Enhancing Primary Students' Online Talks and Epistemic Beliefs through a Knowledge Building Community Approach

Ching Sing CHAI[a], Feng DENG[b*], Angela Lay Hong KOH[c] & Guan Hui QUEK[c]
[a]*National Institute of Education, Nanyang Technological University, Singapore*
[b]*School of Chemistry and Environment, South China Normal University, China*
[c]*Nan Chiau Primary School, Singapore*
*Solomon.deng@m.scnu.edu.cn

Abstract: This paper aimed to investigate the effects of the knowledge building community (KBC) approach in enhancing primary students' online talks and their epistemic beliefs within the subject domain of Social Studies. Participants were four classes of Grade 3 students (N = 157) from a neighborhood primary school in Singapore. Two classes (i.e., experimental group) were taught with the KBC approach, while the other two (i.e., comparison group) with regular (ICT-integrated) approach. By using a within-subject design and Chi-square analysis, the experimental group students' online talks (e.g., questions and answers posted on a platform named Knowledge Forum) during the first three months and the last three months were compared. At the end of the intervention, both comparison and experimental groups responded to a five-point Likert scale on epistemic beliefs. Independent t-tests were conducted to examine the difference between the two groups in the three dimensions (i.e., *source*, *certainty*, and *development*) of epistemic beliefs. Results showed that the online talks of the experimental group shifted from *disputational talks* to *cumulative talks*, whereas no *exploratory talks* were observed. Compared to the comparison group, the experimental group generally demonstrated more sophisticated beliefs in the source and certainty of social studies knowledge. No significant differences were found in the *development* dimension. Findings and implications are also discussed.

Keywords: Knowledge building, knowledge forum, epistemological belief, social studies

1. Introduction

With the emergence of knowledge-based economy, the current understanding of learning and knowledge has been greatly challenged (Bereiter, 2002; MacDonald and Hursch, 2006).In a teacher-centered and test-driven classroom, especially in the Asia Pacific region (e.g., Hogan and Gopinathan, 2008; Law, Lee and Yuen, 2009; Liu and Fang, 2009), students are inclined to become passive knowledge receivers who may seldom actively share and discuss their own ideas during learning activities (Chai, Wong, Gao and Wang, 2011). As an illustration, students' classroom talk is mostly "disputational talk", which "is characterized by an unwillingness to take on the other person's point of view, and the consistent reassertion of one's own" (Mercer, 2000, p. 97). However, this type of talk seems to prevent students from further constructing knowledge and developing ideas with their peers (Deng, 2012). Besides, the traditional classroom may lead the students to *naïve* epistemic beliefs about the nature of knowledge, such as the source, certainty and development of knowledge, which associates with their learning approach and performance (Hofer, 1997; Phan, 2008).

Given the above issues, international educators and organizations have attempted to reform the current classroom practices by designing various learning environments and/or using different pedagogical approaches (e.g., Anderson, 2010; Deng, Chen, Chai and Qian, 2011; Mercer and Littleton, 2007; Scardamalia and Bereiter, 2006). In this paper, we attempted to enhance students' classroom talk and their epistemic beliefs through a knowledge building community (KBC) approach (Bereiter and Scardamalia, 2006). We hypothesize that the KBC approach provides more opportunities for students'

co-construction and creation of knowledge, which may be conducive to their "deeper" classroom talk and more sophisticated epistemic beliefs. Relevant rationale is detailed in the following section.

2. Review of the Literature

2.1 Improving the Quality of Students' Classroom Talk

According to Mercer and his colleagues proposed, students' classroom talk can be generally classified as three categories: disputational talk, cumulative talk, and exploratory talk (e.g., Mercer, 1995; Mercer and Littleton, 2007). Unlike the *disputational talk* defined above, the *cumulative talk* "occurs when participants build a shared understanding and body of knowledge from the accumulation of uncritically agreed-upon pieces of knowledge" (Atwood, Turnbull and Carpendale, 2010, p. 366). Specifically, ideas or knowledge claims are justified mainly through agreement at a group level. By "exploratory talk", it generally refers classroom talk in which students engage critically but constructively in conversation about each other's ideas (e.g., Mercer, Dawes, Wegerif and Sams, 2004). Specifically, ideas are sought for joint consideration and challenge, and changes/revisions of ideas are evident if necessary (Mercer and Wegerif, 1999). As Mercer and Howe (2012) argue, disputational and cumulative talks are generally evident in the classrooms, whereas exploratory talks are rarely observed.

Several studies have focused on how to improve the quality of students' classroom talk through various interventions. These included the Thinking Together program (e.g., Mercer et al., 2004; Mercer and Wegerif, 1999), laboratory verification (e.g., Zohar and Nemet, 2002), scientific inquiry (e.g., Ford, 2008; Osborne, Erduran and Simon, 2004), and scaffolding for argumentation/reasoning (e.g., Deng, 2012; Martin and Hand, 2009; McNeill and Pimentel, 2010). In general, these studies consistently report positive findings that students' classroom talks became more constructive and/or critical (e.g., exploratory talk). A closer examination of these "successful" interventions reveals that they share the similarities in (at least implicitly) engaging students in the process of knowledge building/construction. This lends much support to the hypothesis of the current study that the KBC approach can enhance students' talk in the classroom. Besides, these intervention studies were mostly conducted within the subject domain of Science. Very few studies have investigated the development of students' talk especially in the Social Studies classroom, which constitutes a gap this paper aims to fill.

2.2 Facilitating the Changes in Primary Students' Epistemic Beliefs

The term "epistemic beliefs" generally refers to beliefs about the nature of knowledge and knowing (Hofer, 1997). As suggested by Conley, Pintrich, Vekiri and Harrison (2004), these beliefs include beliefs about the source of knowledge (e.g., from authority figures), certainty of knowledge (e.g., belief in a "right" answer), changing/development knowledge of knowledge (e.g., knowledge can change over time), and justification of knowledge (e.g., role of experiment)

Although many empirical studies (e.g., Price and Lee, 2013; Sahin, 2010) have explored how to change students' epistemic beliefs through various interventions, only a small number of them (e.g., Conley et al., 2004; Smith, Maclin, Houghton and Hennessey, 2000; Wu and Wu, 2011) have targeted the primary school students. For example, in the study of Smith et al, eighteen Grade 6 students were engaged in a constructivist-oriented curriculum (i.e., experimental group) that values students' own ideas, group collaboration, and personal reflection. Compared to other 27 students from the comparison group, the experimental group expressed more sophisticated epistemological stance toward science. Besides, using a pre-post-test design, Conley et al reported that a nine-week inquiry-based science unit was "partly" effective in changing Grade 5 students' epistemic beliefs. That is, students showed more informed beliefs about source and certainty of knowledge over time, but no significant changes were observed in their beliefs about development and justification of knowledge. Involving similar intervention used (5-week inquiry-based science activities), participant group (i.e., Grade 5 Taiwanese students), and research design (pre-post-test), Wu and Wu reported different finding that most students' epistemic beliefs remained naïve, "such that …experimental results are scientific knowledge, and there exists only one method to conduct an experiment" (p. 337). The inconsistency may be a function of duration of intervention, definition of epistemic beliefs, instrument used, and the cultural context.

At least two main gaps can be identified from the above studies. First, very few studies focused on the change in primary students' epistemic beliefs within the learning context of other non-Science subjects (e.g., Social Studies). The existing studies seem to mainly examine students' epistemology of science and/or beliefs about the nature and justification of scientific knowledge. Second, very few studies have explicitly engaged students in knowledge creation practices that may be more beneficial to the change in students' epistemic beliefs. Previous studies seem to rely on regular scientific inquiry activities to imitate scientists' research activity of creating scientific knowledge. Considering the domain-specificity of epistemic beliefs (Hofer, 1997) and the dearth of relevant studies, this study attempted to explore the effectiveness of the KBC approach in developing students' epistemic beliefs.

2.3 Potential Advantages of the Knowledge Building Community (KBC)

Grounded on the social constructivist framework, the KBC approach (Bereiter and Scardamalia, 2006) has become one of the pedagogical models that are highly referenced for the cultivation of knowledge builders/creators. As an idea-centered approach, it places much emphasis on the collaborative knowledge creation among students. To well support the use the KBC approach, an evolving knowledge co-creation platform called the Knowledge Forum (Scardamalia and Bereiter, 2006) have been developed. This platform allows students to articulate their ideas through customizable metacognitive prompts and to share their ideas (e.g., post notes like questions and answers) by using different multimedia. All online notes (or "talk" in this paper) are cognitive artefacts that can evolve if the student or others would like to further revise or refine them. In this sense, we hypothesize that the KBC approach (with the Knowledge Forum platform) may enable students to produce more exploratory (online) talks (see Mercer, 1995; Mercer and Littleton, 2007).

As evident in many empirical studies, the KBC approach seems to show great potential in facilitating changes in individuals' epistemic beliefs. For example, it helps not only promote changes in secondary students' epistemic beliefs about the authoritative nature of science (Goh, Chai and Tsai, 2013), but also develop student teachers' epistemic beliefs towards constructivist orientation (Hong and Lin, 2010). This is probably because the KBC approach creates rich opportunities for students to personally experience the epistemic practices, which may be more beneficial to the changes in how students perceive the nature of knowledge and knowing. Therefore, we hypothesize that the KBC approach may help change students' epistemic beliefs.

3. Methods

3.1 Participants

The participants were 157 Primary 3 students from four classes: Class 3B (n = 42), Class 3C (n = 36), Class 3F (n = 41), and Class 3G (n = 38). Classes 3B and 3F were selected as the experimental group (n = 83) taught by the KBC approach, while Classes 3C and 3G as the comparison group (n = 74). Among the 157 students, about 53% were girls. The four classes were taught by two Social Studies teachers, and each taught one comparison class and one experimental class.

3.2 Intervention

In the two experimental classes, students were provided some anchoring phenomenon related to the key ideas embedded in the Social Studies curriculum. They were given time to work on their initial ideas about the phenomenon and to conduct independent research (e.g., search information from Internet) to better understand the phenomenon. Meanwhile, they were encouraged to post their ideas (e.g., in the form of a knowledge claim or a question) on the platform of Knowledge Forum. Each student was also encouraged to refine/revise others' ideas by adding on new ideas or questions and/or to provide answers to others' questions if possible. The teachers acted mainly as a facilitator, s/he would provide necessary assistance for the students only when necessary. In the two comparison classes, the teacher guided the students to go through the contents in the textbook. The classroom discussions were usually initiated and led by the teacher, while students were inclined to provide answers for specific questions asked by

the teacher. Video clips were sometimes used in the classroom. Overall, the intervention lasted for about 6 months.

3.3 Data Collection and Analysis

Two main data sources were collected for analysis in this study. The first source was experimental group students' online notes/talks, that is, the questions and answers they have posted. Based on Chin, Brown, and Bertram's (2002) classification of questions and answers, we employed the content analysis method to analyze students' online talks. Specifically, one researcher applied Chin et al.'s (2002) coding scheme (see Table 1) to code the data first. Another researcher then randomly selected 20% of the data and coded them with the same coding scheme. This yielded about 97% of inter-rater agreement. To examine the effectiveness of the KBC approach in enhancing students' online talks, Person's Chi-Square analysis was performed to test if any significant difference in question types and answer levels. Instead of using a pre-post-test approach, we divided the data into two parts (i.e., first three months and the last three months) and compared the category distributions accordingly.

Table 1: Coding scheme for analyzing students' online talks.

Type of talk	Categories	Descriptions
Questions	Basic information questions	• Yes/no questions • Basic text-based or encyclopedia questions
	Wonderment questions	• Why/how question • Question of comparison/contrast • Questions with multiple answers • Comprehension questions asking for clarification
Answers	Level 1	• Simple answer
	Level 2	• Answer with reasoning, summarization, clarification, or example
	Level 3	• Answer with reasoning supported with authoritative sources, comparison, or contrast
	Level 4	• Answer with reasoning supported with evaluation and interpretation of authoritative sources

The second data source was all students' responses to a five-point Likert-scale used to measure students' epistemic beliefs of Social Studies knowledge. The survey questionnaire was adapted from Conley et al.'s (2004) instrument with specifying the subject context (i.e., Social Studies). The "Justification of knowledge" dimension was not used in this study. This was mainly because this dimension focuses more on the role of scientific experiments in justifying knowledge, which may be unsuitable for the learning contexts of Social Studies. Besides, considering the participants were Primary 3 students, we did not intend to burden them with too many instrument items. As a result, the questionnaire consisted of three dimensions: *source of social studies knowledge* (e.g., "Only experts know for sure what is true in social studies"; 5 items), *certainty of social studies knowledge* (e.g., "All questions in social studies have one right answer"; 5 items), and *development of social studies knowledge* (e.g., "Ideas in social studies change over time"; 5 items).

To establish the construct validity, the survey data were factor analyzed (e.g., principal component analysis). As a result, three factors with eigenvalue larger than 1.0, each with 5 items, were identified as expected. They explained about 57% of the variance. The factor loadings ranged from .56 to .80 (>.50), which suggests that the instrument shows acceptable construct validity (Hair, Black, Babin and Anderson, 2010). Besides, the Cronbach's α coefficients of each dimension ranged from .69 to .87, which also indicates good reliability/internal consistency. Independent-tests were subsequently conducted to examine the difference between the comparison and experimental groups in the three dimensions of epistemic beliefs.

4. Results

4.1 Improvement in Students' Online Talks

Results of Chi-square analysis showed that significant differences were observed in students' question types ($\chi^2 = 8.45$, $p < 0.01$) and answer levels (($\chi^2 = 9.99$, $p < 0.01$)) between the first three months and the last three months. Specifically, during the last three months, students were more likely to ask "wonderment questions" that involve higher cognitive level as compared to the "basic information questions". Similarly, students' answer levels also shifted from Level 1 to Level 2 and Level 3. That is, students were more capable of providing answers with reasoning (supported by authoritative source, comparison, and contrast), summarization, clarification, or examples. From the perspective of Mercer and his colleagues (e.g., Mercer, 1995; Mercer and Littleton, 2007), students' online talk shifted from "disputational talk" to "cumulative talk". However, as shown in Table 2, students' answer level did not reach the highest level (Level 4) during the whole 6 months. As seen from Table 1, Level 4 requires students to reason with careful interpretation and critical evaluation of the authoritative sources they found. That is, it seems to demand more criticality and higher metacognitive level and it bears much resemblance with Mercer's (1995) *exploratory talk*. These seem to suggest that the KBC approach was *partly* effective in enhancing students' online talk.

Table 2: Distribution of students'' online talks.

Type of talk	Categories	Frequency - first 3 months	Frequency - last 3 months
Questions	Basic information questions	84 (57%)	68 (41%)
	Wonderment questions	63 (43%)	99 (59%)
Answers	Level 1	93 (94%)	287 (81%)
	Level 2	5 (5%)	57 (16%)
	Level 3	1 (1%)	12 (3%)
	Level 4	0 (0%)	0 (0%)

4.2 Differences between the Comparison and Experimental Groups in Epistemic Beliefs

Results of independent t-tests showed that significant differences were observed in *source* ($t = 3.58$, $p < .001$) and *certainty* ($t = 3.26$, $p = .001$) of social studies knowledge, but not in the *development* dimension ($t = .28$, $p = .78$). As inferred from Table 3, the experimental group was less likely to view social studies knowledge as handed down from authority figures, while the comparison group was more likely to believe that social studies questions have a right answer. That is, the experimental group expressed more sophisticated epistemic beliefs (i.e., constructivist-oriented) at the end of the intervention than the comparison group did. However, the two groups did not differ in the "development" dimension. This may be due partly to the "ceiling effect". This interpretation can be supported by the high mean scores and fairly low standard deviations of the two groups. Overall, these results indicate the advantage of the KBC approach in enhancing students' beliefs about the source and certainty of social studies knowledge.

Table 3: Comparison of epistemic beliefs between the comparison and control groups.

Dimension	Experimental Group (n = 83)		Comparison Group (n = 74)	
	M	SD	M	SD
Source	2.83	1.16	3.42	.91
Certainty	2.84	1.05	3.34	.86
Development	3.98	.76	3.95	.69

5. Conclusion and Discussion

5.1 Using the KBC Approach to Enhance Classroom Talk

In this study, we found that the KBC approach partly enhanced students' online talks (i.e., questions and answers posted), shifting from *disputational talk* to *cumulative talk*. However, no evidence showed that students were able to use *exploratory talk* during their learning tasks on the platform of Knowledge Forum. This finding is *partly* consistent with other studies that reported students' ability to produce exploratory talk after specific interventions (e.g., Deng, 2012; Mercer et al., 2004; Osborne et al., 2004). A possible reason why no exploratory talk was spotted in this study could be this type of talk is too challenging and demanding for young children who have been accustomed to the traditional learning environment (Driver, Newton, and Osborne, 2000; Mercer and Howe, 2012). Although they were encouraged to co-construct ideas together, students may end up working individually rather than talk to their peers. Another possible explanation could be students' considerable difficulty in argumentation/reasoning (e.g., Berland and Reiser, 2011; Chinn and Brewer, 1998). Therefore, to enable students to use more exploratory talk, teachers can attempt to teach argumentation skills (Zohar and Nemet, 2002) explicitly and/or provide in-situ prompts/scaffolds (Deng, 2012).

5.2 Using the KBC Approach to Enhance Epistemic Beliefs

We also found that the KBC approach was effective in enhancing students' beliefs about the source and certainty of social studies knowledge rather than the *development* dimension. This result generally parallels findings of other studies that constructivist-oriented classrooms allow students to develop more sophisticated epistemic beliefs (e.g., Conley et al., 2004; Smith et al., 2000). The experimental group's more constructivist beliefs can be due mostly to the KBC approach that underscores the value of students' various "folk" ideas. That is, they would rely less on authorities (e.g., teacher and textbook) and express more doubts about the certainty of social studies knowledge. Akin to Conley et al.'s study, the intervention seemed to be little beneficial to students' epistemic understanding about the development of social studies knowledge. Other than the "ceiling effect" issue (e.g., high mean scores and low standard deviations) discussed above, another explanation could be students were seldom engaged in argumentation and reflection. This interpretation can be supported by the above finding that no exploratory talks were evident. As Conley et al. argued, students may lack the opportunities to recognize and appreciate how ideas/knowledge may develop with the facilitation by critical argumentation and deep reflection. Therefore, future studies can take these two components into consideration when designing interventions for promoting students' epistemic beliefs.

5.3 Limitation of the study

A few limitations of this study should be noted. First, we adopted a quasi-experimental-post-test-only design to investigate the role of the KBC approach in enhancing students' epistemic beliefs. Since no pretest data were available in this study, we could not exclude the potential effect caused by pretest (i.e., two groups' epistemic beliefs prior to the intervention). For example, it is possible that the experimental group did showed less sophisticated beliefs about the development of social studies knowledge before the intervention, which would suggest different interpretation about the effectiveness of the KBC approach. Future research can address this issue by using more rigorous research design (e.g., pre-post-test and experimental design). Second, limited data sources were collected in this study, which may *bias* the findings reported above. Future studies can consider the use of other data sources (e.g., interviews, observation, and reflective journals) for the triangulation purpose (e.g., Deng, 2012).

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