# Students Changing their Conceptions of Collaboration through Computer-supported Knowledge Building

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**Abstract**. This study explored the effects of knowledge building on fifth-graders' conceptions of collaboration. Data were from (1) notes posted online; and (2) a survey on students' conceptions of collaboration. Findings indicate the experimental class was able (1) to work beyond pre-determined fixed-group structure and engage in unplanned, emerging collaboration, and (2) to develop a more informed view of collaboration—i.e., seeing collaboration both as a means to support learning and to foster knowledge creation.

Learning and knowledge creation are two different kinds of cultural activities (Hong & Sullivan, 2009). Learning is ''mainly a process of acquiring desired pieces of knowledge'' (Paavola, 2002, p.24) and highlights a psychological concept of knowledge that views knowledge as possessed within an individual's mind (Hyman 1999; Popper 1972). Knowledge creation, however, values the innovative process of inquiry where ''something new is created and the initial knowledge is either substantially enriched or significantly transformed during the process'' (Paavola, 2002, p.24). Based on this distinction, collaboration can also be divided into two kinds: collaboration to support learning and collaboration for knowledge-creating (Hong, in press). Conventional school culture tends to place more emphasis on collaboration for leaning, whereas in many science or business cultures, collaborative knowledge-creating is a norm. In the study reported, we explored the question of whether it is possible to foster more collaborative knowledge-creating activities in a science class by engaging fifth-graders in knowledge-building and whether doing so would change their conceptions of collaboration.

## Method

Participants were two classes of fifth-graders from Taipei, Taiwan. To ensure comparability, both classes (1) were taught by the same science teacher over a semester (18 weeks), (2) were divided into six small groups; (3) had the same instructional goal (learning about greenhouse effect) and shared same learning resources (e.g., library and Internet); and (4) were tested about their conceptions of collaboration. All instructional activities remained the same except that students in the experimental class (n=34) adopted a pedagogical approach called knowledge building. In brief, knowledge building is a social process focused on sustained production and improvement of ideas of value to a community (Scardamalia & Bereiter, 2006) and is supplemented by Knowledge Forum (KF)—an online multimedia knowledge-building environment. In contrast, students in the control class (n=33) employed group-based, Jigsaw learning (Aronson & Patnoe, 1997). Specifically, it was performed by (1) identifying an overall learning task (i.e., understanding greenhouse effect), (2) dividing the whole task into sub-tasks, (3) helping each group to master one sub-task (e.g., what is greenhouse effect and how does it happen), and (4) finally having each group share its knowledge in the whole class like completing a puzzle. Most participants came from families with a lower socioeconomic status. All students have no experience of using Knowledge Forum before. The teacher, although has taught science for more than 10 years, had only one-year experience of using Knowledge Forum in teaching. Data mainly came from: (1) notes recorded in a Knowledge Forum database, and (2) a self-developed survey assessing students' conceptions about collaboration. For analysis, we first looked into online interactions in Knowledge Forum throughout the whole semester. Then, we qualitatively analyzed the survey. The survey contains several open-ended questions about collaboration (e.g., what is collaboration? why is it important? how do you usually do it?). An open-coding procedure (Strauss & Cobin, 1990), using sentence as unit of analysis, was performed based on the two types of collaboration mentioned above (see Table 1). An inter-coder agreement was calculated to be .92.

## Results

First, to find out whether and how students in the experimental class collaborated, we first analyzed students' overall online activities in Knowledge Forum. In total, it was found that students created 360 notes (M=10.91, SD=7.38) in Knowledge Forum. There were in general two types of collaborative notes in Knowledge Forum: co-authored and built-on notes. First, among all notes, about one third (33.06%) are co-authored notes, while the rest (66.94%) are individual notes. If we analyze all notes in a different way, then, it was found that more than half of all notes (61.67%) are build-on notes, and only 38.33% are non-build-on notes. To further examine the developing process of online activities, we divided the semester into two stages (stages 1 and 2), using midterm as a separation point. As a result, it was found that the total percentage of the individual notes decreased from 81.77% (Stage 1) to 47.77% (Stage 2) and that of the co-authored notes increased from 18.23% (Stage 1) to

52.23% (Stage 2). Likewise, the total percentage of non-build-on notes decreased from 45.81% (Stage 1) to 28.66% (Stage 2), while that of build-on notes increased from 54.19% (Stage 1) to 71.34% (Stage 2). Moreover, when looking deeply into students' collaborative behaviors in terms of network density, it was found that (1) the density of students' note-reading activities increased from 18.23% (stage 1) to 52.23% (stage 2 ), and (2) the density of their note-linking activities also increases from 14.76% (stage 1) to 31.26% (stage 2). The above findings suggest a pattern of an increasing collaborative capacity in the experimental class. Second, to find out whether engaging students in knowledge building would also change their conceptions of collaboration, we analyzed the survey questions. As a result, it was found that there is a significant difference between the pre- and post-survey results for the experimental class ($\chi 2=9.56$; $p<.01$) but not for the control class ($\chi 2=1.16$; $p>.05$) (see Table 2). The findings suggest that engaging students in knowledge building activities is helpful for students to develop a more informed view of collaboration, i.e., seeing collaboration not just as a means to support learning but also as a means to foster knowledge creation.

Table 1: Coding scheme for analyzing students' concepts about collaboration.

| Category | Feature | Example |
|---|---|---|
| Collaboration for learning | Group activities | Everyone works together to complete the task. (B22) |
| | Acquiring knowledge from others | Asking teachers for answers. (B36) |
| | Sharing/learning together | Research a topic and study in a place together. (A26) |
| Collaboration for knowledge creating | Producing ideas | Search for information in the internet to find new ideas. (B35) |
| | Exchanging ideas | Put our ideas together and do research. ( A03) |
| | Improving ideas | We researched scientific problems together, discussed in Knowledge Forum, and then integrated our ideas. (A11) |

Table 2: Students' conceptions about collaboration.

| | Conceptions of collaboration | Pre-test | Post-test | $X^2$ |
|---|---|---|---|---|
| Experimental class | Collaboration for learning | 72.73% | 52.87% | 9.56** |
| | Collaboration for knowledge creating | 27.27% | 47.13% | |
| Control class | Collaboration for learning | 72.34% | 66.84% | 1.16 |
| | Collaboration for knowledge creating | 27.66% | 33.16% | |

*p<.05 **<.01

## Discussion

Collaborative competence has been recognized as an important 21st-century skill essential for one to succeed in the future society; this is in particular relevant in a knowledge economy where the capacity of collaborative work with new ideas and knowledge for solving pressing societal problems is ever-increasing (Trilling & Hood, 1999). To cultivate such collaborative competence, it is essential to design appropriate CSCL environments that allow students to explore various collaborative practices and to broaden their view of collaboration. As assessed in this study, employing group-based collaborative learning (i.e., the Jigsaw method in the control class) may be limiting, as most collaborative learning activities would only occur within groups. In contrast, knowledge building would allow students to work with emerging ideas beyond groups, hence prompting students to collaborate more intuitively and opportunistically, and helping them to develop a more informed view of collaboration. Further discourse analysis will be conducted to triangulate the initial findings.

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