Characteristics of Friends Working Together: Group Work in Linguistically Diverse Mathematics Classrooms

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Abstract: The influence of friendship on collaboration during mathematics group work has not yet been extensively examined across diverse school settings or pedagogical contexts. This study explores students' perspectives towards group work, focusing on the relationship between friendship and group work in linguistically and racially diverse classrooms. Our analysis of interview and video data revealed some of the ways in which students preferred working with friends. There are three main areas that students recognized as advantages of working with their friends: a) focusing on the process of problem solving rather than the product, b) gaining emotional support, and c) diversifying and strengthening ideas. From the analysis of video data of friends working together, we observed that students were gradually diversifying ideas by accepting each other's contributions while also challenging each other's ideas. There were times when the boundary of ideas was blurred and different ideas were combined. Despite the learning and social benefits of group work, researchers have also raised concerns about unequal distribution of learning opportunities among students. This study suggests the significance of attending to students' reports regarding the benefits of establishing and maintaining friendships in relation to group work for mathematics learning.

Purpose and Perspectives

In linguistically and racially diverse schools, there is a need for carefully-designed pedagogy that addresses the linguistic complexity of mathematics. Group work is shown to be an effective tool for developing language and disciplinary knowledge simultaneously (Barwell, 2009; Swain, 2001). Group work, which utilizes collaboration among peers, has been largely influenced by Vygotsky's (1978) theory of the zone of proximal development, which highlights the significance of collaboration with peers for the prospective development of a learner. Sociocultural theory, stemming from Vygotsky's theory, emphasizes a dialectical unity of learning and development and "comprehensive understanding involving the whole person" (Lave & Wenger, 1991, p. 33). Drawing from this perspective, we focus on identity, including friendship building, in relation to learning.

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The influence of friendship on collaboration during group work has not yet been extensively examined across pedagogical contexts, tasks and students' ages, and previous studies have presented mixed findings. On one hand, collaboration among friends is reported to be more meaningful, preferable and productive compared to collaboration among non-friends, because friends tend to know their similarities to and differences from other group members, have a strong commitment to one another to maintain an amicable relationship, and feel more secure in working with each other compared to working with non-friends (Azmitia & Montgomery, 1993; Fonzi, Schneider, Tani, & Tomada, 1997; Hanham & McCormick, 2009; Strough, Berg, & Meegan, 2001).

On the other hand, a study reported that students preferred to work with assigned partners because they feel pressured to choose their friends, even when friends did not work well with one another (Mitchell, Reilly, Bramwell, Solnosky, & Lilly, 2004). Kutnick and Kington (2005) reported that girls working with friends achieved higher performance in tasks during group work, while boys working with friends achieved lower performance with friends compared to non-friends. It is reasonable to consider that the inconclusive nature of studies on friendship and group work may stem from the interrelated influence of various aspects of students' identities, tasks and the classroom environment.

Racial and linguistic diversity has not been addressed in these previous studies but should be considered at the center of analysis as friendship is a complex relationship and that layers of social identities could affect collaboration during group work (Esmonde, Brodie, Dookie & Takeuchi, 2009; Takeuchi, 2016). This study explores students' perspectives towards group work, focusing on the relationship between friendship and group work, in linguistically and racially diverse classrooms.

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Method and Data Sources

The data for this study has been collected in urban schools in Canada. The data collection is still ongoing. The schools were linguistically and racially diverse: More than 45 home languages of students were represented and more than 50% of the students were receiving funded support as English language learners. Findings from this paper draw from the data collected from Ms. Smith's Grade 7 mathematics classes. In her class, students sat with group members to support each other and have discussions with each other. The data collected include teacher and student surveys on group work experiences, video-recorded group work interactions, and video-mediated interviews with students.

For group work, students engaged in mathematical problems that were considered to be group-worthy (Boaler, 2008). The mathematical tasks for group work were based on Driscoll's (2007) geometric thinking tasks. Video-mediated interviews were conducted with individual students, by watching the video of group work they participated the day before. The interview elicited students' comments on particular segments of video. The interview also included the questions regarding their preference to group work, their dispositions toward mathematics, and their parents' expectations.

The focus of this study was on group work and friendships. First, we analyzed student surveys (n=20) to examine their preferences on group members. Second, we selected video data during students' solving mathematical problems with friends. In this proposal, we focused on one friend group's process of problem solving. Both students in the group were considered as English language learners in the school. One of the students (Eira, pseudonym) spoke Urdu as her first language and moved from Pakistan since Grade 5 and another student (Chitleen, pseudonym) spoke Punjabi as her first language and she was born in Canada. Characteristics of discourse during group work were identified through video data analysis and focused on characteristics of idea

development. Third, we analyzed students' interviews where they looked at the video of themselves solving mathematical problems in group.

Results

Students' responses to the question, "with whom do you work best during group work?," was summarized in Table 1 (multiple selection was possible). "Friends" was the most frequently-selected characteristics of a preferable group member. There was one student who selected the opposite and answered "non-friends" would be preferable. "Friends" were chosen more frequently than other characteristics such as students whose math level is similar, students who are good at math, or students with same gender identity.

Table 1. *Students' preference on group members*

	Frequency	Percentage
Friends	13	30.9
Students whose math level is similar to mine	9	21.4
Students who are good at math	7	16.6
Students with same gender identity	5	11.9
No preference	4	9.5
Students who can speak my first language	2	4.7
Friends that are good at math	1	2.3
Non-Friends	1	2.3

Our analysis of interview and video data revealed some of the ways in which students preferred working with friends. There are three main areas that students recognized as advantages of working with their friends: a) focusing on the process of problem solving rather than the product, b) gaining emotional support, and c) diversifying and strengthening ideas. For example, reflecting on her process of working with friends, Chitleen said:

> We agreed on a lot of things. We disagreed with, which was actually a good thing. If you disagree 'cause you have... um... you have other people's ideas that you could apply and then for the first one you showed me, we both had different ideas but when we finished it, I realized both of our ideas were combined.

In terms of the emotional support she can gain from working with friends, Eira said:

> Okay, so, I'm like really competitive and I do accept that and sometimes like when I just like start working, I just kinda get frustrated but then like your partner actually cooperates I think it's really not like that frustrating.

This quote tells us how the student valued both agreement and disagreement to solidify problem solving, while working with friends. Looking back at the problem solving they were engaging, the student realized how different ideas were eventually combined.

From the analysis of video data for two friends (Chitleen and Eira) working together, we observed the very process Chitleen described in her interview. As seen in Figure 1 and Excerpt 1, students were gradually diversifying ideas by accepting each other's contributions while also challenging each other's ideas. There were times when the boundary of ideas was blurred: Different ideas were combined and students worked on the shared object. The ideas developed in a spiral structure: Students came back to the original idea proposed at the beginning but their understandings deepened when the idea was revisited. Miyake and Kirschner (2014) identified the iteration of understanding and non-understanding as one of the characteristics of successful group discourse. We observed this iteration of understanding/non-understanding in the friend group. In our presentation, we will show the video of students' problem solving in order to highlight the characteristics of discourse including the spiral structure of discourse.

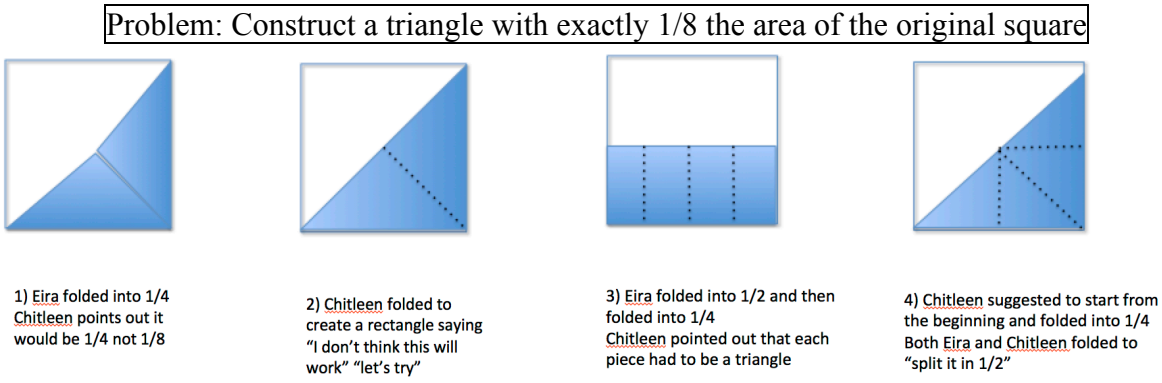

Figure 1. The process of problem solving by a friend group (Chitleen and Eira)

Excerpt 1. Conversations between Eira and Chitleen

Eira	No, no... see, there's like a separator in between so, one *(Counting the number of sections for 3) in Figure 1)*
Both	two, three, four, five, six, seven, eight
Chitleen	ya, but how are we supposed make triangles out of that?
Eira	Triangles
Chitleen	Can we make little triangles?
Eira	No
Both	*(laughing)*
Chitleen	k. Wait, let's try again. Let's try with four this time.

Educational Importance of Study

Findings show that students in this study preferred working with friends for group work in mathematics classrooms and identified some unique characteristics of collaboration in working with friends. According to the student interviews and video analysis, the following characteristics were amplified in friend groups: focusing on the process of problem solving rather than the product, gaining emotional support, and diversifying and strengthening ideas. We are not intended to propose that friend groups are always better for group work. Rather, our aim is to highlight the role of friendship for learning, based on students' voices. Data collection for this study is still ongoing and we are hoping to further solidify our findings.

Despite the learning and social benefits of group work, researchers have also raised concerns about unequal distribution of learning opportunities among students (Engle, Langer-Osuna, & McKinney de Royston, 2014; Esmonde, 2009). In a linguistically and racially heterogeneous classroom, relational dynamics deriving from students' social identities can affect, and sometimes hinder, students' collaborative learning (Dookie, 2015; Langer-Osuna, 2011). Considering this unequal distribution of learning opportunities, this study suggests the significance of attending to students' reports regarding the benefits of establishing and maintaining friendships in relation to mathematics learning.

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