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Robert B. Innes

Vanderbilt University, robert.innes@vanderbilt.edu

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Discourse, especially dialogic communication between students in collaborative problem-solving groups, plays a central role in educational reforms informed by learning science. This study examined the quality of discourse in problem-based learning groups in a university course. The study found a low incidence of high quality dialogue (dialogic communication, elaboration and co-construction of ideas, productive disciplinary discourse) in 12 one-hour planning meetings. The most competent students took leadership in groups and made the majority of the conceptual contributions. Although there was a reasonable amount of time spent connecting theories to cases, there was little time spent in high-level analysis and very few instances of true dialogic discourse. The majority of time was devoted to activities involving organizing, planning and logistics and organizing the presentation. There was very little off-task behavior. Key Words: Classroom Discourse, undergraduate education, learning science.

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Robert B. Innes Vanderbilt
University Nashville,
Tennessee, USA
robert.innes@vanderbilt.edu

Abstract

Discourse, especially dialogic communication between students in collaborative problem-solving groups, plays a central role in educational reforms informed by learning science. This study examined the quality of discourse in problem-based learning groups in a university course. The study found a low incidence of high quality dialogue (dialogic communication, elaboration and co-construction of ideas, productive disciplinary discourse) in 12 one-hour planning meetings. The most competent students took leadership in groups and made the majority of the conceptual contributions. Although there was a reasonable amount of time spent connecting theories to cases, there was little time spent in high-level analysis and very few instances of true dialogic discourse. The majority of time was devoted to activities involving organizing, planning and logistics and organizing the presentation. There was very little off-task behavior. Key Words: Classroom Discourse, undergraduate education, learning science.

Introduction

A basic tenet of recent educational reforms linked to constructivist and sociocultural perspectives and research in learning science is that dialogue (e.g., dialogic communication between students, teacher scaffolding) plays a central role in the construction of useful knowledge (Brown, 1997; Cazden, 2001; Cobb, 1995; MacLellen & Soden, 2004; Mayer, Akamatsu & Stewart, 2002; National Council of Teachers of Mathematics, 2000; Nystrand, 1997; Sfard, 2001). In the tradition of John Dewey (1938), these reforms see *useful knowledge* as developing through *cooperative inquiry* in an *authentic context* within a *community of practice*. This implies that learners must play an active role in constructing their own knowledge (Bransford, Brown & Cocking, 1999). This is contrasted with the traditional view that knowledge can be 'transmitted' to learners (Bransford, Franks, Vye & Sherwood, 1989). In practice, constructivist and socio-cultural accounts of classroom learning replace lecturing with face-to-face dialogue - especially dialogue between students in collaborative problem-solving groups.

Recent reform efforts in K-12 education and the growing body of research in learning science are extending these reforms to teaching in colleges and universities (Gardiner, 1994, 2000; Halperin & Hakel, 2003; Innes, 2004; Krockover, Shepardson, Eichinger, Nakhleh & Adams, 2002; Marchese, 1997, National Center for Post-Secondary Improvement, 2002; Pierce & Kalkman, 2003). This study focused on one key element of these reforms, the quality of dialogue in self-managed, problem-based learning groups.

Review of Literature

Sociocultural theorists place the context for learning within the social practices and activity structures that define the architecture of the learning environment (Bruffee, 1999; Brown, Collins & Duguid, 1989; Greeno, 1997; Jonassen & Rohrer-Murphy, 1999). Social artifacts, especially language, shape discourse and scaffold knowledge construction. If learning is dependent on developing new ways of participating in social practices (Cobb & Bowers, 1999; Lave & Wenger, 1991), reshaping social practices within a learning environment becomes a primary precursor to achieving instructional goals and failing to reshape practices threatens those goals (Webb, Nemer & Ing, 2006). University courses must also acculturate students to the discipline's perspective, methods of inquiry, and dialogic practices. This research focuses on a particular practice that is central to this model: dialogic communication involving productive disciplinary discourse about important ideas.

Dialogic Communication and Knowledge Construction
Assuming that dialogue plays a central role in the construction of experience and useful knowledge, learning scientists have focused their attention on identifying the most effective types of dialogue. The discussion of dialogue in this literature makes a sharp distinction between the forms of dialogue that facilitate useful learning (e.g., two-way, dialogic communication) and other types of communication that produce inert knowledge (e.g., one-way, univocal communication). Dialogic discourse describes forms of two-way communication where participants support their own positions with justification and actively listen to others' positions with the goal of mutual understanding (Bakhtin, 1981, Dewey, 1916, Habermas, 1984). Hufferd-Ackes, Fuson & Sherin (2004) used an operational definition of dialogic discourse that is similar to the operational definition used in this research: "Students ask questions and listen to responses. Many questions are "Why?" questions that require justification" (p.90).

The type of discourse that characterizes the interaction in a classroom is a major determinant of whether an experience will be educative or non-educative (Nystrand, 1997, Sfard, 2001, Wertsch & Toma, 1995). Nystrand (1997) summarized the conclusions of his research on classroom discourse: "the bottom line for instruction is that quality of student learning is closely linked to quality of classroom talk" (p. 29).

Authenticity, Dialogue, and Useful Knowledge
Constructivists believe that the knowledge produced in their classrooms will be useful, rather than inert, because the learning takes place in *authentic contexts* that are meaningful to the learner and relevant to the context in which the knowledge will be used. If learning and the dialogue that creates it take place within 'inauthentic' experiences, classroom experience will be disconnected from meaning outside the classroom. Nystrand (1997), for example, defined the goals of instruction for literature courses as "specifically trying to identify what kind of dialogue 'works': that is, instruction that helps students understand literature in depth, remember it and relate to it in terms of their own experience" (p. 2). Further, Nystrand doesn't believe this objective can be achieved unless the right types of dialogue occur within an authentic context. Stein, Isaacs & Andrews (2004) saw the quality of group interactions as a key dimension of authenticity. The interactions must be contextualized in an activity structure that is authentic both from the students' perspectives (it must be relevant to their concerns) and as a representation of the discourse in the disciplinary community of practice. The term *activity structure* is used to describe the

shaping forces in learning environments ranging from characteristic forms of verbal dialogue to broader features of instructional design. For Polman (2004), broader activity structures "provided a frame that lent both impetus and meaning to verbal exchanges" (p.462).

The Role of Dialogic Communication and Disciplinary Discourse in Constructing Enduring Understandings

Learning scientists with cognitive and sociocultural perspectives have struggled with the problem of developing new ways to characterize the learning process that capture both the structural qualities of knowledge and its contextualized nature (Cobb, 1994; Greeno, 1997). Hershkowitz, Schwartz and Dreyfus (2001) used the term *abstraction in context* to describe the emergence of useful ideas from social processes and activity structures. This is a way of capturing the idea that we can acquire useful abstractions (big ideas and deep principles we can use in a variety of situations) without treating these ideas as totally decontextualized.

The assumption that knowledge is socially constructed places communication and dialogue in a privileged position in the learning process. The nature of dialogue and communication and its role in the meaning-making process is central to understanding how discourse facilitates the development of enduring understandings for use in future problem solving. Discourse is embedded in the inquiry activities of disciplinary communities of practice. These approaches strive to create a "classroom community where students demonstrate competent disciplinary discourse" (Goos, 2004, p.25). Goos (2004) characterized the objectives of this restructuring of classroom interactions for her field of mathematics as the creation of "communities of mathematical inquiry [where] classrooms frame learning as participation in a community of practice characterized by *inquiry in mathematics*" (p. 25). Productive disciplinary discourse occurs when students make specific connections between their group products and the enduring understandings and deep principles drawn from the discipline (Cohen, Lotan, Abram, Scarloss and Schultz, 2002). For example, Hufferd-Ackles, Fuson and Sherin (2004) described a "math-talk learning community" as " a classroom community in which the teacher and students use discourse to support the mathematics learning of all participants" (p. 82).

Constructivist learning models also assume that students who lack knowledge will benefit from participating in dialogues with more knowledgeable peers and teachers in their *zones of proximal development* (Vygotsky, 1978). This process can break down if more knowledgeable peers are unable or unmotivated to be helpful (Sfard, 2001). One marker for effective discourse is evidence that more competent students are sharing their knowledge and correcting misconceptions of other students.

Research that Links Dialogic Discourse to Useful Learning

There is evidence that the acquisition of useful knowledge is related to quality of discourse. Boaler (1999) found that mathematics' students who participated in a learning community were much better at applying mathematics to 'real world' situations and had higher scores on tests using problem situations that did not 'cue' students on which procedures to use. Nystrand (1997) found that dialogic discourse had a strong positive effect on achievement, if the group activity focused on problem solving rather than routine activities. Blanton (2002) found that dialogic discourse facilitated the development of mathematical understanding in an undergraduate geometry course. In a well-controlled experiment, Capon and Kuhn (2004) systematically compared problem-based learning involving student work groups with a traditional lecture/discussion group method. At 12 weeks following instruction, over twice as many students who had learned the target concepts with problem-based learning demonstrated in-depth understanding of the concepts. There is also evidence that students involved in cooperative learning are more actively engaged and more highly

motivated and intellectually challenged than students involved in large group instruction (Csikszentmihayi & Schneider, 2000; Peterson & Miller, 2004).

Chernobilsky, Dacosta & Hmelo-Silver (2004) found that students involved in problem-solving groups in problem-based learning exercises increased their ability to analyze problems using the specialized language of professional educators. Their data indicated a transactional relationship between specialized language use in group discussions and increased ability to use key disciplinary concepts to address problems at higher levels of sophistication. They found a clear link between the quality of group interaction and knowledge construction.

High Quality Discourse is Rare and Difficult to Achieve
Despite these encouraging results, there is evidence that dialogic discourse is very difficult to achieve. Researchers who have attempted to observe the discourse in randomly selected classrooms have found very few instances of dialogic communication. Even teachers who attempt to create dialogic classrooms find that it is very difficult to achieve (Blanton, 2002, Hoffman-Kipp, 2003; Sfard, 2001; Webb, Nemer & Ing, 2006). Nystrand (1997) found that the typical classroom devoted very little time to group problem solving activities. Eighty-five percent of class time was devoted to lecture, question and answer, and seatwork. MacLellan and Soden (2004) found that none of the 25 university students they studied gave reflective responses to justify opinions. Rationales were based almost entirely on personal experience rather than research evidence. Kittleson & Southerland (2004) investigated "concept negotiations" in classroom dialogues in engineering classes. They defined a concept negotiation as "a form of collaborative interaction in which more than one participant actively contributes to the evolving conceptual content of the conversation" (p. 271). They found that concept negotiations were *very* rare occurrences. Staarman, Krol and vander Meijden (2005) found that even though they created conditions to encourage elaborations, very few occurred. Further, they concluded that only 16% of the interactions in collaborative learning dyads specifically designed as student- student help sessions were interactions beneficial to learning. Webb and Farivar (1999) found a very low incidence high-level activity.

Another major deterrent to creating high quality dialogue around important questions is the tendency of students to avoid dialogue altogether because they think it takes too much time. Mintrop (2004) found that students have a strong tendency to be governed by the "ideology of efficiency." He found that students tended to divide the task to get the work done quickly, rather than seeing the value of dialogic communication. His research found that collaborative dialogue was rarely achieved.

Methodology

This study examined the type and quality of dialogue in self-managed, problem-based learning groups. Assuming that certain types of dialogue that connect ideas to contextualized problem spaces are key ingredients in the construction of useful knowledge, the study focused on the incidence of dialogic communication, productive disciplinary discourse, the use research findings and theories to support assertions, and students probing their fellow students for justifications for their positions.

This study examined the communication, analysis, and problem-solving behavior of students in two sections of an undergraduate course in organizational behavior and

development. Both sections were taught by the author in the same semester and had the same readings and basic assignments. The course was designed around a large case study and simulation. Project groups were provided with case materials and were asked to consult with a fictitious organization experiencing several organizational problems. Each of the project groups was asked to consult with the organization about a different set of problems presented in the case. After studying the case, each group made a formal presentation of their analysis and made suggestions for addressing the problems to a group of students playing the parts of the characters in the case. Guidelines required that the presentations include clips from a video case that also ran throughout the course. These clips provided a link to theory and served as a contrasting case to compare with the primary case. In a second round of formal presentations, each group reported on their analysis of a community organization using the full range of theories in the course. In addition, each student wrote 5 papers throughout the semester examining an organization they were personally familiar with from a variety of theoretical perspectives. The capstone task for the course asked students to view a film focusing on organizational problems and use the theories from the course to analyze the organization's strengths and weaknesses and make specific suggestions for solving its problems. Throughout the course students made systematic comparisons between 5 cases: (1) The primary written case, (2) the overarching video case, (3) the community organization each group studied, (4) each student's personal case, and (5) a case focusing on current efforts to reorganize the university into residential colleges. The course also included two communications training workshops designed to promote dialogic communication in small group discussion and large class sessions.

Although the study was primarily descriptive, there was a systematic variation between the two sections of the course. This is best thought of as a "teacher experiment." Students in the class normally began each unit of the course with a quiz covering the content that would be applied to the next installment of the case. The rationale for the quiz was simply to ensure that all the students had read the material before they participated in their planning meetings to develop their presentations. I took this opportunity to see if the quizzes made a difference in the quality of the discussion in the groups. Specifically, in four of the 12 group sessions included in the study, students were asked to read the assignment, but were not quizzed on the material. The data were analyzed to see if this affected the quality of the interaction in these groups.

Data Gathering and Participants
Ten groups of 5-6 students participated in the two sections of the course. The in-class meetings that groups held preceding their presentations were videotaped for use in the communication training in the course. Groups were taped in a conference room adjacent to the classroom using three cameras. One group in each section was eliminated because one or more of the participants did not agree to be subjects in the study. This yielded 2 one-hour tapes for each of the 8 remaining groups. Four of these 16 tapes were eliminated. Two sessions were eliminated because technical difficulties made it impossible to generate an accurate transcript. Two other sessions were eliminated because the groups used the sessions for a different purpose than to discuss the presentation. One group used the entire class period to review videos they had recorded in the community organization they were studying. Another group used the time to break into smaller groups to edit videos and prepare their Power Point. Tapes for the remaining 12 sessions were used in this study. Forty two individuals participated in these 12 sessions consisting of 13 males and 29 females; 27 Sophomores, 12 Juniors, and 3 Seniors; 6 Economics majors, 1 Engineering major, 1 Music major, and 34 Human and Organizational Development Majors; 40 of the students were White, 1 African American, and 1 Asian.

Group Discussion Observation System
The Group Discussion Observation System built on the work of several other observation systems that have been developed to examine dialogic communication (e.g., Argyris, 1990; Boxtel & Roelofs, 2001; Staarman, Krol & van Meijden, 2005). It was developed by the author and adapted to the particular instructional task used in the course by categorizing behaviors of students in the course's discussion groups during previous semesters.

Although each discipline has its own definition of 'poor' thinking and 'good' thinking, there are general guidelines that can capture what we hope to see across disciplines in university courses. One set of guidelines that is representative of criteria used to assess the quality of disciplinary discourse was developed by van Boxtel & Roelofs (2001): "1. The amount and type of discourse about the concepts that have been appropriated…2. The amount and type of elaboration… 3. The amount and type of co-construction…4. The use of available tools" (p. 56). In its most general form, van Boxtel and Roelofs' first guideline indicates that we want students in our classes to go beyond identifying examples of theories to solving problems with concepts and ideas presented in our courses. Students who use knowledge to solve problems are much more likely to retain that knowledge for future use (Webb & Farivar, 1999). Staarman, Krol & vander Meijden (2005) identified a set of behaviors that they considered beneficial to learning: providing elaborated information, asking complex questions, answering with elaboration, accepting or rejecting statements with elaboration, referring to earlier information or prior knowledge, summarizing or concluding, asking verification questions. These are the behaviors we hoped to see in the dialogue in the project groups observed for this research.

The checklist included 7 overall categories that covered the range of activities required to complete the task successfully (See Table 1). For the purposes of this study, enough behaviors must fall in selected subcategories of the D Category (Discourse that links theories to the organization) to indicate that students were achieving the core objective of the course. The definitions of these subcategories appear below:

    D. Discourse that links theories to the organization

1. Simple link between the content and the organization
2. Putting forward a suggestion for ways to analyze or categorizing the organization's problems or describe the organization in theoretical terms.
3. Unsupported Opinion, good or bad, about the organization or specific issues facing the organization
4. Identifying or giving opinions about issues facing the organization supported by simple facts from the case.
5. Identifying or analyzing specific issues, challenges, or problems facing the organization and its problems
    D5A - supported by logic or personal experience, but without connections to theory. (everyday theories)
    D5B - bringing in a parallel example from another organization.
    D5C - Using theory, research, data to identify problems.
6. Putting forward suggestions for dealing with problems
    D6A - without connections to theory. (everyday theories)
    D6B - Problem solutions using connections between the organization and theories or concepts from the course.
    D6C - Problem solutions employing theory, research, data for analysis. Making systematic connections between theories.

A separate analysis looked at the incidence of dialogic communication involving productive disciplinary discourse. These interactions were defined as two-way communication where a student started an interchange that initiated a dialogic exchange with another student. In order for an interaction to qualify as dialogic communication, a student needed to give some form of theoretical or research support for his or her idea and engage another student in some level of dialogue about the idea.

Van Boxtel and Roelof's (2001) second criterion for assessing the quality of disciplinary discourse (the amount and type of elaboration observed) provided another indicator for identifying more sophisticated discourse. If a student connected his or her remarks to a previous student's comments in a way that linked both comments to course concepts, it provided evidence that the class had moved beyond serial story telling and unsupported opinions to van Boxtel and Roelof's third criterion (co-constructing knowledge). The use of available tools (van Boxtel and Roelof's final criterion) provided further evidence of productive disciplinary discourse. If students referred to the textbooks, readings, lectures, cases, etc. used in the course, they showed evidence that they could use disciplinary resources to solve problems.

Transcripts were developed for the 12 one-hour videotaped sessions. Two independent raters categorized the behaviors using the tapes and the transcripts. Disagreements were resolved through discussion. A third rater categorized 25% of the transcripts with 80.1% agreement. After the behaviors were categorized using the video and the transcripts, each segment was timed using the video. The amount of time spent in each activity was compiled.

Estimate of Conceptual Competence
One of the basic questions addressed in the study was whether the students with the greatest academic competence and conceptual strengths made the most significant contributions to the group discussions. The course requirements included 5 papers that asked students to apply theories from the course to the analysis of an organization they were personally familiar with (e.g., a summer job, a family business, a student organization). The average grade for the 5 conceptual assignments for the course provided an estimate of the ability of each of the students to make connections between theory and practice.

 Questions
The data were analyzed to address the following sets of questions:

1. Generally, how did the groups spend their discussion time? Were students actively engaged in the problems presented to them? What was the incidence of off-task behavior?
2. What was the quality of discourse in the groups? How much of this discourse was on a high conceptual level? What was the incidence of elaboration in the groups? How often did one student build on the remarks of another student to produce a co-constructed product? How frequently did students support their assertions with theoretical support from the course content, research findings, data, or parallel cases? Was there evidence of the use of available tools (e.g., class texts, case materials, class readings)?
3. How much of the discourse involved dialogic communication?
4. Who made the higher level conceptual contributions to the group discussions? Did the most competent students make the most substantial contributions?

5. Several questions were posed related to group leadership. Did the groups have clear leaders? If so, what strategies did groups use to select a leader? What was the relationship between a student's ability to make higher level contributions and group leadership? Did the most competent students assume leadership in the groups and make the most significant conceptual contributions to the group's discourse?

Results

Table 1 presents a summary of the amount of time spent in each category of interaction. A substantial amount of time was spent on activities related to organizing, planning, and logistics (45.4%). Almost 1/3 (14.7%) of this time was spent sharing and clarifying the facts of the case. Another 22% of the time was devoted to discussion related to the presentation itself. A surprisingly small amount of time was spent on group process (.3%), humor related to the topic (.5%), and off-task behavior (2.6%). Over 70% of the groups' time was spent in discussing issues that were not directly connected to ideas.

When compared to standards of ideal team functioning, these findings contain both positive and negative indicators. The most obvious positive finding was the very small amount of time spent off task. On the other hand, the groups exhibited a remarkably low level of attention to overall planning and group process (4%): there was very little time devoted to outlining a planning process (.1%), overall discussion of the form of the presentation (3.6%), or group process (.3%). There was some time spent sharing and clarifying the overall task (5%) and the evaluation standards (1.9%), but these activities rarely occurred at the beginning of the planning process. Most typically, a student would mention the guidelines or evaluation standards during the discussion when he or she thought that the group was making a decision that would violate the standards.

The Quality of Discourse in the Groups

The course is organized around the idea that the authenticity of the overarching simulation will stimulate dialogue that connects theories from the course content to understanding and problem solving in organizations. Sharing and clarifying the facts of the case (14.7%) and substantive discussion of academic content (1.5%) provide a foundation for making these connections. Even though a substantial portion of the formal presentations were given to explaining the course concepts and students spent a substantial amount of time discussing what elements to include (16.2%), very little time was spent discussing the concepts themselves (1.5%).

Although 26% of the discussion linked theories and concepts to organizational cases, that category (Category D) included everyday theories as well as theories from the course content. In order to assess how much time was spent on discussion that linked course content to organizational practice, several observational categories were combined: C3 – substantive discussion of academic content (1.5%), D1- simple categorical link between theory and content and the organization (13.2%), D5B – bringing in parallel examples from another organization (1%), D5C – Using theory, research, and data to identify problems (.4%), D6B – solutions using connections between the organization and theories or concepts from the course (2.3%), D6C - solutions employing theory, research and data for analysis, and making systematic connections between theories (1.6%). The total for these categories was 19.8%. Although this represents a respectable total of the amount of time

spent dealing with ideas, it is noteworthy that most of this time was spent making simple categorical connections (e.g., Mary: "Oh, Weber's monocratic bureaucracy kind of fits this thing."). This is a fairly low level of cognitive activity that does not qualify as in-depth analysis. The total time spent in higher level analysis (D5B, D5C, D6B, D6C) was quite low (5.3%). This was less time than the total time spent on 'everyday theories' (6.8%).

The data were reanalyzed without the 4 group sessions where students were asked to complete the reading, but were not quizzed on the material. This raised the percentage of time spent making simple categorical links between theory and content and the organization from 13.2% to 18.7%, but did not increase the amount of time spent in higher level analyses.

The Incidence of Dialogic Communication & Productive Disciplinary Discourse The most striking feature of data gathered for this study on dialogic communication and productive disciplinary discourse was the relative lack of real dialogic interaction. Most of the contributions involving ideas were simple categorical matches between ideas and the case. In most cases, there was no real response to these assertions. Most of the suggestions (58%) were either ignored or included without comment. Only 42% of the assertions received any verbal response at all. Most of the assertions that did receive a verbal response (71%) were met with simple agreement (e.g., "Yes, O.K., that sounds good"). The transcripts contained only 27 instances of dialogic communication involving the exchange of ideas. Most of those exchanges (23 of 27) followed a pattern where one student made an assertion involving suggestions for solving an organizational problem employing theories or concepts from the course content that was then elaborated by one or more other students to produce a co-constructed product. In only 4 instances did a student disagree or challenge another student's assertion and then negotiate a co-constructed idea. Overall, there were very few instances where a student directly corrected another student's understanding of a course concept.

Who Made Higher Level Conceptual Contributions?
I also wanted to know how often the most knowledgeable students contributed their ideas to the group. It is noteworthy that in 4 of the 7 groups, the student with the highest average on the conceptual assignments acted as the group leader and made the strongest theoretical contributions to the group discussion. In some cases, these were students who were relatively quiet in large class discussions. The three exceptions to this pattern were instructive. In one of the groups, one of the group members had considerable first-hand knowledge about the two cases the group addressed. She acted as the leader of the group and the student with the highest grades on the conceptual papers acted as her co-chair. In this case, the chair's contributions focused on clarifying the facts of the case. In the second group, two students were among the top students in the course. A female student had the higher grade in the course, but a male student had the highest grades on the conceptual papers. The female student assumed leadership in the group and the male student made several of the most significant contributions. This was also the pattern in the third group where a female student with the second highest grades served as group leader and a male student with the highest grades served as the technical expert. All of the groups were led by females.

The transcripts were also analyzed to determine which students made higher-level contributions to the discussions. The group leaders (who also tended to be the top students) made 57.1% of the higher-level contributions and co-leaders made 14.3% of these contributions. In general, this analysis indicated that the best students took leadership in discussion groups and made over 70% of the higher-level contributions.

How Did Group Leadership Emerge?

Students were randomly assigned to groups maintaining a balance of major, gender, and year in school. Since no instructions were given about how the groups should be led, I was interested in evaluating the emergence of leadership in the groups. One of the reasons there was such a low level of group process oriented activity was that there were no examples of negotiation for leadership. Although I have seen instances of competition for group leadership in previous semesters, leadership emerged spontaneously at the beginning of the first meeting in all the groups in this study. In each instance, the student who assumed the leadership role in the first meeting held the leadership role throughout the semester. The leader typically began by simply making an organizing statement like, "Why don't we start by looking through the book." From that point forward, that student was deferred to and treated as the leader. A clear leader was evident in all 12 sessions. In four instances there was a secondary leader who acted as a 'vice president' working closely with the leader both inside and outside the class. Most groups also had a person who focused on the technical aspects of the Power Point presentation and the video editing. Although it wasn't part of the current study, it was evident that the members who played these roles did a disproportionate amount of the work.

Table 1

Total Organizing & logistics. A	Total for A1,A2,A4-A5,A7-A9	30.8%
A1	Outlining the Planning Process	.1%
A2	Sharing and clarifying the overall task	5%
A4	Sharing and clarifying the evaluation standards	1.9%
A5	Logistics and simple division of labor	17.7%
A7	Input from the Professor or TA	1.8%
A8	Fellow students sharing general information	.3%
A9	Procedural & Technical Questions	3.9%
Sharing & Clarifying Case A3	Total for A3	14.7%
Discussing Presentation B	Total for B	22%
B1	Planning - Suggestions and general discussion about the overall form of presentation	3.6%
B2	Discussion about the specific topics, content, or general elements to included	16.2%
B3	Discussion of the overall design of the slideshow	2.2%
Discussion of content C	Total for C	3.2%
C1	Sharing and clarifying evaluation standards	.1%
C2	Discussion of elements of the cases	1.6%
C3	Substantive discussion of academic content	1.5%
Discourse that links theories to the organization D	Total for D	26%
	Subtotal for D1-D3	13.8%
D1	Simple categorical link between theory and content and the organization	13.2%
D2	Suggestions for ways to analyze or categorizing the organization's problems	.2%
D3	Unsupported Opinion	.4%
Identifying or analyzing specific issues facing the organization. D5	Subtotal for D5	1.6%
D5A	supported by logic or personal experience without connections to theory. (everyday theories)	.1%
D5B	bringing in a parallel example from another organization	1%
D5C	Using theory, research, data to identify problems	.4%
Putting forward suggestions for solutions to problems D6	Subtotal for D6	10.6%
D6A	without connections to theory (everyday theories)	6.7%
D6B	solutions using connections between the organization and theories or concepts from the course	2.3%
D6C	solutions employing theory, research, data for analysis. Making systematic connections between theories.	1.6%
Linking to content & theory	Total for C3,D1,D5B,D5C,D6B,D6C	19.8%
Other	Group Process, Humor & Off Task	3.4%

Discussion

A common concern of professors is that the dialogue in student self-managed groups will quickly lapse into social conversation. The data from this study indicate that, if the task or simulation is authentic and challenging enough, it will command the group's attention. The simulation used in this study kept the students engaged and motivated to make simple connections, but failed to facilitate dialogic communication that incorporated disciplinary standards for reflective judgment and justification.

The most striking finding from this research was the very low incidence of dialogic discourse in the student discussion groups. There were very few examples of genuine elaboration leading to the collaborative construction of ideas. In this study, there was a low level of dialogic interaction and no student's contributions were challenged directly. In practice, if any group member made a suggestion that the other students didn't support, they just moved on rather than challenge the student directly. These basic findings are consistent with several other studies reported in the literature review that indicate that high quality discourse is rare in student problem solving groups.

If as Wertsch and Toma (1995) assert, dialogic communication both scaffolds the development of useful abstractions and internalizes that form of discourse, it is probable that groups that are able to change the type of communication they engage in would continue to improve the level of their discourse and positively affect the amount of learning they acquire. The development of better dialogue and improved learning would be mutually reinforcing. There may be a 'tipping point' level where dialogic interaction begins to reinforce itself. Beyond this tipping point, the quality of discourse may continue to improve under its own momentum. If groups fail to reach this point, however, the conventions of schooling will be the most powerful forces that shape classroom discourse, overriding the effects of communications training. There was no evidence that the communication training provided in the course had any effect on the level of discourse in the groups.

Goos' (2004) study of inquiry in mathematics indicated that dialogic classrooms can be created if teachers model and scaffold competent discourse. The students in Goos' study created a dialogic classroom by emulating their teacher's behavior. The literature contains several other examples that demonstrate that it is possible to create effective learning communities that enhance the construction of useful knowledge. Excellent models are an important step in the development of new methods, but it is also important to demonstrate that these models can be replicated with a reasonable amount of effort. Webb, Nemer & Ing (2006) concluded that their failure to create dialogic discourse in student groups was a result of their failure to train teachers to provide a model for this type of interaction. Since the teachers in their study received 7 full or half days of special training, it appears that teachers are just as resistant to changing their behaviors as students are. My own experience and much of the research on classroom discourse indicate that many professors would find it difficult to duplicate the high quality dialogue described in Goos' (2004) case study.

There is reasonably strong evidence that a well-executed course design can produce powerful useful knowledge. In general, learning science research has found that dialogic discourse and effective teacher scaffolding are correlated with higher quality disciplinary discourse and higher achievement. The *specific links* between dialogic communication, authentic activity structures, productive disciplinary discourse, and the effective

construction of useful knowledge are not as clear. Gaining more knowledge about these dynamic relationships is a necessary step toward refining and testing the model. A fair summary of this literature is: If higher-level dialogic interaction occurs, it promotes learning, but it doesn't happen very often.

Another question addressed in this study, related to Vygotsky's (1978) concept of the zone of proximal development, was whether the most knowledgeable students made significant contributions to dialogues that scaffolded the knowledge constructions of other students. Generally, there was broad participation by all members of the groups, but group members made positive contributions to the group's efforts by playing specific roles that fit their strengths. There was extensive use of available materials within the groups. Students frequently referred to the textbook and to case material. The evidence from this study indicates that, within the context of a complex problem situation, the most knowledgeable students took leadership in the groups, made more contributions, and made the highest-level contributions. This pattern of interaction created the conditions where the more knowledgeable students could provide their fellow students with support within their zones of proximal development. There were so few dialogic interactions, however, that it would be hard to argue that they represented a significant factor for learning. There were a few instances where less capable students who asked for help were 'tutored' by more capable students, but no instances where misconceptions were corrected spontaneously. It is not clear if less capable students need to be actively involved in dialogic discussions to be supported through their zones of proximal development, but it is doubtful that 'being told' by other students is any more effective than 'being told' by teachers.

Our students come to the university with many years of training in listening passively and answering brief questions from the teacher with correct answers. Teachers rarely ask students how they arrived at their answers (Webb, Nemer & Ing, 2006). School has not been a place where students and teachers come together to talk about important questions. School has been a place where students try to guess what the teacher wants them to say. The results of this study add to the evidence that it is very difficult to change these conventions of schooling.

In addition to dialogic communication, the structure of the activity provides another source of support for knowledge building. Given that we have evidence that useful knowledge does get constructed, the authenticity of the activity structure is a mechanism that could be operating to tie together different forms of discourse. This study didn't have a direct measure of the authenticity of the simulation, but the findings did shed light on this question. The very low incidence of off-task behavior indicates that the students were very engaged in the activity. The activity structure provides the latticework for knowledge building and the mechanism for the constructivist version of transfer. Dialogic discourse is the specific mechanism for the construction of useful ideas. In this case, there was little evidence of dialogic communication related to more sophisticated concepts. There is evidence from the written assignments and the students' performance in the capstone exercise, however, that the students developed skills in this area. The discourse created with the professor through the writing, feedback, rewriting process seemed to have been the most powerful discourse operating in the course. There is some evidence in the literature that conversations among students have a strong positive effect on the quality of conceptual papers. Daiute (2002) found participation in cooperative learning improved the level of sophistication of students' narratives more than conferences with teachers. This may be true, even if the conversations themselves are not conceptually sophisticated. More needs to be known about the interaction of different types of discourse.

My experience using a combined constructivist approach to teaching and learning in a research university has reinforced my general commitment to the model. My experience, reinforced by a growing body of research, supports the importance of creating authentic contexts for learning and actively connecting them to students' previous experience and everyday theories. Activity theory is an especially helpful framework for thinking about ways to strengthen the authenticity of problem contexts and classroom activities. These insights also need to be connected to the content and the forms of dialogue that take place in student problem-solving groups within these activity structures. On the simplest level, we need to understand how well these conversations connect to the activity structure as an arena of experience and how effectively these conversations connect these activity structures to activity structures outside the school environment. I've seen evidence of great improvements in the thinking of students on written assignments and significant improvements in the intellectual quality of group presentations, despite the lack of higher-level dialogue in the discussion groups.

As the findings of this study demonstrate, there are also areas where implementing this model can be challenging. The literature often underestimates the power of the current culture of schooling to resist change and erect barriers to dialogic communication. Most notably, it has been difficult to facilitate higher levels of reflection and disciplinary discourse in class discussions and student problem-solving groups. It is a constant struggle to convince students that they will learn more and perform better if they take the time to engage in genuine discourse rather than splitting up the task to get the assignment done in the least amount of time.

Future Research and Instructional Strategies

Additional research is needed to analyze classroom dialogues for their effective use of disciplinary language, concepts, and higher levels of reflection. Many of the important questions do not currently have clear answers. How often are deep principles from the discipline being used as 'real objects' in student-student dialogues? Do classroom dialogues contain evidence of growth in the level of reflective thinking and the amount of elaboration used (e.g., basing opinions on evidence, building on other students' ideas, referring to ideas from the course reading). What are the direct and indirect connections between the quality of classroom dialogues and the quality of learning? Finally, how do classroom dialogues transact with other forms of discourse? In general, additional research is needed that focuses more sharply on understanding how the *transaction* between the sociocultural and cognitive aspects of learning operates in the construction of useful knowledge.

This research pointed to several questions that need to be addressed in future research. The evidence that the instructional methods used in this study failed to create dialogic communication in problem solving groups also indicated that the instructional strategies being employed in the classroom needed to be altered. I approached this task by reexamining what I had been doing to promote genuine dialogue. I consulted with several leaders in the learning science field and reexamined the literature for ways to promote genuine dialog in work groups. My reading and these conversations convinced me that I needed to shift my focus to improving the quality of discussion in the large group sessions associated with the presentations. This meant sacrificing some of the other things I was doing, creating more time in large group sessions, and clearing more time in these sessions to model and scaffold the kind of communication I would like to see in the small groups.

Although I had moved away from a 'telling and training' approach to teaching, my analysis of what I had been doing in the class indicated that I had been relying too heavily on 'telling them' how they should be communicating and not enough on modeling dialogic communication in the context of the class discussion. Adapting suggestions from Herrenkohl, Palincsar, DeWater and Kawasaki (1999), I created procedural (questioner, commentator, critic), conceptual, and facilitator roles for students to assume during large class discussions. These roles involve taking data and providing feedback on the types and quality of the discourse and actively promoting dialogic discourse during the discussion.

In the beginning of the current version of the course, I asked students to develop demonstrations of good dialogic discourse and present them before the class. These demonstrations and the exercise of collecting data helped students understand the operational definition of dialogic discourse. Real movement toward establishing a new culture of communication in the classroom will depend on my ability to capitalize on opportunities to reinforce positive examples of dialogic communication as they occur in natural discussions. Although the changes have been gradual, early results have been encouraging. Future research will focus on whether changes in the quality of large group discussions will increase the quality of dialogic communication in collaborative problem solving groups.

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