Examining Cognitive Collaborative Annotations Contributions in Knowledge Forum through Idea Magnets tool: Effects and Future Directions

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Abstract: Global issues facing society produce abundant information for students to tackle in complexity in order to grasp understanding. By fostering societal discussions around issues in politics, sustainability and development of humanity, student's learning needs to be supported. Students were to support building arguments from web sources in order to procure data; to support their theories. The study looks at the works of a grade six Knowledge Building community and their approach to world issues. How are student's conceptual understanding in Knowledge Forum utilized through the Idea Magnets tool (Chen 2019). This snapshot study analyzed the Annotation category types (Chen 2020) & the metacognitive annotation types (Li et al 2006) and looks at the potential benefits to support's students learning. We utilized Crowd layers analytics to report results. The results suggest that the students did not produce metacognitive rich annotations, and mostly presented "I Know" annotation types meaning "knowledge" rich annotations were not evident. The author describes what she entitles as void phenomena and the paper theorizes next steps and future work to mitigate these results.

Introduction

Ethically complex, ill structured problems plague humanity daily. There is no simple reasoning or solution to solving these problems with a quick, clear cut solution. Zielder et al, (2005) found that students experience learning difficulties due to complexity, uncertainty fails to identify easy solutions and are usually stuck. Eggert (2017) notes "high cognitive processing demands on students due to scientific and interdisciplinary knowledge yet there is evidence of engagement in various information search, and integration, reasoning and decision making." (p.139). So how are students to tackle authentic and ill structured social issues. With varied information available to students, difficulties are often attributed to failure to maintain a "shared focus" (Veerman, Andriessen, & Kanselaar, 1999). Berners-Lee, Bizer, & Heath (2009) note that an area unexplored in collaborative learning systems is linked data, a method that uses the web to enable data from different sources to be connected and used in new contexts. Building coherent knowledge has become increasing challenging because of the fragmentary character of much digitally mediated information. Knowledge Forum provides a facilitation model to enhance the social construction of understanding of complex ideas and concepts through online community dialogue (Lipman 2003; Scardamalia & Bereiter 1996; Wenger 1998). According to Lipman (2003) "children collaborating with one another allows understanding to grow beyond the material world but also of persona and the ethical world around them" (Wegerif, 2007, p.13).This method uses the web to enable data from different sources to be connected and used in new contexts. One method of understating is through tacking these issues with collaborative annotation. Collaborative annotations have the potential to engage students in actively and meaningfully reshaping received ideas, addressing logical weaknesses in arguments, synthesizing ideas, and assessing ideas for application to complex problems (Wolfe, 2002). In order for ideas to be continuously improved, participants must take collective responsibility for knowledge advancement and constructive uses of authoritative sources.

The goal of this research was to understand the linkages of learning spaces. Students were introduced to the tool Hypothes.is in order to see how they can work with any web object and were able to annotate and highlight. Whatever students wished to take note of, they were shown it would be directly brought back to the community to be worked upon and to further student understanding. Within the Knowledge community, students were learning the importance of referencing, as well as making data claims. The context for improving uses of annotations will be a knowledge building community (Scardamalia, 2002) in which students typically use web resources to address issues they have posed and that lead them to reference material well above their grade level.

The research will focus on forms of annotation and collaborative work with self-selected student texts from web resources. Issues to be addressed: What texts do students search for and how many are annotated? What form do annotations take? To what extent are annotations productively shared and built on to deepen or in other ways extend the meaning of the text? Are annotations enriched through collaborative work?

Methods

In the present study, we aimed to make use of Collaborative annotations as a learning strategy to promote idea advancements, reasoning and decision making on world issues. The belief was that students would-be well-rounded citizens, and through the work within the Knowledge building community could help students in breaking down difficult concepts to grasp.

As an exploratory approach, twenty-four students were learning about Global /World issues and decided as a community to focus on six themes: Poverty, Sexism, Governments, GDP/ Inequality, Climate Change & Venezuela. Students self-organized within groups based on topic of interest but were free to contribute to any group and collect any data. It was important to introduce to the students the idea of data claims. The instructor was finding that students were bombarded with a lot of fake news, misinformation and were making claims about the world. Their teacher noted a gap in understanding and pointed out the importance of why data was useful to support their thinking and claims. As these students were learning about these topics, students were to gather data in order to facilitate inquiry, facilitate argumentation and theories through multiple perspectives. These students had over five years of Knowledge Building pedagogy; however, they were not well versed within an in-depth understanding of the Knowledge building principle Authoritative sources.

Students worked on the course for over two months but did not contribute to annotations on each classroom session. Crowd Layers "CROWDLAAERS" (Capturing and Reporting Open Web Data for Learning Analytics, Annotation & Education Researchers) is an analytic tool and dashboard that captures the discourse layers produced by communities via Hypothesi.s. This tool provided an overview and observation of an entire community, observing the online documents utilized by them. By visualizing the collaborative activity of a community, the tool provides complementing graphics that show connections regarding "annotations, participants, documents, threads, days and tags that reports and captures learning analytics. (Kalir, J. 2020).

Utilizing the framework of Chen et al. (2020), they developed annotation types or reading and response annotations in order to examine student's response and to see if their response types support community scaffolding. Here we are utilizing this classification system to determine how in-depth they are working with the knowledge (information) they have accessed. The annotations were only analyzed based on the reading annotations. Within this study no student directly responded to another student's annotation.

Table 1. Chen et al. (2020) - Description of Annotation Types

Annotation type	Reading Annotation
I know	Provide understanding or known facts of an annotated text
New knowledge	Identify new knowledge learned from an annotated text
Don't understand	Indicate an annotated text that does not understand
Different ideas	Indicate the text that is different from what I think, and give reasons
Additional Information	Provide supplementary information for an annotated text by using an online search tool in WCRAS
I want to say	Give comments to an annotated text and invite other students to discuss their ideas
Correction	–

As well, this study utilized the framework of Le et al. (2006) to determine the metacognitive, cognitive and social processes of annotations. This framework assists in understanding how successful the inquiry and knowledge synthesis of the information students have acquired and student learning outcomes.

Table 2. Li et al. (2006) – Metacognitive Coding Scheme

Dimension	Label	Code
Cognitive1	c01	Agree
	c02	Inform
	c03	Elaborate
	c04	Classify
	c05	Illustrate
Cognitive2	c06	Question
	c07	Criticize
	c08	Summarize
	c09	Synthesize
	c10	Evaluate
Metacognitive	m01	Reflect
	m02	Manage
	m03	Plan
Social	s01	Appreciate
	s02	Request
	s03	Encourage

Analysis and Results

The Knowledge building community made a total of 144 total note contributions to the community. While we are not directly analyzing these notes, it is important to understand the make-up of information regarding the community. Figure 1 examines the results from the Crowdlayer analytic tool. As we can see a total of 29 Annotations were created within the community. Of the total 29 annotations, 3 were created by the researcher, and 26 annotations were created by the students. Within the Collaborative Annotation community consisted of 18 total participants; 17 were students and 1 was the researcher. 19 total websites were utilized and acted as authoritative sources that students incorporated. Of the total documents, the researcher engaged with 3 documents during the initial presentation in order to show students the various ways of how they can utilize web objects.

Figure 1. Crowd Layers Analytics Results.

The instructor provided students with 6 links to annotation and choose from in order to assist with reducing cognitive load, but students actually did not utilize any of these and instead chose their own resources to annotate. Students engaged with 18 different websites, which then enacted as authoritative sources. We can see that one thread occurred but with a closer inspection, we noted that this was in fact the researcher's demonstration to the students of how to utilize the thread but no one student attempted to make a thread. Students engaged with 11 tags and 5 unique tags. Students tags mostly reflected around climate change concepts (#CC, #Climatechange). One student analyzed gender equality and looked at an ad for sports and created the following three tags (#nike, #serenawilliamsequalityjustdoit and #POV for an acronym of point of view).

With the analysis of the 29 annotations, the author examined only the 26-student annotations and categorized them based on the Annotation types of Chen et al. (2020).

Table 3. Annotation Type Results

Annotation Type	Coded Annotations Found	% of Total Annotations
I Know	1	4%
New Knowledge	7	27%
Don't Understand	1	4%
Different Ideas	4	15%
Additional Information	3	12%
I want to Say	10	38%
Correction	0	0%

As we see in table three, most student Collaborative Annotations just incorporates information they found, and just contribute "I want to say". In these annotations' students see an interesting idea, but just want to introduce it without producing an idea with much substance; and utilize the text they analyze as their words as information they also want to incorporate. However, we also see that 27% of annotations produce new knowledge learned from an annotated text. It is noted that here students contribute new ideas based on the information they have gathered and add new knowledge to advance their own understanding

As we can see from the results from Table 3, no student corrected any of the information they found online. This is interesting as students do not believe they should be challenging Authoritative sources. The author believes that students still highly regard authoritative sources,

Table 4. Metacognitive Coding Scheme Type Results

Metacognitive Dimension	Code	Number of Annotations in Category	% of Total Annotations	Total of Annotations per Dimension	% of Annotations Per Dimension
Cognitive 1	Agree	7	27%	15	57%
	Inform	3	12%		
	Elaborate	5	19%		
	Classify	0	0%		
	Illustrate	0	0%		
Cognitive 2	Question	1	4%	4	15%
	Criticize	1	4%		
	Summarize	0	0%		
	Synthesize	2	7%		
	Evaluate	0	0%		
Metacognitive	Reflect	2	7%	2	8%
	Manage	0	0%		
	Plan	0	0%		
Social	Appreciate	4	15%	5	19%
	Request	0	0%		
	Encourage	1	4%		

As we note in table 4, most students produce annotations under the cognitive 1-dimension category at 57% of total annotations. Most students' annotations were coded as "agree" with the text they annotate, at 27%. Within the same dimension 19% of students chose to elaborate which allowed for student voice to explain on how they understood the text they were utilizing and the connection it had to world issues. As a first iteration, it makes sense that 15% of total annotations "Appreciate" as they may have shared the information in a social manner. Many students may have found information that was of interest, but it did not advance any knowledge in the community.

To get a bit more of an in-depth understanding, by looking at some Collaborative annotations within the "Poverty as a world issue" topic, it complements the framework findings we see in the tables above. As we note, there were not many annotations (26) in comparison to notes (144). As we can see in the example below, some students chose to utilize sharing ideas not through Collaborative Annotation. However, in highlighting the notes below -we see a bit of a disconnect and no interaction between notes & collaborative annotation. This highlights a problem, that these activities seem to be in contrast when instead they should be complementary learning actions.

Student O co-authored a note that stated:

"Nearly 1/2 of the world's population ,almost more than 3 billion people ,live on less than $2.50 a day. More than 1.3 billion live in extreme poverty @ less than $1.25 a day". There are 11 horrible facts about poverty https://www.dosomething.org/us/facts/11-facts-about-global-poverty"

Now in the example above the student did not utilize the Collaborative annotation tool near the beginning of the term and mistakenly thought that this was the only way to share data was to paste links into notes. The student was so clearly perplexed and moved by these statistics. We can see the student was driven to tell a story by utilizing data, to support his theories. While the student was shocked this led to the student wanting to continue to pursue data at poverty at the local context.

Furthermore, with the community, we see Student E wrote the following note asking for help from her community about additional statistics on poverty.

"Poverty is really bad. I think most people really want to get rid of poverty because it's effecting many people's lives. Some countries are spending tons of money on poverty, but the question is why is there still so much poverty? Also, if anyone has some data or ideas about poverty please tell me."

While student E had asked for additional data, we see that too wanted to share ideas about poverty. They had a thought and understanding of how bad it is but wanted to further their own understanding.

Student O Had written an Annotation Of the following

> *Child and family poverty is a disturbing reality in every ward in Toronto, a new report from a coalition of community agencies finds. Newly released census data shows that ten wards in the city have a child poverty rate between 33% and 47%, but even wards with relatively low rates include areas where child poverty is pervasive, at double or triple the ward average.*
>
> Look how much child poverty grew, when will it stop? The population of people in poverty in Toronto has started to worsen.

The produced results provide interesting analysis, as we see a chain of ideas, and notes surrounding poverty, yet none are advancing any critical knowledge work. We want to term this concept as the void phenomena. While students have some overlapping ideas, it seems that they do not directly interact begin multi-modal learning objects or may be cognitively overwhelmed by different access points of information.

It seems like students are not actually engaging with each other's notes or annotations and it can be that students may not yet be used to or accustomed to checking these. While there is the Magnet Note (chen 2019) feature, we note that while students dragged their annotation and made use of the Magnet Note - they did not utilize the tool as intended.

Discussion

While this study notes that there was no evidence that students directly worked with Collaborative annotations, we find that these are emerging challenges remaining to be conducted with new iterative practices incorporated on future studies.

One idea with student' learning processes should be to incorporate peers' annotations with as much importance as note creation within a Knowledge building community. Students need to be mindful of their learning outcomes and recognize that multiple multi-modal objects exist and needs to be considered within the community. Students need to not just obtain web objects but continually work and improve on their ideas to see idea improvement and iteration based on these introduced web objects and authoritative sources. While we can successfully say student did work with web objects, there is still more knowledge work and research to be done in order to improve these results.

Future iterations should assist students in demonstrating that they can disagree with an authoritative source and compile more information and data to be incorporate and remixed within the community. As also viewed in the work of Chen et al (2020), better collaborative annotation struggles strategies need to be incorporated and constructed in order to dictate better evaluation of student's perceived benefits in the learning context. As this is one of the first studies with elementary students use of Collaborative annotations, this paper has developed more questions than answers to iterate on new Design documents to be created in order to establish more metacognitive and better integrated Collaborative annotations.

Additionally, future research will examine the criteria the learners use to select annotations. The researcher will hope to examine future cohorts and studies to better examine the relationship between information types and attached annotation.

While Knowledge Building as an educational act can incorporate new epistemic markers, reimaging how new ways knowledge coherence, and transmission can be utilized especially during Covid-19. As misinformation is created and spread faster than we have ever experienced, opportunities for collaborative annotation can develop a new pivotal point to understand we would need to reimage how to develop new ways to gauge student understanding of facts within their own Knowledge schemas. This paper allows for future work to build on of these results allowing for new iterative designs to be established. The author believes that future work should incorporate the use of scaffolds in conjunction with collaboration annotation may help support students to develop more metacognitive & new knowledge coherence opportunities.

References

Berners-Lee, T., Bizer, C., & Heath, T. (2009). Linked data-the story so far. *International Journal on Semantic Web and Information Systems*, 5(3), 1–22.

Chen, B. (2019). IdeaMagnets: Towards Knowledge Building on the open web. Presentation at the 2019 Knowledge Building Summer Institute: Knowledge Building Practices and Technology for Global Hubs of Innovation. April 7-9, 2019, Toronto, ON, Canada

Chen, C.M., Li, M.C. and Chen, T.C. (2020), "A web-based collaborative reading annotation system with gamification mechanisms to improve reading performance", Computers and Education, Vol. 144, pp. 1-17.

Eggert, S., Nitsch, A., Boone, W.J. et al. Supporting Students' Learning and Socioscientific Reasoning About Climate Change—the Effect of Computer-Based Concept Mapping Scaffolds. Res Sci Educ 47, 137–159 (2017). https://doi.org/10.1007/s11165-015-9493-7

Kalir, J. (2020), "Social annotation enabling collaboration for open learning", Distance Education, pp. 1-16.

Li, S. C., Kong, S. C., Lee, F. L., & Henri, J. (2006). Capacity building for lifelong learning: A study of practitioners' perceptions on information literacy. Informatics in Education, 5, 231–244.

Lipman, M. (2003). *Thinking in education* (2nd ed.). Cambridge, UK: Cambridge University Pres.

Scardamalia, M. & Bereiter, C. (1996). Computer support for knowledge-building communities. In T. Koschmann (Ed.), *CSCL: Theory and practice of an emerging paradigm*. (pp. 249–268). Mahwah, NJ: Lawrence Erlbaum Associates.

Scardamalia, M. (2002). Collective cognitive responsibility for the advancement of knowledge. In B. Smith (Ed.), *Liberal education in a knowledge society* (pp. 67–98). Chicago, IL: Open Court.

Veerman, A., Andriessen, J., & Kanselaar, G. (1999). Collaborative learning through computer-mediated argumentation. *International Society of the Learning Sciences*, 31(4), 77–86.

Wegerif, R. (2007). *Dialogic education and technology: Expanding the space of learning*. New York, NY: Springer.

Wenger, E. (1998). *Communities of practice: learning, meaning and identity.* New York: Cambridge University Press.

Wolfe, J. (2002). Annotation Technologies: A software and research review. *Computers and Composition*, 19, 471–497.

Zeidler, D. L., Sadler, T. D., Simmons, M. L., & Howes, E. V. (2005). Beyond STS: a research-based framework for socioscientific issues education. Science Education, 89, 357–377.