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Do Students Progress if They Self-Assess? A Study in Small-Group Work

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Math in the Middle Institute Partnership
Action Research Project Report

in partial fulfillment of the MAT Degree
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Do Students Progress if They Self-Assess? A Study in Small-Group Work

Abstract

In this action research study of my classroom of 8th grade mathematics, I investigated the effects of self-assessment on student group work. Data was collected to see how self-assessment affected small-group work, usage of precise mathematical vocabulary, and student attitudes toward mathematics. Self-assessment allowed the students to periodically evaluate their own learning and their involvement in math class. I discovered that the vast majority of students enjoy working in small-groups, and they feel they are good group members. Evidence in regard to use of precise mathematical vocabulary showed an increased awareness in the importance of its usage. Student attitudes toward mathematics remained positive and unchanged throughout the research. As a result of this research, I plan to continue use of small-group work and self-assessment. I will continue emphasis on the inclusion of precise mathematical vocabulary as well as on training on cooperative learning strategies.

In this action research study, I investigated how self-assessment affected small-group work, usage of precise mathematical vocabulary, and student attitudes in mathematics class. Upon reflection on how my students were learning, I felt I was actively involved in teaching mathematics, but I did not feel my students were actively involved in learning mathematics. Following introduction of a lesson, students would begin their assignment alone, and ask for help as needed. The only communication concerning mathematics was that of exchanging answers. Rarely were the students discussing how a problem might be worked and why it may be worked in one way or another. Students needed to be exposed to a variety of appropriate strategies through verbal communication with group members. Communication among students would allow students to analyze and evaluate the mathematical thinking and strategies of others, and increase discourse of mathematical language in order to express mathematical ideas precisely. My students were not making connections in order to be successful on homework, quizzes, and tests. Internalization of concepts was not occurring. I felt that communication among peers would increase understanding.

I decided that I wanted to incorporate small-group work into my daily classroom lessons to promote mathematical communication. Self-assessment was implemented in order to focus students on the importance of their role in small-group work. Along with self-assessment of small-group work, I wanted to investigate the importance of usage of precise mathematical vocabulary and whether student attitudes toward mathematics class were influenced. Not only do students rarely communicate understanding, but the vocabulary they use is usually not mathematical. Currently I present vocabulary in the context of a lesson. Students are not given the opportunity to verbalize their understanding of precise mathematical vocabulary. They are

not provided a chance to communicate with peers using vocabulary from present and previous lessons.

I know how important attitude is in everything we do. How students feel about a subject can play a major role in whether they are active learners or not and whether they make an effort to internalize and own concepts. Working in a cooperative learning atmosphere seemed to be a way to improve student attitude toward mathematics. Students seemed comfortable in my classroom, but I was unsure of their attitude toward mathematics. Do they have the desire to become mathematicians? Are they striving to become mathematicians? Do they see the importance and relevance of mathematics in their lives?

Problem Statement

There is a need to generate understanding of student learning to be a teacher who successfully creates an environment conducive to learning. The *Principles and Standards for School Mathematics* (NCTM, 2000) emphasizes the importance of communication skills to student learning. In the classroom, communication must be promoted so that students take part in mathematical discourse. Since the goal is that students communicate to gain mathematical knowledge, it is worth considering the role that self-assessment in small-group work plays in student achievement, usage of precise mathematical vocabulary, and positive attitudes toward mathematics. Getting students to focus on and internalize the mathematical concepts at hand is difficult at best. Self-assessment may be a way to promote mathematical focus and desire to learn.

This is an important problem to consider and investigate because self-assessment in any genre is a way to promote internalization and ownership of learning. When students look closely at themselves as learners and see the important role they play in the development of themselves

and others, ownership of learning is more likely to occur. Self-assessment is a valuable teaching tool that applies to all ages of learners spanning all subject areas.

Literature Review

Cooperative learning has long been seen as a valuable tool to improve student understanding of a subject in a classroom. Recently the assessment practices of teachers with regard to cooperative learning have been considered. There has been an obvious turn toward the use of self-assessment as a valuable formative assessment tool in regard to peer learning. The literature suggests giving self-assessment is an important element to increase learning and foster a positive attitude in a cooperative learning environment.

Importance of Self-Assessment

A review of the literature shows a renewed surge toward the use of self-assessment and pinpoints its value to learning as a means of formative assessment. Black, Harrison, Lee, Marshall, and William (2004) collaborated with a group of 24 science and mathematics teachers willing to focus on assessment practices. These researchers found that peer-assessment and self-assessment play an important part in the development of student learning. According to these scholars, “Students can achieve a learning goal only if they understand that goal and can see what they need to do to reach it. So, self-assessment is essential to learning” (p. 5). Students are seen as active learners. They are engaged in not only checking for mistakes, but they “became much more aware of when they were learning and when they were not” (p. 8).

In their book, *Assessment for Learning: Putting it into Practice*, (Black, Harrison, Lee, Marshall, and William, 2005) the writers propose changes in teachers’ classroom practice with regard to assessment. They support many types of formative assessment which bolster student learning. The authors stated,

We judged nevertheless that existing research did provide some important guidance that would be helpful for all teachers. In particular, promotion of self-assessment by students, as a component of strategies to develop their capacity to take responsibility for their own learning, should be fundamental to the development of productive formative assessment (p. 18).

McDonald (2002) researched self assessment techniques used without formal training using a random sample of 570 high school students. In general she found that high school students implemented various self assessment methods in order to succeed. She found that, “High school students perceived self-assessment tasks as contributing directly to better performance in their school work” (p. 423). Another finding of the study was, “For the student, understanding appeared to be an essential ingredient in self-assessment” (p. 423). Self assessment also involved the desire for high school students to achieve.

Brookhart, Andolina, Zuza, and Furman (2004) researched forty-one students in two third grade classrooms involving three teachers. They found that student self-assessment resulted in deeper meaning for the students. The authors surmised that, “Student self-assessment was successful at turning the rote memorization task of learning the times tables into a deeper experience for students about monitoring their own mathematics learning” (p. 213). In a study involving computer math performance of four 6th grade students, Ninness, Ellis, and Ninness (1999) found self-assessment to be an important practice for learners. High rates of academic behavior correlated with self-assessment. The authors remarked, “Moreover, recent outcomes emphasizing the use of self-assessment procedures in applied settings have become increasingly diversified and impressive” (p. 404).

Stallings and Tascione (1996) implemented self-assessment in their own classrooms. They found that self-assessment is a crucial reinforcer and enhances student self-confidence through increased communication. They commented:

The Assessment Standards for School Mathematics (NCTM 1995) supports activities that involve students in evaluating their own progress. According to the Assessment Standards, student self-assessment can be used to improve students' confidence in their ability to do mathematics and allow them to become more independent in their learning of mathematics. We have employed student self-assessment and self-evaluation in our high school and college mathematics classes and have found that the processes engage students in evaluating their progress, aid in developing their communication skills, and increase their mathematics vocabulary. Most important, students reflect on their understanding of mathematics and on their ability to learn mathematics (p. 548).

Self-Assessment and Small-group Work

Implications for use of self-assessment in the cooperative learning setting were positive. Boud, Cohen, and Sampson (1999) wrote an article examining some of the main assessment issues in connection with peer learning. Self-assessment was one of the formative assessments considered. The authors found that present assessment practices work to undercut the goals of peer learning, and they suggest using group assessment, peer feedback and self-assessment, assessment of participation, and negotiated assessment (p. 413). They also encourage use of self-assessment in peer learning for the purpose of improving learning. If learning is to improve, "assessment should leave students better equipped to engage in their own self-assessments" (p. 419). Peer learning activities have the potential to promote critical thinking, and with proper assessment students will learn the skills necessary to become life-long learners (p. 420). "If the ultimate goal of higher learning is lifelong learning which automatically includes forms of reflection and self-assessment, then engaging in assessment in conjunction with peer learning provides a useful start" (p. 423).

In their article considering the Peer and Self Evaluation System (PSES), Strom and Strom (1999) say that self-assessment is one way to judge whether students attain the goals desired in teamwork which includes maximizing understanding in class and gaining group work skills. This holds students accountable individually and gives them credit for helping teammates (p. 171).

They also recount that in group work “self-evaluation gives students the practice they need to become effective judges of healthy group functioning in school, on the job, and at home” (p. 173).

Self-Assessment Affects Attitude

Another theme found in the literature is the connection between self-assessment and positive student attitude. A characterization of many of the research reports considered featured the idea that “The ways in which assessment affected the motivation and self-esteem of students, and the benefits of engaging students in self-assessment, both deserved careful attention” (Black et al., 2005, p. 10). A study by Brookhart, Andolina, Zuza, and Furman (2004) related “For the most part, students enjoyed participating in self-assessment” (p. 225). According to McDonald (2002) high school students believed self-assessment involved the aspiration to achieve, and they liked being able to better self-assess (p. 422). Stallings and Tascione (1996) found in their study that “student self-assessment is extremely effective in enhancing student’s self-confidence by affording many opportunities for students to learn and communicate about mathematics” (p. 252). In his book, *Student Involved Assessment for Learning*, Stiggins (2005) addresses a full spectrum of assessments topics. The writer focuses on demonstrating to teachers how to develop assessments that benefit student learning. Stiggins similarly agreed, “You can use assessment to help your students become confident, motivated, and successful learners by involving them deeply in ongoing classroom assessment, record keeping, and communication” (p. 1).

Importance of Vocabulary

The reviewed literature also acknowledges the importance of understanding necessary mathematical vocabulary in order to increase learning. In their article “Watch Your Language! Recommendations to Help Students Communicate Mathematically”, Bratina and Lipkin (2003)

reported that students need to communicate mathematical concepts and skills well. The authors asserted:

Ask a student for the exact definition of a term (e.g., perimeter, speed, prime number) that appears in the reading. If the student is unable to define the term exactly, there is little chance that the problem will be solved. Even if it is solved, a numerical answer may be devoid of meaning (p. 3).

In her book, *Teaching Mathematics Vocabulary in Context*, Murray (2004) proclaims the importance of students learning mathematical vocabulary. “Deliberate and careful attention to acquiring and using the vocabulary of mathematics, with its wondrously specific technical language, is a must” (p. 1). She also states, “An important way to ensure the development of mathematically powerful students is to build a strong foundation in mathematics vocabulary” (p. 4).

There is a definite agreement in the literature concerning the importance of self-assessment. The value has been observed in many classroom settings, as well as in a peer learning situation. Training the students concerning desired small-group behavior and the techniques of self-assessment has been shown to be critical to student success. A definite affirmative outcome that stems from the use of self-assessment is the positive affect it has on student attitude.

Absent from the literature is whether increased usage and understanding of vocabulary occurs as a result of self-assessment practices and small group work. Through my research I hope to find a link between the communication and strategies involved in cooperative learning and increased usage and understanding of mathematical vocabulary.

Purpose Statement

The purpose of this study is to explore the relationship between self-assessment and student learning in small-group work. It is intended to examine the impact that self-assessment

has on student group work in mathematics class, usage of precise mathematical vocabulary, and students' attitudes toward mathematics. The variables of quality and quantity of work done by students in small groups, quality and quantity of precise vocabulary used by students in small-group work, the amount that all students are involved in the group process, and the change in attitudes toward math class and/or group work will be examined. These variables will be used to help answer the following research questions:

- What are the effects of self-assessment on student group work in math class?
- What are the effects of self-assessment on student usage of precise mathematical vocabulary?
- What are the effects of self-assessment on student attitudes in math class?

Method

A variety of methods were used to collect data for this research project. Data was collected from February 1, 2007 through April 22, 2007 and occurred in the researcher's classroom. All of the research questions were addressed using weekly student self-assessment forms (Appendix A). Pre and post group work interviews (Appendix B) were utilized to assess the effects of self-assessment on student group work and student attitudes in math class.

“Vocabulary Monitor” tally sheets (Appendix C) were utilized and set aside to track the usage of precise mathematical vocabulary during small-group work. Pre and post research surveys entitled “Cooperative Group Survey (Appendix E) and “Math Survey (Appendix F) were administered dealing with small-group work and mathematics in general. A teacher journal was maintained throughout the research to record observations of usage of precise mathematical vocabulary and record observations of small-group interaction and attitudes.

Specifically, the self-assessment forms were filled out weekly by all students. Included were questions about how they felt about working in groups and if it was beneficial, the effort of themselves and group members, their understanding of math concepts that week, and the precise mathematical vocabulary and “slangmath” used during the previous week. “Slangmath” is defined as incorrect mathematical terms that are used though more precise terms are available. There were two weeks that the self-assessment forms were not utilized because there were only two days of school in those weeks. In each of those weeks, only one day of small-group work occurred. The information for six of the questions was tallied and charted to note student responses.

Student pre and post group work interview responses were audio- recorded and written as hard copy. Questions in the pre and post group work interviews included how they felt about mathematics and working in small groups, whether group work was helpful, and the benefits of using precise vocabulary and how they feel about it. Additional questions for the post-interview included reactions to having to be “Vocabulary Monitor” and using the tally sheets, how they felt about the weekly self-assessment forms, what they would do differently with small group work, and whether I should have next year’s 8th graders work in small groups.

The “Vocabulary Monitor” student vocabulary tally forms were completed by the small groups each day. The students were introduced to a problem set and given time to work together in groups. The precise vocabulary tallies were totaled daily, and weekly totals were charted (Appendix D) for comparison throughout the study. Precise mathematical vocabulary to “slangmath” vocabulary ratios were converted to decimal form.

Pre and post student surveys that dealt with small-group work and mathematics in general were charted. A Likert scale of 1 (strongly agree) to 5 (strongly disagree) was used, and the

mean and standard deviation for six of the statements was found. Change in mean and standard deviation was utilized to note commonalities and differences between pre and post surveys, and to note any changes in understanding and attitudes due to self-assessment. Statements dealt with whether students like math and do they consider themselves good at math, do they like working in groups, does working in a group help them get work completed on time, do they ask questions in math class and are they comfortable with asking questions, and are they able to understand and demonstrate math concepts.

A teacher journal was used to monitor what occurred throughout the research study. Daily entries were made, and a longer summative entry was written weekly. The teacher journal documented student participation, any interruptions in research due to illness or school-related issues, and student attitudes in the classroom.

Findings

Research findings indicate that self-assessment has a positive affect on student group work in math class. The students were conscientious of the role they played in their group, and felt they were good contributors to the group. This is evidenced by the weekly self-assessment forms. Throughout the research students responded 108 to 18 that they felt working in groups helped them understand the math concepts presented weekly. A few of the comments were about how group members helped them by; “working together to solve the problems”, “if I didn’t get them someone else might”, and “they knew what to do” (Student self-assessment forms, March-April, 2007). Students also indicated on their self-assessment forms that, over all, the quality of their effort in group work continued to improve. In response to the question: “The quality of my effort this week in group work has been (excellent / pretty good / could have been better),” 41 students marked excellent, 76 chose pretty good, and 9 marked could have been better. By the

end of the study, in week 10, no students marked that their effort in group work could have been better.

I documented in my teacher journal (March 23, 2007) that two students who are rarely contributors to their group spoke up concerning how to work a problem. I also wrote that by April 27, “all students were working well in groups,” and “nearly all were contributing in some way.” The first day of my teacher journal, February 2, I remarked that 5 students in particular were not contributing. By February 21, 4 of these students were interjecting thoughts more often.

The post-interviews completed in April, indicated that students were aware of the importance of a good group member. Many remarked that working in groups in math class made their lives easier because; “if you don’t understand someone will help”, “friends explain it”, “if I struggle, partners will help me” (Post-interview questions, April 2007).

The use of self-assessment has broadened the student self-awareness of how often they use precise mathematics vocabulary and how often they are using “slangmath”. They are recognizing vocabulary as it is used in class by themselves, classmates, and me. At first, the students did not care for the idea of having to keep track of the precise math vocabulary they used. There was some grumbling in the first few weeks, as written in my teacher journal, February 21, 2007. I documented in my teacher journal on March 21, 2007 that “students readily accepted the tally sheets.” I also noted that they seemed to be focusing more on what was being said by the group members and specific wording that was in each problem they were working. On April 27, 2007, I acknowledged in my teacher journal that “students continued to recognize precise vocabulary as I led whole group discussion.” It became obvious that the precise-vocabulary tally sheets and the small-group work self-assessment heightened student awareness of the importance of precise math vocabulary.

Post-interview responses backed-up the importance of the precise-vocabulary tally sheets. In reaction to the question: “Do you think that knowing you will have to fill out the form helps you pay more attention to using precise mathematical vocabulary?”, students said: “people actually try to use the concepts”, “you have to look through the lesson to find the words”, and “you need to know what your vocabulary is to write it down and to use it”. When students were asked about the benefits of precise math vocabulary in general many students remarked that, “it helps you understand the book and your assignments”, and “it will help you in the future.”

The “Vocabulary Monitor” tally sheets show an increased ratio of precise mathematical vocabulary words to “slangmath” used by the students. The first week of research saw a ratio of 69 to 88, or 0.78, of precise math vocabulary used to “slangmath”. By the end of the research in week 10, the ratio of precise math vocabulary to “slangmath” had changed to 205 to 85, or 2.45. New precise vocabulary emerged on the tally sheets as the weeks went on. Progressively, there were fewer “slangmath” words added to the tally sheets. Possibly, as the students added precise math vocabulary and focused on using it, they were not finding the need to derive “slangmath” for those particular words. Some of the increase in precise math vocabulary to “slangmath” may be attributed to the student’s knowledge that I wanted them to use more the precise math vocabulary.

Self-assessment forms also backed up the idea that small-group work helped students understand precise math vocabulary as well as mathematics concepts. Overwhelmingly, the response to the question: “Working in groups (helped / didn’t help) me understand precise mathematical vocabulary used today,” was 108 students said it helped, and 17 said it didn’t help. “Slangmath” they caught themselves using throughout the study remained the same or greatly reduced by the last week of research.

Attitudes concerning small-group work and math remained positive throughout the research study. Data from the two surveys administered before the research began and upon the conclusion of the study illustrate attitudes remained positive or improved. There was a slight increase in the mean of responses to the statement of whether they perceived themselves as understanding math concepts when working in groups. A slight mean increase was evident for the statement, “Working in groups helps me understand the concepts better”, and the statement “I understand the math concepts when I work in a group.” Mean results for the post math survey showed a slight increase for the statements concerning liking math, being good at math, the importance of math skills, and ability to show work to solve math problems. This was also evidenced in the self-assessment forms asking: “I understood the math concepts this week (really well / okay / hardly at all).” Throughout the 10 weeks, 47 students marked really well, 75 chose okay, and 1 student chose hardly at all. 117 times during the study students saw the quality of their group work as excellent or pretty good as opposed to 9 times that they felt they could have been better.

Self-assessment forms from week 1 through week 10 show that students continued to like working in groups. From the first week of responding to the statement: “Compared to working by myself, this week I have liked working in a group in math class (better / worse / about the same)”, 78 students chose better, 47 students chose about the same, and only 2 students chose worse. Only 9 times did the students mark that the quality of their efforts in group work could have been better.

Conclusions

Students like to learn from one another and like the chance to interact in math class. Students understand the value of small-group work in understanding mathematical concepts and completing their assignments. Students also recognized the value of precise mathematical vocabulary and the frequency of its use in math class. Self-assessment made them aware of how often everyone in math class uses precise math vocabulary and “slangmath.” There does seem to be a link between communication and increased understanding of precise mathematical vocabulary. Self-assessment encourages students to take a closer look at themselves as learners and helps them become more accomplished students. They increased their understanding of their role and accepted the importance of their role in the classroom.

With weeks of practice at being in a small-group setting, timid students began to contribute ideas to peers. Unwilling to contribute in whole-class discussions as well as small-group work, these students were more open to interjecting their own ideas as the research progressed. The overwhelming majority of students saw themselves as good contributors to their small group.

These findings support the scholarly literature of Black, Harrison, Lee, Marshall, and William (2000). They found “self-assessment is essential to learning” (p.5). Students were seen by them as active learners, and self-assessment makes them aware of when they are learning. Findings from this study also support those of Black, Harrison, Lee, Marshall, and William (2005). They found that self-assessment warranted careful attention because of its benefits of student engagement and the ways in which it motivated and raised self-esteem.

Implications

Self-assessment is a way for teachers to engage students in the learning process. Small-group work and self-assessment go “hand-in-hand” as a means to increase communication in math class. Small-group work is a way to bolster and improve student attitudes toward problem solving, paying particular attention to using precise math vocabulary over “slangmath”, and completing math assignments. There is a rise in comfort level when students know there is help immediately available.

This research study demonstrates one way in which teachers may increase student use of precise mathematical vocabulary in the math classroom. Students became more aware of what precise math vocabulary was being introduced and used by the teacher as well as the vocabulary in their text books and the vocabulary used by their classmates.

Next year I will begin utilizing small-group work from the very beginning. I believe it will engage the students in becoming active learners and lead them to internalize math concepts. Hopefully, they will feel like they own their learning. A large part of implementing small-group work will be using self-assessment. Self-assessment validates the learner and enlightens them to areas in which they need to improve. I will use self-assessment forms every other week or so. As a part of implementing small-group work into my classroom, I will try to monitor particular quiz and test questions that make use of precise math vocabulary. Hopefully, I will see an increase in what they understand and retain. Even if I may be able to chart only 2 to 4 of the 20 questions on their quizzes and tests, I will be able to make adjustments in my teaching to benefit the learning process. Finally, I believe it is time to add quizzes made up of only precise math vocabulary. I am convinced of the importance of students using precise math vocabulary, and this will give me another way to closely watch what they are accomplishing.

For those teachers who recognize a need for improved communication and/or utilization of precise mathematical vocabulary, self-assessment and small-group work can be the answer. Minimal time is required to set up the groups and enlighten students concerning their group roles. Small-group work does not need to occur daily; setting aside a day or two a week for group work will foster student discourse. A simplified tally sheet may be incorporated to give teacher and student an idea of the quality and quantity of precise mathematical vocabulary words being utilized. Self-assessment of some variety will help the students monitor and acquire ownership of their learning. Self-assessment could take many forms such as; informal individual or group meetings, journaling, quick interviews, or self-assessment forms used occasionally.

I have seen through my research that use of self-assessment and small group work has personally engaged students in the learning process. Attitudes improved or remained positive in the math classroom. The comfort level of many students increased regarding offering ideas as well as using precise mathematical vocabulary. Consistency and continuity of focus on self-assessment, communication skills, and precise mathematical vocabulary, kindergarten through 12th grade, will mathematically empower students.

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Appendix A

Student Self-Assessment Form (Weekly)

Circle the appropriate word in each sentence, and then explain your choice:

1. Compared to working by myself, this week I have liked working in a group in math class (better / worse / about the same) because:
2. The quality of my effort this week in group work has been (excellent / pretty good / could have been better) because:
3. The quality of my group-mates' efforts this week has been (excellent / pretty good / could have been better) because:
4. I understand the math concepts this week (really well / okay /hardly at all) because:
5. The hardest concept we learned this week in math was _____, because:
6. Working in groups (helped / didn't help) me understand this concept better, because:
7. Precise mathematical vocabulary terms I've used this week are:
8. Working in groups (helped / didn't help) me understand precise mathematical vocabulary used today, because:
9. "Slangmath" I caught myself using this week includes:

Appendix B

Student Interview Questions

Questions for pre/post interview:

- 1) In math class, we will be (have been) working in groups. In general, does working in a group make your life easier in math class? Why or why not?
- 2) What do you usually find to be the most frustrating aspect of working in groups in math class?
- 3) What do you usually find to be the most frustrating part of math class when we don't work in groups?
- 4) Why do you think I want students to work together in groups in math class?
- 5) If you could change one thing about working in groups, what would it be? Why?
- 6) What can you think of as a benefit to students using precise mathematical vocabulary?
- 7) What can you think of as a benefit to students not worrying about using precise mathematical vocabulary?
- 8) If you could summarize your feelings about being pushed to use precise math vocabulary, what would it be?
- 9) Compared to other people you know, do you think you like math more, less, or about the same as them? Why?
- 10) What is your favorite subject in school? Why?
- 11) What do you think are some traits of a great teacher?
- 12) Why do you think math is a subject that is required for everyone to take?
- 13) Can you describe some ways you will probably be using math when you are 35?
- 14) If math were a color, what color would it be and why?
- 15) If someone who hadn't ever been to school suddenly joined our class and asked you what math was, what would you tell them?

Appendix B (continued)

Student Interview Questions

Questions for post interview:

1. I've been nagging students lately to pay attention to using precise vocabulary in math class. Why do you think I've been doing that?
2. I've been having you fill out a self-assessment form every week for a while now. How does it make you feel to have to fill out that form?
3. What were your reactions to having to be the vocabulary monitor for your group occasionally?
4. Do you think that knowing you will have to fill out the form helps you pay more attention to using precise vocabulary?
5. Do you think that knowing you will have to fill out the form helps you and your classmates work more productively in groups?
6. Do you think I should have my 8th graders next year do the same project? Why or why not?
7. Do you want to work in the groups like this again next year? Why or why not?
8. If you were in charge of group work in math class, what would you do differently than what I do?
9. Do you feel differently about math class after this project? Explain.

Appendix C

Student Vocabulary Tally Form

Place a tally mark in the appropriate column. Hand this form into the teacher at the end of the class. (If you have time to write down the words your group mates used, please do.)

Precise Vocabulary Used

“Slangmath” Used

Appendix D

Precise Mathematics Vocabulary Tally Sheet Results

WEEK OF RESEARCH	DATES GATHERED	PRECISE MATH VOCABULARY TALLIES	“SLANGMATH” VOCABULARY TALLIES	DECIMAL
Week 1	2/20-2/21	69	88	0.78
Week 2	2/26-2/28	61	102	0.60
Week 3	3/6	22	31	0.71
Week 4	3/12, 3/14-3/15	117	109	1.07
Week 5	3/20, 3/22-3/23	92	68	1.35
Week 6	3/26-3/27	85	35	2.43
Week 7	4/2-4/5	216	105	2.06
Week 8	4/12	55	32	1.72
Week 9	4/16-4/17	108	46	2.35
Week 10	4/25-4/26	205	85	2.41

Appendix E
COOPERATIVE GROUP SURVEY

Please give your honest response to each statement.

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1. I like to work in groups in math class.	1	2	3	4	5
2. I ask questions of others when I work in a group.	1	2	3	4	5
3. I understand the math concepts when I work in a group.	1	2	3	4	5
4. Others in the group ask me questions when we work in groups.	1	2	3	4	5
5. Working in a group helps me understand the concepts better.	1	2	3	4	5
6. Working in a group helps me get the work completed on time.	1	2	3	4	5

Please answer the following questions:

7. You are asked to work in a group. If you get to choose two people to work with, who would they be and why?

8. What is the best thing about working in groups?

9. What is the worst thing about working in groups?

Appendix F

MATH SURVEY

Please give your honest response to each statement.

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1. I like math.	1	2	3	4	5
2. I am good at math.	1	2	3	4	5
3. Math skills are important for other skills.	1	2	3	4	5
4. I am able to show the work required to solve math problems.	1	2	3	4	5
5. I like to answer questions asked in math class.	1	2	3	4	5
6. I feel comfortable asking questions in math if I don't understand a concept.	1	2	3	4	5

Please answer the following questions:

10. This is my favorite math concept and why:

11. One good thing that happened in math is:

12. One not so good thing that happened in math is:

13. What I wish my math teacher knew about me is: