

# Exploring the Use of Contextual Modules for Understanding and Supporting Collaborative Learning Activities: An Empirical Study

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**Abstract.** We report three student groups' collaboration experiences in a semester-long classroom project. The project included both tasks that required completion in virtual group workspace and activities that could be carried out in the physical world environment. We observed different collaboration patterns among the groups with respect to building and maintaining social relationships, submitting individual work to the group, and scheduling group meetings. We use Bereiter's two contextual modules, intentional learning and schoolwork, to help us understand the observed patterns and suggest that the group leader's contextual module plays a significant role in all members' group learning experiences and outcomes. We propose design implications that are intended for encouraging learning-based (as opposed to work-based) practices in virtual group environments.

**Keywords:** computer-supported collaborative learning, classroom study, virtual group learning environment

## 1. Introduction

Research on collaborative learning has shown that groups working together for a common task can outperform individuals working alone by producing higher achievement and greater productivity. In the collaborative learning model, students work together in small groups to achieve a common academic goal, such as a semester project or a homework assignment. This is fundamentally different from the traditional "direct-transfer" or "one-way knowledge transmission" model in which the instructor is the only source of knowledge or skills. In collaborative learning activities, students are viewed as active participants in the learning process in which they interact with peers and experts, which has the potential to produce greater learning than a student learning on their own.

However, research studies have also shown that the effectiveness of collaborative learning is dependent on many conditions such as the group

composition (size, gender, heterogeneity, etc), the group tasks, the group members' background and motivation with respect to the learning subject, and the means of communication, among other variables. In this paper, we report three student groups' collaboration and learning experiences in a semester-long classroom project. The project included both tasks that required completion in a virtual group environment and activities that could be carried out in a physical world environment. We compared and contrasted the group processes in these two environments. Our initial assumption was that groups would have quite different collaboration styles and practices due to the differences of these environments. Contrary to our assumption, we observed that the groups had similar patterns in both virtual and real group environments with respect to building and maintaining social relationships among the group members, submitting an individual's work to the group, and scheduling group meetings.

To help explain the observed phenomenon, we used Bereiter's contextual modules, i.e., the intentional learning module and schoolwork module, which in the past were mainly used in explaining the influence of contextual variables on an individual's learning experiences in a physical world environment. The results suggest that the group leader's contextual module plays a significant role in all members' group learning experiences and outcomes. We propose design implications that are intended for encouraging learning-based (as opposed to work-based) practices in the virtual group environment.

The rest of the paper is organized as follows: first, we describe the research design of the classroom study, including the group tasks in two environments, the tool that provided the virtual environment, and the data collection and analysis techniques for understanding the group processes; next, we present the findings of similar patterns in detail; then, we discuss Bereiter's contextual modules and demonstrate how we used these modules to help analyze the findings; and last, we discuss the design implications of a collaborative tool for encouraging learning-based practices in virtual group environment.

## **2. Research Design**

The classroom study was conducted in a junior-level undergraduate course on project management at a major US university. This is a core course for the major of Information Sciences & Technology (IST). Student learning progression was largely evaluated by the group performance in a semester group project – a project that required students to research best practices for distributed teamwork at each of its five phases. The project included five major activities corresponding to the five phases that a distributed team goes through. During each major activity, the groups identified the top three challenges or risks that a distributed team faces at that particular project phase; compared and contrasted two to three technology tools to be used by

a distributed team; and identified at least three best practice recommendations for the use of technology tools by a distributed team. At the end of each major activity, the group submitted a mini-report. After completion of the five major activities, the group produced a final report.

## 2.1. A Virtual Group Learning Activity

We designed a virtual group activity to offer students experiences of distributed teamwork. In the activity, each student group brainstormed challenges that a distributed team may face during a specific phase, and identified the top and bottom three challenges that were most and least important to address for the distributed teamwork. Students were required to provide a rationale justifying their choices of top and bottom challenges. The proposed challenges, members' choices, and the rationales were all archived and shared within the group.

In each major activity, the students completed this virtual group activity in two days and then conducted the remaining tasks. The students could choose the communication and collaboration means for the remaining tasks. At the end of a major activity, they submitted a mini-report that summarized their work. The students had one and a half weeks to complete the remaining tasks. Figure 1 gives an overview of the group project.

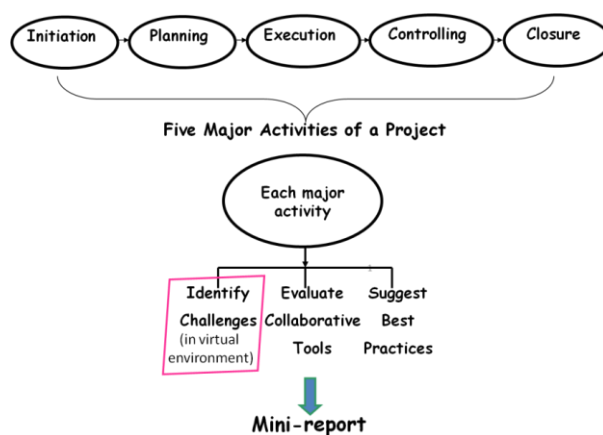


Figure 1. Overview of the group project

## 2.2. A Virtual Group Learning Environment

The student groups carried out the virtual group learning activity in a virtual group workspace provided by the collaborative tool. The workspace had several subspaces: a user list space indicating which students were present in

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the workspace, a group chat space, a document list space presenting a tree view of the shared group documents, a document space for currently opened documents, and a rationale space for the documents' associated rationales. Given the virtual workspace and its available toolkit, the students posted challenges in a shared whiteboard and their choices of top and bottom three challenges in a shared spreadsheet. The rationale space was essentially a blank space with no structure. It would display the rationales when related whiteboard or spreadsheet documents were opened in the document space. Figure 2 shows a screenshot of one student group's workspace provided by the collaborative tool. This group used a color scheme to distinguish who had posted which challenge on the shared whiteboard. The details about the tool design and architecture can be found in Xiao, TEL, 2011.

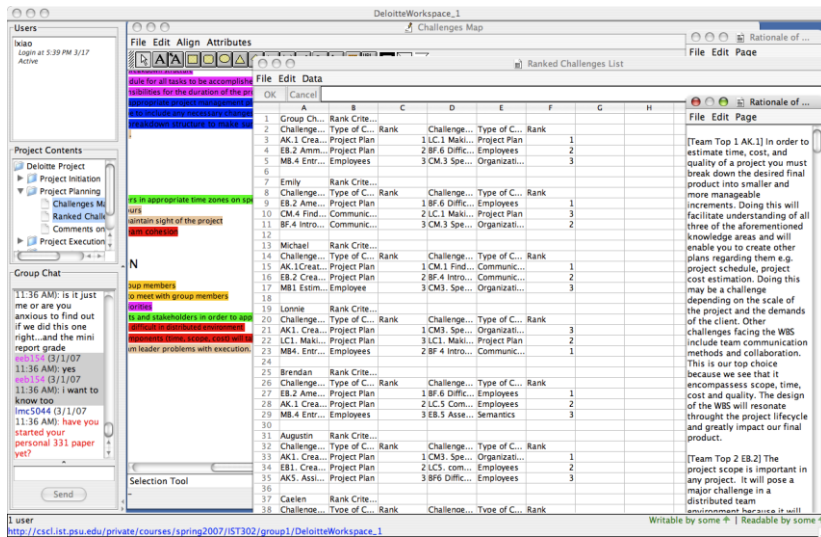


Figure 2. Screenshot of a student group's workspace

### 2.3. Data Collection and Analysis Techniques

Following a triangulation approach, we collected and analyzed various kinds of data to understand the students' collaboration and learning experiences in the group project, including surveys, class observation notes, semi-structured interviews, and the grades of the mini-reports. Students who chose to participate in the study were offered extra credits. To address possible ethics concerns, a different task was made available for those who chose not to participate but wanted to earn extra credits. In total, 33 of 38 students chose to participate in the study. These 33 students were from the seven groups formed by the instructor. However, there were only five groups whose members all agreed to participate in the study.

#### 2.4. Quantitative Data: Survey of Likert Scale

30 participants filled out a survey about their experiences at the end of the project. This survey included three sections: collaboration experiences, feedback on the design of the shared rationale space, and individual learning experiences. This paper focuses on the students' experiences of learning in the groups, so the discussion about survey results will focus on the survey items about collaboration experiences. The design of these survey items were based on existing scales about group work (see Table 1): item 1 was about shared group identity and was from the scale used in Roberson's study [13], and item 4-12 were customized from the existing scale used in the study of partially distributed teams [12]. Item 2 and 3 were created to examine the participant's satisfaction on the teamwork.

**Table 1.** Survey items about collaboration experiences

Value ranging from 1 as "strongly disagree" to 7 as "strongly agree")
1. I see myself as a member of my group
2. I felt satisfied about our group work in challenges assessment activities
3. I felt satisfied about our group work in mini-report activities
4. My group members were competent in terms of generating a diverse set of explanations
5. My group members were competent in terms of generating good quality of explanations
6. My group members were quite competent in terms of generating good quality of mini-reports
7. Much disagreement on performing the tasks existed in challenges assessment activities
8. Much disagreement on performing the tasks existed in mini-report activities
9. A great deal of disagreement regarding the tasks existed in challenges assessment activities
10. A great deal of disagreement regarding the tasks existed in mini-report activities
11. Little tension existed in my group
12. When I needed help I counted on my group

#### 2.5. Qualitative Data: Semi-structured interview and Observation

Three of the five participating groups were interviewed about their collaboration experiences. These groups were chosen based on the grades of first mini-reports. The selected groups were group 1 (highest grade), group 2 (lowest grade), and group 3 (middle grade). A semi-structured interview guide

was used. Specific questions were asked to elicit the members' responses about the group history, social relationships, group dynamics and their collaboration experiences. The interview questions also solicited the interviewees' opinions on the design of the shared rationale space and their history of working in and leading a group project. Following the procedure recommended by Mason [9], the "big" question was decomposed into "small" questions. Because the purpose of these interviews was to gather rich data understanding the group processes and members' feedbacks on the activities, including the software program that supported the virtual group activity, the interviewer was not asked to follow a strict prompt protocol; instead, she was allowed to ask the interviewee questions to clarify or probe details of something the interviewee had said. There were 32 interview questions in total. Listed below are examples:

1. Have you worked with anyone from the group before? Who are they?
2. Do you know if some of your group members have worked with each other before?
3. How do you think of your group, compared to other groups that you have worked with? Examples of the aspects include cooperation, communication, meetings, member involvement, and conflict management?
4. Is there any critical incident or event happened in your group that you want to talk about?
5. Did each member contribute to the project equally? (Follow up: How? Why not?)
6. Which one of your group members do you think contributed to the group project most in this project? Why?
7. Is there any conflict in the group? Working style conflict? Personality conflict? Etc. (follow up: How did the group manage the conflict? Do you think sharing the explanations to each other helped on managing the conflict that is related to the task?)
8. Are you willing to work with your group again?

All interviews were conducted in a face-to-face setting after completion of the third major activity. They lasted from 20 to 90 minutes and were recorded and transcribed.

Besides interviewing the group members, the researcher attended each class lecture, observing the members' interactions. The researcher also attended group meetings of these three groups whenever her schedule allowed.

The interviews and observation notes were coded through an open coding process using ATLAS.ti software. In coding the first document, the researcher created 76 codes. The researcher added two more codes in coding the second document. The researcher then generated the coding scheme which had four coding families and 64 codes. In this process some codes were merged, e.g., the three codes about the interviewee's attitude on the software design – *"attitude on software"*, *"dislike about the software"*, and *"like about*

*the software*” were merged into one code – “*attitude about the software*”. The researcher then presented her coding schema and collected interview data to a professor in the Department of Education of a major US university, which served as a peer debriefing process to check on the data analysis process and increase its trustworthiness. The professor offered additional advice on coding process and agreed on the generated coding scheme. The researcher then coded the rest of the documents with the coding scheme. After coding all the documents, the code list was reviewed and the corresponding quotations were reexamined. The final coding scheme had 54 codes, and 712 quotations.

### 3. Findings

In this section, we first discuss three groups’ performances in terms of their group reports’ grades and rationale grades. We then present our observed similar patterns of the groups’ processes in the virtual group environment and the physical world environment.

#### 3.1. The Group Performance

The group performance is reflected through the group’s average grade of four mini-reports and the average grade of four challenge assessment tasks. The instructor graded the groups’ mini-reports based on the reports’ quality. The researcher graded rationales based on the level of thinking the rationales revealed, that is, a rationale that was well articulated and deeply thought out would be given a higher grade than one that showed less intellectual effort. For example, the challenge of “*keeping track of the group members’ work in distributed teamwork*” was proposed by two members of different groups for the project monitoring phase. One’s rationale was graded 5/5.5 - “*Throughout the project lifecycle, the project team must be carefully managed by the diligent watchful eye of the project monitoring and controlling phase. The monitoring and controlling phase must ensure that the project team is making progress according to the project plan. This will ensure project quality with regard to scope, budget and time and result in successful projects. However in the distributed team environment this is increasingly difficult due to physical barriers. Also (it’s) very difficult due to the grandeur of the objective of this challenge. It is very difficult to manage the entire team effectively enough in a non-distributed team environment. All the more difficult in this environment*”, whereas the other’s rationale, “*logging the work each team member does is extremely important. It allows the project manager to track accountability for each group member in case of mistakes/error*” was graded 3.8/5.5.

As there were five participating groups and each group had four mini-reports, there were 20 mini-reports’ grades in total considered in the study. The average grade was 9.0, with the highest grade being 10 and the lowest

grade being 6. The average grade of the mini-report for the highest performance group was 9.6 (i.e., averaging its four mini-reports' grades) and for the lowest performance group was 7.7.

The average grade for rationale statements was 4.6, with a range of 1 to 5.5. The quality of the rationale statements was in general good with 41% of the rationale statements' grades being 5 or above, and 17% of the rationale statements' grades being 3 or below. The grade of the highest performance group on rationale quality was 5.3, and that of the lowest performance group was 3.5. Table 2 shows the five participating groups' grades of mini-reports and rationales. As it shows, group 1, 2, and 3 were comparable in terms of their performance, with group 1 being slightly behind.

**Table 2.** Group Performance

Group	Average grade of mini-reports	Average grade of rationales	Group Performance (sum of the two grades)
1	9.3	4.4	13.7
2	9.7	4.3	14.0
3	9.6	4.7	14.3
4	9.0	4.3	13.3

### 3.2. Group Work Experiences: Survey Results

30 participants filled out the survey with 5 of them from non-participating groups, i.e., groups that had non-participating members. These 5 participants' responses were removed from further analysis.

Next, a group's response to a survey item was calculated as the average of its members' responses on the item. As the group size was five or six, it would be inappropriate to perform statistical tests to examine the significance of the average value. Instead these results were used for a coarse comparison of the members' experiences between the three groups. As a seven-point Likert scale was used, the biggest difference between two responses on an item would be 6. The difference of at least 1 full point on the Likert scale was considered the cutoff value for the difference between the response values. The analysis showed that being in different groups made survey responses significantly different except in items 7 and 9-11. The author also used ANOVA to examine whether being in a group had an impact on the responses. In other words, "group" was used as the factor in the analysis and there were three levels of that factor, i.e., three groups.

Table 2 presents the results. Item 1's responses show that all three groups were indeed formed. However, group 2 and 3's higher response values seemed to indicate that the groups were more cohesive than group 1. Compared to group 1, group 2 and 3 had higher value responses for item 2 – 6. These imply that group 2 and 3 were more satisfied than group 1 about the



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group performance. The members of these two groups were more confident about the quality of their rationale statements than group 1 members.

**Table 2** Survey results on group work experience for group 1, 2, and 3

Survey Item value ranging from 1 as "strongly disagree" to 7 as "strongly agree")	Group's Average Response			P value of ANOVA Group as the factor (N = 25)
	Group 1 (N = 6)	Group 2 (N = 6)	Group 3 (N = 5)	
1. I see myself as a member of my group	5.5	6.8	6.8	0.005
2. I felt satisfied about our group work in challenges assessment activities	4.3	5.8	6	0.009
3. I felt satisfied about our group work in mini-report activities	4.7	6.4	5.3	0.002
4. My group members were competent in terms of generating a diverse set of explanations	4.5	6	6.2	0.004
5. My group members were competent in terms of generating good quality of explanations	4.7	6.2	5.7	0.004
6. My group members were quite competent in terms of generating good quality of mini-reports	5	6.6	6.3	< 0.001
7. Much disagreement on performing the tasks existed in challenges assessment activities	2.3	2.6	2	0.291 (insignificant)
8. Much disagreement on performing the tasks existed in mini-report activities	2.3	1.8	1.8	0.019
9. A great deal of disagreement regarding the tasks existed in challenges assessment activities	2.2	2.2	1.7	0.240 (insignificant)
10. A great deal of disagreement regarding the tasks existed in mini-report activities	2.8	2.2	1.7	0.109 (insignificant)
11. Little tension existed in my group	4.3	6.2	5.5	0.148 (insignificant)
12. When I needed help I counted on my group	4.7	6.6	6.7	0.001

All three groups had little disagreement during the project regarding the tasks (items 7 – 10), agreed that there was little tension among the group members (item 11), and agreed that one could count on his/her group members when in need of help (item 12). However, groups 2 and 3 had noticeably higher response values than group 1 on items 11 and 12, which suggests that group 2 and 3 perceived a better group relationship and built more trust among the members than group 1 members.

The interview and observation data supported these findings from the survey results. Group 2 and 3 had better social relationships than group 1, and members were more satisfied about each other's contribution as well.

### **3.3. The Similar Patterns of Group Processes in Two Learning Environments**

The comparison of the group processes between the two group environments shows that each group had its way of dealing with *building and maintaining social relationships among the group members, submitting individual's work to the group, and scheduling group meetings* independent of the environment.

#### **Building and maintaining social relationships**

##### *Group 1*

The effort of building group relationships was not observed in group 1 in either environment. Group 1 members Bill and Thomas were friends. They sat next to each other in lectures and turned in their report sections together. They seldom talked to other members during the class except asking the group leader occasionally about the assignments and what they were supposed to do. The remaining four members did not know each other prior to this class. Justin and Jack were often seen standing outside the classroom talking to each other either before or after the class. Tom talked to Justin and Jack during the classes sometimes. Bob stayed quiet most of the time and sat furthest away from the other members.

In the virtual group environment, group 1 used the chat tool when they were first in the group workspace to test if it worked. However, they used it little during the three-month period, compared to the other two groups. The group generated 67 messages in total, most of them about the workspace tool and the task.

##### *Group 2*

Members of group 2 had very good relationships in this project, partially because this group had a good history of working together. Kim, Martin, and George had worked together since their freshman year. Rex had never worked with them before but had been friends with them since his freshman year. Kim and Martin were high school friends and came from the same town. Jordan knew George through a mutual friend.

Because of schedule conflicts, the only time that the group could meet was in the evening; however, this did not seem to bother the members. They really enjoyed the meetings. During the meetings, they worked on the project as well as playing music and joking with each other. Joking was also a strategy the group applied when there was a conflict or tension among the members; as Martin said, "*We don't let the tension build up. We joke around*". Because they spent much time on other things besides work, the group often met for several hours in order to get things done. The members acknowledged this issue but they still enjoyed this collaboration style. For example, Martin said, "*one thing is that everyone always looks at a sense of*

*humor during the group meetings. We all liked joked around a lot, which definitely helped a lot. It actually made the meetings fun”.*

This was the first time that Jordan worked with the other four members. During the interview, group 2 leader George mentioned that Jordan was a very strict person and followed methodology precisely. In spite of the fact that this group’s work style is far from being strict, Jordan also enjoyed working in this group – *“I think this has been one of the most interesting groups I have ever worked with, in terms of really just being loose all the time and really being able to just kind of throw out all ideas and we joke around a lot. Unfortunately that also leads to getting off task sometimes, but I feel that we are all very intelligent group members and the quality of our work is very good”.*

In the virtual environment, members also found ways to maintain and grow the relationships. Group 2 generated 681 messages in the group chat during the project period. It was evident that the group members used this chat for activities other than work. There were many naive behaviors, such as posting messages in Japanese, using special characters in messages, and discussing the researcher’s appearance. Below is one example to illustrate this:

1. sdg5015 (3/21/07 9:58 PM): dvb eats glass
2. sdg5015 (3/21/07 9:58 PM): if that's a turn on
3. ajk5054 (3/21/07 9:59 PM): harmoniously
4. ajk5054 (3/21/07 9:59 PM): there
5. sdg5015 (3/21/07 9:59 PM): pandas eat glass?
6. ajk5054 (3/21/07 9:59 PM): yes
7. sdg5015 (3/21/07 9:59 PM): is that why they're endangered?
8. ajk5054 (3/21/07 9:59 PM): thats why they are extinct
9. sdg5015 (3/21/07 9:59 PM): and sad?

### *Group 3*

Group 3’s members sat in the same row in the class. Laura and Jimmy had worked together previously; Stephen and Jonah had worked in a quality team before. The rest of the members did not know each other before taking this class together. During the semester, Stephen and Jeffrey were in the same group in another class, as were Laura and Jeffrey. Overall, everyone got along with each other in the group, and members were all positive about the group and developed trust for each other in completing the shared tasks – *“In the first two meetings, we would only schedule a meeting when everyone is there so we know that everyone will be there. Now if one or two people cannot make a meeting but other people can. We still schedule the meeting. We trust them that they can get the work done even though they are not going to be at the meeting”.*

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Group 3 generated 1512 messages during the project period. Similar to group 1, most of these messages were about the tasks. But there were occasions that members joked with each other:

1. ctm5017 (2/28/07 8:53 PM): ok what do we want to make the groups
2. lmc5044 (2/28/07 8:53 PM): ill give you a cookie
3. lmc5044 (2/28/07 8:53 PM): :)

### **Submitting individual's work to the group**

#### *Group 1*

Group 1 had issues with members submitting their work. Although Bill and Thomas always sent their individual sections on time, this was not well-recognized by the other group members. For example, Bob blamed Bill and Thomas for causing the grades of the mini-reports to be lower than expected, *"We split it up the parts evenly. And these two people complained about doing their parts even though they won't that big. They turned them in late a couple of times, or hard to get a hold of, or didn't show up in the class. So we end up having to do stuff in the last minute... And we get dark points because of them"*.

For completing the tasks in the virtual environment, Bill was considered to have contributed the least: he proposed 21 challenges in total while the other members proposed 30, and he only participated in the first task of selecting and ranking the challenges. Although the group leader made the group selection on the top and bottom three challenges in all five major activities, the other members were not aware of his work. For example, when asked who made the group selections since there was no group meeting about it, Thomas commented, *"I think someone went through and looked, whether it was Jack or Justin. I was never asked for my opinion except I ranked them in the assessment as individual. That was the only input"*.

In summary, group 1 had several problematic issues compared to groups 2 and 3: the lack of group history and social cohesiveness; disagreement on the group members' contribution; and the lack of visibility of individual effort in the project. All of these could have contributed to the fact that group 1 had lower scores on survey items related to social relationship and trust in the group.

### **Scheduling group meetings**

#### *Group 1*

Group 1 did not establish a regular meeting schedule for the project. During the three-month period, the group met only four times, twice at the

beginning for one group assignment and for dividing up the group report sections, and the other two for final presentations.

Group 1 did not meet online for the virtual learning activities either. The group members did not participate in the task of selecting the group's choice of top and bottom three challenges. Instead, the group leader looked at each member's choices and made the selection. Although the group leader did so in all five major activities, the other members were not aware of his work. For example, when asked who made the group selections since there was no group meeting about it, Thomas commented, "*I think someone went through and looked, whether it was Jack or Justin. I was never asked for my opinion except I ranked them in the assessment as individual. That was the only input*".

#### *Group 2*

The group 2 members loved having meetings. This group met weekly during the project despite the fact that the only time that they could meet was in the evening. They often joked around during the meetings and the atmosphere was more like a group of friends getting together for fun than working on a business matter. For example, in a meeting starting at 7 p.m. on Wednesday, the members did not finish the meeting until it was close to mid-night.

#### *Group 3*

In general, for the tasks in virtual group workspace, the group met online in the workspace to brainstorm the challenges together and then again at another time in the AIM group chat room. The group also had at least one face-to-face meeting for each mini-report.

## **4. Intentional Learning vs. Schoolwork Module**

Bereiter's concepts of intentional learning and schoolwork modules were used to further compare the three groups. According to Bereiter's work, students whose academic activities are all mediated by the schoolwork module do not recognize the learning goals of the activities. On the other hand, students who adopted the intentional learning module in carrying out the activities take the goal of learning into consideration when working on the activities. Also, students of the schoolwork module organize their activities for task performance, whereas those of the intentional learning module organize their activities around goals of personal knowledge construction. The third dimension to distinguish the two modules is the morality of the students. Students who adopt the intentional learning module commit to a truth and depth of understanding, while those who adopt schoolwork module tend to be satisfied with the superficial and pretense of knowledge [14].

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We adapted his work and considered the dimensions of the contextual module at the group level: practice of division of labor, leader's contextual module in collaborative learning activities, and moral dimension of the group activities.

#### **4.1. Practice of Division of Labor**

According to Bereiter's work, students whose academic activities are all mediated by the schoolwork module do not recognize the learning goals of the activities. On the other hand, students who adopt the intentional learning module in carrying out the activities take the goal of learning into consideration when working on the activities. Additionally, the intentional learning module is organized around goals of personal knowledge construction while the schoolwork module is organized for task performance. In the group learning context, this dimension is about whether the learning goal is taken into account in the group practice. The data from this study show that this is specifically related to the group practice of division of labor. In the group project, a large amount of time in group work is on completing tasks and writing the report. The three groups have very different strategies for division of labor in producing mini-reports as follows:

##### **Group 1**

In group 1, each group member picked a section from the report template and produced the content for the section. Group leader Justin chose to be the compiler responsible for integrating individual sections into one coherent piece. He required the group members to send him individual sections two days before the actual due date for compiling. The group members were to stick to the same section and responsibility for all five mini-reports. There were two members who worked on the section discussing two software programs. These two members decided that one would write about a software program first and send it to the other member. Then the other member would write about the second program and send the completed section to the group leader. The group leader did not send out a compiled version to the group prior to the submission, so the other group members did not get to read the report until they received it from the instructor along with the grade.

##### **Group 2**

Group 2 wrote the mini-reports during the face-to-face group meetings. For a mini-report, the group members would first write down the ideas on the whiteboard of the meeting room, and discuss which ideas or topics to be included in the report and why. Members then worked in small groups on different sections. When one small group finished the work, they would then switch to a different section or help the others.

### Group 3

Group 3 members used a rotation strategy to divide up the work for writing mini-reports: the members rotated to different sections for the five mini-reports, enabling each member to construct different sections over the course of the project. The group created an online group folder for sharing the sections and the integrated mini-reports. Usually, the members uploaded the individual sections in the folder the day before the actual due date. The compiler then integrated them into a coherent report and uploaded the integrated version to the group folder a couple of hours before the submission for the group to review. The compiler was responsible for submitting the final version to the company.

These findings suggest that a group's strategy of division of labor can be very different depending on the focus: task performance oriented or knowledge construction oriented. Group 1's strategy was task performance oriented, which is reflected in the group leader's reasoning of having everyone work on the same section in all five activities. When asked "*How did your group decide on the mini-report content*", He said, "*pretty much we just distributed the work and it comes back, and we just put it together. What helps me get consistent is everybody wrote the same part every time. And like in section D where two people are writing in the same section, one talking about one software, one talking about the other, one writes before the other, so it goes from XX to XX, then to me. So at least there is some consistency there at least worked out the same ideas*". In group 2 and 3, however, there was certainly the intention of having everyone involved in different aspects of the project and be responsible for different sections at different stages. For example, group 3 members all liked the rotation strategy and acknowledged that it helped them to explore different parts of the project. Stephen talked about the tradeoff of the rotation strategy – "*I don't argue with the system we have about rotating it, cause it gets everyone to do one part of it, but if we want the best output, I'll probably write my challenges and I'll go back to read the person's tool assessment and best practices for groove, because I am probably the most familiar with groove right now*".

As it shows, Stephen acknowledged that the purpose of this project was not just about getting the best performance, but also about gaining the experience by working on different sections.

Although group 2 did not have a systematic rotation strategy, the group made sure that the mini-report was constructed together in group meetings and members were not assigned to the same sections all the time. In such a highly collaborative group, there was no clear rule as to who worked on which section, and group members knew how each section was constructed and why. Members liked this working style. The leader said, "*I think cohesively we were better because we don't really like most of the groups (in which) everyone just does individual contribution and pieces together, although we sort of do that, it's more of like in a distributed environment, like the work is delegated consistently, and like we form teams and we switch teams, ... it's always usually a group of two, or a group of three when we work, it's just*

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*constantly moving around, communication with each other when we meet face to face and online”.*

These empirical data suggest that one dimension to distinguish an intentional learning group from a schoolwork module group is its practice of division of labor. An intentional learning group acknowledges the individuals' learning goals from the group activity and involves all members in the learning tasks that the project entails. Conversely, the schoolwork module group puts the emphasis on group performance, neglecting the members' learning goals, and develops the group practice that is believed to be best or most convenient to deliver the group product.

#### **4.2. Leader's Contextual Module in Collaborative Learning Activities**

The results of this classroom study suggest that group leader's contextual module with respect to the collaborative learning situation has great impact on the group's contextual module. The interview and observation data indicated that in this study group 1's leader adopted the schoolwork module, while group 2 and 3's leaders adopted the intentional learning module. This can be illustrated through the following aspects:

##### **The Group Leader's Recognition of the Project's Learning Goal**

The group leaders had different understandings about the group project, which showed their different motivations in completing the project. When asked what the project was about, group 1 leader said that the project was about how to improve project management in the distributed team environment, as it was described in the project description. He did not seem to recognize his individual learning goals from the class either. For example, he did not spend time on the content of the mini-reports when compiling the sections together because *“...considering the grades came back very consistent and decent, there were never an area that I need to consume myself on that”*. During the interview, he talked about another class in which the students had several tests and during each test, the students needed to write down their solutions to problems and explain their reasoning. Justin's comments indicate that he did not recognize the learning goal of the problem-solving tasks and merely focused on getting the job done by solving the problem, *“Then, the next question is why? I just don't find that a useful question at that point, cause it's an open ended question at the first place – how would you approach this problem? And then the only logical true explanation to why to me is because that's the knowledge I have to approach the problem. .... I am sure there might be some genetic behind it, but how they are brought up, and how I approach a problem is the same thing. Don't ask me why I solve the problem like that”*.

As the group leader, Justin had great impact on group practices and division of labor. For example, he did not encourage group discussions as he



saw no need to do so with respect to the group's grades. He did not send out the compiled report to the rest of the group for review. In summary, he did not see the learning benefits to managing the group work in this way. Justin affected the other group members' learning experiences by imposing this module on the group. For example, group member Thomas said, "*The only thing that I learn is when we actually see each other's work and why. That helps to better flush out the phase. The report is no teamwork*". Jack also said, "*All IST group projects are supposed to gain experience in working with teams. We are not gaining that type of experiences*".

George, the group 2 leader, however, acknowledged that learning was also an important goal of the project. He said, "*...the outcome wasn't as important as the process. We are working together on a team and understanding the concept of project management, making sure your deliverables are on time, dealing with the client. It is more a way of preparing the students for professional world. I think this is more of educational usage than an actual corporate usage*".

Although group 3 leader Laura did not specifically mention the learning goals, her answer showed that she considered the importance of offering every member chances of working on different aspects of the project. She said, "*... so everyone will have a chance to do the little bit of work... they will just be like one person will get to do one of each task.*"

The three group leaders' understanding of the group project suggests that group 1 leader's perspective was task-oriented and focused on the "work" aspect of the activity, whereas the group 2 and 3 leaders considered the learning aspect of the project and recognized the necessity of offering members learning experiences about the topic.

### **The Group Leader's Perspective on Group Meetings**

Group meetings are crucial to group members' learning experiences from group activities. Effective meetings not only facilitate communication and encourage productivity of the group, but also provide channels to help the students learn from each other and construct knowledge together. However, the group leaders had different attitudes on the importance of group meetings. The group 1 leader Justin believed that it was not crucial for the group to have a meeting because the instructor would not know whether the group had had a meeting or not, and scheduling a meeting was hard to do. He said, "*... we are just pretty much anti-group meetings. The 2 or 3% of doing better on the report is not worth of trying to find an hour time for the group meeting.*"

He further elaborated there was no need to get each other's opinion and knowledge when working on the individual sections and that all the individual work could be done by individuals – "*we don't need the support or knowledge from everybody else, we can complete the work and get it done individually and turn it in and not have to struggle for group meeting.*"

The group 3 leader valued the importance of group meetings in group projects and organized regular meetings both face-to-face and online. Laura explained the reason of having two kinds of regular meetings in the group, "...*Online is good for summarizing things for just making sure that people are task and understand what they have to do, and maybe clear up a few questions. But general brainstorming and talking about what we want to do and how we want to structure the project that kind of stuff that's better to do in-person. By doing both being in-person and online, it kind of makes things more convenient and allows more meeting times*".

George, the group 2 leader, also considered it very important to have group meetings. George acknowledged that the members liked being together, the cohesiveness of the group made the meeting pleasant, and the members were comfortable brainstorming ideas – "*I think we are more creative face-to-face*".

#### **4.3. Moral dimension in group activities**

The results suggest that the moral dimension in distinguishing the schoolwork and intentional learning modules exists at the group level of the modules as well. For example, in selecting the top and bottom three challenges as group choices, all three groups seemed to adopt the same practice by examining individuals' choices and selecting the challenges with the most occurrences as the group choices. However, the process of doing this and generating the group rationales differed. In group 1, leader Justin constructed the group rationales for the group choices and the other members were not involved in the selection and rationale production process. Of the five group choice and group rationale tasks, Justin told Bob and Jack about his work once and that was because they were present in the virtual workspace when he was doing the work. Bob and Jack did not offer to join in the process in later tasks. Bill and Thomas were not aware of this. Bill said, "*I actually never helped with that... I don't know who made the decision, and who wrote down the group explanations.*" Thomas also commented, "*I think someone went through and looked, whether it was Jack or Justin. I was never asked for my opinion except I ranked them in the assessment as individual. That was the only input*". The fact that the group decision was not made by the group and the group was not bothered by this indicates that there was at least an inclination towards satisfaction with the superficiality and pretense of knowledge that the group presented to the outside – the group decisions.

Group 2 and 3 members were more serious about choosing the correct challenges for the group that best represented the top and bottom challenges from the brainstormed list. They discussed their choices and had everyone write at least one group rationale. Some members even felt self-conscious about their challenges being selected as bottom ones. For example, a group 3 member told the researcher that he disliked the idea of choosing the bottom challenge, because "*I don't think anyone is losing any sleep over, but it's like*

*oh man why that is a bottom challenge, that is a good one, but everyone else thinks it's a bottom challenge. So that's the only thing I don't like about it. It's just that little negative aspect".*

The same member explained in details how the group made the group choices, "... then we moved to the rank challenges in which we would all take our individuals we have to have everyone's (challenges) out there so we can pick them, read the rationales, to see which ones we liked best and then based on commonality between the group picks, we will pick the team, and if there is a controversy or there isn't anyone's that show a pattern or repetition, then we have to sit down and actually really debate which ones are the top...".

In fact, there was an incident in group 2 in which some members picked the top challenges which were considered bottom challenges by others for a particular project phase. The group members decided to meet face-to-face and went through everyone's rationales to make the group decisions. In summary, group 2 and 3 committed to a truth and depth of understanding when making decisions on the top and bottom three challenges.

## **5. Design Implications**

The usefulness of Bereiter's contextual modules in describing learner groups suggests new directions for designing intentional learning groups to support and enrich individual learning experiences in collaborative learning activities. For example, the method of using a script for structured interaction (O'Donnell & Dansereau, 1992) can be used to instruct the group's division of labor practices. Recognizing the impact of the leader's contextual module on the whole group's learning experiences, we as designers of virtual group learning environment should consider designing toolkits that are specific for the group leaders for the purpose of reminding them the learning goals of the project and the benefits of group setting in learning processes, helping them organize group meetings by providing templates, and providing an overview of the group's progress and members' division of labor through visualization. For example, the educational tool can provide templates for dividing up the group task so as to scaffold the group practice of division of labor that acknowledges the individuals' learning goals and emphasizes the members' participation in knowledge construction in the project. Along with these templates, the tool will provide a visualization mechanism to indicate the amount of time each member spends on a specific part of the group tasks, reflecting on the members' participation in various aspects of the group activities.

## 6. Conclusion

Although numerous research studies have demonstrated the benefits of collaborative learning, there have also been reports on the failure of collaborative learning setting. Why do some groups learn well when others don't? Why do some groups' members enjoy the collaborative learning process and report enriched learning experiences while others don't? To answer questions like these, this study explored the use of Bereiter's contextual modules to compare three learner groups. The results show that groups can be interpreted using the intentional learning and schoolwork modules as well with adapted dimensions about the modules. Furthermore, the evaluation of collaborative learning activities should not only be based on the group performance but also the group process. Following this perspective, the paper suggests design implications for supporting intentional learning in the virtual environment.

This is only an initial step towards a systematic understanding of how contextual variables affect individual learning experiences in a collaborative learning setting. Instead of trying to generalize the results, which are based on just one classroom study, the intention of this paper is to shed light on the usefulness and usage of the concept of contextual modules in explaining learning groups and their contextual factors. This paper should be viewed as a starting point in a new research direction, rather than a conclusive summary of the research program. Further investigations are called for to use the modules to interpret the learning groups in different contexts and identify additional dimensions of contextual modules for learning groups.

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