Respectful Student Interaction and Learning Through Complex Instruction

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Abstract

Status can be a significant barrier to student success in a cooperative learning classroom. High-status students often attempt to dominate their groups, while lower-status students retreat and fail to engage. This results in an engagement and achievement gap between high and low-status students. This study attempts to determine if the implementation of Complex Instruction would create a more equitable learning environment and close the gaps created by differences in status. Complex Instruction strategies implemented include role training, assigning competence, group accountability, and group-worthy tasks. This mixed-methods study in two sixth grade math classes found a significant change in class culture through collection of surveys, group work artifacts, videotaped class sessions, and student interviews. Students expanded their definition of what it means to be "good at math" and found that previously low-status classmates were capable of critical contribution to group products. Positive student engagement in cooperative learning tasks was improved, and students used increasingly respectful and equitable learning cooperative learning strategies. This expands on previous research, showing positive impact of Complex Instruction on a primarily white, middle class subject group.

Keywords: accountability, cooperative learning, Complex Instruction, equity, roles, status

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Chapter 1: Research Question and Literature Review

Introduction

In the ten years since I began teaching middle school, I have worked to implement cooperative learning strategies within my classroom. I have seen students develop many life skills through cooperative learning, such as listening skills, cooperation, and the value of using classmates as sounding boards for ideas. I am not alone in these observations, as students report both academic and non-academic benefits of cooperative learning (Cerezo, 2004; Gottschall, Garcia-Bayonas, 2008). In addition, many standards-based curricula emphasize a cooperative learning system, including the one recently adopted by my district.

As I have implemented cooperative learning groups as a way to enhance student learning and productive disposition, I have observed that status can become a significant barrier to accomplishing these goals. Status is a generalized social ranking where it is better to be higher than lower. This shows most clearly in the classroom through expectations for competence. High-status students are expected to be more competent at important academic skills than low-status students (Cohen, 1994). Status manifests in cooperative learning as some students attempt to dominate, while others retreat and fail to fully engage in the lesson. My students who do not become fully engaged in the group work show lower achievement than their counterparts and, in this era of high-stakes testing, it has become a widely stated national goal of education that all students succeed. In order to be successful, all students must be engaged.

Students engaged in a lesson involving small group work are not only attentive, but are active participants. They contribute to the group and fully participate in assigned roles (Herrenkohl, 2006). They seek out help when needed and use that help to work through the task (Webb & Mastergeorge, 2003). Engaged students seek conceptual understanding of the lesson and push themselves and others for justification (Webb & Farivar, 1994).

Complex instruction is a suite of strategies which have been shown to reduce differences in status within a cooperative learning classroom and create a more equitable learning environment (Cohen, 1994). This research will look at how implementation of complex instruction affects the engagement of all students in a cooperative learning classroom.

Engagement and Achievement

One goal of an engaged classroom is to produce an increase in student achievement, as this is how students, teachers, and schools are measured in this era of high-stakes testing. It is thus important to establish a positive relationship between engagement and learning before determining strategies for nurturing student engagement. Fortunately, this correlation has been established through numerous studies across cultural boundaries and SES levels (Appleton, Christenson, & Furlong, 2008).

Noreen Webb has researched the connection between achievement and student engagement extensively (Webb & Farivar, 1994; Webb, Farivar, & Mastergeorge, 2002; Webb & Mastergeorge, 2003; Webb, Nemer, & Ing, 2006). Struggling students who not only participated in class but were involved on a deeper level by requesting, providing,

and responding to high quality help showed markedly higher achievement. The quality of help requested or given and an active response to that help were significant predictors of student achievement. High quality help involves either guiding the peer through the problem or giving an answer and including all steps with justification. An active response consists of either reworking the problem or doing another problem on their own or with the help of the peer, going through each step with justification. Every student who requested help by asking for specific information, received high-quality help, and was able to verbalize their work at the highest level passed the post-test. No other students passed, including those who requested high-quality help and then did not receive it and students who did not request high-quality help but then did receive it (they did not use it). This applied to the quality of help from both teachers and peers. Knowing how to ask for, respond to, or give quality help is not something students are often able to do without a combination of training and teacher modeling. Webb and Farivar found that students made significantly higher gains on their post-test if they received extra cooperative learning training with a teacher. Even with training, teachers must continue to model the behaviors they wish their students to reproduce. Given training in cooperative learning strategies, students will not use those strategies if their teachers do not model them as well (Ding, Li, Piccolo, & Kulm, 2007; Webb, Nemer, & Ing, 2006).

While strong student engagement leads to achievement, studies have determined that a lack of engagement in school is the strongest predictor of students dropping out of high school (Appleton, Christenson, & Furlong, 2008; Archambault, Janosz, Morizot, & Pagani, 2009). A striking statistic that makes this issue important in my sixth grade

classroom is the finding that students whose engagement patterns are low by age twelve are those most likely to drop out (Archambault, Janosz, Morizot, & Pagani, 2009).

Jo Boaler's Railside study also supports a connection between complex instruction and achievement (Boaler, 2006). Four years after implementing complex instruction at Railside, students were outperforming traditional schools on standardized tests, more students were taking calculus, and inequities in outcomes amongst all ethnic groups were lessened.

Phoenix Park was another school in which Jo Boaler employed inquiry methods in an effort to create more equitable learning opportunities for all students and successfully lessened the achievement gap (Boaler, 2002). At Phoenix Park, open-ended instruction techniques were implemented and the correlation between social class and mathematics achievement was lessened, while a similar school using traditional instruction saw their achievement gap widen.

Both Railside and Phoenix Park were more ethnically diverse or had a greater proportion of low SES students than the school at which my study will take place. My study will explore what will result from employing complex instruction with this different population, as these demographics seem to be underrepresented in the literature. I will be employing several strategies the Railside School used to improve equity and student engagement, including assigning competence, implementing group-worthy tasks in a cooperative learning environment, and training students in group roles. I will define these strategies in the next sections and detail how these strategies support student learning.

The Importance of Roles

Assigning group roles to students is a way to improve engagement of all members of the group (Belland, Glazewski &Ertmer, 2009; Boaler, 2006; Cohen, 1994; Esmonde, 2009; Herrenkohl, 2006). Assigning a student in each group the role of resource monitor predetermines who will be procuring materials for an activity. This can cut down on arguments and make class time more productive. It also avoids the issue of high-status students assigning the tasks considered to be more menial to low-status students as a method of reinforcing their higher status (Herrenkohl, 2006). A facilitator is also a useful role, as this person keeps the group on task and makes sure everyone stays involved. In addition, a facilitator can be tasked with making sure everyone has an opportunity to speak, so that high-status students do not dominate the group (Esmonde, 2009). Even if a student does not have a lot of input at the moment, an opportunity to speak improves their sense of well-being within the group (Cohen, 1994). Students who report a sense of well-being in their learning environment are more likely to contribute in the future (Strahan, 2008).

While it is true that students will naturally take on roles in groups, if the teacher does not train the students and assign the roles, they often take on unproductive forms such as expert and novice, or oppressor and oppressed (Esmonde, 2009). Depending on the rigor of the roles used, it can also be important for the teacher to assign roles in a heterogeneous classroom so that students with learning disabilities are given an appropriate role (Belland, Glazewski &Ertmer, 2009).

Participating in roles is important, but it is also helpful if students reflect on their experiences in their various roles and how they feel their group performed (Belland, Glazewski &Ertmer, 2009). This can be a written task or a discussion held at the end of an activity. Teachers can also assess students' growth in their roles through informal assessment during the activity itself, checking in on groups to make sure each role is being fulfilled and that all members are getting an equitable opportunity to learn.

Students can struggle with roles initially, especially those which go against their past experience or require them to use social skills in which they have little confidence. This can lead to low class participation while students get used to the idea of roles but eventually each student becomes accustomed to the expectations each role puts upon them (Herrenkohl, 2006). Working in a productive group and fulfilling a role is not only a good way to learn mathematics, but students who have participated in this type of learning eventually report feeling more self-confidence in their social interactions outside of class (Belland, Glazewski &Ertmer, 2009) as well as having a more positive disposition regarding school in general (Strahan, 2008).

Group-Worthy Tasks within Cooperative Learning

Cooperative learning is the practice of students working together in groups, and the value of cooperative learning can be increased by altering the curriculum to include inquiry-based group-worthy tasks. Group-worthy tasks are open-ended problems which illustrate important mathematical concepts, have multiple entry points and solution paths, can be solved using multiple representations, and allow students to use many different skills to complete them (Boaler, 2006; Cohen & Lotan, 1995). Students who complete

these kinds of tasks show an increase in overall achievement (Boaler, 2006; Cohen, 1994; Cohen & Lotan, 1995; Geist & King, 2008; Strahan, 2008; Pell et al, 2007; Webb, Farivar, & Mastergeorge, 2002).

One way in which group-worthy tasks promote student engagement is many students find the process of inquiry more interesting, and they are more likely to go beyond the minimum requirements of the task and take on extension problems (Pell et al, 2007). Students can use a wide variety of competencies in completing the tasks, giving the group true autonomy over which strategies they employ (Logan, DiCintio, Cox, Turner, 1995). This allows students who have not previously had a lot of success in traditional math the opportunity to contribute positively to the group (Belland, Glazewski &Ertmer, 2009; Lotan, 2006). Students with a dislike for math and school in general have reported improvements in their productive disposition after changing to an inquiry-based program (Cerezo, 2004; Ifamuyiwa & Akinsola, 2008; Strahan, 2008). Allowing for varying entry points, different reasoning skills, and use of both verbal and active learning processes through the use of open-ended tasks allows students with multiple abilities access to the activity. When all students have access, more can be engaged in the lesson and the inequity in learning opportunities will be lessened (Boaler, 2002; Cerezo, 2004; Cohen, 1994; Cohen & Lotan, 1995; Geist & King, 2008; Lotan, 2006).

Group-worthy tasks encourage students to justify their answers, and this changes the dynamics of a group. Students will not just ask each other for answers, as is often the case in a low cognitive demand task, when they know justification is required (Esmonde, 1999). Justifying an answer requires conceptual understanding, which correlates with higher achievement (Webb, Farivar, & Mastergeorge, 2002). Students who are not

required to justify their strategy can often build confidence in incorrect strategies as a result of random reinforcement. Random reinforcement occurs when a student gets the correct answer to a problem through an algorithm that only works for that exact algorithm, but since their answer was right they believe that algorithm is always going to be correct. If a student is required to explain how their algorithm works, they will be made aware that their strategy is not correct and random reinforcement can be overcome (MacKay & British Columbia Univ., 1975).

Accountability in Group-Worthy Tasks

Research has shown that some students may try to take advantage of the fact that students at their group are working towards the answer and may reach it without their input, allowing them to opt out of the activity and reduce their engagement (Pell et al, 2007). Likewise, students are often concerned that others will do this and not contribute to group success (Gottschall, Garcia-Bayonas, 2008). These issues can be overcome in a few ways. Roles make it difficult to opt out, since each member of the group is very clearly and publicly responsible for functioning in their role and contributing to group success. Teachers can also stress student accountability for themselves and their group to make sure all students participate in their groups. This means all students know each member of the group is responsible for being able to explain and justify their answer to the problem (Boaler, 2006). A teacher must also consistently emphasize the importance of conceptual understanding over goal completion (Ding, Li, Piccolo, & Kulm, 2007). Students who believe that the purpose of the problem is to learn are going to participate, whereas students who feel that the goal is just to finish the problem (which, from their point of view, can be done without their input) might not feel any real need to participate

(Pell et al, 2007). Throughout the inquiry process, the teacher needs to maintain high expectations for their students to be able to complete and justify their answers to the problem (Boaler, 2006).

Assigning Competence

Assigning competence is a strategy designed to combat the problem of status inequality. Students often take a position of domination over those whom they deem to be low status, leading to inequitable learning opportunities between students of different status. Low status is not only perceived by a student's peers, but is often also accepted by the student themselves. Students who believe they are low status are less likely to participate in class and let higher status students, whom they believe to be more competent, take control of an activity (Cohen, 1994). In order for this inequality to change, a student's peers must come to see the previously low status student as academically competent, and the student must believe themselves to be competent as well. This must be done deliberately, as it is more difficult to improve the expectation students hold for themselves than it is to change the expectations their peers hold for them (Cohen, 1994). Assigning competence relies on the power students bestow upon the teacher as an evaluator. When a low status student shows strength in a particular ability, the teacher publicly evaluates them as being strong. Since students tend to believe in the strength of teachers as evaluators, they accept the evaluation and their view of the evaluated student's status rises. This leads to higher expectations for that student, which often results in improved engagement in class activities and higher achievement (Cohen, 1994). In order for assigning competence to work, however, the teacher must keep several things in mind to ensure that the strategy is effective.

Cohen (1994) discusses three critical features of effective assignment of competence. First off, the evaluation must be public. While giving private feedback to a student is useful, assigning competence is a group treatment. The teacher wants to improve not only the evaluated student's perception of self, but also how other members of the class see that student. Changes in perception by both parties must take place for a student's status to improve. Secondly, the evaluation must be specific and relate directly to real academic or intellectual abilities. This makes the strategy powerful because the student and members of their group will have evidence of the use of the skill, since it is real and was just used, and thus will accept the evaluation. Finally, the ability being evaluated must be relevant to the group task. A student is low status because they and others believe they are not able to contribute to the group, so evaluating them as being strong in an ability unrelated to the task being done by the group will not result in a change in status. The student and their group need to see that, contrary to their previous perceptions, the student can indeed contribute to group success. This can raise the status of the student. The more this strategy is used, the more students will participate in group activities (Cohen, 1994) and this is why this strategy is an important part of my plan for improving student engagement.

Through implementation of group-worthy tasks, training students in roles, and assigning competence, I hope to create a more equitable cooperative learning environment in which students of any prior status can be engaged and thus improve their achievement.

Chapter 2: Methods

Setting and Participants

Students from two sixth grade math classes were selected from Eastside Middle School, a suburban Puget Sound area middle school. The rationale for the selection of these participants is that they were the students in my assigned classes. I had access to them and was able to monitor progress and collect artifacts regularly. In addition, students coming into my classes have not historically had access to complex instruction, allowing me to use the beginning of the year as a baseline. These classes are fairly heterogeneous academically, with only the students scoring in the top five percent on the MAP standardized test placed in advanced classes. 14.5% of students at the school qualified for free or reduced lunch. 76% of students at the school were white, 12% were Asian, 6% Latino/a, and 3% African-American.

Political Context

Since the adoption of the Connected Mathematics Project 2 (CMP2) curriculum three years ago, parent and community reaction to the inquiry-based series has been mixed. There is a very vocal and predominantly affluent group that has very directly opposed both the adoption and the continued implementation, with some parents removing their students from the math program. Most, however, have taken a wait-and-see attitude and are withholding judgment until a few years' results are available.

Data Sources and Analysis

I utilized a whole group, mixed methods approach to this study (Mertens, 2010). Using the whole group is important because it would be unethical to withhold beneficial teaching strategies from part of my student population. In addition, my students' not having previous experience with complex instruction provides baseline data, making a control group unnecessary. I used mixed methods in order to collect the most complete data possible. My quantitative data allowed me to perform analysis so I was able to determine if any changes were statistically significant. Qualitative data allowed me to learn about students' perceptions in more detail. It also helped me determine if students' actions were consistent with their perceptions.

Student surveys.

I collected pre- and post- surveys from all participants. These two identical surveys were conducted during class, at the completion of the first and last group-worthy task of the study period. The pre-survey was completed the second week of school, before any implementation. The post-survey was completed at the end of the curriculum unit, approximately six weeks later. These surveys assessed student engagement and perception of equitable learning opportunities during cooperative learning activities. The survey is modified from Cohen's sample student questionnaire (Cohen, 1994). The purpose of these surveys was to determine if attitudes or perceptions of equitable learning opportunities and personal engagement in group activities had changed over the course of the treatment. An example of the survey is shown in Appendix A. Pre- and post- surveys were compared on a whole-group basis. Individual comparisons were only used to select

candidates for the interviews. Two-sample T-tests and two-proportion Z-tests were used to determine if changes were statistically significant.

Video observation and analysis.

I collected observational data through video of my classroom. One fifteen-minute session of class was videotaped every week to two weeks. The intent was to show gradual changes, if any, in class-work participation and engagement. I also used this data to determine if there were any irregularities in my implementation of complex instruction practices. I reviewed the video recordings of class sessions and looked for behaviors that showed varying levels of student engagement. Examples of these types of behaviors were on-task interactions with members of the group, off-task interactions with members of the group, responding to or ignoring group mates' inquiries for help, and participation or lack thereof in assigned group roles. Off-task behaviors were coded and the frequencies of these behaviors were recorded. I chose to tape only the first fifteen minutes of each task because the tasks had differing lengths. By keeping the length of each recording the same, student engagement would be measured over a consistent portion of each task.

Student interviews.

Interviews with students were held at the end of the curriculum unit and after the post-treatment surveys had been analyzed. These interviews were geared towards hearing students' personal reflections on their experience in learning math with complex instruction. Three students were interviewed. My original intent was for two of the students selected to be those who indicated through the surveys that they felt complex

instruction improved equity in learning opportunities or their engagement in group activities, and for two to be students who reported they did not perceive any improvement. However, I was only able to get permission from one student of the latter group, and thus only three interviews were conducted. These interviews were audio recorded. Examples of interview questions are shown in Appendix B. The audio recorded interviews were transcribed and analyzed for patterns or common themes between students. I looked to see if there were any key patterns that showed any differences or similarities between the students who felt complex instruction changed their experience and those who did not.

Products of student group work.

Throughout the study, student work was collected from the group-worthy tasks. Students worked with the same group for the duration of the study. The student work was used to corroborate the other data sources. For example, students whose engagement appears ambiguous on video may have shown their engagement through their finished product. Artifacts collected from class activities were used in conjunction with the other data sources to see how students' perceived engagement may have impacted their final products. In addition, the products of group activities can show changes in group dynamics over the course of the study.

Limitations

Complex instruction involves multiple complex teaching practices. Due to this, there may be no way to know which of the different aspects of complex instruction was responsible for any changes in student engagement or behavior. Another difficulty was the inherent power dynamic between student and teacher. Students know implicitly what

the study is about, and may have assumed that I wanted the treatment to succeed. This problem could be exacerbated by the fact that the two surveys were the same, so students might have felt compelled to respond in a way that they thought might please me. I attempted to make it very clear that I was taking a scientific view on the issue by clearly stating that I did not know what would happen and I needed their honest thoughts in order to determine how to move forward with complex instruction. The presence of a video camera may have impacted behavior during taping sessions. However, in my previous experience videotaping my classrooms, when the purpose of the camera is clearly communicated, stress or changes in student behavior due to recording is minimized. A final issue with the video recording is that I was the only one coding the behaviors. It is thus important that I made the codes clear in order to minimize my own bias.

Despite these limitations, these data sources and analyses allowed me to state that the treatment was enacted, that an impact on student engagement did occur, and that there may have been a correlation between the two. I may not be able to say definitively if complex instruction caused these changes, but I am able to report student perception on its impact.

Chapter 3: Data Analysis

Institutional Study

This research involved two sixth grade math classrooms at Eastside Middle School. This school is located in a suburban area in the Puget Sound region of Washington State. The school is primarily White (81%) with Asian (9%) students making up the predominant minority. Twelve percent of students qualify for free or reduced lunch. While the school in name is quite old, it was recently renovated in 2006.

The current math curriculum is Connected Math Project 2 (CMP2), which was adopted under controversial circumstances by the school district. CMP2 is an inquiry-based curriculum that encourages cooperative learning and is the curriculum used, with modification, throughout this study. CMP2 was piloted by Westside School in 2004, and adopted and implemented district-wide in 2006. All schools except for the site of this study adopted the entire curriculum, but at Eastside School it was only implemented in the 6^{th} grade while students in other grades were grandfathered along in the older Glencoe curriculum. There was significant public furor over the curriculum selection process, with the majority of dissenting parents and teachers hailing from Eastside School. Dissenters claimed they were not being listened to and their input was falling on deaf ears, while the administration claimed they were indeed listening, but there were many more people in favor of the CMP2 curriculum. As a result of the adoption, one teacher retired and several families pulled their students from math classes or withdrew completely and sent their students to independent schools. Because of this, many parents are wary, if not adversarial, when it comes to teaching methods other than traditional direct instruction.

This is passed along to students, with some coming in claiming that activities such as group-worthy tasks are not "real math." This made Eastside School a complicated environment in which to introduce Complex Instruction.

Description of Participants and Data Collection Methods

The two sixth grade math classes participating in this research are a morning class and an afternoon class, named classes A and B respectively. Class A had 31 students, three of whom chose not to participate in the study, and class B had 27 students, one of whom chose not to participate in the study. These two classes were selected from my four sixth grade math classes because they were the two who had the greatest numbers of students willing to participate. Each class had one student join the class during the study, but data from these two students were not included to maintain consistency throughout. The sample of 58 students included 30 females and 28 males. 44 students were White, four were Black, six were Asian, and four were Latino/a. Two students were English language learners, both with Spanish spoken at home.

I am in my tenth year of teaching. I taught science at a different middle school within the same district for six years, and have spent the last four years teaching math at the school in which the study was conducted. I have endorsements in Biology and Middle School Mathematics. I teach four periods of sixth grade math and one period of seventh grade math. I have always used cooperative learning in my classroom, but this is my first time implementing Complex Instruction.

Interview participants.

I interviewed three students as part of the data collection process. I had planned originally to interview four students, using the results of the pre- and post-interviews as my selection criteria. I wanted to interview two students whose views of cooperative learning had greatly improved after the implementation of complex instruction, and two students whose perceptions had remained largely negative. There were not many students who fit into this latter group, however, and only one agreed to an interview. Thus, I only interviewed three students: Alice, Jack, and Logan.

Alice and Logan both generally meet standard on assessments in class and have passed their state tests in previous years, though neither have exceptionally high scores. Alice in particular puts forth consistent effort and is never a discipline problem. Logan has a positive attitude about math and school. He is very social, which does occasionally lead to minor discipline issues, but nothing that seems to interfere significantly with his learning.

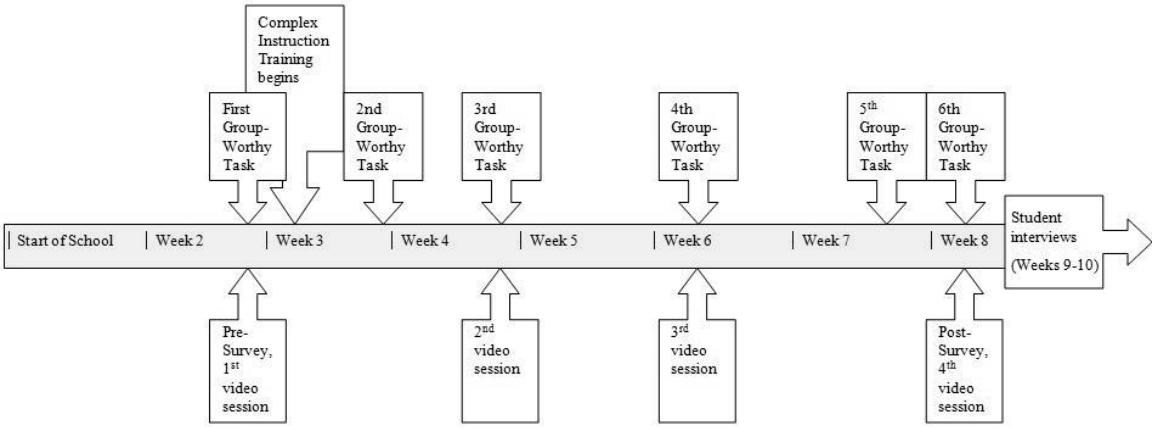
Jack scores below standard regularly on standardized assessments, and his performance in class depends heavily on his engagement. When engaged, he has been able to pass assessments, but unfortunately he tends to only engage in class activities when a teacher or other adult is right next to him. Jack often gets extremely aggravated when repeatedly asked to participate in an activity when he doesn't want to. He is in ongoing testing for autism, which may be a factor in his reluctance with cooperative learning in particular.

Alice and Logan both experienced a positive change in their views of cooperative learning, while Jack's perception of group work and cooperative learning remained negative throughout the study. All three said that they had previously been in classes where they had worked with other students, but they had never experienced group roles and had very rarely worked as a group to create a group project. The majority of their cooperative learning experience consisted of working in groups on individual tasks, which is something I do very consistently in my classroom as well, but is significantly different than a group-worthy task. From these comments and informal questioning of my classes, I can confirm that the majority, if not all, of my students had not previously been in a class that used Complex Instruction. The questions asked during the interviews can be found in Appendix B. Each student was interviewed individually.

Pre- and post-survey.

Two identical surveys, pre- and post-, were given to participant classes following structurally similar group-worthy tasks, before and after treatment. 51 students took the pre-survey, while 54 took the post-survey. The difference in number of surveys taken is due to student absence. An identical survey was given in both instances (see Appendix A). The surveys were completed by the students immediately following the task, as they completed cleanup. The pre-survey was given during the third week of school, before any Complex Instruction had been implemented. The post-survey was given during the 8th week of school, after I had been using Complex Instruction concepts for over a month. A general timeline for the study is shown in Figure 3.1.

Figure 3.1. Project Timeline.



Videotape.

Over the course of the study, each class was videotaped four times as they participated in group-worthy tasks. Each class was recorded for the first 15 minutes that they worked. In each class 20 students were visible on camera. Not all students were taped so that the number of students in each class being taped was the same to allow for class-to-class comparison. In addition, students who did not consent to being videotaped could work off-camera. These segments of tape were coded for off-task behavior, which was used as an indication of a lack of engagement in the task. Off-task behaviors included but were not limited to those where students were clearly not working on the task with members of their group. Examples of off-task behaviors included off-topic conversation within the group and with neighboring groups, leaving one's seat to wander the room or other purposes not intended to help the group, and extended periods of fiddling with materials, staring at the floor/wall, or singing. The number of off-task behaviors during each recorded session is shown in Figure 3.2.

Changing Classroom Culture Through Complex Instruction

I can say confidently that I implemented Complex Instruction to the best of my ability. I introduced students to group-worthy tasks, trained them in the use of roles, and assigned competence to low-status students. Through personal observation, video review, student interviews and analysis of survey data I have identified several changes in class culture. Primarily, students became more positively engaged in cooperative learning tasks. In addition, there was a decrease in student frustration associated with both dealing with high-demand tasks as well as peer interaction. Both of these outcomes were a result of student groups beginning to use strategies which were more respectful of all members of their groups.

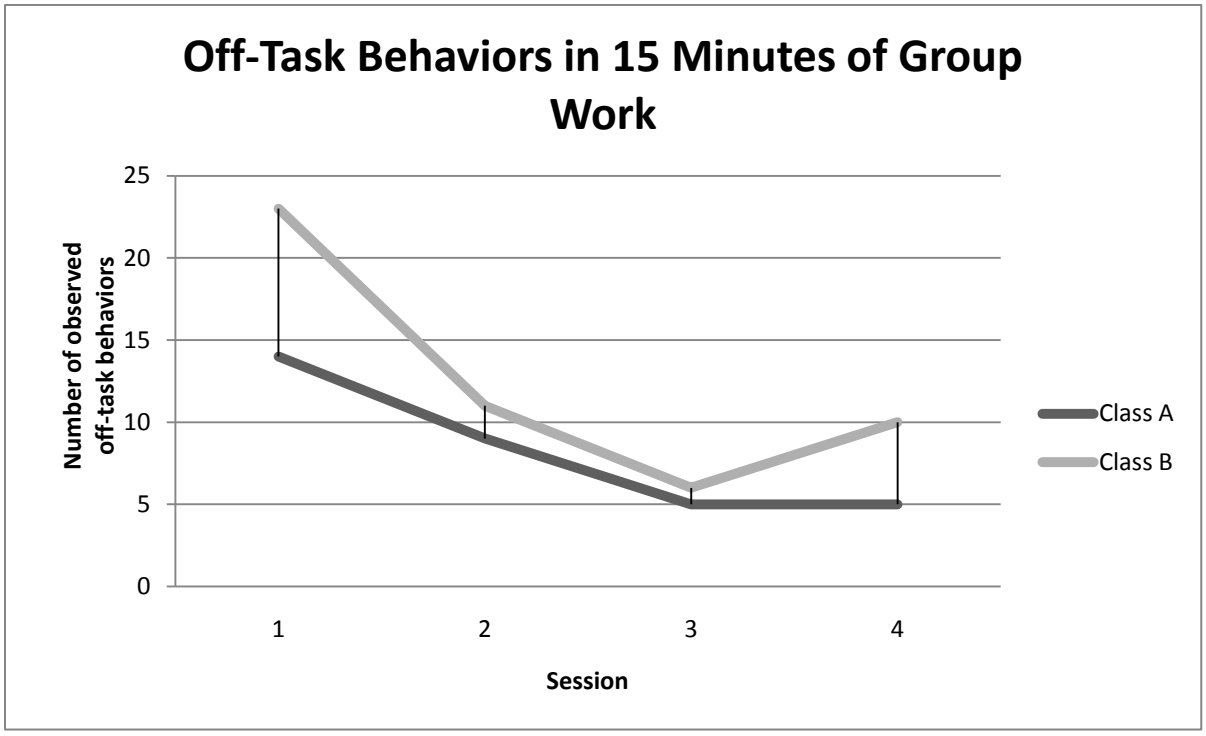
There are several factors that may contribute to these changes. Certainly, students spending more time in their groups and maturing could lead to improvements in engagement, but I feel confident that these changes would not be so pronounced without the implementation of Complex Instruction. Repeatedly students referred to the group roles as the framework which allowed them to engage in the group task. Group-worthy tasks and assigning of competence can show students that many different skills, some of which they may not realize they and their classmates have, are critical to completion of a high cognitive demand task. Significant improvements in student engagement have occurred, and I believe these changes were primarily supported by the implementation of Complex Instruction. These changes were focused around two main themes: improved positive engagement in cooperative learning tasks and more frequent student use of respectful and equitable cooperative learning strategies.

Improved positive student engagement in cooperative learning tasks.

Student engagement in cooperative learning tasks was measured by all of my data sources, as it is the topic directly related to my research question. I observed a decrease in the frequency of off-task behavior during cooperative learning tasks. More students sought and were able to get help from their group when they found themselves struggling with a task. Students shared accountability for conceptual understanding. A greater number of students were involved in the group task and were able to contribute significantly to the creation of higher quality products. These improvements all show that more students were more engaged in the learning process following implementation of Complex Instruction.

One of the means through which I determined an increase in positive engagement over the course of the study was through the sessions of class which I videotaped. Figure 3.2 shows that incidences of off-task behavior decreased throughout the study.

Figure 3.2. Off-task behavior observed in video sessions.



In both classes, these behaviors decreased in frequency by nearly 50% after the introduction of Complex Instruction (which occurred before session two). The frequency continued to decrease week after week, with the exception of session four for Class B. It should be noted, however, that in session 1 there were eight students who contributed to the twenty-three off-task behaviors, while in session 4 there were only two, with one student accounting for eight of the ten codes. Despite the upswing in codes for session four, it seems that overall there was a smaller proportion of the class off-task during that time.

Numerous differences in student behavior and attitude were observed over the course of the study, with the greatest changes occurring after the first session. It was after the first session that Complex Instruction was implemented, so it is likely that this

was a significant contributing factor to the changes observed. A factor that seems to have led to such a drastic change in off-task behaviors is the observation that one off-task behavior often would lead to more. When one student began off-task behavior, such as when a student began disassembling his binder in the first session, this led other students in his and neighboring groups to get off-task as well. A student was off-task by taking his binder apart, and then two other students had pieces of cardboard and were using them to fan themselves. Other not-so-appreciative students were attempting to engage in the expected classroom task despite these distractions. I was able to quickly get those students back to their task, but the time had been lost and groups had moved on without those students. After implementation of complex instruction, there were far less students initiating these off-task behaviors, and so there was less distraction that could draw other engaged students off-task. Students who previously were easily drawn off-task were observed to frequently look around at other groups, but seeing other students at work they soon returned to their task. This shows that changes in off-task behavior appear to be exponential in nature, and a small decrease in off-task behavior by a small number of students can have a major impact on the classroom atmosphere and student engagement as a whole. Clearly, an important function of Complex Instruction was to get students engaged quickly so that a pattern of on-task behavior could begin.

One theme that was seen in the first video-taped session was that students who got in trouble for distracting classmates often claimed that they didn't know what to do on the task, and that was why they were being disruptive. The third survey question attempted to discover if Complex Instruction changed the way students approached a lack of understanding of the task. If so, there would be a marked improvement in students'

ability to seek and get help from their group as Complex Instruction was implemented. The responses of students are shown in Table 3.3.

Table 3.3

Understanding of the group task and use of peers as resources

Did you understand what the group was supposed to do?	**Pre-Survey**	**Post-Survey**
Knew just what to do	14%	70%
Figured out task on own	43%	13%
Figured out task with help of group	19%	11%
Did not understand task, talking to group did not help	20%	2%
Did not understand task, did not ask group for help	4%	4%

A powerful change from pre-survey to post-survey is indicated by the decrease in how many students were unable to get help by talking to their group. A two-proportion z-test was used to see if the difference was statistically significant. It showed that the difference was significant ($p=0.003$). This demonstrates that students became more adept at asking for and giving help in their groups. Logan felt that working in a group made it easier to give help, saying,

> "at first you are nervous to even help people, because you think they might get mad or think you are kind of like, you know, a loser or something...but when you have roles and stuff, and you know what you have to do, why worry, you know? It's ok and people are happy when you help them, because they all know they need to get [the math concepts]."

I followed up by asking Logan and Alice if they felt the comfort in working with their classmates was something that developed just by sitting with their groups for a few weeks, or if it was directly because of the group tasks, and they both felt uncertain that they would have grown as comfortable with their groups had they not participated in the group-worthy tasks. Logan, in particular, stated that the group-worthy tasks were important in this because all members of the group were expected to participate, whereas in some cooperative learning it was optional.

Combining the two survey items that indicate students did not understand the task, "talking to group did not help" and "student did not ask group for help", also gives a significant difference ($p=0.009$). This shows that significantly more students were able to come to understand the task after implementation. Both of these statistics are relevant regarding student engagement. Students who understand the task are more likely to participate in their group, and successfully instructing group-mates on how to do the task is a form of engagement in the task itself.

It is interesting to note that in both pre- and post-surveys the same two students reported that they did not understand the task and did not ask the group for help, and both of these students reported unfavorable experiences with the group-worthy tasks across the board. One of these students was Jack. In his interview, Jack repeatedly stated that being involved in the group work was not important. As he said,

> "It doesn't really matter, because you don't get a grade on it. All that matters is if you can pass the test, and you can just learn from doing homework or I can ask my sister. I would rather just make my own poster, because then there isn't all the

> talking and people aren't bugging you asking what you think they should do and stuff. You can just do it and be done."

He did just that during the first group-worthy task. He left his group and worked alone in the back of the room, producing very little. In the final task (or any task after the second), I did not permit Jack to go work by himself, as by this time this was a class norm. When he completed his post-survey following that task, he marked it as negatively as possible, citing every possible reason for why he wasn't able to contribute except "I was not feeling well." I asked him if he marked those because he felt they had all happened, or if it was a result of not being allowed to work by himself. He asked to see a copy of the survey, and said that probably the only applicable answer was that he "was not interested in the problem", and that the rest of the marks were because,

> "I was kind of frustrated, you know, because I don't want to work with them, but I had to…and they kept asking me what I thought about the poster and I didn't care and they made me mad. So I think I just marked them all because I was mad. Like, I know I wasn't interrupted and I wasn't afraid to speak, because I didn't want to say anything. I just wanted to be quiet."

It is also possible that Jack was frustrated because his group repeatedly pressed him for input as they had been taught to do, and he just didn't want to participate in any activity at all. I have seen similar frustration and behaviors towards myself when I have pressed Jack to participate in a classroom activity. Jack also felt that he didn't like working in a group because it was never quiet. This is a legitimate issue with cooperative learning. It is an important aspect of Complex Instruction to incorporate students with

differing abilities and learning styles through group-worthy tasks, but students who prefer to work in silence are rarely accommodated. In my class, however, I used varied teaching strategies including individual work, partner work, and direct instruction. Jack struggled with participation in cooperative learning tasks throughout the study. He often requested seating at a table by himself away from any other students, and often argued with his classmates. I witnessed repeated instances in person and on video where he would go sit by himself, and members of his group would go to try to convince him to come back. Despite this, when I asked him why he was requesting to sit by himself, he insisted it was because his group didn't want him sitting with them. This makes cooperative learning in any capacity very difficult for Jack, and I can say confidently that Complex Instruction did not improve his engagement in cooperative learning activities.

The data resulting from the survey questions shows that Jack's negative opinions regarding cooperative learning were in the minority, however. Alice and Logan both felt working in a group was beneficial. Alice said, "the best part is that if you aren't sure how to do something, there usually is someone there [in the group] who can help explain." When I asked if there were benefits to this over asking for help from a teacher, she stated that classmates can sometimes explain things in a different way than the teacher, often using simpler terminology or examples in a more familiar context.

Alice and Logan both felt very strongly that all members of a group being involved in the activity helped everyone stay engaged. Students were asked on the survey to report their perceptions of their fellow group members' contributions to the collective effort, shown in Table 3.4.

Table 3.4

Student perception of the involvement of other group members

Do you feel that *everyone* in your group contributed?	**Pre-Survey**	**Post-Survey**
All work was done individually.	4%	6%
Some members contributed.	51%	26%
All but one member contributed.	25%	31%
Everyone contributed.	20%	37%

Assigning the responses point values on a scale of 0 to 3, with "everyone contributed" worth 3 and "all work was done individually" worth 0, a two-sample t-test was performed to determine if the change in perceived group contribution was statistically significant. The t-statistic was significant ($t(105)= -2.25$, $p=0.026$). This is a fairly direct measurement of how students perceived the engagement of members of their group as they worked. The significant improvement shows that more students in each group were involved after the implementation of Complex Instruction.

Starting around the third video session, it became more common to see students refocus their classmates instead of waiting for me to do so. In his interview, Logan expressed irritation with a member of his group whom he did not think was participating, saying, "If they aren't at least paying attention and they get called on to explain a part of the poster, and they don't know, then it kind of looks like you [other members of the group] don't know what you are doing, and they are going to have to take a test on it." This statement shows Logan's understanding of accountability in a group setting. He knows each member of the group is accountable for understanding what the group has learned and how they are depicting that on the poster.

This could be the result of the assigned group role which gives one member of the group the responsibility of ensuring that each member of the group understands everything the group puts into the project. Roles were deemed to be very important to both Alice and Logan, as they both said that following roles was the main thing that their groups did to try to make sure everyone in their group was engaged. When asked what activities we had done that had better prepared them for working in groups, both students cited role training. They also each said that all students should have a role. Each student having a role ensured that all the responsibility for the product wasn't placed on one student, and likewise kept any single student from "taking over." Logan also commented that when everyone was involved, students didn't feel like they had to dominate the group because they believed that the end result didn't depend so much on them.

Another change in class culture that occurred during the study was a decrease in student frustration associated with high cognitive demand tasks and peer interactions. Alice in particular felt this was an important factor in improving engagement in tasks. The survey asked students to describe the difficulty of their work in the group, with the results shown in Table 3.5. Students were allowed to interpret this question freely as referring to both the difficulty of the task itself as well as difficulty in working with their group. All three students interviewed stated that they felt both of the group-worthy tasks done before the surveys were mathematically challenging.

Table 3.5

Perceived difficulty of working on the task

How would you describe your work in the group?	Pre-Survey	Post-Survey
Extremely difficult	10%	6%
Sometimes difficult	65%	20%
Just about right	19%	48%
Very easy	6%	26%

It is clear from the responses that students were much more comfortable with the final group-worthy task than they had been with the first. Assigning the responses point values on a scale of 0 to 3, with "very easy" worth 3 and "extremely difficult" worth 0, a two-sample t-test was performed to determine if the change in perception was statistically significant. The t-statistic was significant ($t(105)= -4.86$, $p=0.000004$). Every student who scored the difficulty of the task as very difficult also marked in question five that they felt that they were not able to contribute to the group as much as they liked, indicating that students may feel more comfortable in completing group work when they feel free to contribute. This was alluded to during student interviews when Alice said,

> "The decimal problem [post-survey] wasn't really harder than the fraction one [pre-survey], but trying to work with people being grabby and arguing was really hard. The problem was already hard…so that made it frustrating. Both problems were hard, actually, but when people know their job at least you get it done."

Logan agreed that differences in difficulty were mostly due to group dynamics, stating that,

> "It's kind of weird that when you have a job, it feels like you maybe don't have to do as much, but it's just kind of quieter…and when you want to do something, you can and at least you are getting answers on paper."

While student perception that completing the task was easier does not directly show engagement in the activity, it does contribute to showing a decrease in overall frustration with group work in general. This decrease in frustration in dealing with both high cognitive-demand tasks and interactions with peers is a theme that ran throughout the course of the study, and was visibly apparent in the videotaped portions of class.

Several behaviors were observed during the first videotaped session that were not seen after implementation. There were four instances in the first session where students physically struggled with each other over supplies, as experienced by Alice. In one case a poster was torn as two students both tried to pull it from each other's grasp. Another poster had a long line across it where a student had tried to pull a pen out of another student's hand. These kinds of events could have contributed to the resulting answers on the pre-survey, where a greater proportion of students felt they were not able to contribute to the group product and had negative feelings about the task. As a result of these conflicts, students were seen to be visibly frustrated, even walking away from the table. This led to a greater number of students being disengaged and off-task. In contrast, there was little if any physical conflict between students after implementation. Students worked one or two at a time on the posters while other students wrote what they were going to do when it was their turn on a blank piece of paper, gave input to the students currently writing, or patiently waited. There were arguments about who was going to do what part of the task on the poster, but these were eventually resolved.

Groups evolved strategies for making sure everyone got a fair chance for input. Students were directly trained in some of these strategies, such as when students took turns picking a part that they would get to do, or when groups partitioned the poster up as shown in Appendix D, with each member of the group getting a section of the poster to be their part to write in. Other times, students created their own strategies, such as raising hands to vote on how they wanted to move forward on the task. In all, these strategies were much more respectful to all members of the group, and the post-survey supports the idea that students felt more easily able to contribute to the success of the group task after implementation than they were before. These new, student-implemented strategies were probably the greatest contributing factor to the improvement of student engagement on cooperative learning tasks. Students felt more able to contribute to the group task as a result of these respectful, equitable strategies, and student engagement increased.

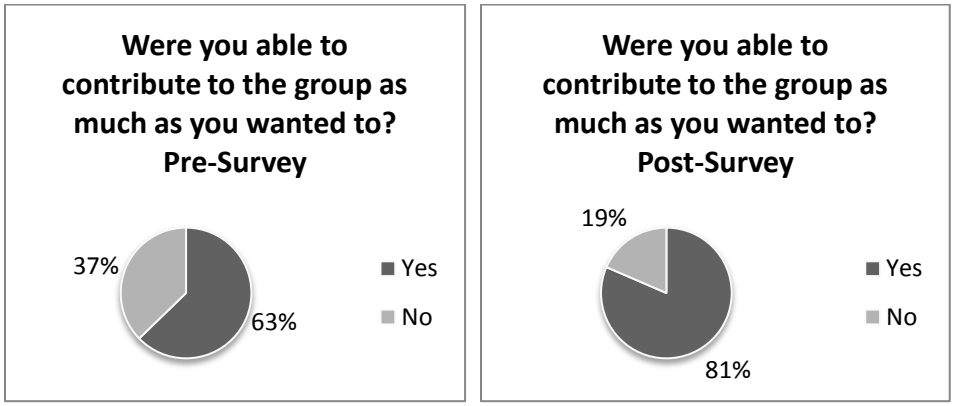
Increased student use of respectful and equitable cooperative learning strategies.

When students become aware that there are many more ways to contribute to group success than just the calculations, they are more likely to feel that there is a way that they can contribute and thus will be more engaged in the learning process. Equitable learning strategies give all students a chance to contribute and to discover valuable abilities in themselves and others.

Students were asked on the survey to state whether or not they felt they were able to contribute to their group as much as they wanted to. Their answers, shown in Figure

3.6, show that after implementation only about half as many students answered that they were not able to contribute as much as they wanted.

Figure 3.6. Student self-perception of ability.



A two-proportion z-test was administered to determine if the difference in students' perceived ability to contribute to the group was statistically significant. The test showed that the difference was significant ($p=0.032$). This is an indicator of student engagement because sometimes students want to be engaged in the lesson but are prevented by other, more dominant students. Complex Instruction strategies, such as assigning competence, try to give low-status students more power within the group and opportunities to contribute. Publicly praising low-status students for legitimate academic success changed how these students were viewed by their peers, and this data shows that after implementation more students were indeed able to contribute more in a group environment. One example of this was Xander, a student who had historically struggled in math and was not very engaged with his group during the first video session. On his homework the next week, Xander came up with a way to simplify fractions that was different from how it was shown in the text but was mathematically correct. I had him

explain how he did it and I showed the class how it related to strategies we had already been taught. From then on, it was referred to as "Xander's strategy" and became a constant reminder to both Xander and the class that Xander was mathematically capable. On later video sessions, Xander was much more involved with his group and became someone other students would look to for help. His quality of work and assessment scores have continued to increase over the course of the year. Without assigning competence to Xander, dominating classmates might have used his low status to exclude him from involvement in his group. Not only did this help Xander, but his classmates benefitted from his contributions as well.

Both Alice and Logan were students who switched from "no" on the pre-survey to "yes" on the post-survey when asked if they were able to contribute as much to their group as they wanted. Both attributed the change to having a group member whose role was to ensure that all students' voices were heard. When I asked Logan if that person had to do a lot of work, he said that they really didn't. The fact that the role existed established the practice of getting input from all members of the group as a class norm. Alice and Logan both agreed that because everyone knew the role existed, they therefore knew everyone needed a chance to participate.

A follow-up to the previous survey question asked: What was preventing students from being able to contribute to their group as much as they wanted? The percentages of students who felt they were able to contribute, and reasons given for why some felt they could not contribute as much as they liked are given in Table 3.7.

Table 3.7

How students felt about their contribution to the group

(students could select all that applied)	Pre-Survey	Post-Survey
I felt free to contribute and did so as much as I could.	67%	83%
Somebody else interrupted me when I tried to contribute.	12%	6%
I wanted to contribute, but was not given the chance.	4%	6%
I felt afraid to contribute.	8%	6%
When I tried to contribute, nobody paid attention to me.	10%	4%
I did not contribute because I was not interested in the problem.	2%	2%
I normally would contribute more, but I was not feeling well today.	6%	4%

The answer to the first part of this question confirms the previous results that after implementation of Complex Instruction, more students felt free to contribute and did so. A two-proportion z-test was performed to determine if the change in students who felt free to contribute was significant, which it was, though marginally ($p=0.048$). The percentage of students who said they felt free to contribute is very close to those who said they were able to contribute as much as they wanted. This shows that students were answering the survey questions with consistency, and that a student who feels free to contribute most often will. This is a significant result, as equitable cooperative learning strategies create an environment where students can feel free and are encouraged to contribute. If this environment can be attained, students will be more engaged in learning tasks.

The largest changes amongst negative comments were decreases in the number of students who said that when they tried to speak, they were interrupted or ignored. This is definitely a goal of the role system, where there are students in each group with roles

which ask them to make sure each student has an opportunity to give input to the group decision-making process. None of these changes are, however, statistically significant according to a two-proportion z-test (none are significant at the 0.05 critical level). In essence, while the number of students who felt they were not able to contribute did significantly lessen, those who still felt left out did so for the same reasons given previously. While the changes may not have been statistically significant, I did observe a difference in class climate on video. Students noticeably interrupted each other less often. Many of the groups also used round-robin style sharing strategies, so more students also got more opportunities to speak with the attention of their group. The lack of statistical significance may be due to the fact that several students who answered that they were not able to contribute as much as they liked on the pre-survey did not check any of the boxes explaining why, while that did not happen on the post-survey.

In order to see if students gained a greater appreciation of the multiple abilities useful in a complex task, students were given an opportunity on the surveys to respond freeform, listing skills they felt would be important for doing a good job on the task. The results were then categorized by whether the student listed only computation-related math skills as being important or whether they also included any other skills. Some examples of non-computational related skills students listed more than once included organization, listening, patience, artistic skill, use of implements, and neatness. Computational skills involved knowing multiplication tables, ability to simplify fractions, and understanding of algorithms possibly used in the task. I intended for there to just be two categories, but upon receiving the surveys I realized some students had left this section blank, so I created a category to show that data, as shown in Table 3.8.

Table 3.8

Student perception of important skills

What abilities or skills were important for doing a good job on this task?	**Pre-Survey**	**Post-Survey**
Listed computational skills only	37%	15%
Listed non-computational skills	53%	80%
Left blank	10%	5%

The primary response in this question that relates to the implementation of Complex Instruction is the increase in proportion of students who gave examples of useful skills which were not directly computational skills. A two-proportion z-test was performed to determine if the change was significant, and it was significant at the 0.05 critical level, p=0.004. This shows an awareness of the importance of these abilities in mathematics, because students with these other abilities are not always thought of as having skills which are important to completion of mathematical tasks. Considering only non-computational responses, the types of abilities students related as being important in the post-survey were more varied than the responses in the pre-survey, which mostly mentioned neatness and/or neat writing. Students' definition of someone who was "good at math" had expanded.

Not only did students see these abilities in themselves, but also in their group-mates. All three students interviewed could cite examples of group-mates surprising them with abilities that they didn't know that they had. Each student mentioned classmates who were skilled artistically and were able to contribute to the final product by keeping it legible and organized. Alice also mentioned that a side effect of this was

that it helped her get to know her classmates better. When I asked if this helped her stay engaged in the lesson, she replied that it did, and that it also made her more comfortable in asking them for help.

Two of the strategies of Complex Instruction are to teach students to value multiple abilities and assign competence, with a goal that students will become aware of their own ability to contribute to a group. The final question on the survey asked students if they thought they were able to use one of those abilities well in order to help their group succeed on their task. Their replies are shown in Table 3.9.

Table 3.9

Student self-perception of ability

Was there a skill necessary for success that you thought you used very well?	**Pre-Survey**	**Post-Survey**
Yes, I used a skill necessary for doing a good job on this task.	51%	78%
No, I did not use a skill necessary for doing a good job on this task.	49%	22%

I was very surprised by the results of the pre-survey, as I did not expect nearly half my students to believe that they were unable to contribute to success on a group task. This did change after implementation, however, as many more students selected that they could contribute. In addition, four students wrote a variation of "but I tried to" after they checked the "no" box, which does not show up in the data above but does indicate that those students were still very engaged in the task. A two-proportion z-test was performed to determine if the change in perception was significant, and it was ($p=0.004$). This data is supported by the increase in multiple ability awareness shown in Figure 3.8. When

students learn there are many abilities which contribute to group success beyond calculations and algorithms, they discover there is a way they can contribute and their engagement in the learning process will increase. As Alice said, "if people know the math, they can maybe get the answer, but you also have to explain it. It helps to have someone who can draw or organize the paper, and especially with the models, some people can do the answer but can't get the picture to…make sense."

As a whole, students felt that Complex Instruction had a positive impact on the classroom culture. Students who had previously been marginalized in cooperative learning activities became critical members of their groups, not because other students were forced to include them, but because they actively chose to include them as they realized the contributions all of their peers could make to their group's success.

Not surprisingly, Alice and Logan said that they would both prefer working in groups to working alone, and neither were able to define any aspects of cooperative learning they would like to change, with the exception that Logan hoped all students would get involved. Alice said she would prefer that personal work time be mixed in as well, saying,

> "sometimes it's good to just work by yourself. I mean, still sit with a group and be able to talk, uh, you know, like check work, but have your own paper. Jack preferred to work alone, and said that he would like there to be an option for people to work on the projects by themselves.

Implementation of Complex Instruction made significant, lasting changes to the culture of my classroom and the practices of my students. Assigned student roles

changed into class norms and became the framework from which all students could be engaged in cooperative learning. Students became aware of the multitude of different skills vital to the successful completion of a complex task, and found those talents in themselves and classmates they might have previously thought had little to contribute. A greater number of my students became more deeply engaged in class activities of all kinds and began to look not just for the answers to math problems, but ways in which they could justify their answers. These changes, which have come about since the implementation of Complex Instruction, have made my classroom a place where students of all status levels are safe to engage with complex mathematical concepts on a deeper level than ever before.

Chapter 4: Conclusion

Effects of Complex Instruction on my Classroom

My classroom has been changed by Complex Instruction in several ways. Classroom culture shifted as concepts such as shared accountability and equitable opportunity to participate became classroom norms. Student engagement increased across status boundaries, both during group-worthy tasks as well as during more traditional sessions such as direct instruction. Student cooperative learning strategies continued to evolve and quality of work improved. The process of implementing Complex Instruction and the effect it had on my students throughout this study has changed my pedagogy now and how I plan to run my classroom in the future.

Impact on classroom culture.

During the study and in cooperative learning sessions since, students have become more conscientious about making sure all students in their groups understand what the group is learning. Each member is expected to be able to explain what the group did in the task, and to justify their work. This is very important, as students who use cooperative learning in this way have been shown to make the greatest increases in achievement on assessments (Strahan, 2008; Webb & Mastergeorge, 2003). While I certainly had to work a great deal in the beginning to train students to be aware of the importance of this shared accountability for learning, students have begun to undertake the responsibility themselves. The task of assuring that everyone has learned is not limited to the person whose role includes the responsibility. As students' experience with group-worthy tasks increased, they became more familiar with all of the roles. The

behaviors reinforced by the roles have become classroom norms, and more groups make sure all students are involved and informed without needing a reminder.

Students are also now aware that they need to be able to justify their answers, a practice linked to higher achievement by Webb & Farivar (1994). A recent example of this is when a student looked up and called out a neighboring student for copying one of her answers on a classwork problem. The student defended his action by claiming that it didn't matter, because he still had to figure out why the answer was correct. She accepted this, and the two proceeded to work together on the problem until he understood how she found the answer. He then went on to try the next problem on his own. The goal was no longer simply to have the answers on the paper, but to understand why those answers were correct. This shows a paradigm shift from product completion to concept mastery, a dramatic change in class culture.

Impact on student engagement.

Student engagement also benefited from the practices I implemented during this study. While the data shows student engagement during group-worthy tasks increased, there has been an increase in engagement from many students in other periods of activity and instruction as well. Engagement has been found to be an extremely strong predictor of academic success, and can be considered the primary model for understanding dropout rates (Appleton, Christenson, & Furlong, 2008). This is why it was so important to find a way to engage more students, especially as low-status students are commonly those who are the least engaged and lower achieving (Boaler, 2006).

Students with lower achievement in elementary school math often come into sixth grade as low-status students in the eyes of their peers. After having opportunities to contribute significantly in group-worthy tasks and through consistent assignment of competence, these perceptions have begun to change. In some cases, this change has been radical and students who claimed to be "bad at math" in the beginning of the year are emerging as class leaders. Not only do these students contribute consistently during group-worthy tasks, but more are active during other cooperative learning sessions. Even during direct instruction I have seen an improvement in many students who spent the first few weeks of the year zoning out. This differs from the results of Webb, Nemer, & Ing (2006), who found that helping skills did not transfer from cooperative learning environments to periods of more direct instruction. I think this is because they focused only on changing teacher discourse, while Complex Instruction directly teaches students cooperative learning skills. These newly engaged students know they are able to contribute in a mathematics classroom and strive to get a better understanding of the concepts in anticipation of doing so.

I think it is crucial to the success of a cooperative learning classroom that the improvement of student engagement and achievement is not drawn along lines of status, an idea evidenced in Complex Instruction through the work of Boaler (2002) and Cohen (1994). What has been so important in my findings throughout this study is there has not been just a positive change amongst high-status students, but there has been improvement distributed amongst students of various backgrounds and levels of previous mathematical achievement.

Impact on student practice.

When more equitable cooperative learning strategies were introduced to students through practice and training, the majority of students adopted them and worked to incorporate them into their group activities. What has changed since the end of the study is that some groups have moved from simply using the strategies to taking ownership of them. Students adapted strategies to fit the needs and strengths of their group. I feel this is remarkable because it shows students are actively looking to find strengths in their peers instead of just assuming weakness, which is what I have seen students do predominantly in previous years. They then tweak group procedures to make sure everyone can get involved and contribute to the best of their ability.

As a result, the quality of group work has improved. Products of the first group task showed answers that are simple, with very little justification (Appendix C). By their sixth group-worthy task, it can be seen that students are dividing up the work and justifying their answers using multiple representations (Appendix D). This was a consistent trend across groups. Through practice and use of better cooperative learning strategies, groups were able to utilize their group members' strengths and create higher quality products.

Impact on my pedagogy.

I feel confident enough that Complex Instruction significantly improved my classroom culture and student learning that I will continue its use next year as well. I plan to pursue further training in its implementation and use as part of my professional development. One of my major continuing efforts is converting activities from my

curriculum into group-worthy tasks. Fortunately, the curriculum is designed to take place in a cooperative learning environment, so making the tasks group-worthy is less arduous than it might otherwise be. Complex Instruction has changed my teaching in more subtle ways as well. I have found that I am now continuously searching for opportunities to assign competence to low-status students. I had to be very disciplined at first, picking out a couple specific students and often reminding myself to keep a look out for their achievements. As time has passed, however, I find the practice has become subconscious and I am able to assign competence more frequently. I will find out next year if this is a result of my own awareness improving or if the job is becoming easier as my students' skills improve.

Implications

The findings in my study can be transferred beyond the boundaries of my classroom. Other sixth grade teachers in my building have been having the same difficulties in cooperative learning environments that influenced me to undertake the implementation of Complex Instruction. They have seen both the culture and quality of student work improve in my classroom and have begun to use Complex Instruction strategies themselves. Two science classrooms have made changes and since reported improvements. Those teachers benefit from my training of the students and have commented on how smoothly the students from my classes have transitioned. This really supports the idea of cross-curricular implementation across the grade level. Doing so would make for more consistent classroom norms and would also allow for teachers to work together to develop group-worthy tasks. There is an opportunity to pursue this, as the district has announced the professional development theme for the next two years is

differentiated instruction. Complex Instruction fits perfectly with that theme, so I will attempt to get Complex Instruction training as an option that we can undertake.

When I began this study, I wanted to see how Complex Instruction would affect student engagement in a school with demographics such as Eastside School. The literature includes numerous studies in schools with high levels of poverty and/or ethnically heterogeneous populations (Belland, Glazewski, & Ertmer, 2009; Boaler, 2002; Boaler, 2006; Ding, Li, Piccolo, & Kulm, 2007; Esmonde, 2009; Herrenkohl, 2006; Strahan, 2008; Webb & Farivar, 1994; Webb & Mastergeorge, 2003; Webb, Nemer, & Ing, 2006), but I found none which took place in a school with primarily middle-class, white students. My findings amongst this population did show that implementation of Complex Instruction through assigning competence, group-worthy tasks, and group accountability as outlined by Cohen (1994) in a cooperative learning classroom did improve student engagement.

Recommendations

While I believe that I implemented Complex Instruction to the best of my ability, there was one area in which I feel the study could have been improved: the length of time over which the study took place. I would have liked more time to collect data and see how students continued to improve with a greater amount of experience. While I have had the opportunity to make these observations as the classroom teacher and will continue to do so, I would have liked to continue in my role as researcher. In particular I would like to have collected formal data on students' achievement on assessments.

While I did see great improvements from my pre-test to the fractions unit test which took place well after the study, a quantitative look at how much students improved on specific concepts which were the focus on group-worthy tasks would have been informative. It fell outside the scope of this study, and would have required a more robust pre-test than I gave the students this year, but is definitely something I can investigate further in the future.

An analysis of how students who have prospered under Complex Instruction fare on their standardized tests could also be worthwhile. In this era of high-stakes testing, this data is what would draw many of my colleagues towards Complex Instruction.

Not all of my students were successful in Complex Instruction, and this has inspired some new questions as well. I would like to know how Complex Instruction could be modified to help accommodate students with social disabilities, such as Asperger's Syndrome. I have had several students with Asperger's Syndrome in my classroom over the past several years, and cooperative learning has been difficult for all of them.

I started this study at the beginning of the year, when students are new to middle school and tend to be more compliant with class norms and accepting of new concepts. I am looking forward to seeing how my training endures as we enter the spring. In my experience, the behavior and focus of many students deteriorates as spring progresses. It would be an interesting study to measure engagement in a Complex Instruction classroom and a traditional classroom over the course of an entire year, to see if this change in spring behavior is more pronounced in one than the other.

Closing Comments

The question for this research, "How does implementation of Complex Instruction affect student engagement in a cooperative learning classroom?" was formed out of a need for a structure which could positively support my students who were struggling in cooperative learning because of low status. Too often, this was due to the cooperative learning involving very little cooperation, with groups dominated by high-status students. Throughout the course of this study and in the time following, I have seen the culture of my classroom evolve towards an environment where all students are encouraged to use their unique talents to contribute to group learning. All students are not only expected to learn, but feel responsible for the learning of their peers. The change has been remarkably positive, creating a level of equity unlike anything in my previous ten years of teaching in cooperative learning classrooms. I look forward to improving my own understanding and ability in using Complex Instruction in years to come.

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Appendix A

Student Engagement Survey

Instructions Name: _____

When answer choices are given, please mark an X on the line to the left of each answer that is most like how you feel for each question. Remember, this is not a test. There are no incorrect answers; I want to know what you think. Period: _____

1. How would you describe this activity?
   _____ a. Very interesting.

   _____ b. Fairly interesting.

   _____ c. Somewhat interesting.

   _____ d. I was not interested at all.

2. How would you describe your work in the group?
   _____ a. Extremely difficult.

   _____ b. Sometimes difficult.

   _____ c. Just about right.

   _____ d. Very easy.

3. Did you understand what the group was supposed to do?
   _____ a. I knew just what to do.

   _____ b. At first I didn't understand, but I figured it out on my own.

   _____ c. At first I didn't understand, but my group helped me figure it out.

   _____ d. At first I didn't understand and talking to my group did not help me figure it out.

   _____ e. I did not understand and did not ask my group for help.

4. Do you feel you were able to contribute to your group as much as you wanted to?
   Yes _____ No _____

5. Which of the following best explain how you feel about ***your*** contribution to your group? (check all that apply)

_____ a. I felt free to contribute and did so as much as I could.

_____ b. Somebody else interrupted me when I tried to contribute.

_____ c. I wanted to contribute, but was not given the chance.

_____ d. I felt afraid to contribute.

_____ e. When I tried to contribute, nobody paid attention to me.

_____ f. I did not contribute because I was not interested in the problem.

_____ g. I normally would contribute more, but I was not feeling well today.

6. Do you feel that ***everyone*** in your group contributed?

_____ a. None of them contributed. I did all the work or we each did it on our own.

_____ b. Some members of the group contributed.

_____ c. All but one member of the group contributed to the finished product.

_____ d. Everyone contributed to the finished product.

7. Do you feel that the students in your group listened to each other's ideas?

_____ a. None of the students in my group listened to each other's ideas.

_____ b. Some of the students in my group listened to each other's ideas.

_____ c. Most of the students in my group listened to each other's ideas.

_____ d. All of the students in my group listened to each other's ideas.

8. What abilities or skills did you think were important for doing a good job on this task?

9. Was there one ability or skill listed above you thought you used very well?
   Yes _____ No _____ If yes, which was it?

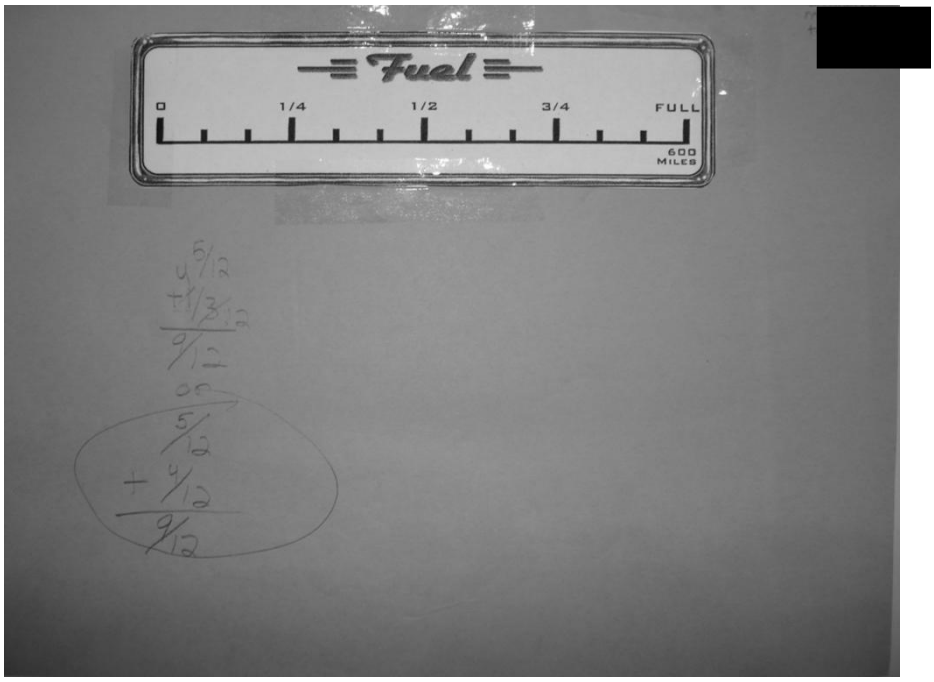
Appendix B

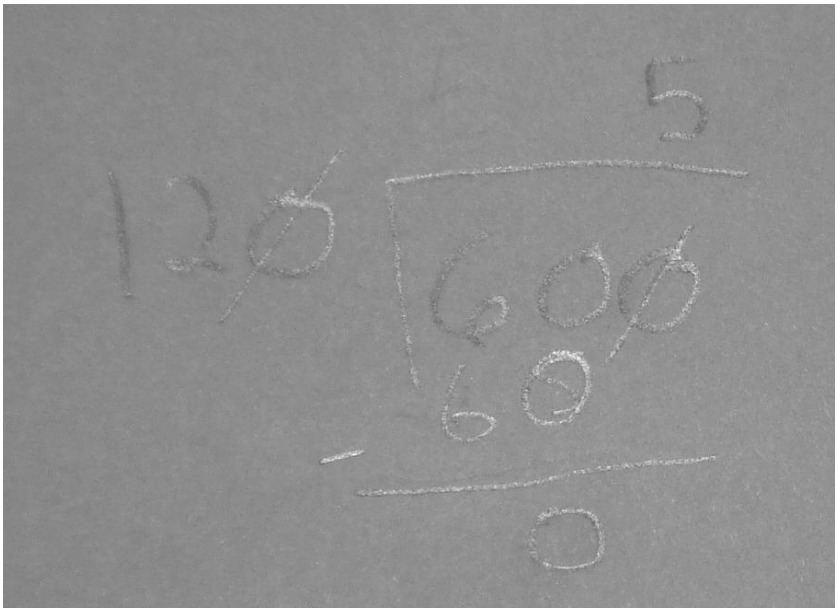
Examples of Interview Questions

1. Before this year, what past experience have you had with cooperative learning?
2. Do you feel that it matters if all members of the group participate in group activities? If not, why? If so, what do you think members of the group can do to make sure everyone gets a chance to participate?
3. Do you feel it is helpful to work with other students in math class? Why or why not?
4. Is there any particular aspect of working in groups that bothers you; that you would like to change or improve upon? (give examples)
5. Do you feel that any activities we have done in class this year have helped prepare you for working more productively in groups? (give examples)
6. At any point during group work, did someone in your group surprise you with an ability that you didn't think that they had? (give examples, do not need names)
7. When you are working in a group, would you rather everyone in the group have a role, or not? Why?
8. Given the choice, would you prefer working in groups, by yourself, or some mix of the two?
9. Do you think working in groups makes a math activity more interesting?
10. (shown both activities) Out of these two activities, do you think one was easier than the other?
11. Why did(n't) you think it was easier to contribute to the group in the second task?

Appendix C

Pre-Implementation Student Work Samples





(Note: this second sample has been cropped, but this is the entirety of the group's work)

Appendix D

Post-Implementation Student Work Samples