

Assigning Learning Roles To Promote Critical Discussions During Problem-Based Learning

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Introduction

Problem-based learning (PBL), as both an instructional strategy and curricular organizer, is often viewed as a complementary match for small groups of self-directed learners as they employ complex reasoning skills to tackle complex, real-world problems (Savery & Duffy, 1995). Implementing PBL activities in an online course accentuates the difficulties students face when both managing their own self-directed learning and coordinating a distributed group to achieve social learning goals. Sage (2000), for instance, examined the interaction of eight learners and two teachers in a six-week graduate course employing PBL pedagogy. Findings indicated that learners struggled with the dual novelty of communicating in an asynchronous computer conference (ACC) and the PBL pedagogy. Those who were novices to playing the role of an active learner and problem solver “found wading their way through multiple resources, online group work, defining and conceptualizing the problem, and using past experience to be overwhelming at times” (p.6).

Research on other types of small group activities in ACC environments indicates that instructors are generally satisfied with the frequency of group interaction (Harasim, 1993), but they indicate disappointment that the group discussions are not more interactive (Hiltz, Coppola, Rotter, Turoff, & Benbunan-Fich, 2000), more critical (Bonk, Malikowski, Angeli, & East, 1998), and more indicative of “negotiation of meaning and co-construction of knowledge” (McLoughlin & Luca, 2000).

The results of two studies conducted by the authors suggest that assigning roles to members of PBL learning groups influences the function, level, and interconnectedness of group interactions. The following is a summary and comparison of these mixed methods research studies conducted during the Fall of 2000 and 2001 on two sections of a online graduate course called “Using and Assessing Technology”. The results are valuable to online instructors and instructional designers because they provide insight into: (1) the competing costs for students’ cognitive resources during PBL; (2) the typical patterns of function and cognitive skill use over the course of PBL; and (3) the relative value of role assignment as a strategy for promoting critical discussions about learning issues.

Methodology

During the first and second offerings of the online graduate course, a PBL instructional strategy was employed to achieve several learning goals, such as: (1) to identify the process, issues, and methods of conducting a technology assessment (TA); and (2) to develop proficiencies in planning, implementing, and reporting a TA. During the second half of the course, students were organized into six heterogeneous groups controlling for group process skill, major, location, and sex consisting of ≈4 individuals. These groups were challenged to conduct and report a technology assessment as indicated in Table 1. During the

six week PBL activity, all distributed groups were directed to communicate in their private asynchronous threaded discussion board of the Blackboard class management system.

Table 1. Comparisons of Fall 2000 and Fall 2001

	Fall 2000	Fall 2001	Dependent Variables
Participants	20 of 26 enrolled	19 of 24 enrolled	
Major Research Question	Are there differences in the dialogue, interconnectedness of messages, and perceptions of students between the cooperative and collaborative approaches?	Are there differences in the productive dialogue, interconnectedness of messages, and perceptions of students based upon different learning roles?	Function Cognitive Organization Social Metacognitive
Role Assignment	Cooperative Groups 3 Groups each with a(n) Schools Specialist Health Specialist Economics Specialist Web Specialist Lead Editor Collaborative Groups 3 Groups - No Roles	6 Groups each with a(n): Inferencer Possibility Generator Summarizer Strategist	Cognitive Skill Elem. Clarification Indepth Clarification Judgment Inference Strategy Level of Processing Surface Deep
Monitoring	Cooperative: Frequent Every 2 to 3 days Collaborative: Less Frequent Every 4 to 5 days	Frequent Every 2 days	Cohesion (Interconnectedness)
Problem or Technology Assessment	Health and Wellness Implications Of Computer Use by Children: Recommendations for School Districts to Promote Lifelong Wellness	Non-Occupational Hearing Protection: Recommendations for the Committee on Health, Education, Labor and Pensions of the U.S. Senate	Perceptions Interdependence Intersubjectivity

The major research questions for the two studies varied slightly (see Table 1) but essentially looked for differences in the interactions between two group structures during the Fall 2000 study and among four roles in the Fall 2001 study. Data were gathered and analyzed in a consistent manner across studies with an examination of the same variables of interest.

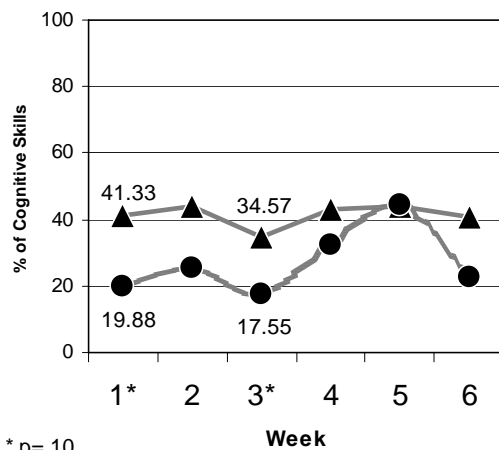
Upon completion of each class, content analysis was employed to analyze all group transcripts using Henri and Rigault's (1996) analytical framework for function and Henri's (1992) framework for cognitive skill and level of processing. All student messages were segmented and coded by at least two independent coders. Interrater reliability ranged from .66 to .89 over the entire coding period. An analysis of the interconnectedness of messages was conducted according to the guidelines of Howell-Richardson and Mellar (1996). Groups' perceptions of interdependence and intersubjectivity were aggregated from the individual results of a self-reported survey developed by Rose (2002). Reliability of the instrument was .77. Nonparametric statistics were used for comparisons and significance levels were set at a liberal .10 to search for results worthy of note on dependent variables.

Findings

Fall 2000: Cooperative vs. Collaborative Group Structures

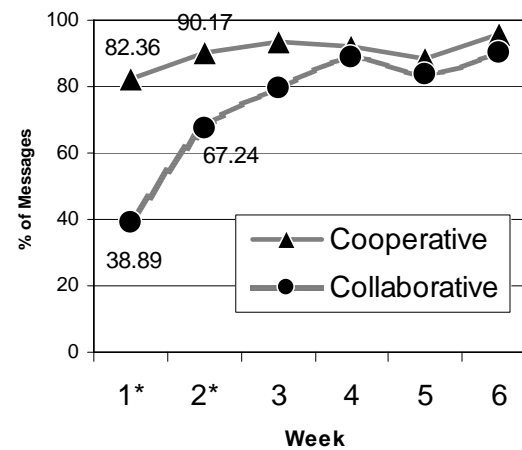
During Fall of 2000, students were assigned to two different group structures: a cooperative structure employing role assignment (see Table 1) and frequent monitoring by the instructor or a collaborative structure that emphasized the use of critical dialogue and employed infrequent instructor monitoring. Analyses of 704 messages within the group discussions (Rose, 2002), yielded no differences between the two group structures on participation level (5.2 messages per student per week), function, cognitive skill use, and perceptions of interdependence. However, the cooperative groups who were assigned performance roles (e.g., group leader and Web specialist) generated higher quality (Figure 1) and more interconnected discussions (Figure 2) during the first half of a six-week PBL activity than those groups without role assignment. Furthermore, the results of a student perceptions survey indicated that this difference could be attributed to the higher initial perceptions of intersubjectivity among the role assignment groups that they shared common understandings about learning and organizational issues. Over time, however, perceptions of intersubjectivity reached similar levels.

Figure 1. Deep Processing, Fall 2000



* p=.10

Figure 2. Interconnectedness of Messages, Fall 2000



The overall percentages of dialogue that served a cognitive or learning function (41%) as compared to an organizational function (36%) raises concerns about the competing demands of learning and coordinating PBL activities in a distributed environment (Rose, 2002). In addition, the relative presence of deep processing (35% of cognitive units) and cognitive skill use, e.g., indepth clarification (only 9% of cognitive units) suggests that specific strategies should be employed to encourage learners to critically engage learning issues. The patterns of these variables over time indicates that specific instructional interventions should be employed during the first and final weeks of the PBL activity to encourage learners to critically engage learning issues.

Fall 2001: Cognitive Role Assignment

Given the positive influence of role assignment in the previous study and the researchers' hypothesis that role assignment based upon learning tasks rather than performance tasks would promote more and deeper discussions about learning issues, the researchers devised a teaching and research plan for the Fall of 2001. This plan included an adaptation of the Jigsaw Cooperative Learning Strategy (Aronson, Blaney, Stephin, Sikes, & Snapp, 1978) and the use of learning roles. More specifically, students were assigned to six heterogeneous groups, then a learning role (i.e., inferencer, possibility generator, summarizer, and strategist) was randomly assigned to each student. A discussion board forum was established for each of

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the PBL groups and for each role. In the role forum, the instructor (1) provided descriptions and exemplars of the role, and (2) facilitated discussions among the students about the responsibilities and importance of the role. In the PBL group forums, the instructor closely monitored group interaction and offered pedagogical support.

Analyses of the group discussions yielded no differences among the roles on level of participation (average of 4.75 messages per student per week), function, 4 of the 5 cognitive skills, level of processing (34% of cognitive units were indicative of deep processing), interconnectedness (90% of messages), and perceptions of interdependence and intersubjectivity. Elementary clarification skills were significantly higher among those with the summarizer role as compared to the strategist role. Comparisons over time also indicated a few differences among the roles. For example, level of processing was significantly higher among the strategists than the inferencers and summarizers at Week 1.

Comparison of the Two Studies

A comparison of the two studies suggests that jigsaw strategy using roles based on learning tasks rather than performance tasks helps focus students upon learning issues (cognitive) rather than coordinating group work. In the first study, 41% of all dialogue was cognitive in nature, while in the second study that included learning role assignment, 52% was cognitive. Other researchers employing Henri's (1992) analytical framework report the cognitive dialogue to be as high as 70% in weekly class discussions (McDonald, 1998; LaPointe, Eddy, & Gunawardena, 1993). However, the nature of the PBL activities in the current studies required the production of a cohesive online report. It is reasonable then, that a higher level of organizational dialogue would be required to coordinate group effort to produce a report.

Comparisons of function over time also indicates that the 2001 group strategy promoted cognitive discussions earlier in the PBL group process. As indicated in Figure 3 and 4, there were higher percentages of cognitive dialogue during Weeks 1-4 in the 2001 study as compared to the 2000 study. During Weeks 5-6, however, the exigencies of creating a group deliverable demanded discussion about coordinating and producing the report.

Figure 3. Function by Week, Fall 2000

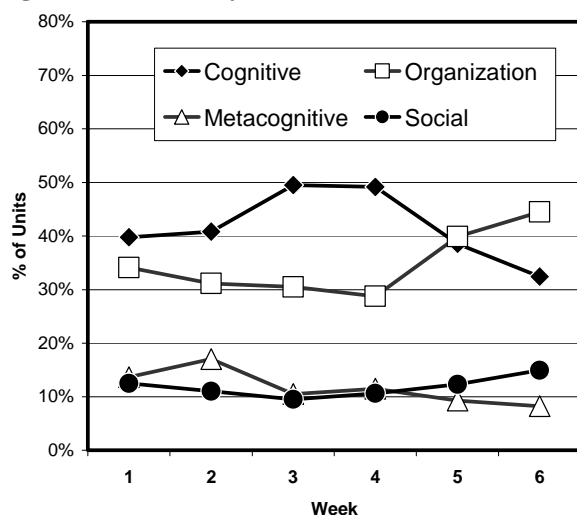
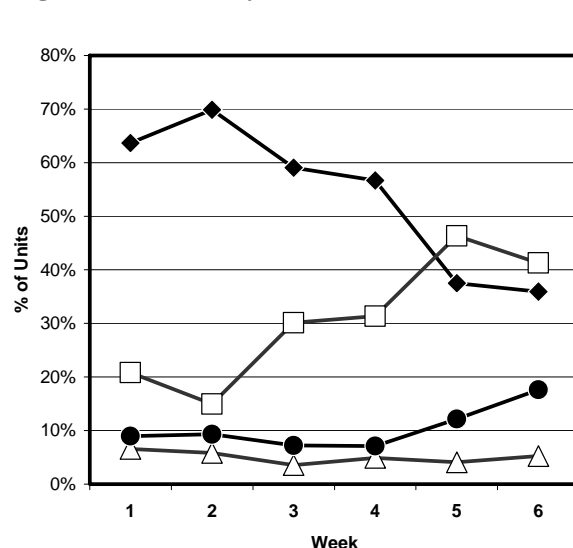


Figure 4. Function by Week, Fall 2001



It should also be noted that cognitive skill use was fairly consistent across studies with the exception of the indepth clarification skill, which occurred in a greater percentage in the 2001 study with 14% compared to 9% in 2000. Indepth clarification, which some consider essential characteristics of critical thinking (Paul, 1993), includes evidence of deferring judgment, identifying assumptions, seeking deeper

understandings, and entertaining possibilities. This suggests that the learning role and jigsaw strategy was more powerful in enabling the use of this critical thinking skill.

The influence of role assignment upon learner's depth of processing is unclear. Across both studies, the overall results for Deep Processing were consistent, with 33% for Study 1 and 34% for Study 2. The similarities in the pattern between the cooperative group in Study 1 and Study 2 suggests a positive influence during the initial weeks of the activity. However, the overall level of processing is low compared to other studies (e.g., 70% in Hara, Bonk, & Angeli, 2000).

Implications and Conclusions

The two case studies described here examined the interactions of distributed PBL groups communicating in the discussion board of Blackboard. Due to the nature of this research methodology and the incomplete picture of online group interaction, external validity is limited and the reader should generalize only to contexts that are very similar to the one described within. In addition, the researchers concede that learner's characteristics, e.g., learning styles and communicative, cognitive, and social skills, vary and thereby influence the nature of group interaction. Future studies should control for these differences to enable more useful conclusions about the influence of group structure and role assignment upon the nature of productive group dialogue.

These studies indicate that an ACC enables PBL among distributed groups; the frequency of these learner-centered messages were consistent with or higher than other types of instructional strategies reported in the literature. These studies also document the competing demands for monitoring and controlling both one's self-directed and social learning efforts in a distributed environment. The need to synchronize and negotiate group process during the initial and final weeks of the PBL activity appears to redirect group discussion away from learning goals. Results indicate that role assignment tends to positively influence the depth of processing and interconnectedness of discussions that occur in an ACC during the initial weeks of a PBL activity. Assigning roles and responsibilities appears to promote high perceptions of intersubjectivity (i.e., common understandings) and provides a common focal point about which groups can begin communicating. Study comparisons suggest that the jigsaw scaffolding strategy which employed roles based upon learning tasks exhibits greater power in focusing groups upon learning issues especially during the initial weeks of the activity. Researchers and facilitators of PBL should continue to explore strategies that enhance complex and critical group discussions.

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