Criss Crossing Science Domains in Knowledge Building Communities: An Exploratory Study

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Abstract: The complex nature of 21st century knowledge work is forcing a shift from single-subject curriculum units to interdisciplinary perspectives. Knowledge Building pedagogy and technology aim to turn high levels of socio-cognitive control over to students to enable them to assume responsibility for functions typically assumed by the teacher. This exploratory study aims to assess the extent to which elementary-school students within Knowledge Building communities are able to criss cross science domains and, in doing so, contribute to the improvement of the community knowledge.

Introduction

Recent reforms highlighted a need for *crosscutting concepts*- linking across the domains- to "provide students with connections and intellectual tools that are related across the differing areas of disciplinary content and can enrich their application of practices and their understanding of core ideas" (NRC, 2012, p. 233). To have a successful crosscutting classroom, it is perceived that the teacher should carefully design the course plans and activities to make a connection between different concepts (Savage, 2010). The purpose of this exploratory study is to explore if students in a Knowledge Building classroom, which turns high-level agency over to students, take over levels of agency for connecting different science domains in the course of exploring core concept, and whether such connections help them improve their understanding of the core concept.

Methodology and data analysis

The dataset used for this study is comprised of 370 notes posted on Knowledge Forum by Grade 1 students, exploring "water" and "water cycle". We employed a lexical analysis tool, called Text Analyzer, to analyze students online discourse in order to extract all the words used by students. We went through the word lists and selected scientific words--the words related to a scientific concept and categorized them into two categories: core topics (*within curriculum)* and *crossing domain*. *Within curriculum words* are the words that, according to the curriculum expectations, students were supposed to discuss and learn when learning the core topic, while *crossing domain words* are the scientific words which students were not required to learn when learning the core concept. Then, we extracted all the notes that included those crossing domain words, and applied Ways of Contributing (WoC) coding scheme (Chuy et al., 2011) to analyze the notes and explore how these cross domain notes contributed to the community knowledge.

Results

Figure 1 shows the scientific words that students used in their online discourses. The "within curriculum" words were displayed in the inner circle while the "crossing domain" words were displayed in the outer circle. As Figure 1 shows, students did not limit their discussions to concepts directly related to water (e.g. water, raindrop, evaporation), but they tried to make connection between the main concept and other topics such as space (e.g. moon, Mars, Jupiter, meteor, gravity), and biology and biodiversity (e.g. body, growth, digest, animals, butterfly, breath). After finding the cross-domain keywords, we looked at the notes containing cross domain words and identified 98 notes contained cross domain key words. Two raters coded and categorized all the notes using the Ways of Contributing scheme (notes may fall under more than one category) and achieved an agreement rate of 99.27%. According to the analysis, 45.5% of the cross-domain notes were categorized as "theorizing" notes, 26.8% as "thought-provoking questions", 10.7% as obtaining information and working with information, 8.9% as synthesizing and comparing notes, and 8% as supporting discussion notes.

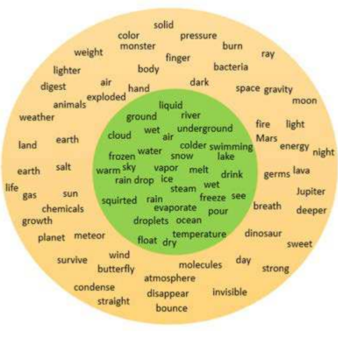

Figure 1. Students scientific words

Discussion and conclusion

As it is evident from the results, the main type of students' contributions is *theorizing*. Knowledge Building aims to provide opportunities for students to engage in theory building by taking collective responsibility for pursuing deeper understanding and explanations of the world (Scardamalia & Bereiter, 2006). Results suggest that concepts from extended fields of science are used in theorizing notes, seemingly a reflection of students' effort to extend and deepen their understanding of the world around them. The second most common contribution of students was thought provoking questions (26.8%). Several studies have shown that questions push dialogue forward and make the discourse more sustainable and productive, which can help increase explanatory coherence (e.g. Khanlari, Resendes, Zhu, & Scardamalia, 2017). While criss crossing knowledge domains students expressed puzzlements and possibilities, discourse moves that help to foster sustainable and productive discourse. Overall, the results show that students as early as Grade 1 exercise epistemic agency in extending and reconstructing knowledge boundaries, going beyond the traditional classroom expectations through crossing science borders. Results show that crossing science domain not only extends the range of science concepts they consider but also helps improve community knowledge--one reason why Knowledge Building has the potential to "set a knowledge building classroom off as profoundly different from even the best of traditional and modern classrooms" (Scardamalia, 2002, p. 77). For the future directions, we aim to replicate the study with a rich data set, and explore if this criss-crossing knowledge domains happens in other grades as well or not..

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