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Towards a procedure for supervising science writing with students for whom English is a second language

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Introduction

Academic scientists need to communicate their results, yet writers in scientific fields are particularly likely to find the writing process aversive. For non-native English writers, this is compounded by the fact that communicating their results effectively in writing also means writing in a second language. The problem for the supervisor thus becomes how to help the reluctant writer develop the skills to become a confident and competent communicator via the written word. This project has the ultimate goal to develop a practical, applicable strategy for helping the non-native writer through the process of producing a scientific report in English. This might eventually take the form of a supervisory handbook outlining a step-by-step method that can be adapted and refined based on future supervisory interactions. In laying out this procedure I have drawn on general theories of writing, problems of second-language (L2) writing, and specific aspects of science writing. The procedure is designed to cover drafting, editing, feedback, and polishing stages of scientific report-writing.

The writing process

The procedure draws on two major general "process" theories (Myles, 2002) of the writing process. The first was put forward by Flower and Hayes (1981) and deals with how the writer approaches composition, particularly constructing arguments and maintaining awareness of a target audience. The second originates with Bereiter and Scardamalia (1987). This theory delves more into the underlying thinking habits and skills that are profoundly intertwined with the writing process, particularly the distinction between what Bereiter and Scardamalia refer to as "knowledge-telling" vs "knowledge-transforming." These aspects apply to writing in the first language (L1), but may variously influence writing in L2. Therefore taking the impact of the L1 -L2 relationship into account with respect to elements of these major writing theories is also important to consider when supervising a student writing in L2.

In Flower and Hayes' model of the writing process, the writer approaches writing as a "problem-solving activity" (Flower and Hayes, 1981). Flower and Hayes divide this activity into two main parts. The first involves the "rhetorical situation" oriented mainly to content-reader parameters. For example, what is my topic in the first place? Who am I writing for? The second part has more to do with the writer's own relationship to the text. How does my

persona figure in my writing? How do I construct the meaning of what I write? Finally, how do I go about producing this text? I would describe this as an initial stage in which

various implicit relationships (writer and reader, writer and text, text and reader, writer and self) are aligned and operationalized into text production. This perspective acknowledges a well-hidden kernel in science writing: like all writing, scientific writing begins with a *person.* Even though science writing strives for impersonality, the fact remains that it - in some way or another - represents a "view from somewhere."

Bereiter and Scardamalia's (1987) cognitive theory deals with indispensable aspects of the thinking-writing relationship. In an applied manner, it aims to explain differences in writing aptitude by using two contrasting models, the "knowledge telling" model (applicable to immature writers) and the "knowledge transforming" model (applicable to mature writers). Knowledge telling can result in written text in the absence of guidance from an overarching plan or aim. For example, a student's unstructured regurgitation of facts on the page would fall under the heading of knowledge telling -"I read this" or "I think this." Immature writers often write as the ideas come. In contrast, knowledge transforming is guided by the writer's overarching goal for the composition (analogous to Flower and Hayes' analytical "problem-solving activity" mentioned above). During all phases of text production, the mature writer's goals drive a shuttle that moves between "content knowledge" and "discourse knowledge" in solving the problems of composition (see also McPhee, 2013). This process includes an interesting event which Bereiter and Scardamalia describe as "a transformation of the rhetorical requirements into content-related subgoals" (page 147). This implies that that content and the "rhetorical situation" go hand in hand, perhaps requiring parallel attention from a supervisor giving feedback.

Writers facing the composition process in a second language face specific challenges that have been identified in the literature (eg, Kern, 2000; Myles, 2002). It is not surprising that numerous challenges have been pointed out, but here I focus on three that seem especially worth a supervisor's attention: 1) potential differences in "contrastive rhetoric" between L1 and L2 (Leki, 1997); a documented bias towards the superficial level of composition in L2 writers Silva, 1993); and 3) a common stumbling-block that Ellis (1985) terms "derailment" (Ellis, 1985). "Contrastive rhetoric" refers to accepted rhetorical conventions or a culture's (or subculture's) preferences for organizing information (Myles, 2002). Contrastive rhetoric goes deep, but evidence indicates that L2 writers tend to focus on the more superficial aspects of composition, especially during draft revision (Silva 1993). A supervisor may therefore expect that many L2 writers will make heavy grammatical corrections without re-reading and reflecting on the content or underlying structure. Together with a student's familiarity

and comfort with accepted contrastive rhetoric in science writing, this flags a potential point at which the supervisor may have to lean on the student more and be particularly attentive. (Indeed, the procedure described in the following section explicitly de-emphasizes grammatical correction in the early drafting stages for these reasons.) "Derailment" is a related issue (Ellis, 1985), perhaps particularly for the more motivated L2 writer - the student can become so discouraged by errors that they "derail" and fail to progress in their writing. This may similarly flag the need for supervisory attention, in helping the student perceive errors as potentially helpful guides for improving writing (and thinking), rather than small, flaming demons manifesting on the page for the sole purpose of incinerating the student's sense of self-worth.

These issues can plague any L2 writer, just as the general challenges of writing can plague any writer. However, the L2 writer's double disadvantage may intensify depending on his or her writing proficiency in the mother tongue. The comprehensive review of Jun (2008) points to two extremely relevant pieces of evidence regarding writers in a second language. The first is that literacy skills correlate highly across the first and second languages, and the second is that writing proficiency in the first language predicts the level of proficiency in a second language (Jun, 2008). The good news is that if the student is a proficient writer in L1, these skills are likely to be transferred to L2. On the other hand, the bad news is that if the student struggles in L1, writing in L2 heaps an added burden upon virtually every aspect of the writing process. L1 proficiency and the student's pre-existing attitude towards writing are crucial issues that the supervisor should be sensitive to, perhaps even by asking the student direct questions about their attitudes towards writing (Myles, 2002).

Writing ability in L1 may have a very close relationship with the writer's fluency and her level of acquaintance with what Kogen (1986) called "the conventions of expository discourse." The term "expository discourse" captures how writing is organized in alignment with the author's analytic and explanatory aims, all of which is geared towards changing a reader's understanding (Kogen, 1986). A wide cultural distance between L1 and L2 may also deepen any differences in a student's approach to expository discourse, depending on how comfortable the writer is in L1 (McLaughlin, 1988; Myles, 2002). Further, even proficient writers may rely heavily on writing habits that have become second nature in L1 while neglecting to develop further skills in L2 (O'Malley and Chamot, 1990). This implies that a supervisor should not be lulled into complacency even if the student appears to be a proficient L1 writer and comfortable with writing norms in L1. Depending on the cultural and linguistic "distance" of L1

from English, identifying pitfalls for proficient L1 writers transferring their skills to English may require extra effort and a nuanced approach on the part of the supervisor. In general, I have the impression that expository discourse in science writing is similar across European and Anglo-Saxon communities, but it may become marked if the L1 belongs to Near and Far Eastern cultures (I have no personal supervisory experience of this, but have frequently noted a distinct "Far East" signature in published scientific reports).

The drafting procedure

In synthesizing literature relevant to the different aspects of a procedure for supervising L2 science writing, I have operationally classified writing/supervisory elements into "cheap" and "expensive" categories. This distinction is somewhat artificial, but may be a useful schematic for decision-making during different stages of supervisory feedback on a student's composition. The underlying idea is that the student may benefit from a combination of "cheap" and "expensive" guidance tailored to each stage of manuscript production - from getting something down on paper in the first place, to placing the final touches on a submittable work. The benefits of careful, judicious mixing of cheap and expensive feedback can operate on both psychological and pedagogical levels. It must be judiciously mixed because too much "expensive" feedback at an early stage might feed a reluctant writer's discouragement, whereas too much "cheap" feedback would fail to help in developing her writing skills in any meaningful manner. This supervisory procedure therefore aims at a combination of "work" and "workability" for both student and supervisor at well-defined stages of manuscript production.

Science reports have highly constrained formats and a narrow, often cliché-ridden style. This makes it difficult to write with flair, but it may have an advantage for the L2 writer. Namely, shrinking the range of possibilities to such an extent can give rise to purely mechanical aids to text production. These mechanical aids are "cheap" and may be most useful to suggest to the student in early stages of draft composition. Shoehorning content into the basic format of a scientific paper - abstract, introduction, methods, results, and discussion - can go a long way towards solving initial structuring problems. At this early point, the supervisor can encourage the production of a classical outline, with nested headings and subheadings, to begin working on an overall structure for the manuscript. The outline could be the supervisor's entry point in the supervisory procedure proposed here. The first feedback would be limited to the level of ideas and argument structure.

More "expensive" aspects at this stage of the procedure concern the problems of getting words on a page in the first place, producing a text while keeping both content and rhetorical goals in mind, and simply sitting down and writing. These issues are formalized respectively in Anderson's (1985) model of language production in composition: construction *(eg*, notes, brainstorming), transformation *(eg*, the "knowledge transformation" moment in which content and goals begin to interplay), and execution (decanting all of this onto the page).

Regarding brainstorming, Wisker (2011) advocates a "free writing" or "splurging" stage in the early phases of planning, in which the writer writes without pausing, without worrying about accuracy, and sometimes even without worrying about the topic. This is done for the sake of getting thoughts on paper, however rough. In my experience, this can indeed help to identify a flow of thought or to turn up valuable nuggets of phrasing which can be used later. Here, the L2 writer may even be at an advantage, because she can draw on at least two languages during brainstorming. In fact, L2 writers sometimes fall back on L1 during potentially crucial processes of generating ideas and considering the details of a topic (Friedlander, 1990). Jun (2008) cites evidence that the language of brainstorming is not a handicap at any rate, in terms of its impact on the quality of the final outcome.

The idea of not worrying about the roughness of writing, expressly for the sake of getting words on paper, is also reflected in Lamott's (1994) advice to produce "shitty first drafts." The most important thing about a shitty first draft is that it is actually on paper, not in the writer's head. Though not perfect, it provides material that can be worked into a more presentable further draft. The splurging onto paper, planning, outlining, and production of such first drafts may be experiences that the writer needs to go through without the outside voice of a reader (or even supervisor) intruding on the process. But once a draft exists, however rough it is, the feedback of a supervisor can begin to come into play.

Formal mistakes at this stage of a draft may also lend themselves to "cheap" feedback. For example, inexperienced writers of scientific reports have a strong tendency to include interpretive phrases in the results section, which are more appropriate for the discussion section. This common mistake is easy to spot. Similarly, scientific reports adhere to conventional formulations at the sentence level (*eg*, "recent evidence has shown... " or "despite *X*, a role for *Y* has never been directly demonstrated... " or "these findings imply that ... "). Word choice is also often so constrained that a supervisory procedure might even include word-choice lists for certain nouns, verbs, and modifiers.

For example, "Recent evidence/findings/results have shown/demonstrated/suggested/indicated/implied... " The nuance varies, of course, but the degree is negligible for an L2 writer struggling just to get words on paper.

For the reluctant L2 writer, the use of models may also be very important, though "expensive." Montgomery (2003) suggests an explicit exercise to model one's writing on an example during composition. First, the writer identifies passages from published writing that she admires. She can focus on a passage, perhaps even memorizing it, and attempt to determine which elements of the writing she had responded to as a reader. This can make the reluctant writer more aware of the anatomy of good writing. Study and memorization of admired passages can even aid in internalizing the tone or style of the writing. "Scaffolding" (Montgomery 2003) involves using the passage more directly during composition. In scaffolding, the writer re-works the admired passage, substituting her own content for the original. For example, a good expository paragraph about geology might be transformed into one about neuroscience.

The feedback procedure

Through the activities outlined above, the student will reach the point at which she can hand in a fairly cohesive draft to the supervisor. At this point in the procedure a true cycle of feedback and changes can begin. Caffarella and Barnett (2000) demonstrated that personalized and iterative feedback was considered by students as the most integral factor for improving academic writing. This evidence deals with the subjective aspects of the writer's anxiety, also suggesting anxiety may even increase with increased feedback despite the student's perception of effectiveness (Caffarella and Barnett, 2000). It is less clear how this relates to outcomes, however, for example whether the writing actually does improve on some objective measure. My own experience with writing, editing, and responding to reviewer comments leads me to expect that reiterative feedback can indeed improve the final result as well as improving writing skills more generally.

The role of feedback on language in the proposed procedure can also fall into "cheap" and "expensive" categories. Correcting errors of spelling and grammar is cheap. A supervisor can also identify common errors or idiosyncracies that the student should get out of the habit of early on (for example, an addiction to starting sentences with "Actually... "). However, as mentioned previously, L2 writers have a bias towards focusing exclusively on grammatical mistakes (Silva, 1993), alongside a risk of "derailment" by a torrent of error feedback (Ellis, 1985). This creates a tension between

the type and quantity of error correction. It seems advisable to take the strategy of giving cheap language feedback sparingly at early stages of composition, tempering it with more expensive kinds of expository feedback that target deeper levels of organization and knowledge, and perhaps also limiting it altogether to later stages of a draft.

In the final stages of a draft, language feedback can take the form of polishing. This is an expensive investment and possibly even a luxury, depending on numerous factors such as student and supervisor motivation, skill, and available time. Writing in scientific reports usually shies away from stylistic expression, but its apparently stylistically-inert stock phrases and clichés can take on meanings and nuances in their own right. Eventually, these nuances need to be learned in order to be wielded as units of meaning. Likewise, the acceptable level of description in these sections is "flat" with regard to narrative structure and point of view, striving instead for an impersonal, atemporal perspective, as well as emphasizing active voice *(eg,* Strunk and White, l972). The challenge for the writer is to maneuver within these narrow constraints to produce clear and elegant writing. Here, clarity becomes a balance between enforcing technical usage and cultivating an expressive flair that is as unostentatious as possible, a challenge even for the native writer of English. Obviously, getting to this stage in the procedure would require a lot of care from the supervisor and enthusiasm from the student. However, a final draft may often be adequate even without such expensive polishing.

The meaning-transforming process of producing a scientific report inevitably involves heavy reliance on the details contained in other scientific reports. There are many facts, methodological issues, and similar details to keep track of and incorporate into the content and argument of the text. At some point one reaches a stage at which one's command of these details is greater than one thinks, yet a reliance on written texts stands in the way of the production of one's own text if one is continually cross-checking, referencing, and delving into ever more labyrinthine literature searches at a time when text should accumulating on the page. Thus one of the most important stages of draft production is what one could call "weaning." I first became keenly aware of the importance of weaning when I was writing my own PhD thesis. Every day I would bring my laptop and a pile of books and papers to the table. My husband watched as I spent all day shuffling around in the papers like a hamster without writing anything. Finally he told me to leave the papers behind, take the laptop only, and write from the knowledge in my head. You can doublecheck later, he said, not before. He was right: I

knew a lot more than I thought I did. This weaning was so effective for me that I consider it important to make it explicit in a supervisory procedure. It may be expensive, particularly psychologically, if the student feels unprepared, so the supervisor must not only identify the weaning point but also encourage the student here. The subsequent fact-checking is cheap and can be done collaboratively between student and supervisor.

Pedagogical stance

I view the pedagogical problem presented here as how to effectively supervise non-native English writers who are probably also reluctant writers in any language. How can I best elicit their abilities to successfully produce a scientific report, and to help them gain skills they can draw on again in the future? Can this be implemented in a general procedure? The quality of the result is the major practical consideration. But I would regard such a procedure as a success if it set up any degree of dialectic between student and supervisor. My pedagogical stance is essentially Socratic: the motion of dialogue produces heat and light. In Plato's *Meno*, for example, Socrates guides a slave boy into insight on how to solve an unintuitive geometrical problem. Socrates never simply tells the boy how to double the area of a square, but grills him on his attempts until the boy realizes the solution himself. This Meno-moment is the ideal situation I hold in my mind as a supervisor. The envisioned procedure for writing supervision is my attempt at formalizing the steps into supervisory stages to some extent.

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