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IMPLEMENTING JOURNAL WRITING IN A GRADE 8 MATHEMATICS CLASS

Jolin Olson
Qualicum Beach Middle School
CANADA.
jolson@sd69.bc.ca

Cynthia S. Johnson
Gonzaga University
USA.
Johnsonc2@gonzaga.edu

ABSTRACT

In mathematics it is vital for teachers to see how their students approach different problems and which strategies they employ to solve these equations. Combining mathematics with writing promotes students' abilities to analyze data, compare facts, and synthesize information. Written explanations enable teachers to better evaluate students' mathematical thinking. This can be accomplished through words, pictures, and labelled diagrams. The use of math journals is one type of formative assessment which can provide students with descriptive feedback on a regular basis so that they will gain greater confidence and experience greater success in a mathematics class.

Keywords: Mathematical thinking, Journal writing, Grade 8

INTRODUCTION

Traditional classroom assessment has, by and large, followed a predictable pattern of teaching, testing, and moving on to the next unit of study. Based on test scores, teachers have made judgments about student achievement and reported this achievement to parents, typically in the form of a letter grade—a summative assessment. More recently, however, this type of assessment has come into question. Is a letter grade, sometimes accompanied by a brief comment, a true indicator of student learning? And more importantly, does it contribute to improvement in student achievement?

In an effort to meet the growing diversity of students, educators have perceived the need to move towards a more authentic form of assessment that provides teachers with valuable information about their students' progress, and their own practices. Formative assessment allows teachers to communicate with their students in a very supportive and non-threatening way, and to guide them through a self-reflection process that will ultimately have students seeing their own progress and experiencing greater success.

Research Rationale

Traditional teaching practices of chalk and talk do not meet the needs of students entering our classrooms today. Teachers must be innovative and rely on a combination of teaching methods that enlist more relevant tools and technology to stimulate students' interest and to elicit their greater participation in their own learning.

In the experience of this researcher, Grade 8 students are very verbal about their general dislike for mathematics. They comment on the difficulty of the subject and often sabotage their own achievement by coming to class unprepared, by failing to complete homework assignments, and by avoiding asking for help when needed. It would appear that the students lack motivation, cannot see the connections between math and the real-world, and do not see the reasons why they need to learn specific concepts. But with honest reflection, it seems that these attitudes and perceptions cannot be attributed solely to the notion that our students are lazy and unmotivated. Rather, it is the commitment to an older curriculum, and reliance on older textbooks and teaching practices that do not complement the diversity of our 21st century students.

Engaging students in math dialogue and encouraging them to communicate about their learning through writing will assist students in attaining a deeper understanding of the concepts taught.

Significance of the Study

With major reforms to mathematics over the past ten years, the National Council of Teachers of Mathematics (NCTM) has published a set of principles and standards to form a national vision of mathematics education in Canada and the United States. These reforms indicate that assessment must be intentional, clear, and purposeful in order to promote improved student achievement (Black and Wiliam, 1998). The fourth goal of the NCTM addresses the need for students to learn to communicate mathematically; both orally and in writing.

When students are asked to write about what they are thinking or how they reached their answer, they start to think about their thinking (Rowan & Bourne, 2001). They gain a deeper understanding of the concepts and learning becomes more meaningful (Burns & Silbey, 2001). For teachers, journals can be used to assess students academically--how they have improved, and what they are still confused about (Whitlin & Whitlin, 2000).

The information gathered from this study may help teachers and students understand that mathematics is more than rote computation. The benefits of incorporating writing in a mathematics class can be motivating and inspiring for both the teacher and the student. The more we know about students and their achievement, the more we can adjust instruction to ensure success for all.

THEORETICAL FRAMEWORK

The theoretical framework behind this study supports the belief that regular, systematic writing, over an extended period of time, would improve student academic achievement and attitude towards mathematics. In addition there was evidence that showed that assessment for learning strategies, such as descriptive feedback and peer and self-assessment, are vital to enhancing students' overall performance. Thus the research suggests a need for change in the instructional delivery and assessment practices employed in a mathematics program.

The main areas of focus were on the historical background of mathematics with respect to scope and sequence, traditional assessment methods, and the National Council of Teachers of Mathematics (NCTM) recommendations to align the mathematics curriculum to current assessment practices. The outcome of the literature review provided the basis and the direction for the purposes of this action research.

Throughout the past century, classroom assessment has been used to monitor student progress based on test scores (Baille, 2009). More recently these assessment practices have come into question as expectations for schools have changed, and on-going research has revealed new insights into the nature of learning (WNCP, 2005). These insights, together with sweeping changes in schools and in society, have resulted in corresponding changes in curriculum and assessment.

In an effort to improve upon assessment practices educators began assessing a wider range of student work; however even this slightly-broadened assessment continued to make statements based solely on students' strengths and weaknesses (WNCP, 2005). Educators today find themselves in a difficult position, an era of new beginnings, yet still burdened with what has worked in the past (Earl, 2003).

The fourth goal listed in the 1989 Curriculum and Evaluation Standards for School Mathematics is for students to learn to communicate mathematically. This standard was written directly in response to, and in anticipation of the mathematical needs of students in the millennial technological revolution. There needs to be an increased attention to "student communication of mathematical ideas orally and in writing," (NCTM, 2000, p.129).

STUDY DESIGN AND METHODOLOGY

A mixed method was used to collect data for this research project. A pre-test, in the form of The Vancouver Island Diagnostic Math Assessment (DMA) was given at the beginning of the school year. This assessment was designed by educators from Vancouver Island and the Gulf Islands and it was selected because, firstly, it has content validity, as the questions are a broad scope of the curriculum and truly measures student achievement. The second reason for the selection of this assessment tool

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was the fact that it has been aligned with the British Columbia (BC) Performance Standards and matches the newly updated Western and Northern Canadian Protocol (2000-2009).

Student achievement was assessed against the BC Performance Standards using a rubric. The assessment's scoring rubric was designed to be reliable as it is capable of providing consistent results regardless of who uses the tool or when it is used.

A second instrument, in the form of a survey was also used to collect data. Students were asked a simple yes or no question as to the effectiveness of the journal writing activities. They were also asked to explain their thinking further. The question on this survey was reliable because it could be reproduced under a similar methodology and receive consistent results as the students respond by indicating a yes or a no, then add additional detail if warranted. If this survey was used in another school, the same types of responses would be obtained. The survey question has validity because it was able to indicate the students' perception of the journal writing activities. The data collected from the survey informed this researcher as to whether or not the students found the journal writing activities to be a positive experience or not.

Students were divided into two groups, Group A would receive instruction in journal writing and Group B would not. The pre-and post-test data was analyzed to determine if journal writing improved student achievement. Other than the journal writing, the mathematics curriculum was the same for both Group A and Group B.

Selection Process

The participants of this research study included four Grade 8 math classes. Participants were selected based on the class formations for the 2010-2011 school year. The administration's general philosophy when organizing classes is to ensure that there is an equitable distribution of males and females, that there is an equitable distribution of students with learning disabilities, and that there is an equitable distribution of student with behavioral issues.

There were only 107 out of a possible 116 participants in this research project. Nine students were omitted from this research study because they were either on individual learning plans and worked well below grade level, or they were registered with the school and worked with a home bound teacher due to a chronic illness. They were divided into Group A and Group B. This division of the participants into Group A and Group B was done at a time when this researcher was unfamiliar with the participants. Selection was completed in this manner to avoid any bias. Group A was selected to receive mathematical instruction using math journals and Group B would receive mathematical instruction without the use of journals.

Data Collection and Analysis

There were two approaches to this study in an attempt to gain a better understanding of the impact that journal writing would have on student achievement in Grade 8 mathematics.

A quantitative approach was the first method of obtaining data. Students were given the Diagnostic Math Assessment (DMA) at the beginning of the study and again at the end of the study. The Diagnostic Math Assessment is divided into three categories: multiple choice questions, written response problem solving questions and basic computation questions. These specific skills were analyzed through each participant's results on the pre-and post-test. Within the rubric used for assessment purposes numerical values were assigned to each category for easier analysis of the data.

Results on the pre-and post-test were collated and compared to determine if journal writing in mathematics had had an influence on improving student achievement.

A qualitative approach was also used in the form of a student survey that was given after the journal writing activities had been in place for six months. The survey was designed to gain an understanding of the students' perception towards the journal writing activities.

Group Results

Within Group A, there were a total of 56 students, who engaged in the journal writing activities. From the data on their pre-and post-test scores, these students showed an achievement increase of 7%.

Within Group B, there were a total of 51 students who did not engage in the journal writing activities. The data collected from this group's pre-and post-test scores showed a 4.9% increase in academic achievement.

Student Perceptions towards Writing

An overwhelming majority of the students felt that the Learning Logs were helpful. Two students even indicated that they believed the Learning Logs would be useful in Grade 9. All of the negative responses to the Learning Log were from male participants. Some of these responses included,

"Learning logs are ridiculously useless.
I don't care if I have to explain the equation,
It's not teaching me anything."

"I never use my learning log. I am not sure
why I have to write sentence answers. Math is about numbers."

However, it was interesting to note that although 43% of the male participants in Group A responded to the math journals negatively, the males in Group A increased their average score by 7.3%.

FINDINGS

The purpose of this research study was to determine if student achievement would be improved with the use of journal writing in Grade 8 mathematics. The reviewed research indicated that regular, systematic writing, over an extended period of time, would improve student academic achievement and attitude towards mathematics (NCTM, 2000) and the findings of this study imply that ***there is merit*** to implementing and using journal writing in a mathematics class.

Student Achievement

In a traditional math class, students are required to memorize the facts and give the correct answer; however, they may not be required to explain how they arrived at the right answer and most importantly why that *is* the right answer. Traditionally, mathematics has been more about right and wrong and "practice makes perfect" (WNCP, 2005).

The journals that the students in Group A kept were called Learning Logs. The name had a positive connotation and it did not carry the stigma of an English/Language Arts writing journal. With many students who struggle with written output and have viewed math class, traditionally, as one where there is very little writing, journal writing in math class might have been be intimidating (Baxter *et al.,* 2002).

The Learning Logs contained open-ended questions that required students to use different representations, such as pictures, symbols and words to describe their thinking. Students also recorded methods of solving equations and examples to help stimulate their memory.

By having students reflect on their learning, through writing, it was found that students began to gain a deeper understanding of the processes involved by connecting their prior knowledge to what they were learning in the present and what they might learn in the future.

The act of implementing journal writing in mathematics' class was a learning experience for both the teacher and the students. It gave the students an opportunity to deepen their mathematical understanding, extend their content knowledge, and helped them to make connections more easily. These reflections allowed the researcher to witness how individual students approached new ideas. Insight was gained into how the students were feeling about what they were discovering and what misconceptions might have held.

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Descriptive feedback was provided to students and has been proven to be helpful in motivating students to continue writing in their journals, as well as in seeing the correlation between writing about their thinking and academic success (Bain *et al.,* 2002).

During this research study, peer-assessment lent itself well to assessment for learning for two reasons. First, the students tended to accept criticism from their peers more willingly and second, a valuable conversation took place where students took the role of the teacher and explained to each other what was needed to fully meet expectations in completing the journal entries. Peer and self-assessment also aided the teacher in lessening the overwhelming burden of responding to 56 journal entries weekly.

The reviewed research and the data collected from this research study have shown that writing can improve student achievement in the classroom. Writing about one's thinking, receiving descriptive feedback from peers and the teacher, as well as self-assessment can provide students with a deeper understanding of the concepts taught and thus, student learning becomes more meaningful.

Student Perceptions

The findings of this study show that the overall perceptions of Grade 8 students towards journal writing in mathematics were positive. This was surprising because the demand for an increase in student written output is often met with verbal protests, minimal effort, and at times a complete sabotage of the assignment.

From this study, it was learned that an overwhelming majority of the students, 79%, found their Learning Logs to be helpful in math class this year. Many of the students indicated that they were most useful when trying to remember a specific detail in an algorithm when they were writing a test or a quiz.

It was also interesting to note that those students who responded negatively to the use of the Learning Logs were all male. Some of these students indicated that they already had a complete understanding of the material; therefore they did not perceive a need to use journals at all.

One of the reasons as to why student perceptions of the journal writing activities were so positive might be the fact that math journals have a unique structure. Journal writing is often thought of as an activity that students engage in during an English/Language Arts class; this researcher has seen first-hand that learning can be enhanced through the use of reflective writing in journals. By making use of pictures, symbols and numbers many students appeared to be more inclined to undertake this process.

Another reason that may have contributed to the students' positive perceptions of journal writing is that each writing activity was individualized. While the process prompts and questions of reflection were standardized, there was no right or wrong answers. With this style of differentiated learning students were encouraged to discuss what they were learning, what it means to do well and what the alternatives might be for them to advance their own learning (WNCP, 2005).

By using the journal writing activities and formative assessment techniques, many students thought deeper and worked harder than they thought possible. The students began to believe in themselves and began to believe that success was possible.

RECOMMENDATIONS

Journals have the potential to make major contributions to mathematics instruction in several ways. First, students are encouraged to express and reflect upon their feelings, beliefs, knowledge and skills about mathematics. Second, teachers receive a wealth of information about their students and their instructional techniques, which consequently could improve their teaching. Finally, a new form of communication develops and makes room for more individualized instruction which in turn could lead to greater student success.

The use of journals proved to be a most rewarding experience. At the onset of this research project, it was often observed that students were not performing to the best of their ability in math class. Students were not actively engaged in the lessons and placed very little value in learning mathematics.

Incorporating writing into a mathematics class was the culminating event to changing this educator's professional practice. With the Learning Logs, student achievement has improved and student motivation is inspiring.

Implications for Teachers

When considering the use of writing in a math class one must understand that writing about one's thinking is challenging. For this reason it is best to have students start writing about familiar math concepts. Begin with affective, open-ended questions where students describe their feelings and past experiences in math class.

Once the students have become accustomed to writing about their attitudes and feelings toward mathematics in their journals, they are ready to write about simple, familiar math concepts. Using writing to review familiar math ideas will increase student confidence and improve their skills in writing. As well, it will give students an opportunity to revisit important math concepts.

Students should write in their journals at least once a week. Without weekly routine, the value and importance of writing in a mathematics class loses its importance. Remind students that there are no "wrong" answers in writing about their thinking. If students indicate that they have nothing else to add, read over their entry and ask them if they have any other questions about this topic or encourage them to revise their last three journal entries. By doing this students will rethink math ideas and work on writing out their thoughts more clearly.

Use descriptive feedback to let students know that time was spent to reading their journals. Teachers will not have time for in-depth comments on each journal assignment, so other forms of feedback will need to be used. Peer and self-assessment activities might also be introduced at this time to encourage students to communicate orally with each other by using math dialogue.

Finally, as teachers, it is crucial to communicate clearly with the students the purpose of writing in math class. Teach them the term "metacognition"-thinking about their thinking- and explain how this helps teachers to understand how students think and ultimately learn. While writing in math class, students are becoming more aware of their thinking processes; thus, they will be able to improve their communication skills and their ability to convey ideas.

Implications for a School Wide Project

Implementing a school-wide project can be seen as either an opportunity or an obstacle. The transition to a school-wide project involves introducing teachers to new roles, re-evaluating assessment practices, and challenging long standing teaching practices. These changes can be disconcerting and overwhelming to the school community and even with a broad support base, new initiatives can be difficult to implement smoothly.

Leadership in any school building, which models a willingness to be open and provides opportunities for shared learning, will be an asset in planning a school wide project. A suggestion by this teacher is to share the data with the building administration team. Invite them to join your class and experience the journal writing process. Demonstrate to them the benefits that can be gained by implementing writing in a math class. Starting small can often lead to bigger and better results.

Reaching a consensus can be a slow process. When planning a successful school-wide project, initiators must acknowledge that "ownership" by all parties is essential. The process is facilitated when principals and teachers participate in workshops on effective planning and collaboration techniques to learn about the roles and responsibilities that must be shared and about changes in teaching that promote achievement.

CONCLUSION

It has been established through this research that the implementation of journal writing in a mathematics class leads to an improvement in student achievement. Teaching experience coupled with research realizes the fact, that as teachers struggle to meet the diverse needs of learners, many tools and techniques need to be adopted to ensure the success for all students. In doing this, teachers

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must reflect on their own teaching practices and make every effort to institute the necessary changes to better serve the needs of their students.

Incorporating journal writing into mathematics class can be one of the many tools used to meet the diverse needs of our learners. Journal writing encourages students to think about their thinking and gain a deeper understanding of the concepts and skills. Writing and thinking provides students with opportunities to make connections, and by doing so they begin to make meaning of what they are learning and understand the importance of why they are learning it.

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