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Using scientific texts as a means to promote disciplinary
scientific literacy among high-school biology students

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1. Abstract

The importance of emphasizing the knowledge and abilities possessed by those who create, communicate, and use knowledge within disciplines has been previously recognized. Learning to read scientific texts requires learning about the unique strategies of reading and writing in a specific discipline. Readers need specific skills and knowledge to support their reading in biology in order to read and understand biology texts. Disciplinary literacy refers to the ability to engage in social, semiotic and cognitive practices consistent with those of content expert. Therefore, being literate in science involves more than having knowledge about scientific phenomena, it involves entering into a different way of thinking and explaining the natural world. High school students are expected to read disciplinary texts. Still, there are many challenges involved in meeting the literacy demands in high schools. Many scholars advocate explicit attention to discipline-specific cognitive strategies, language skills, literate practices, and habits of mind, however, many issues remain unclear regarding the learning goals and the suitable reading strategies to implement in the science classroom aimed at promoting disciplinary literacy.

The main goals of this study are: (1) to illuminate the pedagogical affordances of using Adapted Primary Literature (APL) articles as models for learning the scientific language and scientific reasoning and communication, and- (2) to design and examine text-based strategies aimed at promoting teachers and students' disciplinary literacy. Three studies that were carried out using different methodologies, viewing the use of language in various scientific text genres from the perspective of the text, the teachers and the students, compose this study. The first study presents results of texts analysis using Systemic Functional Grammar (SFG) as an analytical tool. Lexicogrammatical features and semantic relations of APL articles were compared to those of PSL and popular articles. Findings from the SFG analysis suggest that the adaptation of the APL articles lowers the lexical complexity and increases the readability of the text, making it more readable and probably more suitable for high school students, while at the same time retaining the authenticity of the scientific writing.

In the second study, the design and assessment of a professional development (PD) program for in-service high school biology teachers is presented. This PD is a new model for teachers' PD which emphasizes the linguistic, semantic and structural

features of different scientific text genres, and focuses on scientific reading and writing skills. Evidence from discourse analysis suggests that teachers expanded their views about the use of texts in their class, and shifted towards a more disciplinary view for teaching using texts. Specifically, teachers were able to connect the language of science and the epistemology of science to critically assess different scientific text genres, and use the language of science to reflect on their own teaching and on the APL that they adapted during the course.

In the third study, an intervention aimed at promoting students' NOS understanding and critical thinking skills is presented. In this intervention all the students participated in lessons about argument fallacies, and then one group of students read and debated about two popular articles, and a second group of students read and debated about two APL articles. Students were asked to read and criticize a popular article and to answer a NOS questionnaire, prior to the intervention, and following the intervention. It was found that in both the popular group and the APL group the students provided significantly more fallacies in the post-questionnaire compared to the pre-questionnaire. Thus, students' ability to criticize the popular articles significantly improved. In addition, a significant improvement in students' understanding of the argumentative NOS was found in both groups, and a significant improvement in the understanding of tentativeness was found in the APL article group. These results suggest that although engaging with contradictory articles and debating had a significant effect on students' ability to criticize popular articles, the genre of the text may also influence the students' ability to evaluate evidence.

Based on the results from the three studies I argue that to develop students' disciplinary literacy, teachers should teach their students how to read specialized disciplinary texts, and in doing so they must emphasize the specialized linguistic features and their functionality in these texts. I suggest using APL articles as an apprenticeship-genre, for learning scientific reasoning and communication, and to promote teachers' and students' disciplinary literacy.