Where the Social Meets the Cognitive in Group Interactions: Mapping the Intersecting Spaces where "Learning" takes place in the Classroom Community

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Abstract: *Utilizing social learning theory as a theoretical lens and group interaction process analysis as a methodology, this research investigates both the social-relational group dynamics and the task-related problem-based learning activities to map "learning" spaces in the classroom. The setting is a freshman high school classroom where "visiting" engineer/science doctoral students participate in a curriculum on alternative energy sources. Utilizing video-taping of the "visiting" engineers/scientists interaction with small groups of students, findings reveal the complex nature of group structures so central to the classroom experience: where relational constructs between student group members and the visiting engineers/scientists moved from surface relations, or politeness and tolerance, to deeper structures based on trust and acceptance. By placing student engagement in relational context and recording interaction and behaviour as visiting engineers/scientists negotiated their own membership into student "learning" groups, this research begins to reveal how relational issues affect insider and outsider members socially and, consequently, influence overall group connections and performance.*

Introduction

The social learning theory perspective directs researchers to focus simultaneously on the overall learning environment as designed as well as the social situation within that environment as enacted. It is in the mapping of these intersecting spaces that members in a classroom community teach, learn and socially interact, at times interchanging roles, at other times co-existing in shared roles. The objective of this study was to present and illustrate the application of social learning theory for analysing the role of formal and informal interactions in the high school classroom environment when invited graduate student engineers/scientists participate in the classroom setting. Social learning theory posits that there is a complex interaction involving the social situation, the environment, and the learner, and that it is possible to design and facilitate this interaction in ways that best promote or, conversely hinder, learning. Further, decades of research on small groups has suggested that beyond the task-oriented dimension of group objectives are important "verbal and nonverbal messages that create the social fabric of the group by promoting relationships between and among group members" (Keyton, 1999, p. 192). By focusing on the social situation embedded in the classroom community as well as the expertise and resources exchanged through interactions among teachers, invited graduate student engineers/scientists and the high school students, this research moves beyond the bounded definitions of teacher-to-learner exchanges in prescribed learning tasks allowing for social situations to arise in the pursuit of more fluid learning opportunities afforded in small group interactions.

Context & Theoretical Frameworks

Social learning theories locate learning in the context of the interaction between the learner and the learning environment. This interaction is reciprocal affecting the learner, the environment and the learning situation in a myriad of ways. The learner is not passive and the environment is not static: both provide distinctive features that affect learning. And learning is neither solely individual nor solely instrumental; there is both a group context and a social aspect to learning in general and to classroom interaction in particular. In education, social learning theory is usually associated with the foundational work of Bandura (1977, 1986 and Bandura &Walters, 1963) and to a lesser extent, the social constructivist work of Vygotsky (1978). From Bandura's perspective, the individual's self-efficacy, beliefs and expectations of how much s/he may accomplish in the learning situation, contributes to or detracts from motivation, thus from learning. Vygotsky focuses on the social situation as it impacts on learners' construction of knowledge highlighting the interplay of social construction of meaning. Bronefenbrenner's (1977) approach to the ecological components of social interaction offers another framework from which to view learning theories focused on individual development by linking the environment to the person. Lave and Wenger (1991, p.31) describe learning as "an integral and inseparable aspect of social practice within the classroom community" suggesting that learning does not happen within an individual's mind alone, but is situated in a social context in which social interactions among co-learners play a role. Green referencing Bird (2006, p. 171) notes that "in a setting where meaning and knowledge are jointly constructed among co-participants, learning becomes social practice."

Social learning theories provide theoretical frameworks for studying social learning processes and the environments in which they take place. The focus on social learning highlights the significance of social interaction and the social environment as catalysts for learning, and factors that may be manipulated to promote learning. Thus, social learning theories represent an umbrella term for learning theories that focus on the significance of the social situation in human learning. Yet, they do not provide clear analytic schema necessary for studying group interactions in classrooms.

Research on small group interactions spans decades (Lewin, 1951; Homans, 1950; Bales, 1953; Schutz, 1960) with much of the research since the late 60's emphasizing task-oriented dimensions embedded in outcomes assessments and decision-making processes (Frey, 1996). As Keyton (1999, 2000) has noted, scholars have paid less attention to the relational issues embedded in group dynamics. And, when these aspects were noted, the relational or behavioural characteristic was often seen as an obstacle to effective group decision making (Gouran & Hirokawa, 1986) or group productivity (Steiner, 1974). In addition, much of the research was conducted in lab settings with simple low-value tasks and homogeneous members who had no history or future invested in the group membership (Poole, Keyton, Frey, 1999). Poole (1999) argued that studying diversity within groups explains how individuals negotiate their place in groups. Yet, as Keyton (2000) noted, the group is more than the sum of its members, but must be seen as a sub-groups of interrelationships inside a larger group membership. Bales (1979, 1953) systematic coding system provides a means to identify the "socioemotional" or relational aspects of group dynamics, and further provides for levels of coding from the dyadic to the larger group. Accepting the mandatory nature of long-term membership in a classroom environment with opportunities for complex sub-group memberships, this research utilizes a modified version of Bales (1953) and Bales and Cohen (1979) coding systems to identify a schema of classroom group task and behaviour dimensions in which visiting engineers/scientists participate.

Researchers have proposed a multitude of lenses for analyzing teaching and learning in general and, in recent years, classroom communities in particular. These lenses have been useful in describing key concepts inherent in the enterprise of teaching and learning and have advanced our knowledge in numerous ways. Yet, few provide a compelling approach of how to integrate data on learning environment design, "visiting engineers/scientists participating in problem-based learning," with case study data on the socially situated "learning" embedded in classroom group interactions to create a coherent account of the structure and dynamics of *both* task and social learning in classroom communities. As engineers and scientists enter the social situation of the classroom to promote and demonstrate STEM curricula, we need to understand more about their impact on the students they meet and the learning environment they encounter. Studying their interaction with high school students in small groups involved in learning tasks broadens our understanding of how visiting engineers/scientists engage these students by permeating their social group boundaries. It is hoped that this research will provide a much-needed account of the social aspect of group learning when visiting STEM specialists enter the classroom and negotiate their place in the relational world of adolescent interactions.

Research Questions

As this is an ongoing longitudinal exploratory study, the following questions serve as guides: 1) How do graduate students and high school students describe their prior expectations and then their latter experiences of the other's participation in a designed learning environment? 2) Is there evidence that the context, or the environmental space and its physical set-up, facilitate learning activities? social interactions? and, 3) subsequently, what type of social interactions are documented in these physical spaces?; further, 4) within those interactions, what types of activities or conversations can be linked to "learning?" and, 5) extending the documentation of tasks and talk, what evidence is there that social-learning is taking place? And how is this seen in the social interaction of the group? and finally, 6) how do the participants in the designed learning environment describe their social learning experiences at the end of the project?

Methodology

The larger project is a longitudinal mixed methods research design utilizing participant observation, survey, and interview methods. For this particular study, we focus on analyzing the intense video documentation of the classroom environment. In particular, this study applies an analysis scheme to documenting how the learning environment as designed and the social situation as enacted may contribute to developing classroom community that, in turn, could contribute to a student's as well as a visiting engineer/scientist's expectations and experience of task-related and social-learning opportunities.

***Setting*:** An innovative high school setting combined with an innovative graduate program brought ninth graders and engineering/science PhD students together for a curriculum on Alternative Fuel Technology. The illustrations presented are vignettes of a complex mixed methods approach to documenting and illustrating everyday interactions and exchanges in a high school classroom community over a two year period. The teachers were committed to integrating the invited graduate student engineers/scientists into not only the daily instruction, but in the design, implementation and eventual evaluation of the instructional content. In addition, the principal was committed to the idea of fostering an interactive curriculum experience for not only the high school students, but also for the graduate students. Both classrooms, each one year apart, had similar curriculum designs and similar types of students, both the high school and graduate students involved. Nonetheless, each enactment of the planned curriculum environment had different levels of success in creating the most beneficial social situations embedded in an explicitly designed learning environment.

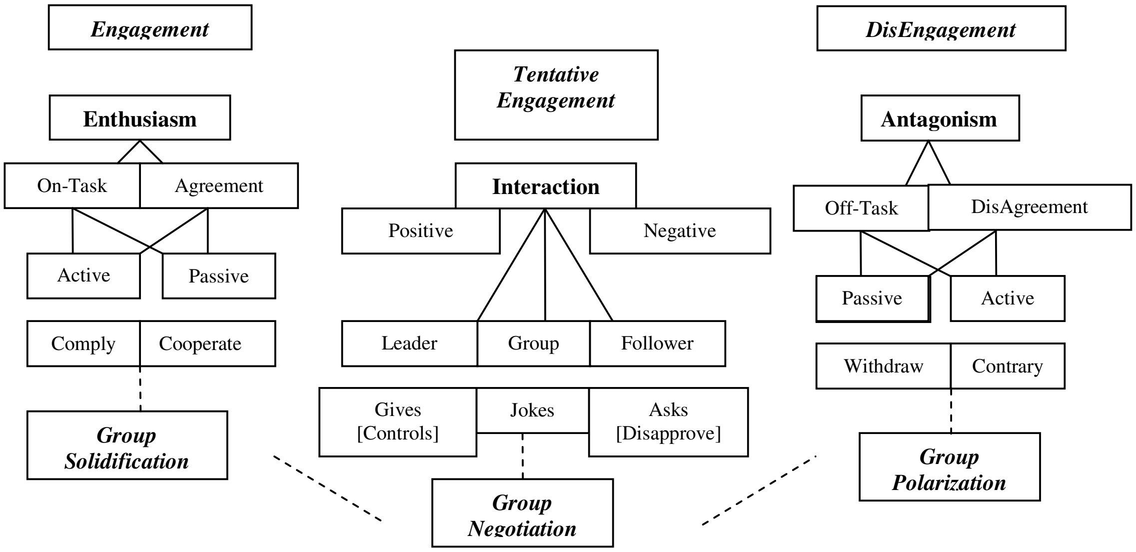
Sample: The sample consists of 3 high school math/science teachers, 5 PhD science/engineering graduate students, 62 ninth grade high school students.

TABLE I
DATA SOURCES

Data Type	Data Source	Number of Participants
Group Interviews	HS Students	62 (~15 per session X 4 sessions)
Interviews	PhD Students	5
Interviews	HS Teachers	3
Classroom Observation	Video, 40 hours	All
Participant Observation	Meetings	8

Methods: Methods included intense video documentation of 2 classes, each 4 weeks long, offered in the Spring of each year for two years, for a total of nearly 40 hours of video over 8 weeks and hundreds of photos. In addition, 4 group interviews of high school students as well as interviews of the high school teachers and the PhD students were conducted to illuminate observation findings. These observations and interviews are now being subject to intense coding utilizing a coding system similar to Bale's social interaction coding of tasks and socio-emotional behaviors/discourse. Multiple codes have been developed to capture both the observed physical environment and interactions amongst members and the reported subjects' experiences of that environment. For the purposes of this present study, the focus is on those coding schemes and emerging themes that document the observed talk, tasks and behaviors surrounding social interaction between the graduate and high school students (see Figure 1).

Figure 1: Thematic Model



Findings

These are early findings. Continued coding with complicated newly released software able to codify video documentation (both visual and discourse) into an organized analyzable system is in process. Combining this new software (NVivo8) with the 1950's then 1970's version of the adapted codification schema in IPA and then SYMLOG continues to be a challenge. Currently, hand-coding of the phenomena is being done with the understanding that the continued future coding will encompass the power of this new qualitative software. Currently, inter-rater reliability of the adapted coding scheme stands at 85-90% of the observed phenomena.

Initial analysis of video documentation noting the physical space of the classroom environment reveals that the teachers' formal intent of "grouping" students had profound affects on both the high school students' opportunities to learn and invited graduate scientists/engineers opportunities to interact around STEM curricula. Interestingly, what accommodated a conducive learning environment also forced students into groupings that were mandatory requiring more social and emotional negotiation of learner roles and a higher dependence on the external visitors as a resource for both learning-tasks and negotiating group relational features. Year1 students had a higher activity-on-task level as well as negotiating relational group-level aspects with the visiting graduate students. Conversely, when the groups were more permeable allowing students to form sub-groups based on familiarity and friendship, the groups tended to either maintain only polite engagement (and therefore distance) with the visiting engineers/scientists or, they engaged the visitors on a more social (versus learning) level attempting to bring the graduate students into a sub-culture of adolescent behavior in the classroom.

Physical/Pedagogical Design: In designing the curriculum in year1, the high school teachers purposively grouped students from the first day of the project. These "groups" were stable from the start of the curriculum project. The teachers admitted to grouping students by motivation and ability. These groups were stable over the month long curriculum and easily identifiable week to week. The latter facilitated the visiting engineer/scientists by allowing them to "pick-up where we left off"[on learning tasks] in the previous visit. In year2, the teachers took another approach and chose not to put students into groups until they showed some proficiency on mathematical learning objectives as well as having made some individual progress on various project task objectives. Essentially in year2, students were working individually and allowed to "sit with" their groups of choice, usually their friends. They were then put into groups as they progressed through the objectives, but generally these groups did not materialize until the final week of the project, some not until the final day. The visiting engineer/scientists noted that this lack of identifiable groups was confusing and problematic. They noted that those sitting in groups were not working together on learning objectives nor were they negotiating learning tasks. This left the visitors with a feeling of providing one-on-one tutoring rather than assisting in group learning opportunities (as in year1). The difference in these purposeful groupings was evident in both student engagement with the materials and student creativity within that engagement as well as the visiting graduate students' capacity to interact with the high school students and effectively create co-learning opportunities.

Perceptions and Reality of Social and Learning Opportunities: Visiting engineers/scientists anticipated high involvement in group learning activities. Their experience of this was acutely different from year1 to year2, to which they attributed the physical grouping spaces in the classroom through the teachers' pedagogical practice of grouping. In year1, where groups were defined from the beginning, visitors reported that they felt their role as learning co-facilitator was obvious and easy to manage. They also reported more intense conversations within groups around the learning topic attributing this to the characteristics of groups involved in negotiating learning tasks. In year2, they reported feeling less sure in their role as a direct result of not knowing the boundaries of student groups. Nonetheless, they also reported surprise at students bringing them into the socio-emotional negotiations of small friendship groups. Here they were being asked to join in conversations and joking about television shows and famous singers. Conversely, in sub-groups in which they purposively (and physically) asserted themselves [in hopes of "creating co-learning opportunities"], they were seen having to help students focus on-task instead of just "goofing-off."

The high school students in both years initially perceived the visiting graduate students as "guests" with some knowledge or expertise to impart regardless of the students' willingness to accept this learning opportunity. Students referred to experiences with previous "visitors" who had come to the classroom as "talking at you kind of like a teacher lecturing" then leaving [without ever really engaging the students]. It was only after several repeated classroom visits "when they kept coming back and talking with us" that the high school students started to engage the visiting graduate student engineers/scientists in meaningful ways, either on learning tasks or on social-relational aspects:. "they helped us learn instead of just throwing information at us." In year1, students were in a position to not only have to negotiate mandatory group member interactions, but also to have to respond to the newcomer visitors. In essence, year1 had to constantly negotiate group boundaries, tasks and social-relational characteristics, including where in the hierarchy of group status to place these visiting engineers/scientists. With year2, high school students were able to work more independently or with groups-of-choice. This led to a higher level of uncertainty surrounding the physical definition of "the group" and a more relaxed attitude toward the visitors. In both years, these students reported having experienced "real" learning opportunities vis a vis the visitors presence with year1 engaging initially more on the learning task-orientation and group membership characteristics and year2 initially focused more on the social opportunities. The differences in the perceived advantage of having visiting engineers/scientists in the classroom was, overall, similar between the two groups despite their different engagement of the visitors. They described the visiting graduate students as "kinda of like a peer … not a teacher … maybe a mentor … ***not*** teaching us but instead helping us understand." But the similarities stopped when students were asked to describe how these visitors assisted in learning versus social aspects of groups. Year1 focused on the learning task, "they're just like regular students, just bigger and they know more stuff that they can teach you… they came up to us and asked us questions, like you didn't have to go to them… It showed us like what we could do with the things we are learning here cause they took it to such a higher level, a level we obviously can't because they are getting their PhD, but it shows how real world connected our projects really are." Whereas year2 focused on the relational attributes, "They were like cool …. They made it so that we could understand it and I think most of us were close with them and we got to know them and things about them and that was cool… you kind of wanted to think of them as a teacher cause they were older. You usually want to think of older people as someone who is a teacher than instead of someone who is a peer, but eventually as you learned who they were individually, you got to know them as more of a peer than a teacher."

Mapping the space in which these interactions happened and coding the interactions along schematics of engagement/disengagement, active/passive activity, as well as how the group negotiated amongst its members on task/social activities and how the group responded to the visitors are outlined in Table II. As noted in this preliminary table, student engagement or disengagement in assigned learning tasks or in negotiated group social aspects affected the overall groups' response to the visiting engineers/scientists. Preliminary summary coding of whole group interaction (via coding of each group member overall interaction) identified an important dimension in designing groups in a classroom environment. Namely, mandatory grouping forces members to engage in negotiating the completion of assigned learning tasks through negotiating members' social interaction. This included assigning individuals to sub-tasks and dealing with leadership/follower aspects inherent in bounded groups (who asks for information, who gives direction, etc). Whether these defined membership groups enthusiastically embraced or passively disapproved or actively (and sometimes negatively) negotiated the learning assignments, they generally stayed focused on the learning tasks. Conversely, a classroom design that invites convenience or friendship groups to form has lower outcomes on learning task engagement forcing students to focus on identifying social aspects that solidify group boundaries around known friendships, or, conversely, forces students without convenience friendship groups to work independently or even to reject the learning task because it by design required a group effort that was not available to them. These types of group formations were found to affect their engagement of the learning tasks and, further, circumscribe the opportunities for the visiting graduate students to interact. How students engage, negotiate and eventually respond to the STEM visitors brought into their social-learning environment is critically important to understanding how visiting engineers/scientists can effectively enter, engage and exit the classroom community.

TABLE II
GROUPS ON LEARNING TASKS VIA SOCIAL CHARACTERSTICS: SUMMARY OF GROUP ENGAGEMENT

Group Type	Engagement	Negotiation	Disengagement	Response to Visitor
Year 1 High Motivation High Skills	Active Acceptance Enthusiastic On-task	Cooperative Respectful Contributes, On-task		Accepts, Engages Learning Tasks On-task
Year 1 Low Motivation Low Skills	Passive Acceptance On-task (group)	Negative, Disrespectful Distracting, Off-task Complies, On-task	Passive Rejection Disapproving	Accepts, Engages Learning/Relational Tasks On-task/some Off-task
Year 2 High Friendship High/Low Skills	Passive Acceptance On-task (independently)	Positive, Respectful Joking/laughing Off-task Complies, On-task	Passive Rejection Distracting	Engages mostly Relational Aspects Off-task/some On-task
Year 2 Low Friendship High/Low Skills		Disrespectful, Cynical Disagrees, Off-task Isolated, detached On-task-independent work	Active Rejection Antagonistic or Withdraws	Rejects, Disengages Learning/Relational Tasks Off-task

Recommendations

This longitudinal case study analysis of two separate but similar classroom communities has begun to provide preliminary evidence that documenting the intersections of the designed classroom environment and the enacted social situation is necessary to account for the various ways learning is both actively performed and passively absorbed. By mapping these intersections, the data help account for the differences in the distribution of *access to* and *engagement with* the various learning situations afforded students in an explicitly designed classroom learning environment. Moreover, there is some preliminary evidence from the data that the distribution of learning situations is related to the level of engagement with the expertise and the mentoring brought to the classroom community by the visiting scientist/engineer. In addition, this evidence suggests, as hypothesized, that the engagement has reciprocal qualities for the high school and the graduate student above and beyond the expected reciprocal benefits of individual learners interacting with their learning environment.

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Acknowledgements

Acknowledgements: The participation of the visiting engineer/science doctoral students was funded in part by NSF IGERT Grant #DGE-0504361. Additional funding for this research was from NSF Award #07-177.

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