

Journal Writing: Taking Math Instruction to the Next Level

by

Anthony Gianvecchio

December, 2009

A thesis submitted to the

Department of Education and Human Development of the

State University of New York College at Brockport

In partial fulfillment of the requirements for the degree of

Master of Science in Education

Journal Writing: Taking Math Instruction to the Next Level

by

Anthony Gianvecchio

APPROVED BY:

Conrad Van Voorst
Advisor

12/10/09
Date

[Signature]
Director, Graduate Programs

12/14/09
Date

Abstract

In the last two decades literacy has been the focus across all content areas, including mathematics, allowing students to demonstrate their thinking processes and understanding. The purpose of this qualitative study was to discover if journal writing in math improves middle school students' ability to gain a greater understanding of the processes involved in mathematical reasoning. Students in an eighth grade math class in a suburban middle school in Western New York completed journal entries at the start of a new unit to discern knowledge of the topic. The conclusions imply that journal writing aids in student mathematical learning. Math journals not only help instructors in understanding students' feelings, but also help students demonstrate their mathematical thinking processes and understanding.

Table of Contents

| | |
|---|----|
| Chapter 1: Introduction..... | 1 |
| General Statement of the Problem..... | 1 |
| Reform in Mathematics Education..... | 1 |
| Chapter 2: Purpose – Why Journals?..... | 4 |
| Research Questions..... | 4 |
| Review of Literature..... | 4 |
| Chapter 3: The Solution Strategy - Method..... | 11 |
| Participants..... | 11 |
| Setting..... | 11 |
| Data Collection..... | 12 |
| Chapter 4: Project Results..... | 15 |
| Research Question One..... | 15 |
| Research Question Two..... | 16 |
| Research Question Three..... | 17 |
| Chapter 5: Conclusions and Recommendations..... | 19 |
| Closing Remarks..... | 22 |
| References..... | 24 |
| Appendixes..... | 26 |

Chapter 1

Introduction

General Statement of the Problem

In 2007 more than 40% of eighth grade students in the state of New York failed to meet learning standards. According to the New York State Education Department, one in eight 8th graders scored in the lowest level possible on the exam, showing serious academic problems (2007). Today's math curriculum provides students with a rigorous approach to solving complex problems that require a significant amount of effort. Students are being asked to justify their answers more frequently and often have difficulty describing their thought processes and mathematical procedures used in the problem. This communication of mathematics has become part of the curriculum in various ways. According to the National Council of Teachers of Mathematics (NCTM), “when students are challenged to communicate the results of their thinking to others orally or in writing, they learn to be clear, convincing, and precise in their use of mathematical language” (2000, p. 4). One way in which teachers can evaluate student progress and recognize strengths and weaknesses is through journal writing. It helps students broaden their thinking and become more actively engaged in classroom activities.

Reform in Mathematics Education

The thought of a journal in math class may at first sound abnormal. One normally would not think that creative writing and feelings about the subject could be a regular mathematics classroom practice. Yet reform in mathematics education has

called for an increased emphasis on meaningful experiences in mathematics and a decreased emphasis on the repeated practice of computational algorithms (NCTM, 1989). One such experience is the use of a journal or learning log. This recent reform supports a variety of teaching approaches away from traditional methods of instruction to a learning environment that supports conceptual understanding of mathematics (Pinzker, 2001).

Perhaps journal writing in math is more common today, but prior to the implementation of new math curricula across New York State there was no need to use this form of communication in the classroom. The level of thinking required in today's math classroom has changed drastically in the last 10 years. This change in philosophy has placed the student at the forefront of the learning process, meaning "the student becomes actively involved in constructing his or her own knowledge of mathematics rather than the teacher demonstrating a skill and having the student practice this skill until it is memorized" (Martinie and Marcoux, 2004, p. 86). Learning is a lifelong process that takes time, patience, and imagination. Prior research shows that by asking students to maintain a journal of their learning experiences and reflections, the teacher enhances the learning process for students (Wormelli, 2005). Through journal writing the teacher gains access to students' thoughts in order to improve instruction. As Corwin explains her feelings about learning math today she states that finding a solution to a math problem is useless unless one can describe the solution process to someone else; communication is the key to understanding math (1996).

Math journals serve multiple purposes and can be set up in many different ways. Wormelli (2005) uses journals as a reflection and communication tool among classmates. Students record the essence of math problems and solutions, are prompted to apply the information to a new problem to prove their level of understanding, and discuss their responses with others. "Students do best when they respond independently and then discuss their responses with partners or small groups before discussing with the whole class" (p. 107). Corwin (1996) believes that writing in math captures the significance of doing the math (p. 58). She has students write in journals, learning logs, free write, create math autobiographies, write formal math papers, and even write test questions. Furthermore, Pinzker (2001) had students write in journals to increase involvement in mathematics and deepen understanding of mathematical concepts. Her entries ranged from affective topics to those that were strictly mathematical in nature to provide a comfortable balance for students. In a traditional math curriculum from years past, writing would not make sense. "To understand what mathematics is we need to look at what mathematicians do, for this is a human endeavor, a thinking process the results of which come from the work of human minds" (Corwin, p. 63).

Chapter 2

Purpose – Why Journals?

Research Questions

The main purpose of this study was to find out if journal writing in math improves middle school students' ability to gain a greater understanding of the processes involved in their work. Students used written and oral communication among fellow classmates and with the teacher at the introduction of a new unit and to reflect on material learned at the completion of a unit. Other entries prompted students to share their goals and thoughts about various aspects of their educational career thus far (see Appendixes A and B for journal prompts and interview questions). The questions posed by the researcher prior to the study were: what types of journal entries will allow teachers to best recognize student strengths and needs, how effectively do eighth graders respond to extended response questions in journal form, and how will the use of journals change the way students respond during daily lessons, if at all?

Review of Literature

Students must be able to see and understand mathematics not as a collection of separate ideas and procedures but as a domain that is relevant and meaningful in many aspects of life (Pinzker, 2001). According to Au (1998), Vygotsky is a theorist who appears to have had the greatest influence on literacy researchers working from a social constructivist perspective. Today's mathematics classroom has a literacy focus with more than just math exercises at its core. A more holistic approach to real life

learning has developed with applications of the math to that which we experience in the real world. A large part of this is the connection between literacy development from the context of a math problem to the math that will enable the follow through of the problem. It is not until the teacher bridges the gap from literacy to math that these real life concepts can reach fruition.

Vygotsky's approach to learning is holistic with the idea that social, cultural, and historical factors all play a part in his theory of cognitive development. Social constructivist theory research on literacy in the classroom includes attention to the motivational and emotional dimensions of literacy, as well as the cognitive and strategic ones (Au, 1998). Students should be provided with the opportunity to practice literacy in multiple forms, including both formal and informal manners. Journaling allows students to use their personal experiences and backgrounds to provide thoughts and ideas in the math classroom. When students are provided the time and resources to meld together their multiple cognitive capabilities, a rich learning experience has been developed.

There is evidence that supports journal writing as part of mathematics instruction because journals provide cognitive benefits to students. Cognitive benefits to students include increased procedural knowledge, conceptual understanding, and mathematical communication (Pinzker, 2001). Journal writing is a strategy for learning that, if done with a holistic approach in mind, incorporates the social, cultural, and historical factors of Vygotsky's approach. When students are able to use self-expression, they are practicing Vygotsky's ideas of cognitive development by

bringing their own views to the learning process. “Research on school literacy learning conducted from a social constructivist perspective assumes that students need to engage in authentic literacy activities, not activities contrived for practice” (Au, 1998). Journaling provides the authenticity in the math curriculum for students to think about their thinking, speak their mind appropriately, and communicate mathematically with their teacher in a non-traditional manner. This practice can be even more positive in classroom “discussions” since some students need the time to think before speaking and are able to share personal ideas in a journal that they wouldn't otherwise in a public discussion.

Social constructivism's motivational and emotional dimensions are another aspect of journal writing. When students are able to use self-expression, a line of communication is established between teacher and student (Pinzker, 2001). Open communication provides a key to the social development of the student which in turn creates a sense of community and safety in the classroom. The emotional anxiety that many students face in math is often a barrier that, without open communication, further inhibits their understanding of the content. This is why students' motivation is tied directly to their emotional connection to the subject. When students feel that their voice is important, regardless of how mathematically correct their responses are, they are more willing to participate and become an active member of the class. It is worthwhile to consider both formal math entries for students to respond to, along with informal thought-provoking entries that allow them to share an opinion that will provide the teacher with some insight into the students' minds. Maybe students share

a positive experience they have had with a previous teacher, or a negative one that sticks with them. They might share something that they want to do in class or oppositely something that they hope to never have to do again. Emotions are equally important as the math content itself when attempting to bring students into the realm of mathematics.

When students feel that their voice is important, a level of comfort is reached that will also motivate them to do well. The emotional connection to the teacher can change their entire perspective on mathematics. Pinzker's research found that students will remember specific incidences that have a negative impact on their perceptions of math. Students' perceptions of math are directly related to their learning and comprehension of concepts (2001). She also found that “the teacher is a critical component of the classroom, and his or her classroom behavior and attitude impacts student learning.” Therefore the teacher can, through the use of journals, allow students to feel comfortable and be an important member of the learning experience.

On a more math-content-oriented view of journals, the writing that Vygotsky feels is crucial in fostering students' relationship with the subject encompasses the emotional development with that of their surroundings. In order for a child to internalize higher mental functions, they must be in tune with multiple aspects of their learning environment in order to make connections with what they already know and what they are being taught (Au, 1998). “Social constructivist research on literacy

focuses on the role of teachers, peers, family members in mediating learning, on the dynamics of classroom instruction, and on the organization of systems within

which children learn or fail to learn (Moll, 1990). The learning process is not a single-minded task, but rather that of the child's surroundings and those who are part of the child's development. Therefore the teacher must keep in mind that he or she is a key component in the student's surroundings, contributing to a major part of his or her social development. According to Vygotsky (1987), the social origin of higher mental functions can be defined as the difference between the child's actual level of development and the level of performance that he or she achieves in collaboration with the adult. Thus it is crucial for the teacher to maintain a positive role in the student's eyes, allowing numerous opportunities for meaningful social interaction.

Vygotsky's (1987) social constructivist theory about the social development of a child and its relationship to learning mathematics today states that the child gains everyday (or spontaneous) concepts through daily life, whereas he or she learns scientific concepts through formal instruction and schooling. Through his research he addresses the manner in which school literacy learning activities can be restructured to allow students to acquire academic knowledge (scientific) concepts by building on the foundation of personal experience (everyday concepts). These thoughts can be put into action with the use of journals since academic knowledge and personal experience are interrelated in a reflective and interactive journal. A teacher might ask students to brainstorm all that they know about slope and explain how they would relate slope to an algebra student who is learning it for the first time. This journal entry allows students to think back to when they learned this concept for the first time and explain what they related slope to in the real world. They might also include a

mathematical explanation of the relationship between slope and its table of values, graph, and equation, or where slope is seen in their everyday lives such as a staircase or ski slope. This gives students the freedom to think, relate, and apply a concept all while building on their literacy skills through the use of communication.

The use of writing in math class goes beyond social development. Corwin (1996) states that writing in mathematics presupposes a different view of mathematics and mathematics instruction; mathematics is a way of thinking about the world. It is important for students to realize how they will encounter math outside of the classroom so that the learning has a realistic and practical foundation in the student's mind. Recent standards from the National Council for Teachers of Mathematics include the idea that connections of math to a world view should be emphasized so students will not only learn mathematics but they will also learn the utility of mathematics (NCTM, 2000). Additionally, Corwin rightfully states that “the intelligent citizen of the twenty-first century needs to know how to analyze data, how to reason in probabilistic situations, and how to make choices.” These are things that every student will encounter in their everyday lives that should also be a part of their learning in the classroom. NCTM's 1989 *Standards* emphasize that students are expected to “reflect and clarify their own thinking about mathematical ideas and situations,” “use the skills of reading, listening, and viewing to interpret and evaluate mathematical ideas,” and “discuss mathematical ideas and make conjectures and convincing arguments.” With such a clear emphasis on understanding and communicating, it is apparent that various forms of journal writing are appropriate in

today's math classroom.

Chapter 3

Solution Strategy - Method

Participants

In this qualitative study, the five participants involved were all 8th graders between the ages of 12 and 14. Of the five participants, four were regular education and one was special education. The special education participant was a high achieving Caucasian female with physical and learning disabilities. Within the four regular education participants, two were Caucasian: one male and one female. One was an African American female, and 1 was an Asian male. Two of the regular education participants were high achieving and two were low achieving.

Setting

Participants were in an eighth grade classroom of a suburban school district in Western New York. The school district encompasses three high schools, four middle schools, and thirteen elementary schools. The school where the research was performed consists of grades six through eight. It was located in a community with families of low, middle, and high socioeconomic status. Two major low income housing complexes comprise most of the students from low socioeconomic backgrounds, while the remainder of students comes from a blend of middle to upper class housing developments.

The participants are part of a 92 student team consisting of 26 special education students in an inclusive education setting. Approximately 80% of the students were Caucasian, 15% were African American, and 5% Hispanic. Students

have remained together from sixth through eighth grade as the district continues to loop middle school students together throughout their middle school years.

Data Collection

Within the classroom students were organized in groups of four. The instructional process has been enhanced with the inclusion of an interactive Smart Board which was initially only part of inclusive education classrooms. This technology has become more prevalent in general education classrooms in the last three years.

Participants in this study completed non-graded reflective journal entries to document processes for solving word problems, to consider mathematics concepts, to reflect on personal progress in learning, and to reflect on various aspects of their educational career thus far (see Appendixes C through I for complete journal responses). The five participants wrote journal responses at various times over a ten week period during the equation solving, angle relationships, and proportional reasoning units. These units have been especially prevalent on the Math 8 State Assessment in the last two years along with the connection of algebra to angle relationships. Data was collected in the form of written journal entries, classroom observations of student behavior and discussions, and interview responses. Journals were collected from the special education student and four general education students.

Interview questions for the angles unit asked participants to describe what they know about angles and where they see angles in their everyday lives. This provided the researcher with knowledge of what the students already knew and on

what level of thinking they were at with angles. This also was a tool to judge participants' misconceptions about angles right away. At the conclusion of the unit participants were asked to look through the unit assessment to find a topic or question they still had difficulty with even after the assessment. These responses were recorded in journals. They were asked to try to explain the mistake(s) they continued to make or to explain what the turning point was with learning how to solve a specific problem. In order for participants to feel comfortable with responding, another journal entry asked participants to define their favorite and/or least favorite part of the angles unit. This type of question was designed to open dialog between participant and researcher in an informal manner.

Similar to the first series of interview questions about angles, another series of questions came at the start of the proportional reasoning unit for students to record responses in their journal. Participants were asked what they already knew about proportions, what they weren't sure about proportions, and what they would like to know about proportions. This type of questioning was informal in nature since participants were not being tested on a specific math question but rather asked for their thoughts on a topic they had not studied in over a year.

Throughout the unit students responded to various affective journal prompts regarding their thoughts, feelings, and educational ambitions. Students wrote freely to provide the researcher insight into their honest feelings about mathematics.

The final form of data collection for this study was observing participants' behavior in the classroom after completing a series of journal entries. The researcher

intended on finding out how journal writing in math class changed the way students responded during class discussions and activities, if at all.

Once the participants completed journal entries the researcher read each entry and noted any common responses. Different categories of responses were written down and each of the responses was organized by category. This allowed for an organized way to find patterns and themes in student thought processes.

Data collection of this manner had both advantages and disadvantages. Reading journal responses allowed the researcher to keep track of their level of understanding, mathematical reasoning, interest, and opinions about a certain topic. It allowed participants to become more involved in the learning process by giving them the chance to speak their minds without worrying about it affecting their grade. The design of this research was intended to not only discover how journal writing in math class affects achievement levels, but to open communication lines between student and teacher. Journal writing allows students to express their feelings freely. When a different line of communication is established between student and teacher the relationship is strengthened, developing trust and a sense of community and safety in the classroom (Pinzker, 2001).

A disadvantage of collecting journals is the amount of time consumed to read and reflect on each one. Since entries had no limit on words, a participant who has difficulty expressing his or her thoughts in a concise fashion may write multiple paragraphs to get an idea on the page while only offering a sentence or two of pertinent information.

Chapter 4

Project Results

Research Question One

My first research question inquired about the types of journal entries that allow teachers to best recognize student strengths and needs. Participants gave the most valuable information pertaining to their mathematical knowledge at the conclusion of a unit by identifying their strengths and weaknesses. Four out of five responses were complete with full thoughts and appropriate math terminology. These were also open ended questions that focused on finding one topic giving participants difficulty during the unit. For instance Student A responded as follows, “I liked finding vertical angles and complementary and supplementary angles. They were easy to see after a while and I could apply them to a picture of parallel lines cut by a transversal.” Student B stated her feelings to the favorite and least favorite part of the unit maturely, “I liked defining the types of angles in parallel lines problems because they made sense after a while. I didn't like setting up equations for the pictures because if you mess up one step, the whole thing gets messed up. I also had trouble finding the angle measures after solving for x . It reminds me of checking a solution to an equation which is what I had trouble with at the beginning of the year.” Student D offered “I had trouble putting equations together, knowing how to combine like terms.”

When asked at the beginning of a unit what they know, what they would like to know, and what they still are not sure about proportions, responses were brief and

did not provide much in-depth reflection from the participants. Student A responded with “they got fractions in them.” Student B stated “we used the fish method last year.” Three out of five participants mentioned the fish method from seventh grade, yet two of them admitted not remembering what the fish method was. Only one participant inquired about another method to solve proportions other than the fish method. Few of the responses for this type of entry at the start of a new unit were longer than one sentence. Two participants failed to answer all of the prompts by leaving them blank.

The entries that were less focused on math content and more about student feelings built the foundation of trust and solidified more positive interactions between teacher and student. It was the affective entries that allowed me to gain access into who they were as people and why they might think, react, and learn a certain way. For example, great insight was provided regarding a student's perception of what makes a good math teacher and how critical their role is for student learning. The most common traits included patience, energy, and knowledge of the subject. It was sensible, yet surprising at the same time, that a student would write “they should love what they do because they put more effort into work.” Students sense when a teacher truly enjoys his or her work and naturally motivates students to want to learn.

Research Question Two

My second research question asked how effectively eighth graders respond to extended response questions. All of the journal prompts were considered extended response since they were not seeking one word answers. With the first journal entry

regarding a personal difficult topic from the angles unit, all five participants answered with at least two complete sentences. They all stated a topic and gave a reason why it remained difficult for them. Entries that were less focused on specific math content tended to be lengthier. Students could write as they might speak, without having to think as much as with a mathematical response. The entry with the smallest response length, yet still quite insightful, was the question asking them for a favorite and least favorite part of the unit. Participants provided feelings about math but had to write about mathematical specifics. Since this was at the conclusion of the unit, most participants were able to provide sound math vocabulary with their descriptions.

Research Question Three

The third research question asked how the use of journals affects the way students respond during daily lessons. Of the five participants, three have shown a higher level of engagement by raising their hands more often and calling me over for reassurance more than ever before. Additionally, students have been inquiring about different methods to solve proportions and have been receptive to multiple alternatives other than the fish method. Student E rarely participates in class but wrote in his journal that he wants to learn how to use proportions in real life outside of the classroom. Since writing that he has offered ways to solve proportional reasoning problems on numerous occasions. He has explained to the class how the fish method is equivalent to cross multiplying and solving an equation. While his participation level has increased, it is difficult to tell if it is because of the journal entry at the beginning of the unit or for other reasons such as strength in mathematical reasoning

skills or a skill that he had success with in the past.

Chapter 5

Conclusions and Recommendations

The results of these research questions have led to some interesting conclusions about the way students think and write in math class. The implementation of journals has been a beneficial experience for both the teacher and students. Having never assigned students journal entries I had no idea how the responses would look, what kind of language students would use (math appropriate or mostly generic terms), and how complete the responses would be. My hope was that students would strive to clearly communicate their mathematical ideas and make sense of math language (NCTM, 1989).

The first major conclusion I made from this study was that students were more motivated during a lesson when they started the class with journal writing. It set the tone for what lied ahead and students were receptive to writing down their thoughts. They took each entry seriously and wanted to share their thoughts with group members and as a class. They enjoyed sharing the fish method with me since it was a method I pretended to know nothing about and told them to share it with me in the journal and to describe it to me after writing in the journal. After recording their thoughts and thinking through the process before talking they were very clear in their verbal description and listening to classmates describe the process. This was a positive listening exercise for students who had difficulty writing down a response to my question. They were hearing a voice other than mine to describe a mathematical process. When a student made a minor error in his description, another student was

quick to chime in to offer her opinion on the process. This indicated that the writing process motivated students to want to share their ideas and be as clear and concise in their mathematical communication, just as NCTM (2000) and Corwin (1996) suggested. I found this to be a powerful learning activity that can be used in future lessons.

Another motivational piece that I concluded from journal writing is that students felt that they had more input in class discussions when they completed journal entries immediately prior to a discussion. Students' motivation to have their voice heard showed that they have an interest in the topic and understood what they were talking about. Martinie and Marcoux (2004) back this conclusion up with their feelings that students gain a deeper understanding of something when they explain their thinking and why their process is reasonable in order to solve a problem. This increases the chances that students will remember what they are learning and why they are learning it. This can be directly related to the response from Student D who has shown severe difficulties in math yet was able to state that one of his deficiencies from the unit was solving equations requiring combining of like terms. He was able to think about a common mistake from the unit and wrote it in his journal while it was fresh in his mind. He then had no problem sharing this with the class and even cracked a smile after I thanked him for sharing.

The power of having students use a journal as a reflective tool was also evident at the conclusion of the angle relationships unit. Students were able to reinforce their ideas with correct mathematical language and make connections

between units. They were able to look at the big picture and narrow it down to what they knew and what was preventing them from mastering a certain idea. Students who rarely share their thoughts and ideas in class used the journal at the end of the unit to communicate with me what gave them difficulty and why. One student in particular shared that she had difficulty with a topic in the first unit of study which prevented her from solving a problem on the assessment but felt I would think she was stupid if she told me this. This is powerful in the sense that I may never have known what was causing the problem had I not read her journal entry and spoken with her about it. She has since been participating more frequently because I told her that the more she becomes involved in class discussions the more she will want to learn more information.

One final conclusion that I have made based on the results is that students are more comfortable asking questions and have developed more trust with me in class. Whether an academically strong student confides in me by taking thought provoking risks in the journal or a student needing more support tells me that something did not make sense, journals have opened the lines of communication between student and teacher. I agree with Pinzker's (2001) notion that student journals are a clear indication that students feel more ownership and responsibility for their learning by communicating in this manner. Some students are beginning to realize that success is not always achieved by being naturally good at math but rather that success can be achieved with effort, time, and seeking help from other classmates and the teacher. Since the inception of journals in class I have read responses including phrases such

as “this is the first time I've been good at math,” and “math is my favorite class this year.” Comments like these reinforce the idea that open communication is necessary to foster positive relationships in the classroom, which ultimately leads to successful experiences with students.

Closing Remarks

In order for journaling to have long term effects in the classroom I believe the process needs to take shape over an extended period of time. Students need to become comfortable with the journal writing process in a math setting so they have time to understand what kinds of responses are most appropriate in helping them become better mathematical learners. I plan on continuing the use of journals in my classroom as a means of open communication and dialog between student and teacher. This also helps students become better prepared for the State Assessment in May by leaving a mark in their minds about certain topics that they will remember longer than simply for a unit assessment. In the eight months of preparation for the State Assessment, students need as much experience as possible with writing to justify their work and to make connections.

After this study I will continue to try different types of journal prompts to see what works best with eighth graders. I would like to ask more questions about math in general and what their concept of studying math as an eighth grader really means. I would like students to continue using their journal as a place to discuss topics other than math as well. I would like to know how students at this age feel about their academic career ahead of them and what future plans they have in life. I would like

them to know how important I feel it is to have and to feel success at this age since they are on the brink of high school when success might not come so easily. The ideas have only just begun.

Journal writing in math is only one way in which educators can enhance the learning experience for today's youth. It falls under the umbrella of caring what students think, feel, and value as adolescents. All teachers have an important obligation to each student who walks into his or her classroom and need to be cognizant of individual student needs. Journaling falls under this umbrella in more ways than one since it can be used in so many different ways to foster the needs of so many students. Future researchers must consider students' emotions about math when figuring out ways to help students succeed. Students who are comfortable in the classroom are more willing to seek help and ask questions. Pinzker (2001) stated that "if students feel as if the teacher cares about their input and concerns, then they are more willing to put forth the effort to take risks in the classroom" (p. 31).

Students sense when a teacher cares about them and wants them to do well. A journal helps both students and teachers to develop trust with one another and provide a non-traditional way of building a strong and lasting academic relationship. This leads to the ultimate goal: student learning.

References

- Au, K. H. (1998). Social constructivism and the school literacy learning of students of diverse backgrounds. *Journal of Literacy Research, 30*(2), 297-319.
- Corwin, R. B., Storeygard, J., & Price, S. L. (1996). *Talking mathematics: Supporting children's voices*. Portsmouth, NH: TERC.
- Dahl, K. L., & Farnan, N. (1998). *Children's writing: Perspectives from research*. Newark, DE: International Reading Association.
- Martinie, S., & Marcoux, C. (2004). *What does it mean to "do math" in today's classroom?* Retrieved Nov., 2008, from <http://oz.plymouth.edu/~bboschmans/ma3070/MTMS2004.pdf>
- Moll, L.C. (1990). Introduction. In L.C. Moll (Ed.), *Vygotsky and education: Instructional implications and applications of sociohistorical psychology* (pp. 1-27). Cambridge, UK: Cambridge University Press.
- National Council of Teachers of Mathematics. (1989). *Curriculum and evaluation standards for school mathematics*. Reston, VA: Author.
- National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. Reston, VA: Author.
- New York State Education Department. (2008). *Grade 3 - 8 math tests results*. Retrieved Nov. , 2008, from http://www.emsc.nysed.gov/irts/ela-math/math-07/3-8math-ela_files/800x600/
- Pinzker, V. (2001, May 1). Increasing the Engagement and Understanding of Concepts in Mathematics. (ERIC Document Reproduction Service No.

ED455117) Retrieved October 6, 2008, from ERIC database.

Vygotsky, L.S. (1987). Thinking and speech. In R.W. Rieber & A.S. Carton (Eds.), *The collected works of L.S. Vygotsky: Vol 1. Problems of general psychology* (pp. 37-285). New York: Plenum.

Wormeli, R. (2005). *Summarization in any subject area: 50 techniques to improve student learning*. Alexandria, VA: ACSD.

Appendix A

Journal Writing Topics

1. What was your favorite and least favorite part of the unit?
2. What do you already know about proportions, what are you not sure about proportions, and what would you like to know about proportions?
3. Look through your unit test and find a topic or specific question that you are still having difficulty with now that the unit is finished. You may also write about a hill you had to climb over in order to fully understand a certain topic.
4. Self-evaluate yourself for this particular unit. Consider a grade for yourself that reflects the time and effort you spent, your level of participation, and your level of understanding.
5. What is one short term goal that you would like to achieve before the end of this quarter? What is one long term goal that you would like to achieve before the end of your eighth grade year?
6. What are the three most important qualities for a math teacher to have and why?

Appendix B

Interview Questions

1. What is a real life example that involves slope and y-intercept?
2. Brainstorm all you know about slope and explain how you would relate slope to an algebra student who is learning it for the first time. Where would you tell this student to look for slope in the real world?
3. Explain the relationship between slope in its table of values, graph, and equation. What about the y-intercept in its table of values, graph, and equation?
4. Describe what you know about angles and where you see angles in your everyday lives.

Appendix C

Student Journal Entries

The following journal responses reflect students' three most important qualities that a math teacher should have. Student responses include:

“A math teacher should be able to explain things as many times as it takes to understand and be patient because math isn't the easiest thing to do. They should also find ways to keep things exciting and not just plain numbers all the time so we don't get bored. The final thing is someone who is kind because sometimes people get unsure if they can do it and they need motivation.”

Patience – It's hard to understand certain things so you need someone who is willing to help teach more than once.

Creativity – Math isn't always the funnest so you need someone to keep it interesting and try new things so you're not always just copying notes.

Understanding – Someone who can relate to how you learn is also important. You need to be taught things in different ways such as by doing, or listening. Some people are visual learners so you need to teach in different ways.”

“A math teacher should be good at talking and explaining methods, new material, etc., and really interact with the class because I think that when teachers know what they are doing and can answer questions it makes it easier for the class. They should be willing to help because in a difficult high school class things can be tough and sometimes we need help. They should love what

they do because they put more effort into work.”

“The teacher should be knowledgeable; if they don't know anything how can we learn? He should be fun. Having a fun teacher can make a boring subject really good. He should not be ill tempered. If you have a teacher that has a very short temper it makes the class less fun and puts a strain on the students.”

Appendix D

Student Journal Entries

The following journal entries are from students who gave themselves a grade at the end of a unit, including reasons why they chose that grade.

“I think this unit has been very good for me. I always did my homework and did the best I could. I understood the math a lot better than I used to. I would consider at least an A for this unit. I tried to participate as much as possible and I feel I have been very successful.”

“I give myself a C because I am not trying my hardest but have to start so I can get a better grade.”

“I give myself an A. I have been doing good this unit and have really been paying attention. The reason I don't give myself an A+ is because I make silly mistakes on homework that could bring my grade up. I feel that I am getting prepared for the state exam.”

“I think I deserve an A. My work has been good and consistent but not A+ material. I've worked hard but have made some stupid mistakes on some homework and on the test. I make these mistakes even though I understand the work, I need to check over my work better.”

Appendix E

Student Journal Entries

The following journal entries are from students describing how they could be a better math student.

“For me to be a better math student I will study more before quizzes and tests. It will help me get a better grade on the tests/quizzes.”

“For me to be a better math student I need to talk a little less, and not go ahead so much so that when I'm done I don't distract others. Also I should organize my papers better by unit so I can find papers easier.”

“For me to be a better math student I need to really focus and not get distracted. And study more.”

Appendix F

Student Journal Entries

The following journal entries are in response to students' short term and long term goals this school year.

“A short term goal for me would be to get at least a B+ on every test this quarter. A long term goal for me would be to keep my overall GPA at 4.0 or above on every report card.”

“I would love to get straight A's on my report card. For long term, I would like to do good in wrestling and keep up all my grades.”

“By the end of the second quarter I would like to receive an A+ in math and really understand what we worked on. By the end of eighth grade I would like to have passed (with an A or higher) a high school course.”

“A short term goal of mine is to get a 10/10 on a State Exam Prep on the first try.”

“One short term goal I would like to achieve before the end of the second quarter is to balance my new schedule of extra-curricular activities and school work. One long term goal to achieve by the end of the year is to read at least 20 books.”

Appendix G

Student Journal Entries

The following journal entries are in response to the question “What was your favorite and least favorite part of the unit?”

“I liked finding vertical angles and complementary and supplementary angles. They were easy to see after a while and I could apply them to a picture of parallel lines cut by a transversal.”

“I liked defining the types of angles in parallel lines problems because they made sense after a while. I didn't like setting up equations for the pictures because if you mess up one step, the whole thing gets messed up. I also had trouble finding the angle measures after solving for x . It reminds me of checking a solution to an equation which is what I had trouble with at the beginning of the year.”

“My favorite part of the angles unit was when you had to solve the equations for complementary, supplementary, and vertical angles. My least favorite part of the angles unit was when I first found out about the transversal, but then I began to get a hang of it when there were word problems including the transversal.”

Appendix H

Student Journal Entries

The following entry required students to state what they know about proportions, what they are not sure about proportions, and what they would like to know about proportions.

“What I know about proportions so far is you solve them with a fish. You multiply a number then divide two numbers and get your answer. You solve with fractions. What I'm not sure about is remembering what they are called. I don't know, definitions? What I would like to know is the easiest and simplest way to solve without using the fish. More ways and hints about proportions. Definition of proportion. How do you know when to use them in word problems?”

“They got fractions in them.”

“We used the fish method last year.”

Appendix I

Student Journal Entries

The following entries were written in response to the prompt: "Look through your unit test and find a topic or specific question that you are still having difficulty with now that the unit is finished. You may also write about a hill you had to climb over in order to fully understand a certain topic."

"I had trouble putting equations together, knowing how to combine like terms."

"As I was looking through my packet I saw that sometimes when you have to combine like x's on the same side I would subtract instead of combining them."

"On my test I need to do a lot of checking on my equation work. I kept on messing up if I needed to add or subtract on the Vikings or the Chargers."

"The topic I still have trouble with is determining the angle pair relationship when given two parallel lines cut by a transversal and solving for x. I have a hard time writing the right equation."