Deepen Students' Understanding of Sustainability in a Knowledge Building Environment

Kun Liu, The University of Hong Kong, Hong Kong, lilianlk@hku.hk
Carol Chan, The University of Hong Kong, Hong Kong, ckkchan@hku.hk
YawenYu, The University of Hong Kong, Hong Kong, yawenyu@connect.hku.hk

Abstract: This study developed and implemented a knowledge building environment, to facilitate students' collective scientific understanding on Sustainability. The aims of this study are: 1) to investigate the concepts students discussed in the online discussion. 2) To explore how students developed their understanding and awareness of energy sustainability in the knowledge building environment. Findings suggested students gained gradually deeper understanding of energy and sustainability. Students were more aware of the consequence of the environmental issues as they learn more about the concepts.

Introduction

Education plays a pivotal role in global sustainability (UNESCO, 2005). To develop students understanding of and awareness of sustainability in the school context, it's significant for learners to active engaged in the current environmental issues with real-life experiences through investigating scientific concepts surrounding such issues in the collaborative discussion, online investigation and experimentation. However, Energy and sustainable living turns to be "a new area of the curriculum with little exemplification of how it might actually be taught in classrooms" (Corney, & Childs 2003, p. 327). Knowledge Building, an idea-centered, principle based, technology supported pedagogy, aims to prepare students through engaging in socio-cognitive interactions as epistemic agents. To prepare the 21st century students in a knowledge – based society, schools need to shift to knowledge building communities and cultivate a collaborative inquiry–based learning environment for students to advance their community's knowledge (Scardamalia and Bereiter2006).

This ongoing study aims to investigate 1) what were the concepts students discussed in the online Knowledge Forum (KF)? 2) How students developed their understanding and awareness of energy sustainability in the knowledge building environment?

Methods

The study was implemented in a Grade 7 Integrated Science class with the topic of Energy and Sustainable living for 15 classes, each lasting 60 mins.

Pedagogical Design
We developed a KB environment focusing with the meta-discourse strategies to facilitate students' sustained inquiry. Pedagogical design included: 1) students initiating questions, engaging in explanatory inquiry both in class and in an online Knowledge Forum 2) students also wrote portfolio notes, KB talk, KB reflection to help them to reflect their online and offline discourse, and rise above to higher level conceptualization.

Data sources
Students' KF participation analyzed by Analytic Toolkit (ATK). KF notes were exported and analyzed by Knowledge Building Discourse Explorer (KBDeX) and Word Cloud. To identify student's understanding of sustainability, their reflective journal, KB reflection, and their portfolio notes were analyzed and key themes and characteristics are identified.

Analysis and Findings

Students' KF participation

The ATK general descriptive picture revealed that, over a five-week period, the student participants contributed 237 written notes. On average, each student created 12 notes, read 44.2% per-cent of other students' notes and used 10.8 scaffolds; In addition, there were frequent student interactions on Knowledge Forum, with links being made to 55.6% of all notes posted.

Analysis of Progressive Discourse

KBDeX was implemented to identify the pivotal points the network change of students' discourse units. As Figure 1 shows, at turn 19, the network of discourse were segmented, with one main cluster and fragmented notes, however, from 19 to 20, note 1241 (heighted in red) connected the main cluster and the small cluster indicating that the discussion become cohesive at turn 20, suggesting that students moved their discussion and knowledge towards to a more cohesive way. Figure 2 is an example of how the structure of original note threads structure gradually moves to sustained inquiry thread after students' in-class reflective talk.
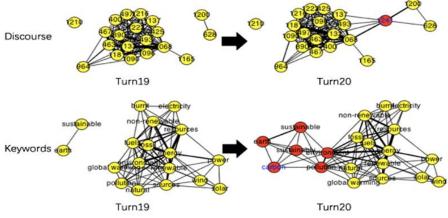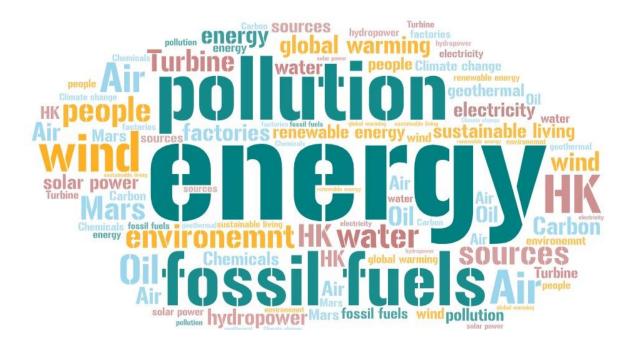

Figure 1. Discourse and Keywords Network at turn 19 and 20

Key words discussed on the Knowledge Forum

All the notes on Knowledge Forum was output and divided into individual days. Key words discussed each day on knowledge forum was analyzed using the Word Cloud. Results shows that the most frequently discussed key words at the initial stage are general concepts, such as energy, pollution, global warming, environment etc. As they got into deepened inquiry, the concepts such as wind turbines, solar power, geothermal were discussed more in the thread, suggesting that students' moved from big concepts to sub-concepts through sustained inquiry.

Students' Understanding of Energy and Sustainable living
To track students' understanding in different areas, their KB reflection, reflective journal, and meta-discourse on discussion were analyzed and four categories were identified:

Awareness of Sustainable Living
Qualitative data shows that as students were gradually aware of the environmental issues around as they learned more about this topic. For example, "This topic has necessary made me aware of the usage surrounding pollution." "We need to take action rapidly, because even here in Hong Kong, we are surrounded by air pollution and it can cause sevre problems with our health." Students also realized the significance of sustainable living and the actions needed to tackle the environmental issues. E.g. "I have been intrilgued about pollution, so I think this topic will be very beneficial and the end result will turn out great."; "I think that people should buy land and make wind farms to collect energy."

Understanding of nature of science
Qualitative data shows that as students gained deeper understanding of the topic and a deeper epistemic understanding of science. E.g. "Without improving our ideas, science would have faded away, centuries ago and facts like the Earth being round not flat and Pluto being a dwarf planet would not exist."

Conclusion

This study aims to investigate how KB intervention, could help students to carry on sustained discussion toward deeper understanding of energy and sustainably living. Our findings suggested that the intervention help students to pay attention to shared high-interest focuses, identify the limit of community knowledge and future directions and community effort required to get there, which increases the potential of higher level of conceptualization. Students were more aware of the consequence of the environmental issues as they learn more about the concepts. Ongoing analyses are being undertaken to understand the thread moves of the database, further investigation is needed to explore the possible integration of the strategies in a longer duration and in multiple classes.

Reference

Chen, B. and H.-Y. Hong (2016). "Schools as Knowledge-Building Organizations: Thirty Years of Design Research." Educational Psychologist 51(2): 266-288.

Cutter-Mackenzie, A. & Smith, R. (2003). Ecological literacy: The "missing paradigm" in environmental education (part one). Environmental Education Research, 9(4), 497524.

Scardamalia, M., & Bereiter, C. (2006). Knowledge building: Theory, pedagogy and technology. In R. K.Sawyer (Eds.), The Cambridge handbook of the learning sciences, pp. 97-115. New York, NY:Cambridge University Press.

Scardamalia, M. and C. Bereiter (2014). Knowledge building and knowledge creation: Theory, pedagogy, and technology.

UNESCO (2005) Guidelines and recommendations for reorienting teacher education to address sustainability (Paris, UNESCO).

van Aalst, J. (2009). "Distinguishing knowledge-sharing, knowledge-construction, and knowledge-creation discourses." International Journal of Computer-Supported Collaborative Learning 4(3): 259-287.

Zhang, J., et al. (2015). Metadiscourse on collective knowledge progress to inform sustained knowledge-building discourse. Annual Meeting of American Educational Research Association (AERA 2015), Chicago, IL., USA.