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## Friendships and Group Work in Linguistically Diverse Mathematics Classrooms: Opportunities to Learn for English Language Learners

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### Abstract

This ethnographic study examined students' opportunities to learn in linguistically diverse mathematics classrooms in a Canadian elementary school. I specifically examined the contextual change of group work, which influenced the opportunities to learn for newly arrived English language learners (ELLs). Based on analyses of video-recorded interactions, this study revealed a shift in these ELLs' opportunities to learn from when they worked with teacher-assigned peers to when they worked with friends. In both settings, ELLs tended to be positioned as novices. However, when working with friends, they accessed a wider variety of work practices. In friend groups, ELLs were occasionally positioned as experts and had more opportunities to raise questions and offer ideas. In contrast, when working with teacher-assigned peers, ELLs tended to remain in the position of being helped. In some teacher-assigned groups, interactions were characterized as authoritative, and ELLs' contributions and ideas were rejected or neglected without relevant justifications or mathematical authority established by their peers. The findings will contribute to ongoing discussions on group work and friendship in linguistically diverse classrooms.

Group work and pair work have been implemented across disciplines as a tool for providing rich academic and social learning opportunities to students. For example, in its Principles and Standards for School Mathematics, the National Council of Teachers of Mathematics outlines the importance of group work for communicating, explaining, and justifying mathematical ideas among learners (National Council of Teachers of Mathematics, 2000). Group work can also be a tool to enhance students' opportunities to discuss with and learn from each other and to improve their social relationships (Cooper & Slavin, 2001). Previous studies on group work demonstrated that students who engage in elaborated explanations and participate in discussions tend to gain more opportunities to learn mathematics (Chizhik, 2001; Webb, 1985). Despite the benefits of group work for learning and socialization, however, researchers have raised concerns regarding the imbalance in learning opportunities that might arise among students with different social backgrounds during group work (e.g., Chizhik, 2001; Cohen, 2004).

This study examines the relationship between group work and friendship in a linguistically diverse school. Due to global mobility, schools in many countries are facing issues stemming from their linguistic and cultural diversity. For example, in Toronto, the largest city in Canada, where this study took place, 45 % of the entire population uses a first language other than English and French, the official languages (Statistics Canada, 2012). In relation to this growing linguistic diversity, equal access to high-quality mathematics learning opportunities for all learners has been recognized as an important issue (Diversity in Mathematics Education Center for Learning and Teaching, 2007).

This paper presents an ethnographic video-based study of group work in Grade 4 mathematics classrooms in a school where more than half of the students spoke first languages other than English, the language of instruction. I examined students' opportunities to learn in "friend" groups and teacher-assigned groups by analyzing video data on group work interactions involving newly arrived English language learners (ELLs) who were receiving English as a second language (ESL) instruction. As described in detail in the Data Sources and Analytic Methods section, *friendship* in this study is defined in two layers: (1) being stable playmates during recess and (2) selecting each other as group members when a choice was given.

In this study, I address the following research question: how do newly arrived ELLs' opportunities to learn differ between student-selected friend groups and teacher-assigned groups? As elaborated further in the subsequent sections, this study draws from sociocultural theory of learning and conceptualizes opportunities to learn as access to classroom mathematical discourse practices and access to identities as a competent participant in the community (Esmonde, 2009; Gresalfi & Cobb, 2006). The principal findings of this study suggest that newly arrived ELLs accessed a wider range of opportunities to learn when friendships were established among the group members. Specifically, ELLs tended to offer more ideas, engage in more discussions, and be positioned as competent participants in the friend group. The interactional analysis revealed power imbalances when ELLs were grouped with teacher-assigned partners who either were considered more advanced in mathematics or who played a leader role in the classroom. In these teacher-assigned groups, ELLs tended to be positioned as novices and did not actively engage in discussion with peers. Given that providing and receiving

elaborated explanation can lead to better learning opportunities for both mathematics learning (Webb, Farivar, & Mastergeorge, 2002) and language learning (Swain, 2001) and gaining an identity as a competent learner is an essential aspect of learning, ELLs gained richer opportunities to learn in friend groups. As reviewed in the following section, the current study will advance the discussion on group work, particularly regarding two topics: 1) linguistic diversity and group work, and 2) friendships and power dynamics in group work.

### **Linguistic Diversity and Group Work**

In second language education, the quality and amount of interactions available during group work have been examined in relation to students' linguistic proficiency development (Liang, Mohan, & Early, 1997; Swain, 2001). Additionally, the patterns of member relationships have been examined in relation to language learning opportunities (Storch, 2002). When focusing on ELLs or linguistic minority students' participation, previous studies have suggested that their contributions tend to be devalued during group work across different educational levels, from higher education (Leki, 2001; Morita, 2004) to K-12 settings (Kanno & Applebaum, 1995; Toohey & Day, 1999). For example, Toohey and Day's (1999) study on classroom interactions described how subtle power imbalances in group work can hinder ELLs' opportunities to contribute to the process and product of group work. Overall, these studies have shown that linguistic minority students tend to remain in marginalized positions during group work and internalize the perception that they are less competent members of the group.

The inequity in learning opportunities can be challenged with a well-designed pedagogical intervention. Previous studies on a particular group work pedagogy,

Complex Instruction (CI), shows the possibility of balancing inequities among students with different statuses and identities (Boaler, 2006; Cohen, Lotan, & Holthuis, 1997; Lotan, 2007). CI suggests a group work pedagogy including respecting multiple abilities, assigning group-worthy open-ended tasks, distributing roles, being explicit about students' responsibilities, and shared accountability (Boaler, 2006). Focusing on linguistic diversity, Bunch (2006) found that ELLs who presented fluent conversational proficiency but limited academic proficiency were able to better integrate into group work under CI. These studies altogether demonstrate the significance of attending to contexts and power dynamics in group work. The current study pays careful attention to students' friendship as one of the salient contexts affecting ELLs' engagement in group work.

### **Friendships and Power Dynamics in Group Work**

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; Zajac & Hartup, 1997). Students also reported a preference for working with friends of the same gender identity (Strough et al., 2001). During the interactions in groups, friends tended to make more proposals and spend more time on discussion (Fonzi et al., 1997).

Consequently, friend groups were reported to lead to more productive problem solving (Zajac & Hartup, 1997).

On the other hand, a study reported that students prefer to work with assigned partners because they feel pressured to choose their friends, even when friends do 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. Students reported that friendship is a complex relationship and that layers of social identities could affect collaboration during group work (Esmonde, Brodie, Dookie & Takeuchi, 2009).

Because friendships in school are dynamic and fluid (Faircloth & Hamm, 2011), treating friendships as an isolated variable will not necessarily generate an ecologically valid account. Students' friendship formation can change over time and can be affected by classroom learning experiences, especially experiences in group work. The very process of group work can impact friendship, as revealed in studies conducted in racially heterogeneous classrooms (Cooper & Slavin, 2001; Slavin & Cooper, 1999).

Additionally, friendships can be interrelated with other aspects, such as students' achievement, motivation, or personalities, and the way that friendships influence group work can be affected by the social organization of the classroom (Beaumont, 1999). As such, an ethnographic approach chosen for the current study is beneficial for capturing

the complexities of the classroom and the relationship between friendship and group work.

### **Identity and Learning in Sociocultural Theory**

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 distance between the level of a learner's independent problem solving and the level determined through problem solving in collaboration with peers and under appropriate guidance. It sheds light on the "buds" of development, namely, the prospective development of a learner that can "bloom" through collaboration with others. Sociocultural theory of learning, based on Vygotsky's theory, emphasizes that learning is not an individual's possessions. Rather than reducing learners to passive recipients of a body of factual knowledge, sociocultural theory emphasizes a dialectical unity of learning and development and "comprehensive understanding involving the whole person" (Lave & Wenger, 1991, p. 33). Conceptualizing learning as a process involving a change of identity is particularly relevant for the examination of group work, in which students simultaneously engage in "a content space (consisting of the problem to be solved) and a relational space (consisting of the interactional challenges and opportunities)" (Barron, 2003, p. 310).

To frame the concept of identity, I draw from the central tenet of sociocultural theory, which pays close attention to different time scales and multiple levels of history in development (Lemke, 2000; Saxe & Esmonde, 2005; Scribner, 1985). In emphasizing the multiplicity of identity, Holland, Skinner, Lachicotte Jr, and Cain (1998) conceived of

“persons as composited of many, often contradictory, self-understandings and identities, whose loci are often not confined to the body but spread over the material and social environment, and few of which are completely durable” (p. 8). By considering identity as working across different time scales, Wortham (2006) described how social identification during classroom micro-interactions of “participant examples” came to focus on certain students’ sociohistorical identities and shaped these students’ academic trajectories at school. For example, Wortham’s study demonstrated how two students were gradually identified according to sociohistorical models of identities through a locally constructed version of participant examples.

Conceptualizing identities on multiple time scales can help to capture the reality of the classroom, where students negotiate and develop different scales of identities. In this study, I focus on locally constructed social identity and positional identity in relation to students’ learning during group work. Through the lens of locally constructed social identity, I examine identities such as “ELLs,” “students who are adept at mathematics,” and “students who can speak ELLs’ first languages and can thereby help these students.” These social identities are reinforced by the way the school, classroom, and teacher’s assessments and observations are structured and may have prolonged effects over several months or even beyond the academic year. Positional identity is “the day-to-day and on-the-ground relations of power, deference and entitlement, social affiliation and distance—with the social interactional, social relational structures of the lived world” (Holland et al., 1998, p. 127). Positional identity sheds light on the moment-by-moment negotiation of a position actualized through “access to spaces, activities, genres and through those



genres, authoritative voices, or any voice at all” (p. 128). In this study, I examine students’ interactions and positional identities that they play during group work.

This study does not analyze participants’ reports of self-understanding or explanations of their identities. Instead, students’ agency to negotiate their positional identities is examined by the way they choose their group members when they are given a choice. This methodological decision is motivated by my concerns about the relationship between opportunities to learn and the power that is circulated through social relationships and social classification (Wortham, 2006).

### **Setting**

This ethnographic video-based research was conducted in an urban elementary school in a large school district in Ontario, Canada. The instructional language of this school was English, and the students began to learn French during Grade 4. The school had approximately 450 students, with more than 30 different language groups represented; 23 % of the students were born outside Canada, and for approximately 53 % of the students, English was not the language spoken in their homes. Students’ home languages varied; the major home languages other than English included Bengali, Cantonese, Farsi, French, Romanian, Russian, Spanish, Mandarin, Tamil, Urdu, and Vietnamese. Each regular class in the school had 15 to 20 students. I conducted participant observation in two Grade 4 mathematics classes taught by Ms. Sally Wilson<sup>1</sup>.

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<sup>1</sup> All of the participant names used are pseudonyms.

The school offered ESL programs for students who were new to Canada (less than two years since their arrival) and whose English language proficiency was developing<sup>2</sup>.

This study focused on four newly arrived immigrant students who were receiving ESL support at the school and attending ESL classes during language and social science classes. In my analysis, I focused on four participants, Ajmal, Daniel, Karim, and Sabina, who were the only students considered eligible for ESL programs at the school at the time of study. They were eligible because they came to Canada less than two years before the study was conducted and because they had limited English language learning opportunities at home or in their home countries.

Ajmal and Karim came from Afghanistan and spoke Farsi as their first language (L1); Sabina came from Bangladesh and spoke Bengali as her L1; and Daniel came from Mexico and spoke Spanish as his L1. Before coming to the school, Daniel had lived in Québec, a French-speaking province, where he had received school education in French. Sabina was a girl, and Ajmal, Daniel, and Karim were boys.

### **Context of Group Work**

In Ms. Wilson's classroom, group work was used daily for mathematics teaching. She used group work among full class discussions, word problem solving, project-based learning and hands-on activities. A variety of tasks were used for group work, with some tasks categorized as being accountable to individuals and others to the group. Some of

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<sup>2</sup> Even though there were many students who were considered to be ELLs in a broader sense, newly arrived students who were receiving ESL instruction were called "ELLs." Sometimes teachers called them "ESL students."

the tasks had multiple solutions, and others had one correct answer. In an interview, Ms. Wilson described her goal of using group work as follows:

I wanted them to talk about the math. So, if they're talking about math, they're learning from each other; they're having an opportunity to discuss it to use, hopefully, the vocabulary that's been introduced or that they have prior knowledge of. And then that will help them to start to form their own ideas and make connections.

As this quote suggests, Ms. Wilson used group work to increase the opportunities for students to talk, discuss ideas with each other, and use the mathematics vocabulary they were learning. Additionally, she used group work for students to formulate their ideas and make associations through discussion with other students.

In terms of the teacher's grouping strategy, at the beginning of the year, Ms. Wilson tended to assign groups to students. In assigning groups, Ms. Wilson grouped Ajmal, Daniel, Karim, and Sabina with students who were perceived as "being mathematically adept," "multilingual," "exhibiting leadership," and "caring." As suggested in the following excerpt from an interview with Ms. Wilson conducted at the beginning of the academic year, these groupings were intended to support ELLs who struggled to communicate in English:

I am hoping to get them working with classmates—I mean, working with somebody in the class I know who has good mathematical understanding but will help them to learn the math as well. But it's a double-edged sword because I'm worried that, instead of really learning math, they just sort of copy or go along with what the other student has—not really understanding the math.

Ms. Wilson also allowed students to choose their own group members later in the year and sometimes switched between two types of grouping depending on the students' attendance and desk arrangement. As such, there were periods when teacher-assigned groups and student-selected groups co-occurred during the same period of time. This unique context allowed me to examine newly arrived ELLs' opportunities to learn in both settings, especially by examining how their opportunities to learn varied between friend groups and teacher-assigned groups in the same month. Generally, newly arrived ELLs' academic language proficiency development requires a minimum of five years (Cummins, 2000). As such, I also included interactions from different months within the academic year for my analysis.

### **Data Sources and Analytic Methods**

This study draws from ethnographic data on group interactions in mathematics classes over an academic year. Video data and field notes on cooperative group interactions and audio-recorded interview data with the teacher were the main sources of data. The above-described lens of sociocultural theory was also influential for designing this study in framing the reciprocity between identity and learning, which is manifested through the relationship between friendships and group work.

The analysis focused on four ELLs' opportunities to learn in teacher-assigned groups and friend groups. The ELLs' friends were identified through the analysis of field notes taken during recess that recorded, for example, the games the students played and with whom they spoke. If I observed two or more students playing and talking together during recess for more than three weeks and if they chose each other for group members,

I categorized them as friends. Although this method does not leverage student interviews or questionnaires, it can offer ethnographic insights into students' friendship formation.

The total of forty-five hours of video data were collected over an academic year; however, the analysis focused on the segments of video that captured group work in which focal students were involved. Because group work was the main focus of this study, I did not use the videos of whole-class discussions, teacher lectures, or individual work. Ultimately, 20 hours of video were selected as the major data source for this study. Students' work and classroom artifacts were analyzed as supplementary data.

As a first step of analysis, for each video-recorded lesson, I wrote a detailed narrative of group work by focusing on the tasks completed by the groups, the artifacts the students used, and the groups' conversations. I then separated each narrative into episodes that were identified as the phases of collectively completing tasks. For example, when the students worked together on a word problem involving addition, phases of collectively completing tasks could include comprehending the word problem, proposing solution(s) and equation(s), solving the equation, and writing the solution. I identified all different phases of collectively solving word problems as separate episodes. I excluded episodes during which the teacher stopped by and provided a lecture for a small group (rather than simply checking on how the students were working in their groups) to analyze students' dynamics. As such, in total, I analyzed 77 episodes. For the analysis of group work processes, I transcribed the segments of the interactions, focusing on both the content of the conversation and the participants' actions (e.g., pointing to the picture on a worksheet, flipping through a notebook). The coding and descriptive quantitative analysis

were completed using the data analysis software MAXQDA. Fisher's exact test was used to compare students' interactions between the two types of groups.

### **Analysis Procedures for Group Work Interactions**

The analyses of interactions during group work entailed two steps. First, in order to obtain a broad picture of the relationships and identities that students constructed during group work, I referred to the coding schemes developed by Esmonde (2009) on work practices and positional identities. The code for work practices was used to characterize interactional patterns that students constructed during group work, and the code for positional identities was used to describe the power dynamics that students constructed during group work. I added the dimension of social authority (not necessarily mathematical authority) to the coding scheme I employed (Storch, 2002). The coding scheme for work practice is summarized in Table 1.

(Insert Table 1)

The code for positional identities was used, only when power imbalance was observed among group members, with reference either to their competence or to other forms of authority. By using the codes summarized in Table 2, I analyzed episodes in which newly arrived ELLs were positioned with respect to competence in relation to their peers or to a particular knowledge or task.

(Insert Table 2)

In order to calculate inter-rater reliability, out of the 77 coded episodes, I randomly selected 12 episodes (15% of the entire coded episodes) from different periods in the academic year. I recruited another coder who was not involved in data collection and hence did not know which students were considered to be friends. To compute the inter-rater reliability, I used Krippendorff's (2004)  $\alpha$ . Coding of both work practice and positional identities showed high inter-rater reliability. For the work practice coding, agreement rate was 83.3 % (Krippendorff's  $\alpha=0.771$ ). For the positional identities coding, agreement rate was 91.7% (Krippendorff's  $\alpha=0.88$ ). After a subsequent discussion with the other coder, I came to understand that disagreement occurred largely because we paid attention to different aspects of interactional details. For example, the other coder coded a work practice as helping based solely on a student utterance, "Can I help you with this?" However, I coded the same episode as authoritative by paying attention to the subsequent interactions in which one student was forced to erase his written work by another student. Subsequent discussion was held until the two coders came to an agreement.

Second, I focused on the process of group work by examining student interactions. In the subsequent results section, I present excerpts of interactions from the most frequently occurring patterns of work practices and positional identities in friend groups and teacher-assigned groups. Additionally, I present the interaction patterns observed uniquely in both types of groups. In analyzing the video-recorded interactions, I focused on the types of mathematics and language learning opportunities available to ELLs. Specifically, I analyzed tasks that were undertaken by ELLs, types of questions and responses, and who shared ideas and how.

## Results

### Work Practices and ELLs' Positional Identities in Friend Groups and Teacher-assigned Groups

This section presents the findings on work practices and ELLs' positional identities during group work in friend groups and teacher-assigned groups. As summarized in Table 3, when focusing on work practices, helping work practice was most frequently observed in both groups. In other words, during group work, students were often seen helping each other to complete tasks or to understand particular concepts, formulas, and definitions of terms. There was a significant association between students' work practices during group work and types of groups ( $p=0.015$ , two-tailed Fisher's exact test). In friend groups, 27.5% of the episodes were categorized as collaborative, whereas 5.4% of the episodes were collaborative in the teacher-assigned groups. Students tended to work together and discuss each other's ideas when working with friends. Authoritative work practice was observed only in teacher-assigned groups. In authoritative work practice, students did not engage in meaningful discussions. It is noteworthy that few off-task work practices were observed and that there were more off-task conversations in teacher-assigned groups than in friend groups.

(Insert Table 3)

The findings on ELLs' positional identities during group work were crucial for distinguishing between two different types of helping work practices: ELLs being helped by others and ELLs helping others. Table 4 summarizes the number of episodes at the intersection of the particular positional identities of ELLs and the work practice.



(Insert Table 4)

As Table 4 indicates, in both friend groups and teacher-assigned groups, focal students tended to be positioned as novices. However, when working with friends, these students also accessed the positional identity of experts, meaning that there were occasions when ELLs offered their expertise in relation to tasks. In non-friend groups, there were occasions when focal students were positioned as subordinates, even when their peers did not necessarily have a sufficient knowledge basis to merit a dominant role. In these interactions, ELLs were forced to follow others because certain tasks were taken away from them or because they were denied the opportunity to participate.

### **Qualitative Characteristics in Friend Groups and Teacher-assigned Groups**

In this section, I examine the interactional characteristics when ELLs worked with friends whom they selected, versus with teacher-assigned peers. The following excerpts of interactions were selected to show both the most frequently occurring patterns of interactions observed in friend and teacher-assigned groups and the patterns unique to each group.

**Helping work practice, ELLs as novices (teacher-assigned groups).** The relationships constructed in the teacher-assigned groups were characterized by ELLs staying in a position of being instructed, helped, and given the correct answers. As the following episodes demonstrate, one of the students (i.e., the student who was perceived to be good at mathematics) played the role of a “teacher,” and the knowledge presented by that student was not questioned by his or her peers. The conversation did not yield opportunities for challenging, revising and exploring ideas. I describe this process in

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further detail by drawing from the following episode of a teacher-assigned pair between Ajmal, who was a newly arrived ELL, and his peer, Craig, who was considered to be good at mathematics. Craig's first language was English, whereas Ajmal's first language was Farsi.

In this episode, Ajmal and Craig were working on the following word problem, which was written on the blackboard: "The archery team A hit 367 times. Team B hit 412 times. Did the two teams together hit 800 times? If not, by how much did they miss?" They were given one sheet of chart paper between them and were expected to provide one answer. Initially, Craig alone read the word problem aloud.

Excerpt 1 (November 19)

1	00:00:06	Craig	Four hundred twelve, okay? <i>Ajmal holds a pen. Craig and Ajmal both look at the chart paper.</i>
2	00:00:10	Craig	Four. <i>Ajmal writes. Craig watches what Ajmal is writing.</i>
3	00:00:14	Craig	Yeah. <i>Ajmal looks up and at Craig.</i>
4	00:00:20	Craig	Twelve. <i>Ajmal writes.</i>
5	00:01:03	Craig	Seven plus two?
6	00:01:06	Ajmal	Seven plus two is. <i>Craig waits for Ajmal.</i>
7	00:01:28	Craig	Nine. <i>Craig writes on the chart paper.</i>
8	00:01:43	Craig	Okay, six plus one. What's six plus one?
9	00:01:52	Ajmal	Seven.
10	00:01:55	Craig	Yes, seven. <i>This time, Craig writes down the number.</i>
11	00:02:27	Craig	Three plus four is? <i>He looks at Ajmal.</i>
12	00:02:30	Ajmal	Three plus four.
13	00:02:33	Ajmal	Seven.
14	00:02:35	Craig	Okay, write that down.
15	00:02:36	Ajmal	Here?
16	00:02:41	Craig	Yeah.

The interaction (e.g., utterances 8–10) in Excerpt 1 is characterized by the *I (Initiation)-R (Response)-E (Evaluation)* pattern (Mehan, 1979). Craig provided Ajmal with step-by-step instructions without engaging in discussions of what was being asked in the problem or how to solve the problem (utterances 5, 8, and 11). Craig broke down the addition of three-digit numbers ( $367 + 412$ ) into several additions of single-digit numbers ( $7+2$ ,  $6+1$ ,  $3+4$ ). As observed in Craig's approval of the answers (utterances 10, 14) and in his answer to his own question (utterance 7), Craig was checking whether Ajmal could answer his questions. Ajmal recorded the sum of each digit by connecting two numbers with arrows but did not record the sum of the whole numbers. Thus, the interaction did not reveal information about Ajmal's understanding of adding three-digit numbers, which was one of the learning goals of this lesson. In this sense, this interaction is considered a simplification of a word problem rather than an interaction leading to Ajmal's engagement in solving word problems. In the subsequent interaction, the teacher checked on the group and worked with Ajmal to check his comprehension of the word problem. Because Ajmal responded that he did not understand the problem, the teacher explained the meaning of some words, such as "archery," using gestures of drawing a bow.

In these interactions, Craig did not engage in a discussion about his current mathematical understanding. For example, to add three-digit numbers, Craig invented a system of notation that connected each place value with arrows (Figure 1). This notation can be difficult to transfer to addition with regrouping; however, this issue was not addressed in the group. Instead, as demonstrated in Excerpt 1 above, Craig gave instructions on how to write the answers, and Ajmal strictly followed his instructions.

(Insert Figure 1)

Language learning opportunities in this interaction between Ajmal and Craig were limited to spelling feedback, as observed in Excerpt 2, as follows. Craig gave an answer to the word problem, and Ajmal copied it down. In this process, Craig also gave spelling instructions to Ajmal. Although this instruction provided Ajmal with an opportunity to learn the spelling of words, it also reinforced Ajmal's linguistic deficiencies and hindered his engagement in conversations about the mathematical problem.

Excerpt 2 (November 19)

- |   |          |       |   |
|---|----------|-------|---|
| 1 | 00:09:07 | Craig | Okay, <u>you</u> write, you write. "The archery academy."<br><i>Ajmal writes.</i>   |
| 2 | 00:09:14 | Craig | T-H-E<br><i>(Craig spells it out for Ajmal.)</i><br><i>Craig stands up and goes to point to the word "archery" in the word problem written on the blackboard.</i> |
| 3 | 00:09:26 | Craig | A-R-C-H-E-R-Y<br><i>Craig watches over Ajmal.</i>   |
| 4 | 00:09:28 | Craig | Write a little bigger than that.<br><i>Ajmal continues writing, and Craig observes what Ajmal is writing.</i>   |

The interaction between Craig and Ajmal leaned towards a calculation orientation, focusing on identifying and performing procedures without a careful examination of contexts (Thompson, Philipp, Thompson, & Boyd, 1994). Craig's initial incorrect answer ("the archery academy would need to hit the target 131 more times") was maintained until the teacher later noted the mistake.

Similar interactional patterns were observed in group work between Sabina who is a newly arrived ELL, and a teacher-assigned partner, Cathy, who was considered to be good at mathematics. During group work, Cathy asked several times for Sabina's ideas; however, Sabina did not contribute verbally and simply agreed with Cathy's ideas. An

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example of this type of interaction is given in Excerpt 3. In this interaction, Sabina and Cathy worked together to identify and write characteristics of various three-dimensional objects. They attempted to identify the characteristics of an octagonal prism in front of them. Cathy took the lead in completing the task but occasionally solicited Sabina's ideas.

### Excerpt 3 (February 3)

1	00:00:10	Cathy	<i>Cathy counts how many corners the shape has. It's an octagon.</i>
2	00:00:17	Cathy	<i>I'm not sure how to call a 3D octagon. I forgot.</i>
3	00:00:21	Cathy	<i>I forgot what it's called.</i>
4	00:00:33	Cathy	<i>That has 6 bridges, I think. She starts to write that down. Sabina does not talk.</i>
5	00:00:44	Cathy	<i>Anything else?</i>
6	00:00:54	Cathy	<i>Sabina takes the shape and continues looking at it. Cathy, without consulting Sabina, writes down the answer. It has 10 faces.</i>
7	00:00:58	Cathy	<i>Anything else?</i>
8	00:00:56	Sabina	<i>Sabina nods. Yeah.</i>
9	00:01:00	Cathy	<i>What?</i>
10	00:01:03	Sabina	<i>Sabina holds the shape and looks at it. Sabina then shakes her head.</i>

As is evident in this interaction, even when Cathy solicited Sabina's ideas (utterances 5, 7, and 9), Sabina did not offer any. Cathy continued providing opportunities for Sabina to contribute her ideas, such as stating that she forgot the term to describe a 3D octagon or soliciting Sabina's ideas. Sabina did not express where she needed help; therefore, from this interaction, it is difficult to identify how Cathy offered to help Sabina.

**Helping work practice, ELLs as novices (friend groups).** As the following interaction demonstrates, in contrast to the interaction with the student who was adept at

mathematics, Sabina tended to express her problems and share her ideas when working with her friend. In the following friend group episode, which occurred during the same period as Excerpt 3, Sabina was working with her friend, Jasmine. Jasmine was an immigrant student from Pakistan but was not receiving ESL instruction because she had been in Canada for more than two years. When given the opportunity to select their partners, Sabina and Jasmine chose to work with each other. They were each provided with a worksheet, and the task was to calculate the area of each given shape. In this particular episode, they worked to calculate the area of a rectangle (height: 3 cm; width: 5 cm). In contrast to the above interactions with power asymmetry, the following interaction is characterized by an equal power balance between the students, and Sabina explicitly raised questions and told Jasmine when she needed help. In this case, Sabina was unsure how to calculate the area of the rectangle. In the following interaction in Excerpt 4, Sabina initiated a conversation by asking, “What’s a base?” Jasmine answered Sabina’s question by providing information on how to compute the area, assuming that Sabina was asking what the length of a base was. Even after this interaction, Sabina expressed uncertainty about calculating the area. In the subsequent interaction, Jasmine clarified the meanings of the base and the height of a rectangle.

Excerpt 4 (February 18)

- |   |          |         |   |
|---|----------|---------|---|
| 1 | 00:15:05 | Sabina  | What's a base?<br><i>Jasmine shows her work to Sabina and begins explaining.</i>              |
| 2 | 00:15:15 | Jasmine | There's two over here, and this is three, so two over here and three over here.               |
| 3 | 00:15:18 | Jasmine | See, three times two, so six units.   |
| 4 | 00:15:22 | Sabina  | <u>So, six?</u>   |
| 5 | 00:15:26 | Jasmine | So, over here, one, two, three, <u>it's</u> three.  |
| 6 | 00:15:29 | Sabina  | No, no, no ... we have to do this one first.<br><i>Jasmine moves on to the next question.</i> |

## FINAL ACCEPTED VERSION

- 7 00:15:39 Jasmine *Jasmine talks to herself.*  
Three times five...three, six, nine, twelve, fifteen....  
*Jasmine writes.*
- 8 00:15:47 Sabina What?
- 9 00:15:53 Jasmine *Jasmine shows her work to Sabina.*  
See, over here, it's three, and then, over here, it's five, so,  
you do three times five; how much is it?
- 10 00:15:56 Jasmine *Jasmine answers her own question.*  
Three, six, nine, twelve, and fifteen! See? Get it?  
*Sabina also looks at the problem and starts writing while saying, "Ohhhh."*
- 11 00:16:02 Sabina But how do you get three?  
*Jasmine does not respond.*
- 12 00:16:04 Sabina How do you get three?
- 13 00:16:06 Jasmine *Jasmine points at her worksheet.*  
Over here.
- 14 00:16:08 Jasmine *Jasmine points to the picture on the worksheet, and Sabina leans over Jasmine's desk and looks at it.*  
One, two, three, this is the height.
- 15 00:16:14 Jasmine *Jasmine draws on the picture on the worksheet.*  
This is called "base" and this is called "height."
- 16 00:16:16 Sabina Oh ... now I get it.

This example can be contrasted with interactions in a teacher-assigned group. Although Sabina was still positioned as a novice and Jasmine as an expert in this interaction, Sabina was able to clarify when she needed help and what she did not understand. When working with Jasmine, Sabina was often more talkative than when she worked with students who were perceived as being good at mathematics.

**Collaborative work practice, ELLs as experts (friend group).** Here, I present an example from episodes classified as collaborative work practices in which Sabina was positioned as an expert. In this friend group interaction, Sabina and Jasmine worked together on a textbook problem regarding appropriate units for measuring various objects (such as desks, pencil cases, and students' heights).

Excerpt 5 (February 11)

**FINAL ACCEPTED VERSION**

- 1 00:15:39 Jasmine *Jasmine reads aloud the word problem from the textbook (with only one book between them). Which unit would be best ... perimeter of each object ... explain your choice. Sabina is also looking at the textbook.*
- 2 00:15:44 Jasmine *Jasmine stops. Ah?*
- 3 00:15:58 Jasmine *Ohhhh... so only what we do here, we'll write a, b, c, d and what we would choose and what we would choose for this one. Sabina points to the textbook.*
- 4 00:16:00 Jasmine *I know. What we would choose, like...*
- 5 00:16:02 Jasmine *Jasmine picks up an object. It stinks! Ew... Sabina laughs.*
- 6 00:16:15 Jasmine *Jasmine returns to looking at the textbook. For these things, what kind of unit would you use? Would you use kilometers? Would you use millimeters?*
- 7 00:16:14 Sabina *Hmmm... Let's use centimeters.*
- 8 00:16:24 Jasmine *No, but, okay, so, for teacher's desks, what would you use?*
- 9 00:16:22 Sabina *Kilometers?*
- 10 00:16:26 Sabina *Millimeters?*
- 11 00:16:38 Jasmine *Hmmm... What did we use for our desks? Did we use millimeters?*
- 12 00:16:38 Sabina *Yeah*
- 13 00:16:41 Sabina *Wait, let me ... Sabina flips through her notebook.*
- 14 00:16:58 Sabina *She turns to the page on which the information is written. Anyways ... we used for our desks centimeters.*
- 15 00:17:18 Jasmine *Jasmine mumbles "centimeters" and then starts to write this down in her notebook.*

In both Excerpts 4 and 5, Sabina's partner used questions to elicit Sabina's ideas (i.e., "What do you think?" "What unit would you use?" "Anything else?"). This type of "other-monitoring" question (Goos, Galbraith, & Renshaw, 2002, p. 199) is a characteristic of collaborative group work. In Excerpt 5, Sabina decided their final answer. In this process, Sabina was able to use her notebook as a resource in which she had recorded the information given in class.



The interaction between friends in Excerpt 5 was characterized by reciprocity in conversational turns. Utterances were divided equally; thus, there were more opportunities for Sabina to participate. Their relationship was already well established before engaging in group work. This established relationship contributed not only to the mutual participation of both students but also to a focus on the content. When Jasmine went off-task in conversation (in utterance 5), Sabina reacted by laughing with her; however, they quickly returned to discussing the mathematical problem. Thus, their interaction tended to focus on content rather than on off-task conversations. The interaction below shows how discussing mathematical content can be sidetracked if the relationship between group members is not well established.

**Authoritative work practice, ELLs as subordinates (teacher-assigned groups).**

Excerpt 6, taken from a teacher-assigned group, illustrates how content space can be sidetracked when the relationship is not well established. Karim, another newly arrived ELL, worked with Michael, who sat close to him. Their work practice during group work was characterized as authoritative because Michael unilaterally rejected Karim's contributions. In the interaction in Excerpt 6, they were solving a problem on elapsed time (how much time had elapsed between 7:40 am and 9:15 am). Just before the interaction in Excerpt 6, the teacher had asked Michael and Karim to discuss each other's work because they had reached different answers. They did not begin a discussion; instead, Michael continuously criticized and mocked Karim's handwriting (utterances 5–8). Even after the teacher checked their work and asked them to discuss the differences between their answers, they still did not begin discussing the problem (utterances 12–16)

**FINAL ACCEPTED VERSION**

and instead played with pencils. Their relationship was not collaborative, as observed in the utterance by Michael mocking Karim's pencil (utterances 14–16).

Excerpt 6 (March 11)

- 1 00:03:31 Michael *Michael looks at Karim's notebook with a yawn.*  
It's not supposed to be one hour—but it's supposed to be thirty-five minutes.  
*Karim leans over to Michael's desk.*
- 2 00:03:33 Karim *Karim looks at his own notebook, which Michael is holding.*  
One hour.
- 3 00:03:38 Michael *Michael also looks at Karim's notebook and asks him.*  
...And how long is that one?
- 4 00:03:42 Karim *Karim mumbles his answer (inaudible).*
- 5 00:03:53 Michael *Michael laughs out loud.*  
Yeah. You didn't write one full hour. You wrote forty-three hours and fifteen minutes.
- 6 00:03:56 Michael *Forty-three hours and fifteen.*
- 7 00:04:01 Karim *Karim yells.*  
That one is for this.
- 8 00:04:03 Michael *Yeah, but that can't be forty-three hours.*
- 9 00:04:04 Michael *I get this.*
- 10 00:04:09 Karim *This one?*
- 11 00:04:14 Michael *Michael, while erasing what Karim wrote, says:*  
How can that be forty-three hours?  
*Michael continues to make fun of Karim's handwriting. As they become noisy, the teacher checks in on the group.*
- 12 00:04:51 Teacher *The teacher looks at both of their work and compares their answers.*  
So, this answer says "thirty-five minutes," and you have a very different answer here. You have four hours... No, one hour and thirty-five minutes. You guys should check this one.  
*The teacher leaves.*
- 13 00:05:32 Teacher *As Michael and Karim are playing with pencils and erasers, the teacher returns.*  
Why do you have a different answer here?  
*She then leaves.*
- 14 00:06:04 Michael *When the teacher leaves, Karim and Michael start to play with pencils again.*  
Is that yours? Where did you get it?
- 15 00:06:08 Karim *At Dollarama.*
- 16 00:06:10 Michael *Michael laughs.*  
Huh, Dollarama.

The authoritative relationship between Karim and Michael affected how they discussed the problem. As seen in utterance 12 in Excerpt 6, the teacher noted the difference between Karim's answer (1 hour and 35 minutes) and Michael's answer (35 minutes). For this particular problem, Karim's answer was correct (as seen in utterances 1 and 12). Noticing this difference, the teacher encouraged students to discuss their answers on their own. However, when the teacher was not monitoring their work, Michael and Karim did not begin a discussion; instead, Michael teased Karim about his handwriting or his belongings.

Throughout this interaction, Karim was not positioned as a competent contributor; therefore, his ideas were not even solicited. Even though Karim's answer was correct, Michael insisted that his answer was correct throughout (utterances 1 and 9) and did not listen to Karim, even after the teacher intervened and encouraged discussion. In this case, Michael's authority was backed by his social authority rather than his mathematical authority. This example shows how a relational space can interfere with a content space that is being constructed. In the data set analyzed for this paper, this type of authoritative work practice was observed only in teacher-assigned groups, in which friendships were not well established.

### **Discussion**

This ethnographic study examined students' opportunities to learn in linguistically diverse mathematics classrooms in a Canadian elementary school, given the contextual change of group work. I examined how newly arrived ELLs' opportunities to learn differ between student-selected friend groups and teacher-assigned groups. Based on analyses

of video-recorded interactions, this study revealed that ELLs tended to gain access to a wider variety of work practices and positional identities when working with friends. The interactions in friend groups demonstrated that ELLs were able to express their difficulties and problems to their peers. In friend groups, ELLs were also positioned as experts and engaged in collaborative work practices in which ELLs were able to further engage in discussion and offer ideas.

Relatively few studies have examined linguistic diversity in relation to group work processes in mathematics classrooms. Issues examined by previous studies include how social organization and pedagogical orientations impact students' mathematical communication in groups (Brenner, 1998) and how bilingual learners' languages served as resources for social and problem-solving functions during group work in mathematics classrooms (Moschkovich, 2007; Zahner & Moschkovich, 2011). Little investigation has been conducted on the relationship between friendship and group work in linguistically diverse content classrooms. Newly arrived ELLs tend to be transient and are thus more vulnerable to challenges in establishing friendships, partially as a result of this mobility (Gunderson, D'Silva, & Odo, 2012). Additionally, in racially and linguistically heterogeneous schools, friendships and social groupings can be based on racial and linguistic groups (Olson, 1997) and friendship formation can influence how students experience group work. Consequently, this study contributes to the discussion on learning through group work by revealing the role of friendship for mathematics learning in the context of various groups in linguistically and racially heterogeneous classrooms.

### **Opportunities to Learn and Identities in Group Work**

The findings from this study can be partially explained by some of the positive interactional characteristics among friends: understanding each other better, having a stronger commitment to maintaining a good relationship, and feeling more secure in working with each other (Azmitia & Montgomery, 1993; Fonzi et al., 1997; Hanham & McCormick, 2009; Strough et al., 2001; Zajac & Hartup, 1997). However, this ethnographic study does not aim to demonstrate a causal relationship between friendship and ELLs' opportunities to learn in group work.

Rather, this study highlights how opportunities to learn are contextualized by students' multiple layers of identities and their friendships constructed inside and outside classrooms. In this light, it is noteworthy that the teacher initially assumed that the best group members for newly arrived ELLs would be students who were categorized as "being mathematically adept," "exhibiting leadership," and "caring." The interactions presented in teacher-assigned groups show that students who were assumed to be mathematically competent tended to offer more ideas, assume the lead, and have more opportunities to discuss ideas. In contrast, newly arrived ELLs tended to assume a more passive role and occasionally depended on peers to solve problems. This finding can be interpreted from positioning theory, which maintains that a person who is positioned as incompetent in a certain field will not contribute to discussions in that field (Harré & Van Lagenhove, 1999). Given that previous studies have maintained that students who engage in explanations and participate in elaborate discussions tend to benefit more from group work (Chizhik, 2001; Webb, 1985), this difference in participation can further perpetuate the existing learning gap between ELLs and students who are considered to be adept at mathematics.

By focusing on friendship as a context of group work, the current research advances the discussion on social identities and power dynamics that influence student collaboration (Engle et al., 2014; Esmonde & Langer-Osuna, 2013; Langer-Osuna, 2011). Rather than treating power dynamics as fixed, this study compared and contrasted ELLs' opportunities to learn under different contexts of group work. Furthermore, this study provided insight into students' friendship formation. When given a choice, students did not select teacher-assigned partners for group work but rather chose students with whom they played during recess. This finding supports the idea that students' friendship formation and group member preferences can be influenced by implicit power dynamics shaped through students' social identities (e.g., race, and gender) (Esmonde et al., 2009). Further analysis of this aspect will be beneficial to consider whether and how group work process can challenge existing group and friendship formation and power relations in linguistically diverse classrooms (Cooper & Slavin, 2001).

This study also contributes to the discussion on the unity of affective and intellectual processes. By critiquing the dominance of cognition in psychological research on learning, Holzman (2009) maintained that cognition and emotion are unified processes of learning and development; therefore the zone of proximal development proposed by Vygotsky (1978) can be interpreted as the zone of emotional development. Because group work is a collective space in which individuals learn and develop together, the way they feel about working together cannot be less significant than the way they solve a task or what they collectively think.

### **Limitations**

The findings presented here are based on an ethnographic study in a single school. To further investigate the complex relationship between friendship and group work involving ELLs, additional studies with various methodologies will be necessary. For example, this study did not measure students' mathematical and linguistic performance subsequent to group work. As shown by Barron (2003), such an investigation can yield rich findings on whether and how group work interactions can be internalized by each member of a group. In this study, I did not combine insights gained from group work learning or other contexts of learning such as whole class discussions, because the main purpose of this study was to investigate different contexts of group work. In future research, cross-analysis across group work, individual performance, and whole class discussions can be meaningful to identify the relationships between different contexts of learning.

Additionally, because this ethnographic study compared interactions in teacher-assigned groups that were mainly observed earlier in the year and friend groups, which occurred later in the year, there is a potential order effect in the results I presented. This limitation was partially addressed by including and analyzing the interactions in both types of groups occurring in the same month. Given that academic language development for ELLs generally takes five years or longer (Cummins, 2000), the potential order effect can be assumed to play a minimum role for the difference in ELLs' linguistic performance between the two types of groups over the academic year. Further trajectory analysis beyond an academic year will be meaningful to help reveal ELLs' mathematics language development in group work over a longer period of time.

### **Pedagogical Implications**

This study aims to initiate discussion regarding how and when ELLs and/or linguistic minority students can meaningfully engage in group work and ultimately enhance their learning opportunities. In the classroom examined in this study, the teacher regularly observed which groupings were effective and how students engaged in the interactions. The teacher keenly observed the students' group work, and her observations led to flexibility in grouping the students. This study highlights the significance of this type of experimentation by the teacher to enhance students' opportunities to learn during group work. This finding corroborates previous research examining the role of teachers' discourse in creating productive learning environments in linguistically diverse mathematics classrooms (Aguirre, & del Rosario Zavala, 2013; Takeuchi & Esmonde, 2011).

As noted by Barron (2003), learners simultaneously engage in a content space and a relational space in group work. In group work, students not only discuss the content or tasks but also engage in relationship building. As a significant part of school life, friendships can affect students' classroom learning and identities in school. In a group that adopts authoritative work practices, the inferior position assigned to ELLs can be further reinforced. Because learning involves the development of participant identities in communities of practice, it is important to design cooperative group work that helps all students develop identities as significant and competent contributors to a classroom community.



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TABLE 1  
Coding Scheme for Work Practices

<i>Work Practice</i>	<i>Definition</i>	<i>Example</i>
Individualistic	<p>“A propensity for working individually before consulting one another, for not asking for help when needed, and for denying help to group members who expressed confusion or requested assistance” (Esmonde, 2009, p. 256). In addition, if a student was excluded from group interaction, I coded it as an instance of individualistic work practice.</p>	<p>Sabina (an ELL) and Cathy are both writing down conclusions based on the survey they have conducted. They are sitting next to each other but working individually, without talking. Cathy leaves Sabina to ask the teacher questions.</p>
Collaborative	<p>“Group members put their ideas together, worked together, and seemed to act as ‘critical friends’ when considering one another’s ideas. Rather than quickly accepting or rejecting one another’s idea, collaborative groups discussed and critiqued ideas put out onto the public floor” (Esmonde, 2009, p. 256).</p>	<p>Jasmine and Sabina (an ELL) are working on a word problem. Jasmine reads the problem aloud while Sabina is looking at the problem. Once Jasmine finishes reading aloud, Sabina takes out a calculator and suggests adding some of the numbers in the problem.</p>
Helping	<p>“Mathematical talk was asymmetrically organized, in which one or more students instructed other students about what to do” (Esmonde, 2009, p. 256).</p>	<p>Iris and Ajmal (an ELL) are working on textbook problems. Iris completes the problem earlier than Ajmal does. Looking at Ajmal’s notebook, Iris asks him to mark all of the numbers in a stem-and-leaf graph. Iris then shows him an example of how to mark the graph. Ajmal starts working quietly while Iris waits for him to complete his task.</p>
Authoritative	<p>Students with social authority (but not necessarily mathematical authority) dominated the conversations and held the power to assign tasks or to decide the correctness of ideas (Storch, 2002).</p>	<p>Karim (an ELL) and Naomi are creating a survey sheet. While examining Karim’s work, Naomi repeatedly asks him, “Can I help you with this?” Karim does not respond but continues working. Eventually Naomi takes away his survey sheet, starts to erase what he has written, and rewrites it.</p>

*Note.* ELL = English language learner.



TABLE 2  
Coding Scheme for Positional Identities

<i>Positional Identity</i>	<i>Definition</i>	<i>Example</i>
Expert	“A group member who was frequently deferred to (mathematically) and who was often granted authority to decide whether his or her own and other students’ work was correct” (Esmonde, 2009, pp. 257–258).	Iris, Laura, and Daniel (an ELL) are designing a survey. Iris gives Daniel instructions on how to create a survey. She takes out the paper he is holding and starts writing down the example survey. Daniel grabs the paper and starts writing down something on his own. Iris examines his work. Expert: Iris Novice: Daniel
Novice	“A student who deferred to an expert (positioning himself or herself as less competent) and whose opinion was frequently passed over in discussions of mathematical controversies (positioned by others as less competent)” (Esmonde, 2009, pp. 257–258).	
Dominant	A group member who dominated the conversation without presenting any validation of mathematical competence or knowledge (Storch, 2002).	Karim (an ELL) and Naomi are creating a survey sheet. While examining Karim’s work, Naomi repeatedly asks him, “Can I help you with this?” Karim does not respond but continues working. Eventually Naomi takes away his survey sheet, starts to erase what he has written, and rewrites it. Dominant: Naomi Subordinate: Daniel
Subordinate	A group member who followed instructions or orders without questioning the dominating students’ authority (Storch, 2002).	

*Note.* ELL = English language learner.

TABLE 3  
Work Practices in Friend Groups and Teacher-Assigned Groups

<i>Work Practice</i>	<i>n</i>	<i>%</i>
Friend groups		
Off task	1	2.5
Authoritative	0	0
Helping	18	45
Collaborative	11	27.5
Individualistic	10	25
Total	40	
Teacher-assigned groups		
Off task	4	10.8
Authoritative	3	8.1
Helping	15	40.5
Collaborative	2	5.4
Individualistic	13	35.1
Total	37	

TABLE 4  
The Intersection of Positional Identities of Focal English Language Learners and Work Practices in Friend Groups and Teacher-Assigned Groups

<i>Work Practice</i>	<i>Positional Identity</i>			
	<i>In Between</i>	<i>Novice</i>	<i>Expert</i>	<i>Subordinate</i>
Friend groups				
Helping		13	4	
Collaborative	1		4	
Individualistic		3		
Teacher-assigned groups				
Helping		15		
Authoritative				3
Individualistic		2		