Motivation and Collaborative Behavior: An Exploratory Analysis

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Abstract: The motivating effects of collaborative learning have long been argued, however a careful analysis of the relationship between the motivation orientation of a student and perceptions of himself, his partners, his collaborative behaviors, and learning in a collaborative context have not been as thoroughly explored. In this paper we present an exploratory analysis of data from a collaborative learning study from the standpoint of motivation type of students and their partners. Overall, what we see is that a student's own motivation orientation may color their perception of the exchange of help in the collaboration, sometimes obscuring the reality of the help actually exchanged.

Introduction

A student's motivation is often the recipient of both the praise and blame behind his successes and failures. If he does his homework and asks questions without external rewards, then he is intrinsically motivated and is expected to succeed academically. Alternatively, disinterest and laziness are often reversed with threats of bad grades or even monetary rewards for achievement. And so, in this way, parents and educators have intuitively understood the importance of motivation orientations in a child's academic successes, but it is not obvious how the individual motivation orientations contribute to specific behaviors and learning outcomes in collaborative learning exercises.

Despite numerous acknowledgements of the motivational benefits of computer-supported collaborative learning (Järvelä et al, 1996; Lipponen et al, 1997), research exploring the specific effects of individual motivations on the quality of interactions in collaborative environments appears to be lacking. By determining what combination of motivational pairs yields the most positive results, we can contribute to both the CSCL and motivation communities, while improving the collaborative learning experience for students.

The concept of intrinsic motivation versus extrinsic motivation (i.e. performing an action for external rewards or to avoid negative outcomes) is explored further in the self-determination theory (SDT) literature (see Deci et al., 1991). According to SDT, students are intrinsically motivated only for activities that they find intrinsically interesting, but that an activity can evolve from being extrinsically motivated to intrinsically motivated by internalizing and integrating the value and regulation of the activity. Optimal situations where a student's psychological needs for competence, relatedness, and autonomy are maximized result in a more effective internalization process. That is, in a classroom environment that fosters a love of learning, rather than fear of control, the student will display more internally regulated motivations that rely less upon external rewards and punishments and more upon enjoyment.

Research based upon help seeking and achievement goal theory shows that an intrinsic goal-orientation reduced help seeking avoidance and increased the likelihood of more optimal help seeking strategies (Newman, 1990) providing further support for the benefits of intrinsic motivation. Help seeking as well as help receiving are experienced in collaborative learning contexts, a classroom activity whose positive effects on learning, self-esteem, and attitudes toward classmates and school have been documented for decades (Slavin, 1980). While other studies have previously examined how group composition based upon combinations of high and low ability students affects learning outcomes and helping behaviors (Webb et al, 2002), there does not yet appear to be any work to determine the effects of group composition based upon varying intrinsic and extrinsic motivational compositions on learning and helping behaviors.

This paper describes an exploratory study to determine the effect of motivation composition on group performance and behavior in a CSCL environment, with the aim of providing a foundation for future studies that elicit optimal collaboration between learning group members.

Method

We designed an exploratory experiment to determine the influence of sixth-grade students' motivation orientation on their interactions in a collaborative learning environment. As this is an exploratory study, there is not an experimental manipulation.

The collaborative environment used in our study was the Virtual Math Teams (VMT) environment (Stahl, 2006) which has a chat panel and an interactive whiteboard. Students worked in pairs on a series of tangram problems designed to teach them a basic conceptual understanding of fractions. As a graphical representation of fraction concepts, we used the same tangram representation throughout all of the problems,

with movable pieces representing different fractions of the whole, which the students were able to manipulate the same way they would physical tangram pieces. Students worked in pairs on a series of 13 problems, spread over two lab days. The problems were adapted from similar materials developed by the Math Forum (http://mathforum.org/vmt) and pilot tested in an earlier exploratory study. Problems increased in difficulty over the two days, starting with the very basic due to the students' inexperience with fractions.

Thirty-two sixth-grade students were arbitrarily assigned to pairs by their teacher and were not told who their partner was. In order to enforce communication through typed chat, students were placed on opposite halves of the computer room. Of the 16 groups formed, four were homogenous gender pairings with three female-female groups and one male-male group. Students were primarily middle-class Caucasian children.

The materials for the experiment consisted of the following: collaborative software with an interactive whiteboard and text chat area, 13 conceptual fractions math problems, the Academic Motivation Scale (AMS)-elementary questionnaire to assess motivation orientation, a collaboration questionnaire used in earlier studies (Gweon et al., 2007), isomorphic pretests and posttests, and two quizzes with both near and far transfer problems. The students took the pretest and motivation questionnaire on Day 1, the first computer lab, quiz 1, and the collaboration questionnaire on Day 2, the second computer lab and second quiz on Day 3, and the posttest on Day 4. The fourth day was separated from the third day by a weekend.

Results

As our exploratory experiment does not have an experimental manipulation, our results will consist of comparisons between motivation orientations, rather than between conditions. Due to the small sample size, we adjusted our AMS motivation questionnaire results and distilled four different motivation types: Extrinsically motivated, Intrinsically motivated, Unknown (if their score for intrinsic motivation was identical to their score for extrinsic motivation), and No Data.

Student Learning and Behavior

There were no significant differences in learning between motivation groups, $F(3,13) = 1.02$, p = n.s. However, since the difference was not significant, we will not focus on learning per se for the remainder of the analysis. When we look at the sum of substantive chat contributions and object moves together as contributions to the collaborative problem solving, we see a marginal effect of motivation type, $F(3, 28) = 1.95$, $p=.1$, where the largest number of contributions come from students who are Intrinsically motivated (mean 171.6, s.d. 55.6), followed by students who are Extrinsically motivated (mean 150.6, s.d. 61.3), followed by students who were Unknown (mean 117.3, s.d. 70.5) or had No Data (mean 112.0, s.d. 36.0). Only the two endpoints were significantly different. Thus, we see little evidence that motivation orientation significantly affected behavior in this task, however below we see evidence that it did affect perception of behavior within the collaboration. This discrepancy between the reality of student behavior and the perception of behavior is the main finding of this study.

Student Perceptions of Themselves

Here we analyze questionnaire data to examine how students of different motivation orientations perceived themselves as well as how student perceptions of themselves were affected by the motivation type of their partner. Three indicators were computed, namely I-Know (the extent to which they perceived that they knew how to solve the problems), I-Interest (the extent to which they were interested in the material), and I-Help (the extent to which they offered help to their partner).

Student self perceptions were significantly affected by their own motivation type. For example, students who were Extrinsically motivated perceived themselves as knowing significantly less than students in the other three motivation groups, $F(3,27) = 3.4$, $p < .05$, effect sizes ranged from 1.1 to 1.5 standard deviations. Nevertheless, Extrinsically motivated students rated themselves highest out of the 4 groups on the extent to which they offered help to their partner $F(3,27) = 6.6$, $p < .005$. A posthoc analysis shows that the difference between Extrinsically motivated students and the No Data and Unknown groups was significant. The contrast between Intrinsically motivated students and the No Data group was also significant. Effect sizes of significant contrasts ranged between .88 and 1.2 standard deviations.

Student perceptions of their knowledge were largely consistent with their pretest scores, although the positive correlation between perceived self knowledge about the problems and their pretest score was only marginal, R-squared = .1, $p = .1$. The discrepancy may have been due to the effect of motivation type on perception of knowledge. There was no significant relationship between pretest score and motivation type.

Student Perceptions of Their Partner

Next we examined whether student perceptions of their partners in the collaboration was affected more by their own orientation or that of their partner and we only see evidence of a relationship between these indicators and the perceiver's own motivation orientation. We see a marginal effect of student Motivation type on perception

of how much help the partner offered $F_{(3,27)} = 2.1$, p=.1. A posthoc analysis shows a significant contrast between students with Extrinsic motivation orientation and those with no data. Students with Intrinsic motivation and Unknown orientation fall in the middle, not being significantly different from either end point. It is interesting to note that while it was the Intrinsically motivated students who contributed the most to the collaborations they participated in, it was the Extrinsically motivated students who perceived themselves as exchanging more help with their partners. The effect size of the difference between Intrinsically motivated and Extrinsically motivated students in their perception of how much help their partner offered was about .5 standard deviations, although it was not statistically significant.

Student Perceptions of the Collaboration

In looking at data related to student perceptions of the collaboration, we see a significant effect of partner Motivation type on Frustration with the collaboration, $F_{(3,27)} = 3.5$, $p < .05$. A posthoc analysis shows that partners who are either Intrinsically or Extrinsically motivated are rated as the least frustrating to work with, while students who are Unknown are significantly more frustrating to work with. The effect size of that contrast was 1.4 standard deviations. However, one possible explanation is that students of Unknown orientation contributed less to the collaboration than students who are either Intrinsically or Extrinsically motivated.

Conclusions

Perceptions of the exchange of help in collaboration are important for fostering a sense of community membership and participation. Thus, the significant impact of motivation orientation on these perceptions that have been found in this study have important implications for future investigations of the role of motivation in collaborative learning. In particular, one surprising finding is that we see evidence that a student's own motivation orientation might affect their perceptions of their partner's performance in the collaboration, although their partner's motivational motivation may not affect their perception of their partner in the collaboration. To the extent that motivational orientation affects behavior, which we saw along some dimensions, this is a surprising finding. Another surprising finding is that student motivation orientation might lead them to perceive their behavior significantly differently even when it does not significantly affect their actual behavior. Overall, what we see is that a student's own motivation orientation may color their perception of the exchange of help in the collaboration, sometimes obscuring the reality of the help actually exchanged.

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