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Strategies for Idea Improvement using an Idea-Centric Discourse Analysis

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Abstract: This paper investigated the differences between the online discourses of K12 and higher education students, in an effort to understand differences in knowledge building behaviors between them. The higher education students are represented by 13 in-service graduate teachers and K12 students include 20 eighth-graders. An idea-centric analysis was conducted, which showed that discourse in the K12 setting contained ideas less promising to the discourse community than those found in higher education discourse. By considering the differences in the build-on of notes and utilization of scaffolds in discourse, potential strategies were suggested to change the patterns of build-on and use of scaffolds in Knowledge Forum so as to improve the quality of ideas in knowledge building discourse. Teachers can focus resources on promising ideas and strategize the use of scaffolds to maintain engagement and idea improvement within knowledge building discourse for better understanding and attainment of knowledge building goals.

Keywords: Strategies, scaffolds, idea-centric discourse analysis, knowledge building

1. Introduction and Background

In an technologically advanced era where discourse is increasingly taking place in online spaces, current state-of-the-art technology has provided bountiful opportunities and affordances that provide analysts with methods and techniques to analyze untapped features and attributes within online discourse. The approach of framing and co-constructing knowledge through technology (Cohen & Scardamalia, 1998) has been established for some time; the building of ideas through discourse has also garnered attention in other fields such as political science (Schmidt, 2008). Examining online discourses, the focus of analysts could be extended beyond the content of a discourse to the understanding of the process of learning and more specifically, recognize how students represent and co-construct their knowledge through improvement of ideas in discourse. Lee and Tan (2017) have developed a framework of discovering the dynamics of ideas in a discourse, one that enables end-users to be able to recognize ideas that are potentially interest to the community and continue improving these ideas to enhance their own learning and understanding.

The process of idea analysis aligns considerably with the analysis of knowledge building discourse. In this paper, discourse analysis involved knowledge building (Scardamalia & Bereiter, 2003) as an approach to knowledge creation in education. Knowledge building was implemented as a pedagogical approach to leverage learners' natural capability of idea generation for collaborative improvement of ideas. Teachers play the critical role of maintaining student engagement in creative work to support processes of idea improvement. Considering that discourse is an important medium that plays a creative role in encouraging improvement of ideas (Lakatos, 1970), the productive use of the principle of "improvable ideas" (Scardamalia, 2002) through inquiries and productive discourse can lead students to value every contribution and idea in discourse as being potentially improvable. Hence, the analysis of an idea-centric discourse, such as knowledge building discourse, will furnish students and teachers with crucial information to acknowledge knowledge gaps and navigate emergent themes of inquiries from multiple sources of inputs (Zhang, Scardamalia, Reeve, & Messina, 2009).

Despite the benefits that such idea analysis will be able to provide in assuaging pedagogical and policy concerns, rarely do the methods produce similar results between novices (represented by K12 students) and experts (represented by higher education students). With the growing acknowledgement that the nascent field of learning analytics has the potential to provide insights

into teaching and learning behaviors in classrooms, an idea analysis methodology (Lee, Tan, & Chee, 2016) was extended and an analysis of scaffold usage in an online knowledge building discourse was conducted in this paper to discuss the differences between the discourse of a middle school class and a higher education course. One key assumption is that K12 students are still developing their knowledge-building capacity and higher education participants are more mature in such an approach. The findings in this study could shed some light on this assumption and provide information about strategies to guide and scaffold students or participants at different levels, to improve their ideas and understanding through knowledge building discourse. The research question guiding this study is: “Considering the differences in knowledge building online discourse between K12 students and higher education participants, what are the implications and strategies to support the deepening of their understanding?”

2. Methods

This paper used a combination of methods and analytics in conducting idea analysis of knowledge building discourse in classes from the K12 and higher education settings. Idea Identification and Analysis or I²A, developed by Lee et al. (2016), was used for processing various measures within a discourse network. The inbuilt analytics in the Knowledge Forum (Scardamalia, 2004), an online knowledge building environment that supports knowledge building discourse, were also used for the collation of statistical data for comparison and analytical insights. The following sections describe the methods and analytics in greater detail.

2.1 Idea Identification and Analysis (I²A)

The methodology called Idea Identification and Analysis or I²A (Lee et al., 2016) was developed for discourse analysis to identify ideas that are promising to the students, instructors, or the discourse community in general. In essence, I²A was able to analyze knowledge building discourse using network measures such as *betweenness centrality* (BC) for identifying features in BC trends that were monitored over time in the discourse; ideas that have a subsequent impact on the discourse were identified and classified as potential or promising ideas. The discovery of promising ideas and their effects through network analysis were subsequently validated qualitatively by analyzing the content of notes.

The classification of promising and potential ideas from the I²A methodology was adopted in this paper as part of a process that measures the progress of idea development in knowledge building discourse; it helps in the determination of the relationship between the improvement of ideas and the use of scaffolds in discourse. This paper focuses on two types of ideas: promising ideas and potential ideas. *Promising ideas* are defined to be of great relevance to the discourse community, are able to sustain interests of the community and, hence, are worth pursuing and are likely to have an impact on the ensuing discourse. *Potential ideas* show lower communal relevance; some effort is required to sustain the community’s interest in these ideas, thus requiring scaffolds or other interventions in order for the ideas to have some form of impact or influence on communal discourse. Based on the investigations of the promising and potential ideas, the relationship between improvement of ideas and scaffold usage in discourse will be explored to gain deeper insights into ways to nudge students towards deeper knowledge building.

2.2 Knowledge Forum

Prior to the commencement of the lessons, the online platform, Knowledge Forum, was setup as the designated online discussion space for both classes. Students were encouraged to contribute to the Knowledge Forum in the form of notes, which are online entries that contain content authored by discourse participants and contributed to the discussion space during lessons. These notes were archived in the cloud server. When discourse participants reply to one another’s responses in the discussion space, the replies are considered a *build-on* of the previous note. Thereafter, discourse data in the textual format with related timestamps and authorship details were extracted from the Knowledge Forum for discourse analysis. By observing the discussion space, also known as a *view*,

a visual overview of the quantity, density and spread of notes contributed by the respective communities can be obtained. The depth of discussion can be quantified by analyzing the network of build-on replies in the discussion space. Statistical data could also be retrieved from the inbuilt analytics on the Knowledge Forum platform for a more in-depth analysis.

Regarding the use of scaffolds within Knowledge Forum, default scaffolds (e.g., “I need to understand,” “my theory is,” “this theory cannot explain”) or new scaffolds can be created to help discourse participants advance their discussions and clarify the intent of the authored notes. The extent to which scaffolds are being created and utilized is representative of the effort of support that the discourse community is trying to develop in an attempt to helping one another in the knowledge building process. These statistics are similarly retrieved and used as part of this comparison study.

3. Datasets and Settings

There are two datasets that were analyzed in this paper. For a fair comparison, the period of discourse spanned a week from the start of instruction in both K12 and higher education settings. The textual discourse data were then extracted for anonymization before analysis. There were 20 eighth-graders in the middle school class who contributed a total of 101 notes over a week and discussed about the scientific topic of the human circulatory system. The teacher was experienced at planning and executing knowledge building lessons, using authentic problems such as an impending heart attack in a patient to trigger interactions and stimulate responses. He also acted as a co-constructor of knowledge and helped to regulate the online behavior of students. Similarly, a week of discourse data was extracted from a post-graduate course in the higher education setting, consisting of 13 in-service teacher participants and two instructors. The key focus of the discussion was to deliberate on the basic principles of “Computer-Supported Collaborative Learning (CSCL).” In total, 162 Knowledge Forum notes were generated by the discourse community with minimal contributions or guidance from the instructors. The role of instructors in the graduate course was also to be co-constructors of knowledge in the communal discourse and provide minimal guidance only when necessary.

4. Findings and Discussion

4.1 Results from analysis of ideas and mechanisms in Knowledge Forum

The methodology I²A builds a network of notes and keywords for the two discourses in this study, based on a bipartite relationship between the students, notes, and keywords. Network analysis was then conducted on the network of notes to obtain network coefficients, such as betweenness centrality, to identify and trace the evolution of ideas within a discourse space. Results show that there were 9 potential ideas and 1 promising ideas identified from the discourse in the K12 setting; whereas 4 potential and 4 promising ideas were found in the discourse from the higher education setting. This result offered a new perspective on the development of ideas in knowledge building discourse from different settings. The participants from the higher education were able to produce an equal split of potential and promising ideas from their communal discourse. Comparatively, the student community in the K12 setting was able to contribute more ideas than the higher education discourse with a lesser number of notes, but the majority of them were potential ideas. Although not definitive, this result shows a trend in the type of ideas that could be generated from discourse in different settings within a same amount of time.

Therefore, apart from the idea analysis and classification of ideas in discourse, the build-on mechanisms and scaffolds in Knowledge Forum were further analyzed to provide insights on how the idea improvement process in the knowledge building discourse can be affected by the use of scaffolds. We present the statistics obtained from a full dataset analysis in Figure 1, which shows the thread count, build-on (measured by thread branches), and discussion depth of discourse (measured by thread length), in the K12 and higher education settings.

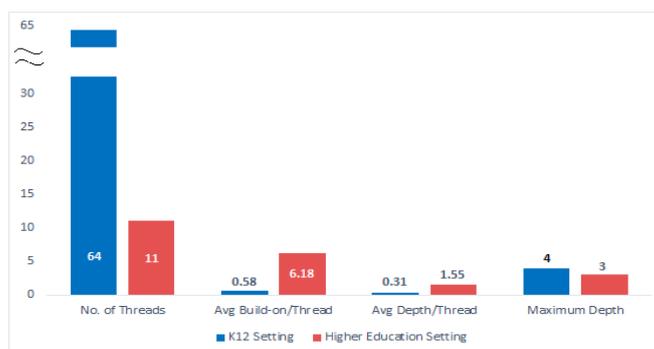


Figure 1. Comparison of thread build-on and depth in K12 and higher education settings.

The results in Figure 1 suggest that in a knowledge building setting where students were given an authentic problem to stimulate discussions, K12 students were unable to converge their discussions into a central theme or topic. Most students were observed to start a new note and provide their responses to inquiries or claims from other participants due to the several reasons: 1) the lack of confidence in students to choose an appropriate note to reply to, alongside the convenience of starting a new note over the effort required to search and reply to a related note; 2) an innate urge to possess and own a response on the discussion space instead of building on other notes, likely due to competitive traits in the classroom to own a note and “to have something on the board”; and lastly 3) students are simply not reading or considering other contributions and are more inclined to post something to satisfy a quantity count instead of contributing a note of quality. Therefore, most of the isolated and single notes contain ideas fragmented from key discussions and have to be rearranged by the end of discourse, so that relevant notes are in close proximity with other related notes for ease of viewing and reflection.

In comparison with the discourse in the higher education setting, graduate students entered the knowledge building environment with expectations to contribute responses of quality over quantity. Most threads in the higher education setting consist of multiple branches of responses built onto each other over time and these responses were relevant and stimulating for further discussions. The observation of such response patterns signals a high likelihood that students were reading and responding to one another’s contributions with much thought. By understanding the context and information within the note that students are responding to, we understood that there was an apparent intent by most students in the higher education setting to manifest their ideas into their responses, such that readers and any ensuing responses can potentially improve ideas or advance the understanding of participating students in the thread.

Overall, from the above comparisons, the differences in the construction of threads and build-on notes between K12 and higher education settings primarily lie in the epistemological approach of the knowledge building community. The learning situation of this K12 community may be closer to the acquisition metaphor of learning (Sfard, 1998). Knowledge is objectified and finite, often fulfilling requirements of students and is often “on-demand” in this K12 setting. Although knowledge is deemed to have physical properties and can be built upon as shown in the Knowledge Forum, the process tends to careen into spoon-feeding situations where students acquire knowledge for assessment purposes and thereafter quickly ceased inquiries and discussions when the assessment criteria were fulfilled. This process suggests a performance oriented intent (as opposed to intrinsic interest in learning); it does not stimulate active participation and independent learning, and possibly fosters rote learning. The students in the higher education setting were more forthcoming in their intention to develop deeper understanding, with an eventual goal of knowledge transfer beyond the classroom and across contexts.

4.2 Using findings to strategize the use of scaffolds and aid idea improvement processes

In this paper, technical affordances in the form of a default set of six scaffolds were provided to both discourse communities to aid them in writing of concepts within a note. For a more meaningful comparison, Figure 2 shows a comparison of scaffold usage in both settings, based on the percentage of scaffolds used in discourse, rather than the absolute number of scaffolds used in both discourse.

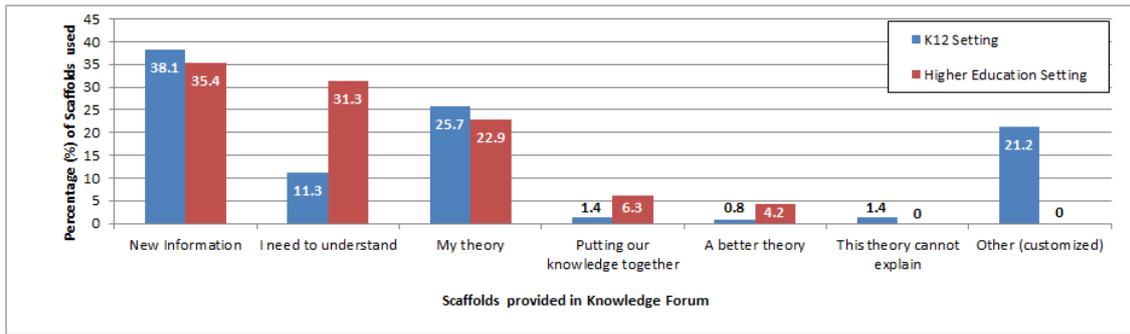


Figure 2. Comparison of scaffold usage in K12 and higher education settings.

The results in Figure 2 show a conscious effort by students from both settings utilizing scaffolds for gaining new information and proposal of their own theories in the knowledge building discourse. There are two distinct differences in the comparison, essentially a large contrast in the use of two types of scaffolds, namely the “I need to understand” scaffold and “Other” scaffolds; the latter constitutes the use of newly customized scaffolds by the students in their respective discourse.

We explain the possible reasons for these two differences. First, the pronounced disparity in the use of the “I need to understand” scaffold was interpreted as a sign of how students and teacher participants perceive and understand the underlying purpose of the scaffolds in Knowledge Forum. On one hand, teacher participants indicated that the use of the scaffold aided their participation in processes that unraveled insights from improving ideas, resulting in far-reaching impact on their learning process than mere gains of information. On the other hand, K12 students were more concerned with summative assessment and therefore, placed more emphasis on scaffolds that helped them fulfil knowledge goals and assessment criteria. In short, this difference could be due to the different metacognitive ability of discourse participants in identifying and fulfilling their knowledge gaps. Second, K12 students customized their scaffolds, partially due to their inability to grasp the meaning of certain scaffolds. Most students thought scaffolds were substitutes for titles of notes, and terms in the provided scaffolds were not relatable to them, such as “theory” in the “This theory cannot explain” scaffold. For these reasons, scaffolds that made sense to the students were created and Table 1 shows a mapping of student-crafted scaffolds to the existent scaffolds in the Knowledge Forum. Teacher participants have no issues in the use and understanding of existent scaffolds and hence see no need to create customized scaffolds.

Table 1

Usage and mapping of customized scaffolds to existing scaffolds in Knowledge Forum

Existing scaffolds in Knowledge Forum	Customized scaffolds crafted by K12 students	Percentage of new scaffolds usage (%)
New information	Opinion	49.3
I need to understand	Learning point	12.0
My theory	Experience	12.0
Putting our knowledge together	Pulling our thoughts together	4.0
A better theory	Why I chose this	16.0
This theory cannot explain	Reason	6.7

When strategizing the possible ways to conduct knowledge building sessions and balance the use of scaffolds in discourse, the goal of individual lessons could be explicitly stated upfront, especially in the higher education setting, such that the teacher participants would be assured that the gain of information would be far more treasured when shared among the community to aid the goal of advancing communal knowledge. K12 students could be educated on the concept of meaningful learning in contrast to the obsession with information gain for assessment. When faced with situations whereby K12 students were unable to understand some of the more complex

terminologies in the scaffolds, teachers could create new scaffolds that are easily understood by the students, or alternatively spend more time to explain the meaning and exemplify the intended use of the existent scaffolds. Even though most teacher participants indicated that current needs are met and existent scaffolds do not warrant further changes, instructors could still advocate the use of customized and adaptive scaffolds as part of an efficient means for supporting self-directed learning, which has gained importance in higher education and workplace settings (Ley, Kump, & Gerdenitsch, 2010).

5. Conclusions

A study was conducted on the differences of knowledge building discourse from a K12 and higher education setting, in an effort to understand how students in different settings deepen their understanding using ideas in knowledge building discourse. An idea analysis found somewhat less promising ideas in K12 discourse as compared to higher education discourse. By analyzing the discussion depth, build-on and scaffold usage in Knowledge Forum, findings show that K12 students have difficulty in harmonizing with the community's goals and there is a consideration for different cognitive ability of discourse participants. Although both discourse communities display markedly high levels of social interactivity, strategies are suggested to be used alongside the technological affordance in Knowledge Forum. Together with the continuous assistance from teachers in maintaining and improving ideas through discourse, more promising ideas could be generated for deeper understanding and attainment of knowledge creation goals.

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