The Effects of High-Structure Cooperative versus Low-Structure Collaborative Design of Decision Change, Critical Thinking, and Interaction Pattern during Online Debates

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Abstract

The terms "cooperative" and "collaborative" are sometimes used interchangeably in reference to group learning activities in classrooms and in online settings. However, they can be viewed as differing in terms of characteristics such as pre-structure, task structure, and content structure (Strijbos & Martens, 2001; Panitz, 1996). This study attempted to help clarify these differences and the effects of the two types of groups on learner performance in an online debate. The study investigated the effects of a highly structured cooperative learning (HSCP) group, which had pre-assigned debate positions as a pre-structure, argumentation scaffolding as a task structure, and evaluation scaffolding as a content structure, compared to a low structured collaborative learning (LSCL) group, which did not have these structures, in terms of pre-service teachers' decision changes, critical thinking, and interaction patterns. Results demonstrated that there were greater amounts of critical thinking, and of critical and dynamic interaction patterns in the HSCP than LSCL group.

Objectives or purposes

The purpose of this study was to clarify the differences between cooperative and collaborative learning groups determine whether a highly structured cooperative learning (HSCP) group would have positive effects on individuals' changes in decision making, use of critical thinking, and engagement in critical and dynamic interaction patterns compared to a low structure collaborative learning (LSCL) group. The groups were differentiated by high levels of pre-structure, task structure, and content structure in the cooperative group and low or zero levels of these features in the collaborative group.

Perspectives or theoretical framework

Cooperative and collaborative learning have often been used interchangeably without clear distinctions even in face-to-face settings. In online learning settings, most of literature regarding group-based learning has predominantly used the terminology of collaborative learning rather than cooperative learning, but has not provided empirical evidence of the groups' structural characteristics or results. However, it is possible and perhaps useful to distinguish between the two types. Cooperative learning involves a group of people for a single task based on a structure with series of steps (Kagan, 1985), and mutual responsibility with highly structured and specialized roles (Kessler, 1992). On the other hand, collaborative learning is defined as a group activity where a group of people work together to create meaning, explore topics, or improve skills (Eastmond, 1995; Harasim et al., 1995) without forceful accountability of group learning which is unlike cooperative learning (Zvacek, 1991). According to Pantiz (1996), cooperative learning is highly structured, relates to more well-structured tasks for limited solutions, and requires the acquisition of a well-defined domain of knowledge and skills. Collaborative learning, on the other hand, is less structured, relates to ill-structured tasks for open and flexible solutions, and requires the acquisition of an ill-defined domain of knowledge and skills. Since there are varying ways of implementing these structural elements in the design of a group-based learning environment, this study operationalized two extreme group-based learning strategies in terms of three structural elements: pre-

structure, task structure, and content structure. The resulting two groups are high-structure cooperative (HSCP) and low-structure collaborative (LSCL), which is consistent with Panitz's (1996) definition.

Based on these structural differences, there were three ways in which the HSCP group was expected to perform differently from the LSCL group. The first pertains to changes in decisions made at the beginning of the debate compared to those made at the end. One of the main functions of group debate is to allow group members to compare their positions to those of others (Jellison & Arkin, 1977); and to evaluate or reevaluate alternative decision choices prior to group decision-making (Bernstein, 1982). Blumenfeld et al. (1996) also empirically reveal the significant effects of structure on online, group discussion in terms of achieving consensus and making better decisions compared with those online, group discussions characterized by unstructured discussion. Therefore, it was hypothesized that participants in the HSCP group would have more decision changes than in the LSCL group.

Secondly, Paul (1993) suggests that the quality of critical thinking is determined by the quality of critical reasoning. Highly interactive and learner-centered debate based on roles and the provision of scaffoldings can affect both the process and outcomes of online debate (Cavalier et al., 1995; Hooper et al., 1993; Singhanayok & Hooper, 1998). Therefore, it was hypothesized that the HSCP group would have more improvement in critical thinking than the LSCL group.

Thirdly, structured interactions are very effective ways to raise the level of student discourse and facilitate more student engagement (Smith, Johnson, and Johnson, 1981). Elaborative procedures and structures can also foster the benefits of debate in the group-based learning process (Smith, Johnson, & Johnson, 1981). The considerable assistance of social scaffoldings in the process of debate can guide students to consider alternative explanations, to negotiate complex issues, to evaluate progress, and to systematically offer justifications for their reasoning (Palincsar et al., 1993). Groups under structured interaction can be better supported in solving problems effectively with the help of explicit thinking processes with precise goals, planed procedures, generated alternatives, and repetitive modification process for better outcomes under the structured interaction process (Chang and Well, 1987). Therefore, it was hypothesized that the HSCP group would have more dynamic and interactive interaction pattern than the LSCL group.

Methods, Techniques, or Modes of Inquiry

One independent variable with two levels, high-structure cooperative (HSCP) and low-structure collaborative (LSCL), was implemented in an online debate assignment in terms of the amount of pre-imposed structure, task-imposed structure, and content-imposed structure.

Online Group Debate with HSCP Design

To create a high level of pre-structure, the researcher posted a proposition, which asserted that one of two WebQuests was more effective and efficient than the other for online debate. For the HSCP design, the researcher randomly assigned subjects to a pre-position of either 'pro' or 'con' with respect to the proposition for debate. For the low level of pre-structure approach, there was no pre-assigned position. Students, therefore, just chose and supported one of two given WebQuests, based on their personal preferences. To create a high level of task structure, argumentation scaffolding was given to provide structure to the task such that students were directed to insert appropriate labels for their comments whenever they posted a message during online debate. The instruction provided specific examples of propositions and possible types of message labels for debate. To create a high level of content structure, content specific scaffoldings for WebQuest evaluations were provided while subjects participated in online debate. Subjects performed the task of evaluating two different WebQuests, based on the given WebQuest evaluation criteria. Subjects evaluated the given WebQuests by referring to these descriptions of Web Quest evaluation specifications.

Online Group Debate with LSCL Design

For the online debate with the LSCL group, the researcher used the three subcomponents of low level pre-structure, ill-structured task, and open content structure, based on Panitz's (1996) definition of collaborative learning. For the low level of pre-structuring, there were no pre-assigned roles or positions while subjects participated in the online debate. For the ill-structured task, no argumentation scaffolding was given. For the content structure, content specific scaffolding for the evaluation criteria was given to the students.

Data sources or evidence

Participants consisted of forty-four students enrolled in an undergraduate pre-teaching course in educational technology at a large southeastern university in the USA. Four of the subjects were eliminated from data analysis because they did not participate in one or more of the pre-test, debate, or post-test activities. Decision-making, critical-thinking, and interaction patterns were measured in order to determine the effects of HSCP and LSCL design on online debate.

In order to measure decision changes, the evaluation scores in both the pre-test and post-test were compared and the difference between HSCP group and the LSCL group was examined using a t-test. The change in decisions was measured by three elements of the pre-test and post-test as described in the results. The increase in critical thinking was measured by comparing the rationales written in the pre-test with those in the post-test, regarding the strengths and the weaknesses of each given WebQuest using the same WebQuest Evaluation Worksheet. The significance of the differences in the improvement of critical thinking was investigated using an independent sample T-test. In order to have consistency in grading the comments, the two graders engaged in considerable discussion. A Spearman Correlation-Coefficient test was conducted to establish inter-rater reliability between two coders.

For the investigation of online interaction patterns, the critical event sequences were observed. The researcher calculated the frequency of message event sequences based on the coding that was developed to correspond with Toulmin's model of argumentation (Toulmin, 1958) with the following matches (see Figure 1): "claims" corresponds to "proposition," "warrants" corresponds to "argument," "backing" corresponds to "evidence," "rebuttal" corresponds to "critique," and "qualifier" corresponds to "explanation." Another category, called "Others," which does not occupy a position within the diagram, indicates any type of message that does not fall into any of the categories. It was not necessary to use the "Others" category in the present study.

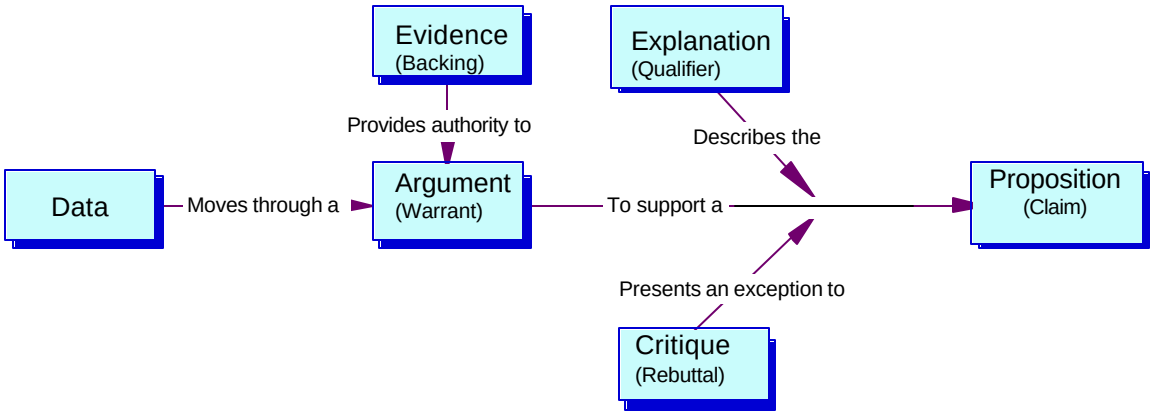

Figure 1. Debate Coding Plan based on Toulmin's (1958) Model

In the process of online debate the critical event sequences were observed in order to examine the critical reasoning process. The researcher observed the frequency of the following event sequences: argument-argument, argument-evidence, argument-critique, critique-critique, critique-evidence, critique-argument, evidence-argument, and evidence-critique based on the literature regarding the process of critical thinking (Paul, 1993; Derry et al., 2000). The researcher applied an independent sample Chi-Square test to determine the significance of differences in the critical and dynamic event sequences and also calculated Cohen's Kappa (1960) to establish the inter-rater reliability between two coders.

Results and/or conclusions/point of view

The three dependent variables examined in this study were: 1) decision changes in determining the better-designed of two WebQuests, from initial decision to decision after online debate; 2) the level of improvement in both the quantity and quality of critical thinking (the differences in critiques and evaluative comments between pre-test to post-test; and 3) the interaction pattern based on event sequence analysis for

critical interaction processes of the online debate messages stored in the online discussion board for three weeks.

Contrary to the hypothesis, the total mean score for decision change was 5.16 (SD = 3.14), from a possible range of 0-to-15. The descriptive statistics revealed that the mean score for decision change in the LSCL group (M = 5.41, SD = 3.84) was slightly higher than in the HSCP group (M = 4.91, SD = 2.31). However, the result of an independent sample T-test based on all three elements of decision change revealed no significant difference between the two group means (t (42) = .524, p > .05). At the same time, there were no statistical significance in the results of any of the three elements as follows: the first element of decision change based on the perceived quality of the first pair of WebQuests (t (42) = .000, p >.05); that of the second element of decision change based upon a comparison of the decisions regarding the better-designed WebQuest (t (42) = -.592, p >.05); and that of the third element of decision change regarding the reflected change of rank order of the first two, out of six, WebQuests (t (42) = .815, p > .05).

The total mean score for the development of critical thinking was M = 11.52 (SD = 9.36). The improvement of critical thinking was much higher in the HSCP group (M = 14.05, SD = 9.59) than in the LSCL group (M = 8.46, SD = 8.43). This finding did support the hypothesis (t (40) = -2.21, p < .05), at the alpha set at .05 with the power .58 for determining large effect size in a two-tailed test. The inter-rater reliability between two coders in grading the improvement scores of critical thinking, the Pearson correlation-coefficient test was conducted with alpha set at .01 with the significance of ? (44) = .000, p < .01. Therefore, there was high reliability between two graders in measuring the critical thinking skills using the WebQuest Evaluation Worksheet. The proportion of variance of coefficient value was .98 ($?^2$ = $(.99)^2$).

The total mean score for the observed frequency of critical event sequences for both groups per week, including all the possible types of event sequences between argument, critique, and evidence, was 104.67 per week. The mean score under the HSCP condition was higher (M = 61) than that of the LSCL condition (M = 43.67). This finding was consistent with the hypothesis based on a Chi-square test for two independent samples ($?^2$ (6, N= 44) = 18.479, p < .05) with p value = .005. Based on the Cohen-Kappa test for inter-rater reliability between two coder's coding in LSCL group, the strength of agreement was considered "very good" with a Kappa value of 0.840. For the HSCP group, the inter-reliability between first coder's coding and the subjects' coding was found to be "Good," with a Kappa value of 0.735. The confidence interval was 95% in both tests (Cohen, 1960).

Educational or scientific importance of the study

This study concludes that the HSCP learning strategy as distinguished from the LSCL strategy based on pre-structure, task structure, and content structure is statistically significant in facilitating group members' critical thinking as well as dynamic and critical interaction processes in an online learning environment. Several significant issues are identified in this study that may contribute to a more reasoned approach to the design of strategies for online, group-based learning as follows: 1) a more rationalized approach to the terminologies involved in collaborative and cooperative learning, 2) a clearer identification of the characteristics of strategies employed in collaborative and cooperative learning, and 3) an analysis of online, group interaction patterns in order to establish the key elements involved more concretely. The unique characteristics of three sub-components of cooperative learning employed in this study (pre-structure, task structure, and content structure) can be effectively implemented in designing group-based learning for online learning environments especially for the increase of critical thinking, and more dynamic and interactive online group interactions.

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