A Preliminary Study of University Students' Collaborative Learning Behavior Patterns in the Context of Online Argumentation Learning Activities: The Role of Idea-Centered Collaborative Argumentation Instruction

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Abstract: Learners have more and more opportunities to encounter a variety of socio-scientific issues (SSIs) and they may have difficulties in collaborative argumentation on SSIs. Knowledge building is a theory about idea-centered collaborative knowledge innovation and creation. The application of idea-centered collaboration practice as emphasized in knowledge building may be helpful for facilitating students' collaborative argumentation. To examine the perspective above, this study attempted to integrate idea-centered collaboration into argumentation practice. The participants were 48 university students and were randomly divided into experimental and control group (n=24 for both groups). The control group only received argumentation instruction, while the experimental group received explicit idea-centered collaborative argumentation (CA) instruction. This study found that two groups of students revealed different collaborative learning behavior patterns. It is also noted that the students in the experimental group benefited more in collaborative argumentation from the proper adaption of knowledge building and explicit idea-centered collaborative argumentation instruction.

Introduction

In the knowledge-based societies, learners have more and more opportunities to encounter a variety of social dilemmas coming with rapid development in science and technologies. These social dilemmas are often termed "Socio-scientific issues (SSIs)" which are controversial social issues that are generally ill-structured, open-ended authentic problems which have multiple solutions (Sadler, 2004; Sadler & Zeidler, 2005). When trying to find better solutions, learners may need to be involved in SSI-based argumentation learning activities in order to find better ideas reaching consensuses and achieve compromise solutions (Walker & Zeidler, 2007).

Beretier and Scardamalia (2003) distinguished between "belief mode" and "design mode" in work with ideas. If activities that are related to ideas evaluating, questioning, accepting, or rejecting knowledge claims, they belong to "belief mode"; whereas the activities have broader range that are related to knowledge production, improvement, searching for better ideas, they belong to "design mode" (Beretier and Scardamalia, 2014). It should be noticed that SSI-based argumentation sometimes falls in the situation of win-or-lose argumentation which are not in collaborative manner or related to idea refinement. In other words, SSI-based argumentation is often implemented as the "belief mode" activity. To address the aforementioned issues, argumentation practice emphasizing idea-centered collaboration that is adapted from knowledge building could be promising. Knowledge building emphasizes the importance of creating knowledge jointly in a community, and it describes what a community of learners needs to accomplish in order to improve ideas and create knowledge (Scardamalia & Bereiter, 1994; 2003; 2006). The adaption of idea-centered collaborative argumentation regarding a SSI may turn the win-or-lose situations of SSI-based argumentation into more community knowledge refinement situations. That is to say, turning the "belief mode" argumentation to "design mode" one. Therefore, in the study, idea-centered collaboration argumentation learning activities were designed and implemented.

Moreover, as revealed in previous research, students often have limited argumentation skills. For example, they often have difficulties in generating counter-arguments due to the lack of knowledge of different perspectives (Leitao, 2003). To improve students' argumentation skills, previous research has suggested the use of explicit instruction in argumentation (e.g., Andriessen, 2006). However, relevant studies are still not available in SSI-based collaborative argumentation contexts. Therefore, this study also examined the effectiveness of explicit instruction that focuses on both collaboration and argumentation skills in students' SSI-based argumentation. To sum up, this study is one of the initial attempts trying to exam the role of explicit idea-centered collaboration argumentation in students' argumentation practice. The research questions are as follows:

1. When implementing KB-based SSI argumentation learning activities, how these two groups of students

with different instructions (idea-centered collaborative argumentation instruction vs. argumentation instruction only) differ in terms of their knowledge building behavior patterns?

2. When implementing KB-based SSI argumentation learning activities, how these two groups of students with different instructions (idea-centered collaborative argumentation instruction vs. argumentation instruction only) differ in terms of collaborative argumentation behavior patterns?

Methods

Participants and learning contexts

The participants in this study were two classes of 48 students (14 men and 34 women, mean age 21 ± 3 years) in a university in southern Taiwan. They were students from different departments and institutes who took the same academic course (from March to June 2016) called "Science, Technology and Society". The study started from March to May in 2016. All the participants were taught by the same teacher who had been using knowledge building pedagogy and Knowledge Forum in the classroom for over one year. Participants from the two classes were randomly divided into two groups (Experimental Group n=24; Control Group n=24). In each group, 4 participants were also randomly assigned into a small group for knowledge building-based argumentation learning activities. There were 6 small groups in the experimental and the control group respectively.

Idea-centered collaborative argumentation instruction and Knowledge Forum

There were three phases in this study. In the first phase, all participants were required to read articles or listen to academic speeches about different SSIs topics, such as energy, climate, and environment issues. In this phase, the participant teacher also gave a mini lesson of collaborative knowledge innovation and creation (based on the knowledge building core principles) to the participants. Then the students were given a SSI topic for discussion in Knowledge Forum (KF) for four weeks. To ensure participants' familiarity and the quality of discourses in Knowledge Forum, further in-class discussions and feedbacks were given at the end of phase 1.

In the second phase, both groups received a two-week instruction in class. The control group received argumentation instruction including the concept of arguments, counter arguments, and how to do rebuttals. In the instruction phase, a mini lesson of argumentation was given to the participants. The participant teacher gave some questions to the participants to discuss in class (e.g. Why argumentation skill is important for you? What is the result of argumentation?). Then, the participant teacher taught them the definition of argumentation and its step by step skills. Finally, SSIs topics that the participants have learned were used in argumentation practices in class. For the experimental group, besides the aforementioned argumentation instruction, they also received the instruction focusing on the idea-centered collaboration argumentation. They learned the phrases which showing idea-centered collaboration and practice saying them in the argumentation practice (e.g. I am looking forward to seeing my group member's opinion. I think it is a good idea. I think the idea can be listed into our consensus). The purpose of idea-centered collaborative argumentation instruction was to help the group members have deeper understanding on the topic and reach consensus at the end. (Sadler, 2011). The students in the experimental group learned how to cooperate with other group members in argumentation, how to conduct collaborative argumentation like scientists do. They especially focused on how to make arguments collaboratively. They were also encouraged to provide evidence and justify them within their groups.

In the final phase, a highly controversial SSI topic in Taiwan, "There are many ways to solve the power shortage issue in Taiwan, such as thermal power, hydroelectric, nuclear power. What could be the better solution by using these different approaches?" was given to the two groups for argumentation for four weeks. All participants were required to discuss the topic anonymously in class and asynchronously in KF. The control group used the normal openers provided in Knowledge Forum, while openers related to collaborative argumentation were also provided to the students in experimental groups additionally. At the end of this phase, each group needed to synthesize their ideas and finish a group report.

In traditional classrooms, students may feel shy or frustrated when they express their ideas in public. In particular, they may not propose their arguments because they are afraid of losing face or may fight against with others especially in the face to face interaction environment (e.g. in the classroom) (Andriessen, 2006). Researchers suggest that learners may also need technology helping them to work together when they are involved in collaborative argumentation learning activities (Clark et. al., 2010; Noroozi et. al., 2012). In this study, Knowledge Forum is adopted to promote learning equity and improve their argumentation performances. Scardamalia (2004) described that the KF scaffolds help students clarify and organize the writing of their concepts in a note and help students focus on particular aspects of the knowledge-building process when exchanging

information, working in ways similar to a scientific group. In this study, several KB principles were enacted. For example, the ideas are real and authentic (Real ideas and authentic problems), students continuingly refine, generalize and synthesize the ideas (Rise above), every group member possesses equal right and take equivalent responsibility for advancing community knowledge (Collective responsibility for community knowledge).

Data collection and analysis

The primary data sources were students' online entries (notes) in Knowledge Forum in the final phase. Students posted notes whenever they had free time outside the classroom. The students in both groups were encouraged to post notes with openers. In the study, there were 327 entries and 425 entries in the control group and experimental group respectively.

In this study, two coding schemes, the knowledge building coding scheme and the collaborative argumentation scheme were used to analyze students' entries in both the groups. The knowledge building coding scheme includes "My idea (KF1)", "I need to understand (KF2)", "New information (KF3)", "This idea cannot explain (KF4)", "A better idea (KF5)", "Putting our knowledge together (KF6)". This coding scheme is exactly the same as the openers in Knowledge Forum. The collaborative argumentation coding scheme is adopted from McAlister, Ravenscroft and Scanlon (2004), it includes "Inform (CA1)", "Question (CA2)", "Challenge (CA3)", "Reason (CA4)", "Support (CA5)", and "Others (CA6)". All the entries were arranged according to the two coding schemes respectively and were given appropriate codes by the authors separately. The authors then discussed the codes regularly. If the authors had different opinions on the codes, they discussed the differences until they had reached the consensus. In other words, each students' note was given both a knowledge building code and a collaborative argumentation code. After the qualitative coding, Lag Sequential Analysis (LSA) was adopted to analyze the sequential correlations between chronologically ordered behaviors including the group knowledge building behavioral patterns and collaborative argumentation behavioral patterns. The method was utilized to visualize the sequential correlations between chronologically ordered behaviors (Bakeman & Gottman, 1997; Hou, 2012; Hou & Wu, 2011). The inter-coder reliability is greater than 0.8. Authors discussed and reached consensus if any disagreements occurred.

Results and discussion

Figure 1 shows the results derived from the Lag Sequential Analysis of students' knowledge building behavioral patterns (see Figure 1, Left). In the experimental group, "New Information (KF3)" and "This idea cannot explain (KF4)" indicated the significant sequences; "Putting our knowledge together (KF6)" shows significant self-sequence. It seems that when there was new information regarding an idea proposed, the students in the experimental group significantly tended to challenge the idea with new information. Also they significantly tended to synthesize their ideas together frequently. However, no significant sequences were found in the control group. The results indicate that the implementation of collaborative argumentation instruction in the experimental group may improve their ideas and help them synthesize their ideas regarding a SSI.
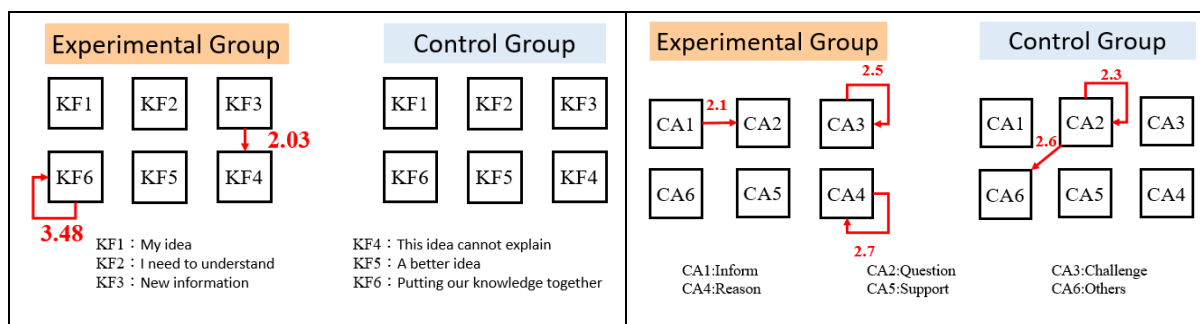
Figure 1. Knowledge building behavioral Patterns between the two groups (Left) and Collaborative argumentation behavioral Patterns between the two groups (Right).

Figure 1 also shows the results derived from the LSA of collaborative argumentation behavioral patterns in the two groups (see Figure 1, Right). Both the groups revealed significant collaborative argumentation behavioral sequences, but their learning patterns are various. In experimental group, "Inform (CA1)" and "Question (CA2)" indicate the significant sequences, "Challenge (CA3)" and "Reason (CA4)" both show

significant self-sequences. It indicates that the students in experimental group tended to elaborate new ideas or arguments after they were proposed. Besides, they also tended to refine their arguments or challenge new arguments, and they tended to reason and synthesize their arguments. It is noted that in the control group, "Question (CA2)" shows significant self-sequence and has significant sequence with "Others (CA6)". However, in the control group, students tended to ask questions again and again, indicating that they might always fail to clarify their arguments. Besides, after asking questions to clarify existing arguments, they also tended to be off-task or lost focus. In sum, the students in the experimental group benefited more from the explicit idea-centered collaborative argumentation instruction in this study in terms of their idea and argument refinement and achieving a synthesized solution regarding a SSI. On the contrary, the control group may not refine their arguments regarding SSI due to their win-or-lose or off-task patterns.

Conclusion

This study was one of the initial attempts to adapt the idea-centered collaboration argumentation regarding a SSI. Both argumentation instruction and explicit idea-centered collaborative argumentation instruction were implemented in this study. By analyzing the students' knowledge building and collaborative argumentation behavioral patterns, the results showed that KB-instruction is useful for improving collaborative argumentation (Scardamalia and Bereiter, 1994). However, the two groups of students revealed different collaborative argumentation and knowledge building behavior patterns. The students in the experimental group benefited more in both their knowledge building and collaborative argumentation learning processes from the proper adoption explicit idea-centered collaboration argumentation instruction in online SSI-based argumentation learning activities. They tended to synthesize their ideas and find the better solution at the end. The findings of this study may provide researchers, educators, designers with a useful basis for improving learners' ability of collaborative argumentation.

Limitations

This study has some limitations within which our findings need to be interpreted carefully. First, the study was a preliminary experiment which may need more careful design. Second, because of the time limit, this study was a short-term experiment conducted with only a small size of population. To generalize the results for larger groups, future studies should have involved more participants.

Selected references

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