Evaluation by Grade 5 and 6 Students of the Promisingness of Ideas in Knowledge-Building Discourse

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Abstract: Knowledge creation requires identifying and pursuing promising ideas—ideas that in their nascent form may not seem like much but that with development could grow into something big. The goal of our research is to develop a tool to explore the concept of promisingness and "big ideas," especially elementary school students' ability to make "promisingness judgments" regarding ideas in peer discourse. Toward this end we developed a "Big Ideas" tool to facilitate students' selection of the ideas they thought were promising in their online discourse. A study conducted in two Grade 5/6 classes examined the nature of "big ideas" selected from the online discourse of younger Grade 4 students. A preliminary analysis indicated that students tended to identify as promising important facts and questions in the Grade 4 discourse. This study will inform future work in designing tools, language, and techniques to facilitate the concept of promisingness.

Introduction

This paper describes a preliminary study aimed at investigating elementary students' ability to evaluate the "promisingness" of ideas in student-generated "knowledge-building discourse." The study is part of a broader research effort aimed at pursuing designs and techniques to support idea-centered, knowledge-creating dialogue including an empirically grounded taxonomy of students' ways of contributing to knowledge-building discourse.

The dynamics of knowledge creation and pursuit of "new ideas" serve as a focal point for three influential "models of innovative knowledge communities" identified by Paavola et al. (2004). They include Nonaka and Takeuchi's (1995) model of knowledge-creation, Engestrom's (1999) model of expansive learning, and Scardamalia and Bereiter's (2003) theory of Knowledge Building. Among these three models, Knowledge Building theory is the one most applicable to educational contexts. Foundational to Knowledge Building theory is the notion that ideas ought to be at the centre of educational endeavors and continually improved through a social process, with a shared goal of advancing the frontiers of knowledge, as members of the community perceive those frontiers (Scardamalia & Bereiter, 2003). Knowledge creation is a risky business, requiring community members evaluate the *promisingness* of ideas to determine if those ideas are worth laboring to improve (Bereiter & Scardamalia, 1993; Bereiter, 2002).

The view of ideas as real things that can be treated as objects of inquiry and improved has informed the design of Knowledge Forum software that supports knowledge building pedagogy and the process of knowledge creation (Scardamalia, 2004). Current features in Knowledge Forum, such as theory-building scaffolds and rise-above notes and views, have produced strong educational results and allowed us to identify levels of competence that young students are capable of but are obscured by traditional learning environments and not revealed by current assessments (Scardamalia & Bereiter, 1991; Scardamalia, 2003; Sun, Zhang & Scardamalia, 2008). The current design does not explicitly support students' evaluation of the promisingness of ideas. As a result, students may become lost in unpromising ideas, with promising ideas lost due to information glut. Is there a way to facilitate the process of identification and evaluation of promising ideas within complex knowledge spaces? How can we help students move from the first-level processes of reading and posting ideas in Knowledge Forum to higher-level ones such as creating rise-above contributions? What design improvements can help students develop better and bigger ideas in their community space? Answering these questions calls for a deeper understanding about what students perceive as promising in knowledge-building discourse.

This paper describes a preliminary study aimed at uncovering elementary students' ability to evaluate the promisingness of ideas in their community. In this study, we are going to examine the nature of the ideas that have been identified by students as being "promising." Previous research lists a number of taxonomies through which these aspects can be analyzed. For instance, Leng, Lai, and Law (2008) studied levels of cognitive complexity in knowledge-building discourse, by categorizing notes into four categories: *argument* (a claim with one or more reasons), *statement* (a claim without reason), *information*, and *question*. Based on the procedures of Grounded Theory, Chuy and colleagues (2010) came up with a finer grained list of ways of contributing to knowledge-building discourse, including *formulating thought-provoking questions*, *theorizing*, *designing an experiment*, *working with evidence*, *creating syntheses* and *analogies*, and *supporting discussion* as the main categories. Since structural complexity is treated as an important criterion in evaluating students' ideas,

we apply Biggs and Collis' (1979, 1982) structure of the observed learning outcome (SOLO) taxonomy as a measure of structural complexity and as a correlative of the "bigness" of students' ideas.

Methods

Participants

Participants in this study were students and teachers from two Grade 5/6 classes at an elementary school located in downtown Toronto. Each class included one teacher and around 20 students (with almost equal numbers of boys and girls). In this elementary school, knowledge-building discourse is integral to regular classroom activities, and both classes we studied had been committed to knowledge building pedagogy and had been using Knowledge Forum for several years.

Big Ideas Tool

By integrating various functions such as highlighting, tagging, and visualization, the Big Ideas tool enables students to collaboratively evaluate the community's ideas. As they read these ideas they can tag ones they find promising, using a categorization scheme of their choice (promising idea, big idea, misconception, etc.). They can then view the subset of selected ideas in their public space, and if they wish, export that subset to a new view for further inquiry. The user interface for identifying ideas in the study reported in shown in Figure 1. When reading a note, a student may highlight a portion of the text by clicking on the "Ideas" button. In the activated pop-up menu, the student can choose a color, corresponding to the categorization scheme defined by community members. For example, Green might be defined as "big idea," Blue as "promising theory." After the idea is identified with the "color wand," its text is highlighted with that color in the note content editor pane. The highlighted text will also show in the idea text pane below. The default option is that students do not see each other's highlighted ideas, so as not to interfere with reading. However, the "Show All Ideas" checkbox will allow a student to display all ideas color-coded. The "Hide Colors" option enables students to hide or show colors in the note editing area.
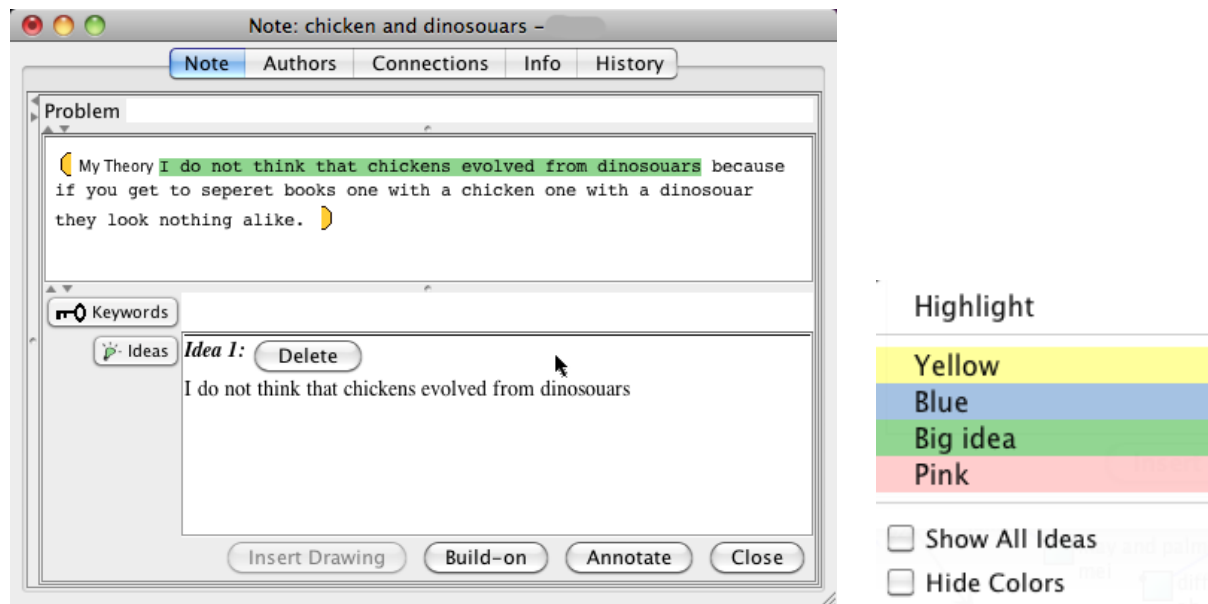

Figure 1. Note editing window with an idea highlighted; the pop-up menu shows color coding options.

When students collaboratively identify promising ideas in their Knowledge Forum database, the ideas they highlight might have partial overlap. Eventually, their collective efforts will lead to the list of promising ideas spanning overlapping sets. A menu button allows them to display ideas of any color categorization in descending order according to the times the idea was identified (the number is displayed to the left of each list entry, see Figure 2). Students can easily toggle back to the full note and context for an idea through a link backwards to the *note* in which an idea "lives." Since the goal of promisingness judgements is to move knowledge-building discourse forward, students and teachers can choose ideas from the list and export them to a new view for further dialogue.
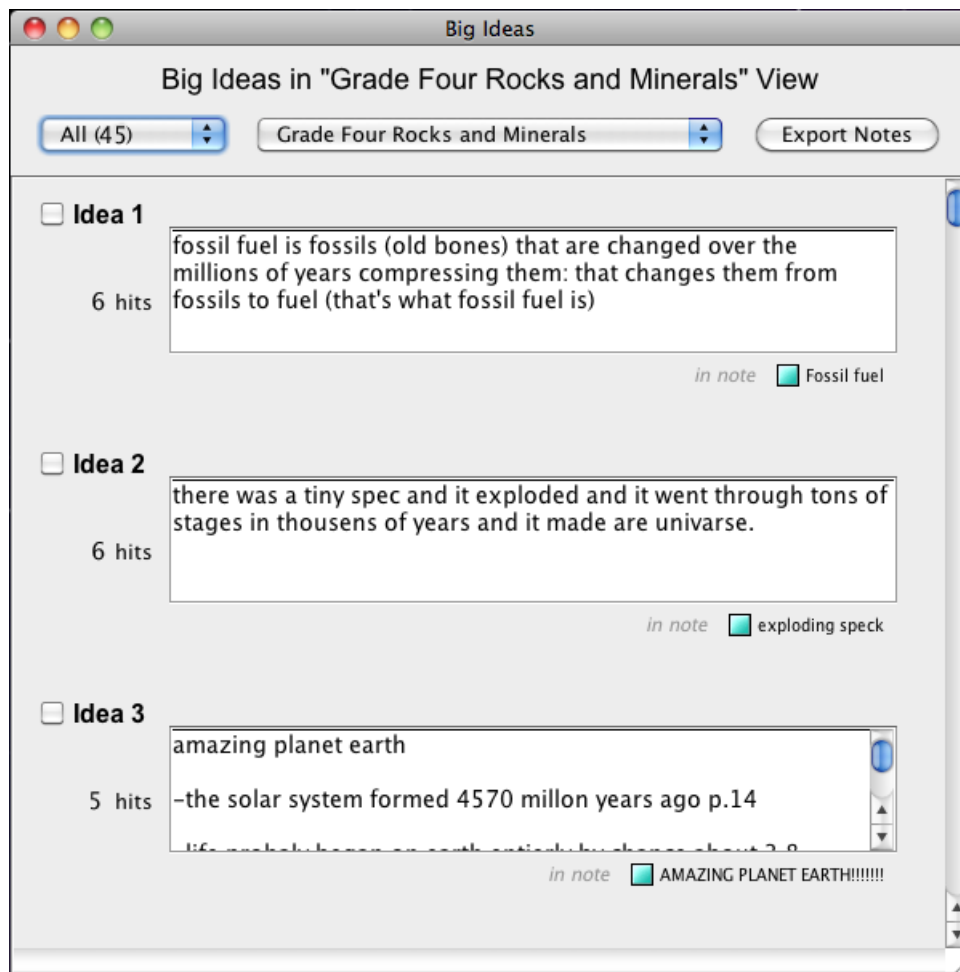
Figure 2. Big Ideas window that lists all selected ideas from a view.

Procedure

A pilot study was conducted using this tool in two Grade 5/6 classrooms. Three sessions were conducted, lasting a total of 45 minutes and comprising (a) introduction of the Big Ideas tool to students and teachers; (b) students reading notes about "Rocks and Minerals" generated by Grade 4 and identifying promising ideas by means of the "Big Ideas Tool"; and (c) students and teachers providing researchers with feedback regarding the experience and tool.

In the two classes combined, students identified 83 "promising ideas" from 207 notes. Among those ideas, 21 ideas were highlighted at least twice, so there were 45 distinctive ideas. The "hits" of the final idea list ranged from 1 to 6 ($M = 1.91$, $SD = 1.33$).

Data Analysis

To determine if selected ideas fell within specific "idea types," student selections were divided into three categories (see Chuy et al., 2010 for details): (1) *Theory*—a thought proposed by a student usually with an explanation, (2) *Fact/Evidence*—a well-accepted fact or a piece of information from authoritative sources provided by a student, and (3) *Question*—an expression in an interrogative form.

Because the structural complexity of ideas is often evaluated in school learning, students might think that "big ideas" are more structurally complex ideas. To check this possibility we used Biggs and Collis' (1979, 1982) structure of the observed learning outcome (SOLO) taxonomy to evaluate student selections. The SOLO taxonomy contains five levels of complexity:

1. *Pre-structural*: bits of disconnected information.
2. *Uni-structural*: simple and obvious, but unelaborated connections
3. *Multi-structural*: connections between ideas, but no meta-connections or elaborated significance.
4. *Relational*: information meaningfully related to the whole.
5. *Extended abstract*: connections not only within the given subject area, but also beyond it; generalize and transfer principles.

Two independent raters used the two coding systems to code the identified "big ideas." They agreed in 71% of the coding, and arrived at a final agreement on the remaining 29% through further negotiation.

Results and Discussion

What Do Students Perceive as Promising Ideas?

Using the Big Idea Tool, students identified 83 promising ideas in total: 63.9% of them were "theories" ($n = 53$), 22.9% of them were "fact or evidence" ($n = 19$), and the rest 13.2% were questions ($n = 11$). Thus, while most of the promising ideas identified by students were of a "theoretical nature", they also included a number of facts, evidence, and questions. This finding is in line with results reported by Chuy, et al. (2010), showing that *working with evidence* and *formulating questions* are two frequent contribution types in students' discourse. Facts and questions play an important role in moving discourse forward, with questions serving to define or analyze the frontiers of the community knowledge. It seems students are selecting questions of curricular importance: "What is a rock?", "What is universe?", "Why rocks are colored?", and "Is that the diamonds are very small bits of lava when gets cold?" Detailed analysis of discourse contexts and related discussion threads in Knowledge Forum showed that these questions spurred a variety of discourse moves or other ways of contributing to the discourse. Some of them included: *proposing an explanation* (e.g. "a rock is something that got hardened over time. It could be a sand stone, a lava rock and many different kinds of rocks."), *creating analogies* (e.g. "it [the universe] is a place that planets live, a place like home"), *looking for evidence* (e.g. "good question. I am not sure but the answer may be in a book in the classroom…"), and *contradicting a theory* (e.g. "I do not think that chickens evolved from dinosaurs because… they look nothing alike"). Student choices seem to reflect what they believe is important to their school work.

As for facts and evidences, the following examples represent the ones that helped moving the dialogue forward. "How old is the universe" and "how many layers does a rock could have" were two questions many students kept making guesses about. Students put forward their theories and argued against each other's theories for many times until two students provided the following authoritative evidence to settle these two problems: "The universe is 13,000,000,000 years old! and the earth is 4,000,000,000 years old!" and "There could probably be tons of layers in rocks like the grand canyon could have 912,456 layers of rock."

Besides these examples, however, there were also facts and questions that were highlighted not because they were important, but because they had some distinctive "attractiveness." For instance, there was a note containing nine facts about the earth that included page numbers as references, however the points listed lacked specific context. Thus, such a note could appear to be attractive because of its detailed information, but it may not necessarily be promising for a knowledge-building dialogue.

An interesting phenomenon we noted but could not quantify was that there was little relationship between the promisingness judgments made by the Grade 5/6 students and the amount of emphasis or attention given to these in the original Grade 4 database. Although competing explanations could be proposed to explain these mismatches (e.g., personal or grade-level difference in perceiving promisingness), they seem to highlight the importance of making promising evaluations so as to bring such results forward to the community.

Are Student Judgments of Promisingness Based on Structural Complexity of Ideas?

To answer this question, the SOLO taxonomy was applied to evaluate the structural complexity of "promising" ideas. Results showed all 19 *facts* and 11 *questions* resided on the *pre-structural* and *uni-structural* levels, i.e. they were mostly facts or question with no or only simple and obvious connection. One possible explanation would be that the Grade 4 students' ideas, which were examined by Grade 5/6 students, did not involve much evidence or explanatory content or design ideas. That is, the students were inclined to ask factual questions or introduce evidence with little obvious connection to the problem. As for 53 theories identified as promising, the following distribution of complexity levels was observed: *pre-structural* ($n = 8$), *uni-structural* ($n = 16$), *multi-structural* ($n = 16$), and *relational* ($n = 13$) levels. There was no theory that reached the level of *extended abstract*. In order to examine whether students tend to highlight theories with higher structural complexity, a one-sample chi-square test was conducted. The results of the test were nonsignificant, $\chi^2(3, N = 53) = 3.226, p > .05$, which implies the distribution of SOLO levels was not significantly different from a chance distribution.

Overall, structural complexity did not seem to be the basis for selecting "big" or promising ideas, but this might simply reflect low complexity of ideas developed in Grade 4 classrooms.

Conclusion and Future Directions

Understanding the promisingness of ideas is a significant challenge in knowledge creation, and is also an important component in moving a knowledge-building discourse forward (Bereiter & Scardamalia, 1993). The goal of this study was to investigate elementary students' ability to make promisingness evaluations in knowledge-building discourse, to test a new tool to explore promisingness judgments, and ultimately to improve students' competencies in making promisingness judgments. Towards this end we developed a Big Ideas tool to

enable students to collectively identify promising ideas in Knowledge Forum. A pilot study was conducted with two Grade 5/6 classes. Overall, we were not able to detect promisingness judgments that reflected student selections of interesting ideas that had potential for growth. Instead, students selected as important facts and questions of the sort they address in their school work. Analysis of structural complexity additionally showed that promisingness judgments did not relate to complexity of ideas.

This study represents a first step in exploring students' ability to do promisingness evaluations. Results indicated that students were not working with a concept of promisingness in the intended sense—as an idea with a promising growth trajectory. Substantial additional research is needed to understand the language and tools needed to facilitate judgments of promisingness. To further improve the Big Ideas tool and to find ways to engage students in promisingness judgments, we plan to conduct targeted interventions with this tool in various student populations and use experienced adult raters to more directly assess the promising ideas and seed databases with such ideas. We also plan to extend current functions of the tool by incorporating more sophisticated techniques, including data visualization, social network analysis, and semantic analysis, to better support students' collective work with ideas.

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