992). There was also concern that L2 students' literacy practices were culturally bounded, which could be problematic in peer feedback activities (Leki, 1990). Other studies portrayed L2 feedback more optimistically, where L2 reviewers were shown to focus on global writing issues (Anderson et al., 2010; Liou & Peng, 2009; Min, 2005; Zhu, 2001), on content (Anderson et al., 2010; Suzuki, 2008) and on support arguments and detail (Kamimura 2006).

That findings differ regarding L2 students' feedback focus is perhaps unsurprising when we consider the multiple factors that can influence feedback provision. Differences among student groups, text types, instructional conditions, language of feedback, and the medium of communication complicate the construction of a unified picture of L2 feedback practices. In consideration of this disjointed puzzle of peer feedback practices, I look here at a few of the factors that can inform the current case study of L2 doctoral students providing feedback to one another.

A factor that appears to influence the focus of feedback is whether the reviewers and writers have a shared L1. Reviewers seem to provide more global feedback when they are able to use their L1s when commenting. In an L2 feedback study in Japan, peers commented on the sufficiency and quality of support arguments and the relevance of the conclusions, foci that the researcher attributed to the students' use of the common L1 (Kamimura, 2006). In a study where Chinese student reviewers were able to choose their L1s or L2s for feedback provision, students were found to primarily use the mutual L1 for content or organizational feedback comments, while the mutual L2 was used for surface level comments (Yu & Lee, 2014). Content, rhetoric and organizational feedback appear to be more challenging when students must use their L2s to comment.

Another factor influencing the focus of commentary is reviewers' training in feedback provision. Research has found that students' previous experience or familiarity with providing review influences the focus of their feedback. L2 reviewers who receive training have been found to focus more on rhetorical structure (Hu, 2005), on content (Liou & Peng, 2009; Min, 2005, 2008), and on higher-order issues in paragraphing (Min, 2016).

The temporal mode of the feedback activity has been shown to influence the focus of peer feedback in inconsistent ways, where in one study an asynchronous mode resulted in a high proportion of local comments due to the lack of interactivity (Chang, 2012), while in another study the asynchronous mode resulted in a more global focus, such as idea development and text organization (Anderson et al., 2010). The differences in findings might be explained by the affordances of the digital tools used in PR. It appears that feedback provided via word processing programs can result in high proportions of surface-level comments because of automatic editing functions (Chang, 2012; Liu & Sadler, 2003). In contrast, feedback provided via blogs was found to focus more on global issues (Liou & Peng, 2009) while PR provided via wikis was found to focus primarily on content (Kessler, 2009). Student interviews reinforce the idea that differing digital affordances encourage particular forms of commentary (Chang, 2012). That said, it is not only the tools' affordances that impact reviewers' focus, but also the participants' cultural assumptions about the digital tools in use (Thorne, 2003).

This review of findings suggests that students' focus upon genre features may be influenced by the language of communication, the students' familiarity with the activity, the time conditions, and the type of digital tools used for feedback. In consideration of these earlier findings, the current study will explore the nature of the review comments provided by non-native English speakers (NNES) who are working on their doctorates in the natural sciences in Sweden. Specifically, the study asks the following questions:

- What is the focus of the feedback comments that L2 doctoral students provide in repeated rounds of peer reviews?
- How does the feedback that L2 doctoral students provide reflect the genre and conventions of research articles in the natural sciences?

2. The Study

2.1 Educational Context

The peer review activity under exploration in this study was connected to a writing course that is offered each year at the Swedish University of Agricultural Sciences (SLU), a highly ranked research institute (Times Higher Education, 2020) with about 600 active doctoral students (5-year average 2014 to 2018). The writing course that is connected to the study is available to 15 doctoral students per year who have already collected and analyzed data, but have not yet written the accompanying research article (RA). Course goals are to provide a writing schedule for students as an incentive, and to familiarize participants with the RA structure, with writing and publishing strategies, and with online tools for lexicon, outlining and editing. The course is an elective, graded on a pass/fail basis, and is taught in English.

Every three weeks throughout an academic term, a campus-based workshop is co-taught by an EFL teacher (author) and the director of doctoral studies who serves as content specialist. Each workshop focuses upon a particular text section as based on the IMRD form, though the order in the course is as follows: results, methods, introduction, discussion, and abstract. After any given non-obligatory workshop, students write the specified text and upload it to an online student forum in a dedicated teaching platform. Participants review the text that is uploaded chronologically before their own, with the last uploaded text being reviewed by the first forum participant in each text cycle. Matching is arbitrary and differs for each round depending upon the order that participants load their texts to the forum. The forum is open, so the review activities are not anonymous; however, participants in the courses typically are only vaguely acquainted with one another. Reviewers tend to comment primarily using the review function in Word and occasionally through summative comments at the bottom of the digital documents. Reviewers choose their feedback language—English, Swedish, or a blend of the two. Use of Swedish occurred to some extent in about 20% of the dyads. Students are instructed to provide feedback that can improve their peer’s RA text section (results section, methods, etc.), and it is understood that the PR forum does not involve the instructors. Due to the nature of their fieldwork schedules, students tend to participate inconsistently in the review forum, but most participate for at least three of the five RA text sections.

After providing and receiving PR, writers revise and submit the given text section to the director of studies who acts as content specialist, and to the writing

instructor. Both instructors provide feedback on each of the texts, usually within two weeks throughout the course.

2.2 Study Participants

At the completion of each writing course, students from two different years ($n=15 \times 2$) were invited to join a larger research project about PR. Of these 30 doctoral students, 11 agreed to allow for the use of all review comments that they provided to their peers. Another 13 students granted me permission to use the comments that they had provided to the 11 primary participants. Participants' research areas included fisheries, wildlife biology, landscape ecology, forest harvesting technology, landscape analysis, soils, natural resource economics, aquaculture, and plant ecology. Research methodologies varied greatly. Participants came from Europe and Africa and represented seven L1s. Half had Swedish as their L1. Most of the Swedish participants had not had writing instruction of any kind since high school, whereas five participants had received some kind of writing instruction during their undergraduate or graduate studies. Some participants had written their Master's degree in English, though none came from native English speaking (NES) educational backgrounds. Most participants were writing an RA in English for the first time.

2.3 Developing a taxonomy

Participants' reviewed texts were uploaded to NVivo, where coding and analysis was carried out. In total, 73 texts representing 1457 comments as given by 24 reviewers were used reflecting 8 Results sections, 20 Methods, 20 Introductions, 18 Discussions, and 7 Abstracts. All comments that referred to the writer's text were used in the analysis, irrespective of where the comments were written.

A taxonomy was inductively developed to classify feedback comments. Thematic analysis was used that allowed for coding of patterns derived inductively, but informed by external theory (Braun & Clarke, 2006). Approximately 400 comments representing 18 texts were analyzed in a first round of classification using open coding. Comments were identified at the ideational unit rather than at syntactic boundaries. The initial coding resulted in 42 categories, which were then collapsed into five themes through conceptual analysis. The transparency of the five themes was tested on an applied linguist and an editor of scientific writing, who coded two texts each and were then interviewed about their decisions in light of the taxonomy. Their interviews further informed the description of the themes which were then tested on two writing researchers who coded two texts each (85% inter-rater agreement). The themes are shown in Table 1.

2.4 Coding of Review Comments

In total, 1457 comments were coded into the five major categories. There were more comments available, but multiple comments about a minor issue, such as the spelling of a particular word, were coded only once per text.

Table 1: Taxonomy of feedback types

Cohesion and Order <i>C&O</i>	Clarity of message as influenced by the inclusion, combination and order of information; cohesion within and between sentences, within and between paragraphs; information placement at the sentence, paragraph and text levels; use or non-use of rhetorical devices, meta-discourse, cohesion devices, topic sentences, and old to new information; preferred order of ideas within a text section.
Precision of Scientific Expression	Requests for greater specificity, accuracy, and disciplinary appropriateness at the word, phrase or clause level; transparency of lexicon and syntax in representation of scientific activities; warnings about non-disciplinary jargon, euphemisms, new coinages, ambiguous words, heavy use of initialisms; inconsistent use of key words, ambiguous noun clusters, confusing stacked modifiers; ambiguous or confusing placement of modifying adverbs, phrases and relative clauses.
Research Knowledge <i>RK</i>	Focus on the research activities, the background knowledge, and the use of evidence. Disciplinary knowledge, including constructs, theories, methodology, agreed upon facts and phenomena, and ways to conduct research; questioning the basic tasks implicit in scientific inquiry within the natural sciences, including the posing of research questions, defining problems, developing and using models, planning and carrying out investigations, analyzing and interpreting data, using mathematics and computational thinking, constructing explanations, and designing solutions.
Voice and Stance <i>V&S</i>	<i>Voice</i> : authorial role that the writer of the text has taken, including issues of visibility, formality, assertiveness, and use of engagement features; noting the existence of perceived stylistic rules, encouragement to break such rules, or to follow them. <i>Stance</i> : writers' encoding of epistemic or attitudinal assessments; conventions of the disciplinary community concerning authority and strength of claims; strength of

	language as matched to the status of knowledge, usage of hedging, boosting, and attitudinal markers.
Correctness of English	Lexico-grammatical conventions of English: spelling, mechanics, punctuation, grammar, and choice and usage of everyday vocabulary.

Comments on typing mistakes were not coded, nor were comments that were too vague to be understood.^o After the initial round of coding, a second round of open coding was conducted on the comments within each of the 5 major categories. This provided patterns of comment types within the major themes. For example, authorial distance became a prominent category within the theme of *Voice and Stance*. The most salient categories of this second round of analysis are discussed in the findings.

2.5 Description of the RA Genre

In order to explore the relevancy of the comment types to the RA genre in the natural sciences, the findings from the coding were compared with a description of the features of the RA in the natural sciences. This description is developed elsewhere (Sandström, 2016). In brief, salient features of the RA were determined by the number of mentions garnered in artifacts that are considered to have status with research writers in the natural sciences. Artifacts included descriptions of the scientific RA (Bazerman, 1988; Gross et al., 2002), author guidelines from primary journals of the participants' discourse communities, style guides referenced in those journals, writing textbooks referenced in the author guidelines, and published research about scientific RA genre over five years as found in the journals *English for Academic Purposes* and *English for Specific Purposes*. In the current study, I have used parts of the description to explore the relevance of participants' comments to the features of the RA in the sciences. These descriptions are summarized after each finding.

2.6 Findings & Commentary on Genre Relevance

The results of the classification reflects the comments given in 73 texts (1457 comments). The distribution is as follows: *Precision of Scientific Expression* = 31% (454); *Cohesion and Order* = 24% (344); *Voice and Stance* = 17% (243); *Correctness of English* = 15% (226); *Research Knowledge* = 13% (191). In the next sections I describe the nature of the participants' comments within each of the categories and provide examples. After that is a description of the relevancy of the comments' foci to the RA genre. Comments originally written in Swedish have been translated to English.

2.7 Precision of Scientific Expression Comments

Precision of Scientific Expression was the most frequently provided comment type (31%), reflecting a reading scenario where reviewers presumably paused in their reading because a particular word, phrase or formulation made the meaning ambiguous or confusing.

Reviewers' most common precision focus was at the word level, requesting a change or providing a replacement. One kind of comment focused on everyday words that were too imprecise, as seen in the comment *use positions or sampling point, not **points***, and again in the comment *What do you mean by straight here? What is a straight rate?* Reviewers also pointed to the loaded nature of commonly used words in English when such words are used in the research context, such as, *to be picky, you didn't **create** anything*. Reviewers targeted specialized words or phrases, where they often provided a replacement as seen here: *When you say tree volume, do you mean timber or also canopy volume including branches?* They also focused on writers' usage of compressed language. In the example *Could you say **EM fungal respiration**?* the reviewer compressed a pair of prepositional phrases into a single conceptual entity, while other reviewers instead unpacked nominal constructions, as seen where the reviewer highlighted *soil organic matter content* and suggested instead *content of organic matter in the soil*. Other times reviewers simply complained about nominal constructions: *It's not a noun cluster, but it definitely looks like some kind of cluster*. Key words and critical constructs were given special attention if interpreted to be ambiguous, poorly described or inconsistently used. *Use the same word the whole way! Sawmills/mills?* Reviewers' concern with lexical precision accounted for nearly half the comments in this category.

The second most common type of *Precision* comment focused on the order or placement of information in the sentence, clause or phrase as it related to precision of message. In particular, comments identified confusing placement of modifiers, such as *you are saying "together the results are given," but I think you mean "the results are given in both .. and .."* Ambiguous order of prepositional phrases was also in focus such as when the reviewer underlined a series of prepositional phrases and then provided two competing interpretations. *Is it recently that harvesting stagnated after this half century of increase in general productivity? Or do you mean that while general productivity increased during this last half century this wasn't the case for harvesting operations?* The third most common type of *Precision* comment highlighted redundancy or over-writing that impaired the meaning. Reviewers often provided simplified reformulations such as *sounds like the fixture only works when held. Is that how it is?* Reviewers reminded writers to use only as many words as necessary to not mislead the reader.

2.8 Relevance of Precision comments

Precision in scientific RAs is arguably one of the most important principles of writing. The importance of lexical precision is seen in the reference book by the Council of Science Editors, where they devote 11 pages to common words that are often misused in scientific texts, and devote further sections to excessively long compound terms, and to unnecessary words, phrases, jargon, and abstract nouns. Over 250 pages of this style manual are dedicated to nomenclature in an effort to standardize terminology and symbols (Council of Science Editors, 2014). Top-ranked research journals advise writers to use internationally agreed upon nomenclature, to avoid use of technical jargon, to concisely explain specialized terminology, and to define abbreviations (Nature, 2020; Science). Lexical precision is emphasized as well in commonly used textbooks for research writing in the sciences. Textbooks warn about vagueness in expression, and alert writers to not use synonyms (Day & Gastel, 2011; Matthews & Matthews, 2014; Paradis & Zimmerman, 2002; Rogers, 2007) but rather be consistent with usage and to clarify distinctions for the readers (Day & Gastel, 2011; Rogers, 2007). When two equally precise words mean the same, the more simple word should be chosen (Day & Gastel, 2011; Matthews & Matthews, 2014; Paradis & Zimmerman, 2002). The importance of lexical precision in scientific RAs is emphasized in studies of technical vocabulary, where academic word forms are understood to hold different meanings among different disciplines, as do words from the General Service List (Hyland & Tse, 2007; Martínez et al., 2009).

Precision in scientific RAs is also emphasized in relation to sentence construction, which is compressed. Nominal constructions are modified by embedded phrases and by other nouns, making relationships among ideas challenging to tease apart. Such constructions are used with the purpose of making the texts precise for a specialized readership (Biber & Gray, 2010) but can lead to unintended ambiguity. Conciseness is therefore balanced against precision in use of nominal constructions, where writers are warned about overly complicated syntax and ambiguous relationships (Council of Science Editors, 2014; Day & Gastel, 2011). Sources encourage the removal of nonessential modifiers and the careful placement of modifiers for the sake of precision (Council of Science Editors, 2014; Matthews & Matthews, 2014; Paradis & Zimmerman, 2002; Rogers, 2007; Swales, 1990). The reviewers' extensive focus upon lexical and syntactic precision reflects attention to a key genre feature.

2.9 Cohesion and Order Comments

Cohesion and Order (C&O) was the second most commonly provided type of comment. Text-level *C&O* comments were the most frequent in this theme, for example, the overall organization of an Introduction text. Reviewers gave advice on how to restructure text sections, sometimes creating outlines of the entire section.

When I look at the paragraphs quickly, I find the following topics for each paragraph: 1 Scientific debate about the role of forest on soil composition; 2 same as 1; 3 Potential beneficial impact of trees; 4 ground plants; 5 soil composition plus objective 1; 6 objective; 7 GAP and aim of study. So, it takes some time before you get to your own topic, and 1&2 could probably be less, and joined to 1.

Reviewers recommended that ideas be moved to other IMRD sections, as seen in the comment *to me, parts of the text seems to belong in either methods or discussion*. They also provided ideas to rhetorically develop sections, such as *I suggest you add a sort of introduction to the methods section*. In other instances, reviewers simply described their experiences reading the text section but gave no advice on how to restructure: *I had a problem understanding what you had done until I reached the end of the document and could put things together*. Advice of a larger text nature in C&O included the order of material in figures as connected to the running text: *consider the order of individual diagrams in this figure: you talk about diagram D, then C, then B, etc*. Clarification of subheadings was also suggested: *You describe behaviors of several species other than roe deer here. Change the title of the subheading*.

Reviewers focused on the internal order of paragraphs, for example, *maybe move this to the end of the paragraph? Then you have the two similar sentences together*. They also emphasized the integrity of paragraphs, indicating topics that did not belong: *In this paragraph, you talk about one study, but other references appear which confuse me*. They pointed out where information should be placed: *Why don't you join this to the previous paragraph where you talk about "reasons," and have the "results" in the next?* They also addressed the cohesion between paragraphs. *Here I really would like to see some kind of slick connection. I was forced to stop and wonder what this paragraph had to do with the previous one*.

Cohesion between sentences was a common focus, where reviewers highlighted disjointedness and hinted at linking devices: *It could be nice if you could start this sentence in a way that linked to the previous one. Is this one of the negative consequences you were talking about?* Lack of clear focus in sentences was discussed, in particular, sentences that had too many unrelated ideas in them. Such sentences were described as cumbersome, impossible to grasp, heavy, complicated, and too long. Reviewers often determined precise boundaries between the ideas, and even provided connecting devices between the new sentences they had created, including indexical references (this), repetitions of keywords or roots of words, and parallel structure. Finally, recommendations to follow old-to-new information flow in sentences was apparent in such comments as *Most often I had problem with a good flow. I think this could be improved by flipping over the sentences*.

2.10 Relevance of Cohesion and Order

Readers expect RAs in the sciences to adhere to a particular order, even if this order varies somewhat among disciplines and academic journals. The IMRD structure—Introduction, Methods, Results, Discussion—serves as a template for many disciplines' research articles, as is apparent in research writing textbooks, where the chapter divisions often reflect the text sections. When academic journals do *not* follow IMRD, they use the expectations of IMRD as a point of comparison. Research that explores variation of genre features of RAs among disciplines use the IMRD sections to categorize such features (Bertin & Atanassova, 2014), and research comparing rhetorical structure use IMRD as the basis for comparison (Lin & Evans, 2012).

The pervasiveness of IMRD as an organizational device is perhaps most apparent in the attention that has been paid to rhetorical moves within RA introductions as first described in the seminal text on creating a research space (CARS) (Swales & Najjar, 1987). The CARS model has since been used as a reference point in comparative studies of moves within introductions for RAs in numerous disciplines (Del Saz Rubio, 2011; Ozturk, 2007; Samraj, 2002, 2005) and as a reference point to compare RA introductions written by researchers from different cultures (Fakhri, 2004; Loi, 2010). Participants' many comments addressing text order as related to IMRD reflects awareness of this critical aspect of RA genre.

Cohesion in scientific RAs is executed in ways that can be regarded as particular to the sciences. The binding of ideas relies on simple cohesion devices (Day & Gastel, 2011; Matthews & Matthews, 2014) and repetition of key words that act as lexical glue (Matthews & Matthews, 2014; Paradis & Zimmerman, 2002; Swales & Feak, 2012). Sentences typically contain only one clause, so they infrequently rely on coordination and subordination for cohesion (Biber & Gray, 2010). Instead, cohesion is accomplished through nominalization of scientific activities which are connected through verbs of relationship. The nominalizations are then repositioned as the text develops, allowing the text to flow from old to new information (Halliday & Martin, 2003; Schimel, 2012). The participant's comment about "flipping the order" of the sentences is an example of this manner of creating flow in the texts. Techniques used for cohesion can also differ according to the IMRD text section. For example, Methods sections allow for lists of activities and depend on parallel structure, whereas cohesion in Introductions rely on commonly understood cue words and phrases that introduce key moves.

Cohesion and order are not particular to the scientific RA, but are common standards in academic writing. Nevertheless, the ways in which cohesion and order manifest themselves in scientific RAs differ from generic academic writing and are reflected in participants' comments.

2.11 Voice and Stance Comments

Voice and Stance (V&S) comments were the third most commonly provided type. Most common were comments on formality of register, for example, reprimands over conversational tone, posing of rhetorical questions, and attempts to befriend the reader. Reviewers' reformulations showed subtle shifts in formality to create more theoretical sounding texts. In one example, the initial phrase *regardless of what ecosystem is studied* was re-written to *regardless of ecosystems studied*. In another example, the introductory phrase *The importance of large carnivores* was changed to *Large carnivore importance*, making the phrase more theoretical and distant without making it more precise. Many suggestions prioritized formality over readability, for example, systematic removal of definite articles, and replacement of coordinating conjunctions with synonymous, multi-syllabic connectors. Conversely, other reviewers appeared to reject formality and removed what could be perceived to be pretentious constructions, replacing them with simple expressions. For example, *access is therefore of importance for* was changed to *access is therefore important for*. In another example, a reviewer attempted a more common style when he struck through *each site consisted of a clear-cut* and offered *was placed in a clear-cut? Was within a clear-cut?* Where some reviewers deleted definite articles, others added them, resulting in less theoretical-sounding prose.

The researcher's presence in the text was also a focus of V&S comments, with the reviewers mostly leaning toward less visibility. In one example, a reviewer removed the researcher from the methods section, changing the original phrase from *where we have data* to *where data is available*. As exemplified here, such changes often altered the meaning. In contrast, some reviewers seemed to make efforts to make the narrators more visible, even writing the researcher into the text. We see an initial sentence *the model results may hold* changed by the reviewer to *we think our model results are still valid because...*

In addition to researcher presence, comments often questioned the writers' posturing, seen here where a reviewer struck through *if this is true* and replaced it with *if this holds*. In contrast, some reviewers seemed to find the writing to be too humble and encouraged the writer to use less passive, less progressive, less present perfect, and fewer modals and adverbs that hedged observations, findings and analysis. Such advice occasionally resulted in potentially unintended changes in meaning, as the conviction in voice could actually be seen to be a stronger claim than was in the original text. Nevertheless, the comments arguably reflect reviewers' concern for the ways writers fit into their discourse community.

One final sub-category was reviewers' focus on the way that the writing sounded *foreign*. For example, a reviewer exclaimed, *This you cannot keep as it is!* and noted the ways in which an expression was directly translated from Swedish. Comments also argued against use of polysyllabic, Latin-based words. Such

comments were mostly directed at those writers who had Romance languages as L1s and were accused of sounding too “literary” or “dramatic.”

2.12 Relevance of Voice and Stance

In the genre of RAs in natural sciences, voice is a tool to persuade readers of the importance and validity of research. Self-presentation is typically understated (Myers, 1985). The writer is de-emphasized in the text since the contract with the reader is impersonal. The researcher retreats partly by using dummy subjects and passive voice (Gross et al., 2002), where the subject position that is opened is filled with activities, abstractions, and objects of research. This de-emphasis on the researcher has, however, been changing with time. Thirty years ago Bazerman (1988) found that 70 to 80 percent of sentences in RAs de-emphasized the researcher, while more recently the Council of Science Editors (2014) explicitly encouraged active voice for the sake of clarity. The doctoral students’ focus on theoretical sounding texts and on researcher presence in the texts likely reflects their awareness that one must tread cautiously to effectively present one’s research rather than oneself.

Accomplished research writers adjust their voice and stance to effectively persuade their community members, a readership described as knowledgeable and skeptical of knowledge claims being made (Bazerman, 1988). Researchers are cautious when they demonstrate their relationship with the subject matter and the reader (Hyland, 1999). Furthermore, the researcher’s implied relationship with the reader should sound inclusive and respectful, as scientific communities rely on a form of team rules when constructing new knowledge (Bazerman, 1988; Myers, 1985). To establish relationships they indicate their attitudes to, certainty of and allusions to common knowledge (Koutsantoni, 2006). Emphasis is often placed on what the community members have in common, not how they are unique (Silver, 2012). With this in mind, epistemic stance and attitudes about research knowledge are expressed through cautious use of modals, adverbs, and verbs (Biber, 2006) to not alienate their readers, and to be consistent with their distinct communities (Yang et al., 2015). As members of research communities, writers are warned to not sound haughty or superior (Day & Gastel, 2011) or too timid or assertive (Myers, 1985), to not underestimate the reader’s knowledge (Pérez-Llantada, 2012), to use non-biased language (Council of Science Editors, 2014) and to not waste the reader’s time with verbose language when simple language suffices (Day & Gastel, 2011; Science). The doctoral students’ concern with writers’ posturing and levels of confidence reflects this cautious relationship with the reader.

Though this section mentioned only a fraction of the concerns related to voice and stance as found in the natural science RAs, the section points to the importance and nuances of voice and stance in the RA genre. In the current study, the reviewers’ focus on voice and stance reflects an understanding that these linguistic

choices are vital to the acceptance of a scientific text, even if the actual linguistic practices reflect specific communities.

2.13 Research Knowledge Comments

Research Knowledge was the category with the fewest comments, with about three comments per text. However, the number is perhaps misleading, since an ideational unit in *Research Knowledge* was typically 2-5 sentences long. Most commonly, comments concerned missing information connected to research activities, in particular, details about methodological procedures: *how did you do it, counting everything from a car? And using GPS to determine the distance to things? Reviewers offered information that might be missing: and then the average weight was estimated?* They requested details about software, statistical procedures, and measurements, all which reflected a concern with detail and the study's credibility and replicability.

Reviewers identified missing explanations and justifications, for example, why a particular field site or methodology had been chosen over a competing option. Reviewers wanted more developed analyses, as seen in the example *Perhaps the effects of soil types and tree species could be further discussed*, and also in the comment *you might want to discuss why growth reduction was lower*. They requested explanations about the stated problem area: *write more about why this is important--wastefulness of both natural and human resources with the catching of small fish*. They wanted the relevance of the research to be explicit: *add a sentence about the effect of MeHg on health and biodiversity so we understand the dilemma*. These comments reflect a concern that writers had not adequately motivated the purpose of their studies, as the comments identify ways that the studies could be challenged or dismissed.

Reviewers questioned the analysis of the data, for example, the inclusion of questionable variables such as *Since hunting is not allowed during the mating period, I wonder if it really is relevant to include hunters here*, or exclusion of a variable such as *Here you have a possible learning effect that was not included in the analysis*. They noted contradictory reasoning, for example, *I thought that you didn't need to predict the prior distribution because it was "what we already know before we observe any new data,"* and again in the comment, *If the above given information is not accurate, why refer to it?* They questioned the strength of the writer's premises, *(Isn't it questionable to motivate research on that species with references to continuous forestry?)*, the nature of relationships *(I understand that it can stagnate, but why does it decline?)*, the sufficiency of evidence *(did you observe or study the vegetation in your areas? And did this confirm this explanation?)* and even the conclusions *(If it is not fully known why can't it be lower as well as greater?)*.

Finally, reviewers questioned the relevance of information, such as *Does this information add something to the method section?* and *Why are you talking about wood at all?* Other such comments focused on unnecessary repetitions of details (*you already refer to a study that explains this model*) and information directed at the wrong audience (*This is important for the lab, but not the reader*).

2.14 Relevance of Research Knowledge

Comments in this category reflect the type of feedback that journal referees in the sciences would provide (Gosden, 2003; Mungra & Webber, 2010). Though such comments do not focus on *the ways* to use language to achieve a purpose, they focus on the activities, the knowledge and the analysis that is being communicated. *Research Knowledge* comments are the heart of peer review, because an RA that conforms to genre expectations but that is based on weak science would be perceived as a meaningless contribution. These comments are perceived of as an essential component of the PR activity in this setting, even though they are not defined as genre commentary.

2.15 Correctness of English Comments

Correctness of English comments comprised 15 percent of the review comments given, which is about three comments per reviewed text. Comments focused primarily on general word choice, word form, grammatical correctness, and punctuation. Regarding word choice, reviewers questioned appropriateness of verbs, prepositions, and idiomatic expressions as would be found in general academic texts as seen here: *I feel this is a "through", but maybe "by" is correct as well*. Reviewers would typically repeat odd-sounding lexicon, or provide substitutions, or state a rule such as *between is for two items and among is for more than two*. PR on word form often focused on questionable compound words that the reviewer thought should be hyphenated, for example, *lengthmeasured doesn't sound right*. Word form also focused on irregularities such as *This is a little tricky I think – you write mosses (plural) were planted*. Grammar-oriented comments mostly pertained to perceived problems with adjectives, adverbs and subject-verb agreement. Here, reviewers would commonly explain what they thought was wrong, for example *plural instead?* or *Adjective, it doesn't fit me there*. Punctuation comments focused primarily on the overuse or misplacement of commas and semicolons and were explained in everyday language: *Is this correct here? I would have it if you removed the dot and joined both sentences, I think*.

2.16 Relevance of Correctness of English Comments

Correct spelling, mechanics and grammar are required features of doctoral texts and RA manuscripts. One study investigating the feedback of 35 NES academic supervisors across three disciplines found that feedback on linguistic accuracy was

more prolific than other forms of feedback, particularly so as regards to texts written by L2 writers (Bitchener et al., 2010). An extreme example of such supervisory focus is shown in a case study of an NNES doctoral student, where over 50% of the supervisory feedback related to correctness (Xu 2017). Academic journals value correctness, as well. In a study of 228 reviews responding to research texts in applied linguistics, 20% of the comments focused on expression, a category partly comprised of correctness comments (Hewings, 2007). Nonetheless, it may be that supervisors focus less upon correctness of English in the sciences. In a large study about the role of supervisors on doctoral students' writing in the sciences, supervisors contended that there was insufficient time to focus on sentence level problems, that they lacked the expertise, and that such commenting was not part of their jobs (Aitchison et al., 2012). Expectations that texts will conform to standards of correctness may be less stringent in journal submissions in the sciences, as well. For example, a study of 33 journal reviewers' comments on medical texts that were all written by NNES researchers found that only 17% of comments remarked on issues of correctness (Mungra & Webber, 2010). Another study of journal reviewers in the sciences found that less than half the reviewers commented at all on standard language features of texts submitted by 40 NNES writers, and those reviewers who did comment on language only referred to general problems (Gosden, 2003).

Science journals publish manuscripts that adhere to academic standards of English, but the burden of correctness perhaps rests less heavily with the researcher. This is hinted at in the vague author guidelines regarding linguistic standards in the sciences (Kirkman, 2001). It may also explain the practice of scientific researchers and doctoral students in non-Anglophone European countries using language professionals to edit their texts before submission (Burrough-Boenisch, 2006), or leaving editing to the journals (Lang, 2020). In the current study, correctness comments are seen as a less important feature of the RA genre in the sciences.

3. Discussion

This research explored the focus of L2 doctoral students' feedback on peers' texts in asynchronous, computer-mediated review conditions. The findings do not focus on the perceived accuracy of the review comments, but rather the extent to which reviewers focus upon genre features. The participants represented a mix of academic writing backgrounds, levels of English, educational cultures, L1s, and scientific disciplines. They had in common their status as NNES doctoral students in the sciences working in a Swedish university. The first section of the discussion focuses upon the participants' L2 status as reviewers and how their feedback focus compares with earlier L2PR research. The discussion then explores possible explanations for why they may have commented as they did.

Common in L2 feedback research is the division between global comments that peers make in contrast with local comments. Findings in the current study showed that over 30% of feedback comments fit the description of global features, that is, on content and organizational features as reflected in *Research Knowledge* and *Cohesion and Order*. Comments that fit the description of local were those identified in *Correctness of English* and comprised 15% of the feedback comments. The remainder of the comments that doctoral students made did not neatly fit the global/local categorization typically described in L2PR research.

The participants provided more global feedback than expected of L2 reviewers, as global feedback is more commonly associated with conditions where reviewers can comment in their L1 (Kamimura, 2006; Yu & Lee, 2014). The Swedish reviewers did in fact rely often on their L1 when commenting on *Research Knowledge* of Swedish peers, a language configuration that occurred about 20% of the time in both years. The feedback where reviewers used Swedish to comment on content likely contributed to the higher proportion of global comments. In the 80% of pair configurations that did not allow for L1 commenting, the reviewers' focus on global issues might be explained by participants' familiarity with English as a research language. Over 50% of the researchers and lecturers in the natural sciences in Sweden's higher education institutions are foreign born (Statistics Sweden, 2020), so English is often the language of use in the workplace. Participants would have been accustomed to using English when discussing their research, and this may have influenced their willingness to comment on global features in an L2.

Past L2PR shows that temporality and computer mediation (CM) influence the focus of reviewers' comments. Asynchronous feedback provision was found in one study to result in 87% local comments, while synchronous and face-to-face conditions resulted in better balance between local and global feedback (Chang, 2012). In contrast, current findings indicate that the asynchronous CM mode resulted in only 15% local comments. This result aligns more closely with another study conducted in Sweden where L2 asynchronous PR resulted in low levels of local comments (Anderson et al., 2010). In the current study, the lack of interactivity due to asynchronous review may in fact have been advantageous, providing reviewers with time to attend to global features. The solitary work at a keyboard mimics peer review practices in professional settings, where scientists review the ideas of their peers via digital text exchange. Earlier L2PR studies also indicate that the type of digital tools can influence the focus of review. In those studies, use of word processing programs resulted in high proportions of local feedback (Chang, 2012; Liu & Sadler, 2003). However, it is understood that the manner of using digital tools is influenced by the respective cultural assumptions of the group (Thorne, 2002), so using automatic editing to inform PR was perhaps not acceptable in this doctoral group.

Of particular interest in the current findings are the global comments that reflect *Cohesion & Order*, as such comments were notably higher than has been found in other similar studies (Hu & Lam, 2010; Zhu, 2001). For example, a study of graduate students in China found that of 240 comments given in their PR sample, only 13 focused on text organization (Hu & Lam, 2010). In the current study, a fourth of the comments provided by the SLU students focused on a combination of cohesion and order, and these comments were extensive (20 words per comment). Such attention to text structure is more common when reviewers have training in PR (Hu, 2005; Liou & Peng, 2009; Min, 2005, 2008, 2016). SLU participants were not explicitly trained in PR; however, they did have opportunities to attend lectures that focused on features of the RA, including text structure. Review comments show the influence of the lectures in comments such as “*pronoun reference problem like Karyn chatted about*” and in the comment “*remember she talked about putting the big idea in the main clause?*” So although they did not receive explicit training in PR, the lectures can be seen as a form of training to the extent that the participants had access to similar information about the RAs. Furthermore, the instructors provided feedback on participants’ texts after each round of completed PR, feedback that can have served as a form of modeling of PR. Another influence on the reviewers’ organizational focus could be the extensive number of RAs they would have read in their doctoral studies, texts that may have sensitized them to organizational expectations in RAs.

The reviewers’ focus on precision, voice and stance is seen as a key finding in this study. Their feedback comments indicate that the doctoral students are noticing critical features of the RA genre such as disciplinary lexicon, use and placement of modifiers, strength of modals, use of verb forms to show strength of claims, and nominalization of theoretical constructs. Though any given review comment may not be what a supervisor may have identified as most relevant, the overall proportions of provided comments indicate a strong focus upon genre issues that are taken up in scientific style manuals, historical descriptions of scientific RAs, text books, and research articles that explore features of scientific RAs. In other words, the reviewers are tilting their reviewer lenses toward text issues that are relevant to the genre. *Define this. It is extremely subjective* writes a reviewer. The reviewer who notices time and again that other RA writers are using subjective words in their writing is a reviewer who is actively engaging in the genre that she herself is learning. When reviewers notice genre features of peers’ texts that they are negotiating in their own writing journeys, the writing and reviewing work in tandem to mediate knowledge (Caffarella & Barnett, 2000).

One likely explanation for this genre focus is participants’ educational backgrounds in the sciences. In science education, writing is considered a heuristic tool whereby students express their understandings of concepts, negotiate meaning, and problem solve through literacy practices (Blair et al., 2007; Krajcik &

Sutherland, 2010). Development of literacy practices and disciplinary knowledge through PR is premised on mediation through articulating one's thoughts and explaining elaborated constructs to others (Amy, 2003; King, 2002; Palaez, 2002). Learning is thought to occur partly when the writer's ideas conflict with the reviewer's understanding (Pelaez, 2002), a phenomenon that parallels professional PR enculturation where the writer commits to a position that is then potentially challenged by the reviewer (Blair et al., 2007; Kern et al., 2003). Giving and receiving peer review in science education provides students with new perspectives that allow them to further analyze and revise their scientific texts (Trautmann, 2009). The role of PR as an educational practice in science education provides a potential explanation for the doctoral students' PR focus, which is that they are reviewing more like scientists than L2 users, and this allows them to notice genre features.

The focus of the current research was on the role of PR in mediating genre features, meaning that surface issues would hopefully be less prioritized by reviewers. Therefore, the low number of *Correctness* comments in relation to other comments is seen as unproblematic. Not only are *Correctness* comments less relevant to the reviewers' genre learning, research indicates that even expert-provided written comments aimed at improving linguistic accuracy vary immensely in their potential to affect the receiver's uptake of such corrective feedback (Ferris & Kurzer, 2018). L2 writers attend to corrective feedback that is comprehensible and explicit (Bitchner, 2019), features associated with reviewers who have expert knowledge. Furthermore, L2 writers must be motivated to focus on form (Bitchner, 2019) and to be amenable to reviewers providing corrective feedback (Storch & Wigglesworth, 2010). As L2 writers themselves who are receiving review from L2 reviewers, it is likely that their attitudes about receiving non-expert corrective feedback influence their willingness to provide corrective feedback.

Another potential explanation for SLU reviewers' limited correctness comments is that the submitted texts were first drafts and were likely seen as such by reviewers. When L2 writers have limited time to compose drafts, they tend to neglect form (Ferris et al., 2013). As course participants on strict writing timelines, reviewers may have understood that correctness comments were less appropriate. Furthermore, findings on feedback preferences have shown that more proficient language users are less interested in correctness comments than are lower proficiency L2 writers (Liu & Wu, 2019), so it may be that these doctoral students are too advanced to appreciate correctness comments and therefore do not provide them. Finally, the low proportion of correctness comments might be explained by the linguistic setting of the work environment, where being a non-native English writer is the norm. NES researchers are rare at SLU, so there are few perceived language experts. The doctoral students are surrounded by fellow researchers and supervisors who are all attempting to write research in an L2. As seen in many NNES academic environments, these multilingual scientists must use their linguistic and

rhetorical resources from their L1s to solve writing problems in an L2 (Lillis & Curry, 2010). It may be that in a setting where few have the luxury of writing in their L1, commenting on correctness might be inappropriate.

4. Conclusions

The idea that doctoral students can help one another with their writing is not novel. Expanding doctoral students' reader base through writing groups (Aitchison & Guerin, 2014), and mentoring one another as a supplement to supervisory feedback (Carter & Kumar, 2017) are recognized as solid practices in the development of doctoral writing.

The current findings show that peer review is another way that doctoral students can work with one another for the benefit of their own writing, in this case mediating genre knowledge for high stakes writing by serving as reviewers.

This case study provides a glimpse into a particular kind of L2PR environment which is unlike the investigations conducted in NES settings where L2 doctoral students are linguistic outsiders. Instead, at SLU, it is the norm to be a researcher in the natural sciences who must write in an L2, and the PR activity is likely influenced by that setting. The reviewers mostly did not share L1s, disciplines, or educational backgrounds; they received no explicit training, and they worked in isolation in an L2 in a digital environment. Nonetheless, the hours spent examining their peers' texts appear to have provided opportunities for them to notice, evaluate and remark upon genre features of the scientific RA. Viewing these PR activities through a sociocognitive lens (Han & Hyland, 2019) where mediation of genre is made possible through the reviewers' noticing (Schmidt, 2001) and languaging (Swain, 2009) of genre constructs, it is reasonable to conclude that PR can support these L2 doctoral students' genre learning. The study's findings might encourage writing instructors and doctoral supervisors in L2 science settings to more heavily promote peer review communities among their doctoral students in order to provide them with genre help when such help can otherwise be in short supply.

Note

° Ambiguous comments that could be interpreted to be in more than one category could often be coded after evaluating the surrounding comments of that particular reviewer. However, 15 comments were excluded due to ambiguity.

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