Bridging Literacy and Mathematics:
The Value of Math Journals

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Table of Contents

Introduction

Introduction

The presence of **math journals** is evident in Case 5; its **structure**, **implementation process** and **affordances** will be highlighted in this Research Package, beginning with its relevance to the new **BC Curriculum.**

Links to the Case

"See you later, alligator!" says Maya with a shy grin as she slaps your raised hand. One by one, your 28 **grade 5/6 students** give you high-fives as they file out the classroom door at 3 o'clock. You grab a cup of tea from the staffroom and then sit down at your desk for the first time all day. The desktop, so clear this morning, is now hidden below student work, books, forms and letters. You take a sip of tea and dig in…

You pull a pile of student notebooks toward you. These are the children's new **math journals** and you're curious to see what they have written. You were sceptical when you first heard that **writing could help develop mathematical thinking – and provide information for assessment** - but now you've decided to give it a try. You open the first journal and begin to read…

Finally, you close the last math journal. You've already gained some new insights into your students' thinking about math. **How will you make the most of this new teaching tool?**

Guiding Research Questions

Why is writing an important part of math learning?

How do we bridge numeracy and literacy?

What is a Math Journal?

How do Math Journals link to the BC Curricular Competencies?

What are the benefits of Math Journals?

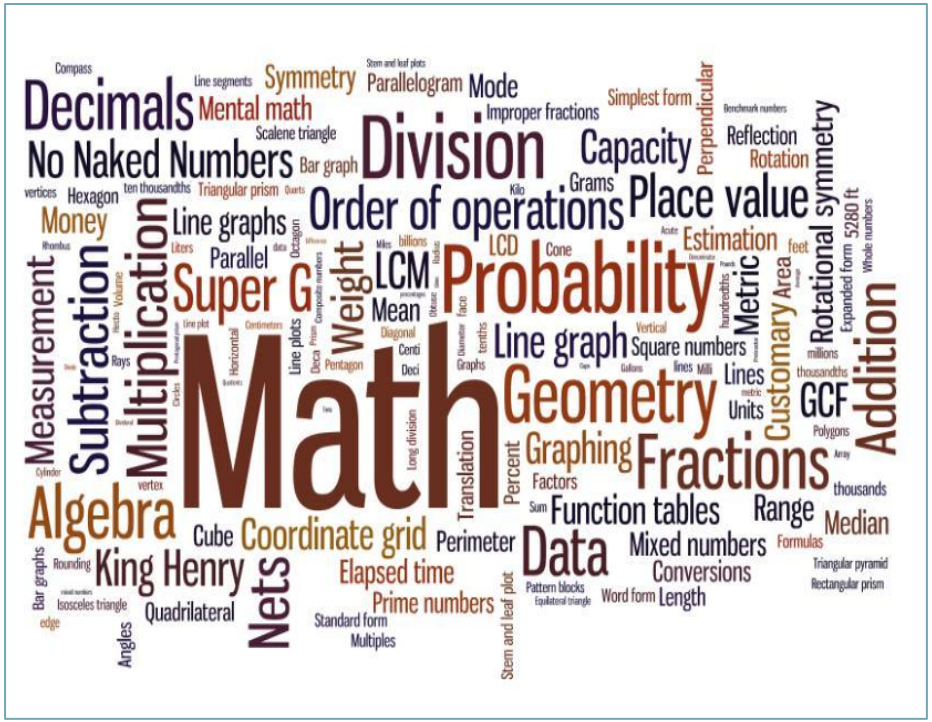
How can we integrate math into other subject areas?

What Does It Mean to be Numerate?

Numeracy is “the ability to understand and apply mathematical concepts, processes and skills, to solve problems and to make decisions in a variety of situations, including real-life scenarios.”

It involves communication, reasoning, active involvement and making connections to the real world.

In regards to the BC Curriculum, this includes being able to understand patterns and relations, shape and space, statistics and probability, as well as having number sense.



Creating a Positive Math Community

As an educator, it is your responsibility to create a positive math community. Creating an environment where students are excited about and have positive feelings towards math is a vital component in every student's journey in becoming numerate.

It is your responsibility to:

- Create **positive dispositions and attitudes** of stakeholders
- Create **culturally responsive** math lessons
- Initiate **active involvement** in math through play and engagement
- Supply a wide variety of **math literature**
- Encourage **collaboration**
- Always include **dialogue, discussion and questioning**

Dot Clouston (2016)

BC Curriculum

Grade Five Math

Big Ideas & Curricular Competencies

1. Reasoning and Analyzing
2. Understanding and Solving
3. Communicating and Representing
4. Connecting and Reflecting

Big Ideas

Numbers describe quantities that can be represented by equivalent fractions.

Computational **fluency** and flexibility with numbers extend to operations with larger (multi-digit) numbers.

Identified regularities in number **patterns** can be expressed in tables.

Closed shapes have **area and perimeter** that can be described, measured, and compared.

Data represented in graphs can be used to show many-to-one correspondence.

Grade Five Curricular Competencies

Students are expected to do the following:

1. Reasoning and **Analyzing:**

- ➔ Use reasoning to explore and make connections
- ➔ Estimate reasonably
- ➔ Develop mental math strategies and abilities to make sense of quantities
- ➔ Use technology to explore mathematics
- ➔ Model mathematics in contextualized experiences

2. Understanding and **Solving:**

- ➔ Develop, demonstrate and apply mathematical understanding through play, inquiry and problem solving
- ➔ Visualize to explore mathematical concepts
- ➔ Develop and use multiple strategies to engage in problem solving
- ➔ Engage in problem solving experiences that are connected to place, story, cultural practices and perspectives relevant to local First Peoples communities, the local community and other cultures

Grade Five Curricular Competencies

Students are expected to do the following:

3. Communicating and **Representing:**

- ➔ Communicate mathematical thinking in many ways
- ➔ Use mathematical vocabulary and language to contribute to mathematical discussions
- ➔ Explain and justify mathematical ideas and decisions
- ➔ Represent mathematical ideas in concrete, pictorial and symbolic forms

4. Connecting and **Reflecting:**

- ➔ Reflect on mathematical thinking
- ➔ Connect mathematical concepts to each other and to other areas and personal interests
- ➔ Incorporate First Peoples worldviews and perspectives to make connections to mathematical concepts

Grade Six Math

Big Ideas & Curricular Competencies

1. Reasoning and Analyzing
2. Understanding and Solving
3. Communicating and Representing
4. Connecting and Reflecting

Big Ideas

Mixed **numbers** and decimal numbers represent quantities that can be decomposed into parts and wholes.

Computational **fluency** and flexibility with numbers extend to operations with whole numbers and decimals.

Linear relations can be identified and represented using expressions with variables and line graphs and can be used to form generalizations.

Properties of objects and shapes can be described, measured, and compared using volume, area, perimeter, and angles.

Data from the results of an experiment can be used to predict the theoretical probability of an event and to compare and interpret.

Grade Six Curricular Competencies

Students are expected to do the following:

1. Reasoning and **Analyzing:**

- ➔ Use logic and patterns to solve puzzles and play games
- ➔ Use reasoning and logic to explore, analyze and apply mathematical ideas
- ➔ Estimate reasonably
- ➔ Demonstrate and apply mental math strategies
- ➔ Use tools or technology to explore and create patterns and relationships, and test conjectures
- ➔ Model mathematical contextualized experiences

2. Understanding and **Solving:**

- ➔ Apply multiple strategies to solve problems in both abstract and contextualized situations
- ➔ Develop, demonstrate and apply mathematical understanding through play, inquiry and problem solving
- ➔ Visualize to explore mathematical concepts
- ➔ Engage in problem solving experiences that are connected to place, story, cultural practices and perspectives relevant to First Peoples communities, the local community and other cultures

Grade Six Curricular Competencies

Students are expected to do the following:

3. Communicating and **Representing:**

- ➔ Use mathematical vocabulary and language to contribute to mathematical discussions
- ➔ Explain and justify mathematical ideas and decisions
- ➔ Communicate mathematics in many ways
- ➔ Represent mathematical ideas in concrete, pictorial and symbolic forms

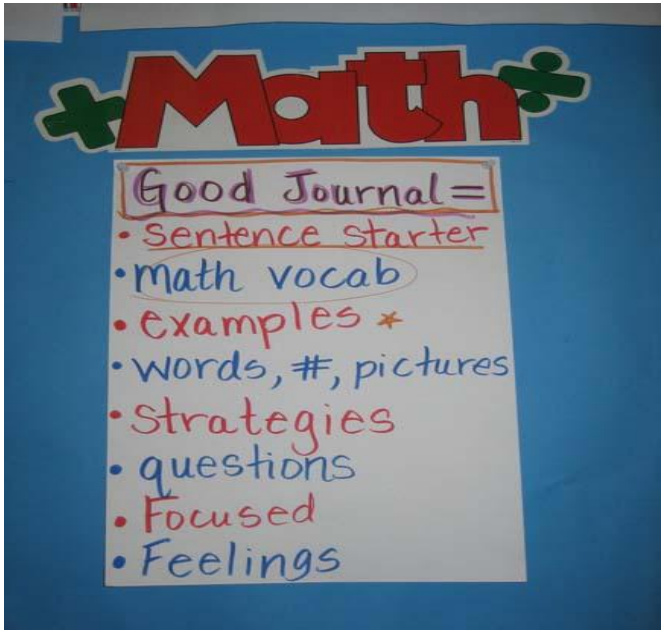
4. Connecting and **Reflecting:**

- ➔ Reflect on mathematical thinking
- ➔ Connect mathematical concepts to each other and to other areas and personal interests
- ➔ Use mathematical arguments to support personal choices
- ➔ Incorporate First Peoples worldviews and perspectives to make connections to mathematical concepts

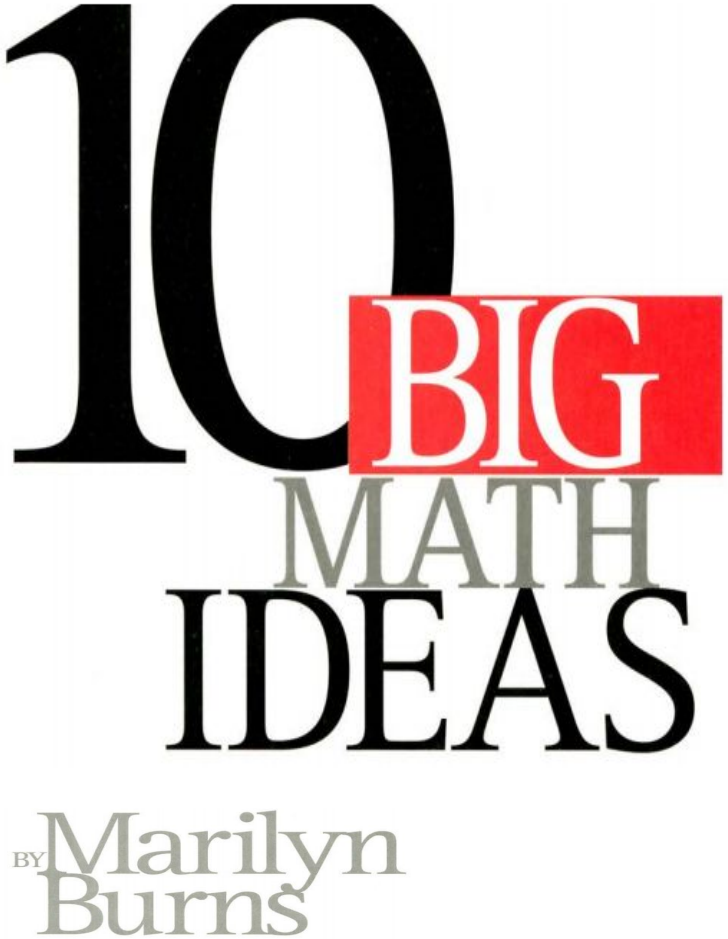
Curricular Competencies and their Connection to Math Journals

The highlighted bulletpoints in the grade five and six Curricular Competencies are the competencies that can be explored and assessed through Math Journals. The abundance of highlighted competencies demonstrates the importance of including Math Journals in the classroom and the value they can add to a child's mathematical journey.

Math Journals serve many purposes: reflection, problem solving, building math vocabulary, making connections to real-world experiences, demonstrating understanding, visualizing, including your local and Aboriginal community, and much more.



Marilyn Burns' 10 Big Math Ideas



1. Success comes from understanding.
2. Have students explain their reasoning.
3. Math class is a time for talk.
4. **Make writing a part of math learning.**
5. Present math activities in contexts.
6. Support learning with manipulatives.
7. Let your students push the curriculum.
8. The best activities meet the needs of all students.
9. Confusion is part of the process.
10. Encourage different ways of thinking.

4. "Make writing a part of math learning."

"Communication in math class should include writing as well as talking. Writing is how we think our way into a subject and make it our own. When children write in math class, they have to revisit their thinking and reflect on their ideas. Student writing gives teachers a way to assess how their students are thinking and what they understand. Writing in math class best extends from children's talking. When partner talk, small-group interaction, or a whole-class discussion precedes a writing assignment, students have a chance to formulate their ideas before they're expected to write. At the end of a lesson, students can write in their **math journals** or about what they learned and what questions they have. Or ask them to write about a particular math idea - "what I know about multiplication so far," or "what happens to the sums and products when adding even and odd numbers." When solving a problem, encourage students to record how they reasoned. Writing prompts on the board can help students get started writing. For example: "Today I learned…" or "I'm still not sure about…" or "I think the answer is…" or "I think this because…"

*Marilyn Burns from "**10 Big Math Ideas**" (2004)*

Bridging Numeracy and Literacy with Math Journals

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The Implementation Process

Guiding Questions

What does a math journal look like?

How do you implement the math journal writing process?

How do you assess a math journal?

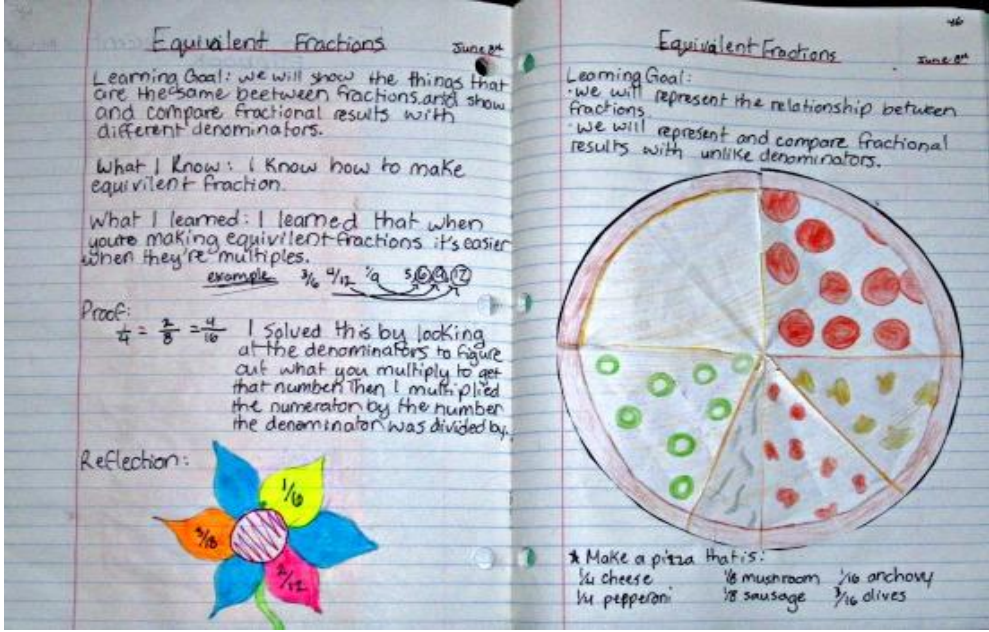
How do you motivate students to write math journals?

What are other kinds of writing in math?

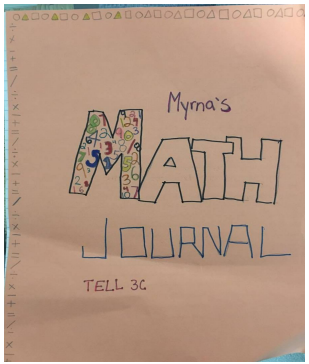
What is a Math Journal?

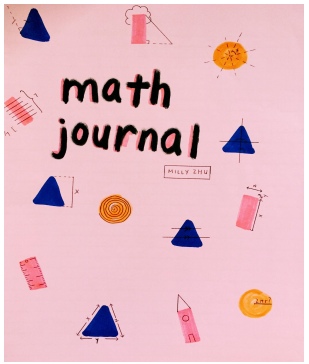
The use of words or sentences to **explain** or **reflect** math ideas, processes, and solutions.

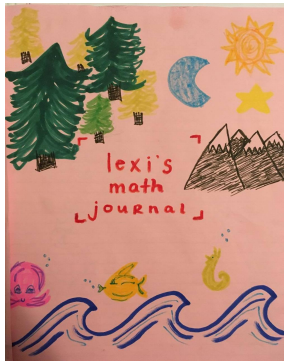
From OUR Math class >>



Picture taken from TeachJunkie.com







What Does a Math Journal Look Like?

- Location: Typically in a **notebook**, ruled or blank. *K-5 Teaching Math Resources* suggests a blank notebook allows students to **record their thought process** more freely. Marilyn Burns (2004) also suggests putting together booklets or giving loose leaf paper to be filed away at a later date.
- Format: Math Journals should be **dated** to show the progressing thinking of the students throughout the year. The teacher can decide the topic of the journal entry - whether it be a **personal reflection** or an **explanation/solution** of a particular math problem.
- Enhancements: Entries can be supported with **illustrations**, **charts** and **diagrams** to demonstrate further comprehension and creativity.
- Response: After reading entries, teachers should **comment** on the student's work to enhance the **communication** between them. Encouraging and personalized comments ensures the journal as a safe learning space.

Implementing the Math Journal

Time: Depending on the teacher, journals can be a simple warm up at the beginning of class or closure to a lesson. They can be written once a week to several times a week. The important thing to consider is keep journal writing as a **routine** and ensure that students have **plenty of opportunities** to "make sense" of their mathematical ideas. The more journals are implemented on a daily basis, the more it will help "promote mathematical understanding."

Setting Up Journal Writing: A suggested preparation for students to journal write includes having **open dialogue** about math before the writing process, use after class discussions as writing opportunities, and respond to each student's journal writing entry with comments or extending questions.

On the Road to Successful Journal Writing

1. Have plenty of "math talk." Allow for opportunities to communicate about.
2. Create a safe and supportive math environment.
3. Make your expectations clear!
4. Model the writing.
5. Plan and deliver lessons that promote critical thinking.
6. Provide a clear purpose and format for each journal entry
7. Make use of writing prompts to begin the writing process.
8. Give a well-thought and written entry as an example to motivate students.
9. Be flexible in allowing the kind of responses you receive from students (point-form, dictation, illustrations)
10. Be persistent and patient with the journal writing process.

(Frontier Math Consultants, n.d.)

Examples of Writing Prompts

Personal Reflection

- Write about what you did in class.
- What are you unsure about, confused by, or wondering about?
- Describe what was easy and what was difficult for you.

(Burns, 2004)

- I saw a pattern…
- I predicted…
- I made a connection…
- My plan for tomorrow is…
- Something in math I'd like to learn…

(Frontier Math Consultants, n.d.)

Problem Solving/Explanation

Grade 5

- When do you round off numbers?
- Describe your favourite estimation strategy. Explain why it is your favourite and when you use it.
- Two of the digits in a 3-digit number are 6 and 7. The number is a multiple of 2. What could the number be? Is more than one answer possible? Explain.

Grade 6

- Share examples of where integers are used everyday.
- Nick and Pam are combining their money to buy a gift. Together they have $52.08. Maria has $12.08 more than Nigel. How much did each have before they combined their money? Explain. Make a new problem like this one.

(Frontier Math Consultants, n.d.)

Assessing Math Journals

Math Journals provide teachers a glimpse of students' understanding and confidence level of math concepts. This is a form of **assessment** to see whether or not a student needs more assistance or clarification on a concept.

Teachers can choose to **formally evaluate** each entry as a *contribution* to overall academic assessment. Frontier Math Consultants suggests that students **"tend to give writing more thought if it is to be scored"** (p. 8, n.d.)

The rubric design for math journals is up to the teacher, but the following are some examples on how to evaluate students responses. Remember, **content is the focus**, not grammar or style of writing.

Rubric Sample 1 - A four point scale

4 points	The student's work includes: • a completed prompt or an answer to the question posed. • support for statements made by using either examples or counterexamples. • ideas clearly communicated to the reader. • legible writing, drawings, pictures, charts or tables, and diagrams • accurate mathematics or information.
3 points	Omission of one criterion from level 4.
2 points	Omission of two criteria from level 4.
1 point	Omission of three criteria from level 4.
0 points	Omission of more than three criteria from level 4.

(Frontier Math Consultants, n.d.)

Teachers are the main audience of students' writing; their focus should be on "what they write, not how they write it."

(Burns, 2004)

“I Don’t Want To Write Another Journal!”

It is important to keep in mind the motivational factor for students to write math journals. Especially if math journals are introduced mid year, students may see journal writing as “one more thing to do” in a math lesson (Vukovich 1985).

Strategies to Raise Motivational Levels

- Have students design and personalize their math journal books.
- Establish routine of journal writing (which part of the lesson?)
- Assign personalized writing topics initially: “What is your favourite part about _____ ?” “What do you dislike?” “Draw a cartoon of _____.”
- Open up writing topics gradually. Have students write about their math experiences and what went well or did not go well.
- Include journals as a contribution to final marks.

Other Forms of Writing in Math

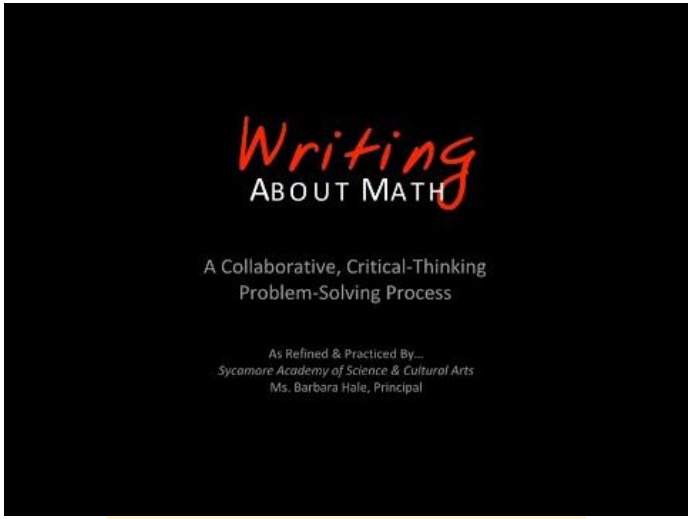
In a math class, there are plenty of writing opportunities. Keep in mind that this kind of writing will differ from other subjects. There is no "final draft" to be produced. The intent is for students to reflect, "explore, extend, and cement" their thinking in math (Burns, 2004). Here are a few examples of writing opportunities:

Explaining Math Ideas

Through a more structured format, essay writing can be used in math lessons. Example topics include comparing and contrasting multiplication and division, or "What I Know About Fractions So Far" (Burns, 2004).

Writing about Learning Processes

Writing about the math learning process itself can include procedural writing. For example, "What are qualities a good problem solving partner should have?" or "What are the steps in long division?"



Watch this! A step by step approach for writing in math!

Other Forms of Writing in Math (cont.)

Solving Math Problems

Writing enhances the problem solving process for students; it allows for monitoring, reflecting and clarification. There may be more than one way to get to a conclusion; writing allows for students to demonstrate their reasoning. Problem solving is probably the greatest opportunity for **cooperative learning** among students. A "recorder" can be designated to write the ideas and procedures within a small group.

Student-created math problems

Through cooperative learning, students can come up with their own word problems to "move beyond their misconceptions about mathematics" (Muth, 1997, p.73). As K.D. Muth explains, when students solve problems straight from a textbook, they think that math is just a collection of "right answers" from teachers and professionals. If students create their own problems, they become more "authentic" and not contain the diction and syntax of a textbook problem. With cooperative learning, the various background knowledge and cultures each student brings enhances the creation and application of a word problem.

Bridging Numeracy and Literacy with Math Journals

The Affordances

Guiding Questions

Why should students write in math?

What learnings are Math Journals intended to support?

How do we make the most of Math Journals?

The Affordances

There are many affordances to incorporating literacy in mathematics. By increasing the amount of reading and writing in mathematics, students receive **additional practices** in these disciplines. Incorporating Math Journals support students' learnings in many areas.

Math Journals are intended for assisting students in their **comprehension** of mathematical concepts. It also demonstrates their understanding of the different areas of mathematics through the development of their **personal invented strategies**. As students are able to use **multidisciplinaires** in their math journals, such as drawing and writing, it takes the anxiety away from numbers and difficult mathematical concepts.

(Vukovich, 1985)

Some other affordances that Math Journals lends itself to are students' social, mental, and metacognitive well-being.

- Creates a **relationship** between teachers and students as teachers are able to get an inside look into what their students think and how they learn
- Students feel free to **express** themselves and "communicate their concerns" to teachers
- Informal exchanges between teachers and students enhances **communication** and elicits **teamwork** towards the **common goal** of learning mathematics
- **Cooperative learning** between students as they interact and share their Math Journals

The Affordances

When students take the time to write down their thoughts and reasoning processes in their Math Journals, they are able to slow down and **think critically** about the problem. By noting down the way they think, it helps students **reflect** on their learning. Through sharing Math Journals between peers, students are able to gain **different perspectives** into how one problem can be successfully solved in many different ways.

Math Journals also **diminish math anxiety** as students are able to express their concerns and worries in writing. Teachers are then able to **reflect and respond in a positive and supportive manner**.

(Vukovich, 1985)

The Affordances

In order for teachers to make the most of Math Journals, there must be **structure and direction** when it is **initially introduced** to students.

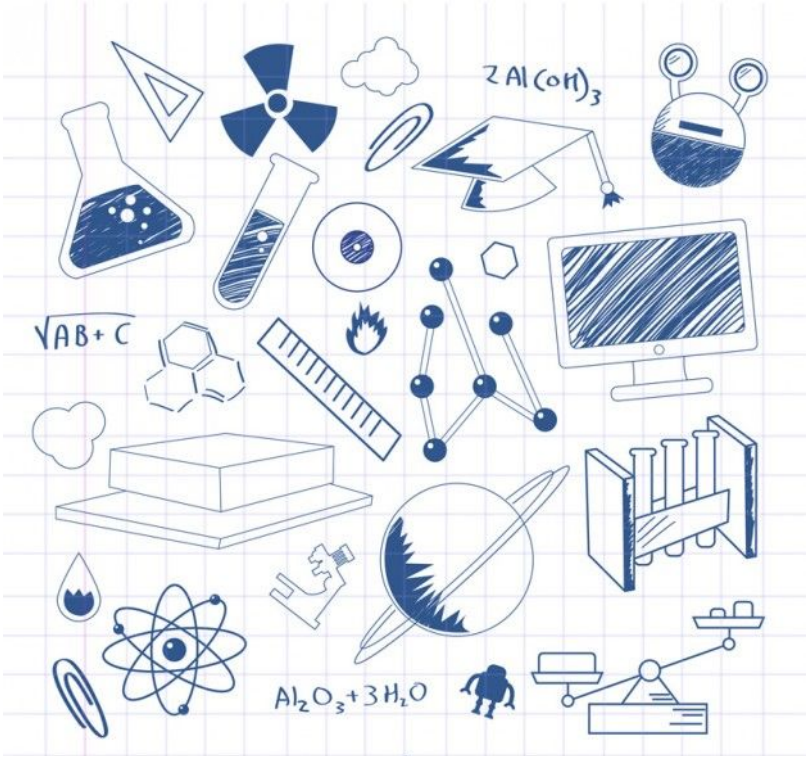
1. Open discussion: have a class discussion on the assigned topic.
2. Provide writing prompts during the initial stages.
3. Make it a routine: assign specific time during class time to work on Math Journals (eg. beginning of the week).
4. Assessment: as Math Journals are not intended to be used as a grading factor, teachers can still use them to gain better and quicker insights into struggling students.

(Vukovich, 1985)

Integrating Math Across All Subject Areas

Integrating Math Across All Subject Areas

It is important to demonstrate to students that mathematics is all around us and can be found everywhere - from grocery shopping to reading picture books. By actively integrating mathematics across other subject areas daily, such as Language Arts and Social Studies, students will be engaged with mathematics and be more proficient with it. They will develop "**math lens**" and be able to discern the mathematics in their everyday lives.



Core French

Calendar

Students can learn **how to count in French** by doing a **calendar routine every morning**. By going through the days of the month everyday, students will grasp **numeracy in French**. Once students have a firm understanding and practice of counting in French, teachers can then challenge students to incorporate other numerical aspects in everyday life, such as reciting phone numbers in French.

(Bunker, 2016)

Language Arts

Math Word Walls

Word walls aids students in learning and retaining mathematical concepts through the use of written and visual language. Students **discuss and define mathematical terms and concepts**. This **cooperative learning** approach provides a place of discussion about math, and encourages students to **scaffold ideas** from each other.

The Virginia Department of Education offers comprehension packages online of mathematical vocabulary for all grades that teachers can use for their math word walls.

(Virginia Department of Education, 2016; Yates, Cuthrell, & Rose, 2011)

Social Studies

7 Billion… and Growing

Incorporating human geography with mathematics by researching the **world population and its growth rate**. Teachers can elaborate on this topic by including sustainability and resources, such as having students calculate the number of years that our resources can sustain us for. Students will be able to use **"data, measurement, unit analysis, percentages, and statistical analysis"** in this activity while learning about **sustainability, population growth, resources from the Earth, and growth models**.

(National Council of Teachers of Mathematics, 2015)

Art

Growing Patterns

Students **build patterns** using geometric shape blocks and continue to grow the pattern. They have to **create rules for their pattern** and note "simple expressions to describe the growth." Students can also create patterns for their peers to solve, as well as create and solve these patterns in groups to initiate **collaborative learning**. Students should be encouraged to use multimodal ways of representation aside from geometric shape blocks (eg. Lego, leaves).

(National Council of Teachers of Mathematics, 2015)

Aboriginal Education

Number Concepts

Discuss with the school's Aboriginal Resource Teacher to invite "local Aboriginal language speakers" to teach students **how to count in the language** and "discuss name variations and the reasons for them." Students should find out if the "numbering system is a base 10 number system" and prepare for either a "real or imaginary ceremony" where they have to a**pproximate and calculate** "quantities of food, supplies and associated costs" for the event.

(Shared Learnings, 2006)

Science

Solar System

** Note: This lesson plan has been adapted from Dan Meyer's* Neptune *lesson.*

The lesson plan integrates science and mathematics in terms of the **relation and distance between other planets and earth** in the solar system. The task for students is to determine **where earth is in the solar system and its size**. Teachers can then challenge students to provide **estimates and calculations of other planets** in a similar manner, then in relation to each other through **measurement and comparison of the planets' volume and area**.

(Meyer, 2012)

Conclusion

Conclusion

It is clear that incorporating writing into math is a beneficial application. As Marilyn Burns reflects, the two literacies are so much more than “oil and water” (Burns, p. 1, 2004).

Not only are Math Journals beneficial to students and teachers alike, it also covers many aspects of the BC Curriculum. It is a great tool for teachers to implement and students to use as it offers many benefits, such as lessening math anxiety and increasing reasoning processes. It aids students in comprehending mathematics by using their personal invented strategies and creates a safe outlet for students to communicate their thought processes and ideas.

Glossary of Terms

Glossary of Terms

Cooperative Learning: Interdependence among the members of a group.

Curricular Competencies: Checkpoints that students are expected to hit in each subject area by the year's end.

Literacy: Knowledge of a particular subject; ability to read and write.

Numeracy: The ability to understand and apply mathematical concepts, processes and skills, to solve problems and to make decisions in a variety of situations, including real-life scenarios.

Personal Invented Strategies: The ability to develop one's own way of analyzing, comprehending, and solving mathematical problems.

Positive Math Community: An environment where students are excited about and have positive feelings towards mathematics.

Recorder: A particular role assigned in a given cooperative learning situation; To write and record ideas and observations within a group.

Annotated Bibliography

Annotated Bibliography

(2006). Shared learnings: integrating BC aboriginal content K-10. *Victoria, Canada: Province of British Columbia Ministry of Education.* Retrieved from http://www2.gov.bc.ca/assets/gov/education/kindergarten-to-grade-12/teach/teaching-tools/aboriginal-education/shared_learning.pdf.

This resource is from the Aboriginal Education Enhancements Branch under the BC Ministry of Education and it offers many different lesson plans that caters to kindergarten to grade 10 in all subject areas. It is an authentic resource for teachers wanting to integrate British Columbia Aboriginal content into their subject areas. This resource is relevant to the issue because there is a section that integrates Aboriginal content with mathematics that teachers can use in their classrooms.

British Columbia Ministry of Education: BC's New Curriculum: Mathematics. (2016). Retreived from: https://curriculum.gov.bc.ca/curriculum/mathematics/5.

This government document provides an overview of BC's new curriculum in regards to Big Ideas, Core Competencies and Curricular Competencies. It pertains to our research package as we focused on mathematics in the grade five and six classrooms. It was a useful tool in seeing how Math Journals connect to almost every requirement of BC's new curriculum.

Bunker, B. (2016). *Lecture on numbers in French*. Personal Collection of B. Bunker, University of British Columbia, Vancouver, British Columbia.

This lecture on numbers was taught over the course of the three classes. Information from this lecture was used to illustrate an example of a possible lesson activity for integrating French and numeracy through the use of a calendar and telephone activity. This lecture is relevant to the issue because it incorporates French in numeracy through the counting of the days in a month, as well as reciting phone numbers for further practice in numeracy that engages with everyday practices.

Annotated Bibliography

Burns, Marilyn. (2004) Writing in math. *Educational Leadership*. Retrieved from http://www.mathsolutions.com/wp-content/uploads/2004_Writing_in_Math.pdf.

Marilyn Burns provides a relatable view on incorporating writing with math. She describes her initial belief that math and writing were like "oil and water"; the two just did not go together. After years of teaching, and eventually confronting her fear, Burns integrated writing into her math instruction – and has not looked back since. Writing in math had two positive outcomes for her: a deeper understanding of mathematical concepts among her students and an "invaluable" assessment tool for herself as a teacher. *Why?* Because writing provided the students an opportunity to reflect and organize their ideas while giving a "window" to their understanding of the concept. Burns presents four categories of writing to support math: "keeping journals or logs, solving math problems, explaining mathematical ideas, and writing about learning processes." Each of these categories are explained in terms of instruction and how they support comprehension in math. Furthermore, she lists strategies on how to incorporate writing in math. These strategies capture the purpose and language literacy elements of math (vocabulary, fill in the blanks, etc.) The realistic nature of this article makes it practical and easy to read. It also makes a good starting point for investigating the beneficial relationship of math and writing.

Frontier Math Consultants. (n.d.). *Journal writing in math class k-8*. Retrieved from https://www.frontiersd.mb.ca/programs/SiteAssets/SitePages/MathPrime/JournalWriting.pdf.

This practical guide provides strategies, templates and examples of writing prompts for math journaling. The introduction emphasizes the importance of writing in math; it "encourages students to think about math and reflect on what they are learning." The introduction also includes a purpose and "path" of successful journal writing in math. This resource was most helpful in explaining the general organization of a math journal and the different formats that can be used. These attributes help identify the math journal as part of the research package. The examples of writing prompts are clearly listed and organized under each grade level, which fit well with identifying the appropriate examples for the intermediate grades. Sample rubrics are also provided for evaluating math journals, which helped in the assessment component of our research package.

Annotated Bibliography

K-5 Math Teaching Resources. (2010). *5th grade math journals.* Retrieved from http://www.k-5mathteachingresources.com/support-files/preview-5th-gd-mj.pdf.

Another practical guide consulted for this research package is catered specifically to the intermediate level. The guide itself is available for purchase and provides "tasks" (writing topics) for teacher use. However, the guide served as a helpful reference as to what a math journal is, why to use it, and how to evaluate them. Similar to the Frontier Math Consultants guide, the introduction provides background information on math journals and concludes with sample rubrics. The rubrics are explained in more detail, as well as more examples. The guide also gives sample word problems to be solved in math journals, which give inspiration to the activity of our research package presentation. Although great in practicality, the resource is lacking in theory.

Kostos, K., & Shin, E. (2010). Using math journals to enhance second graders' communication of mathematical thinking. *Early Childhood Education Journal*, 38(3), 223-231. doi:10.1007/s10643-010-0390-4

This formal study assessed the effectiveness of math journals on a set or second grader's communication of mathematical thinking. Results showed that math journals had a positive effect on student's mathematical communication and math vocabulary, as well as serving the teacher as an assessment tool and as a way to communicate with their students. Conclusively, math journals are highly beneficial to both students and educators in the classroom.

Meyer, D., (2012, September 28). *Neptune*. Retrieved from http://threeacts.mrmeyer.com/neptune/.

This resource incorporates science with mathematics by incorporating Maine's solar system model and fostering students' curiosity through mathematics by having them ponder where Earth is located and estimating how big it is. This lesson plan was adapted to better fit the intentions of our Research Package. This resource is relevant to the issue because it includes the grade six Science curriculum with that of its counterpart in Mathematics by inquiring about the solar system and the measurable properties of the planets. It demonstrates how Mathematics can be integrated in other subject areas, which in this case, is Sciences.

Annotated Bibliography

National Council of Teachers of Mathematics. (2015). *7 Billion… and Growing*. Retrieved from http://www.nctm.org/Publications/Student-Explorations-in-Mathematics/2015/7-Billion%E2%80%A6and-Growing-_May-2015_/.

This resource provides multiple lesson plans for teachers wanting to teach mathematics in different ways of engagement. The activities and lesson plans provided can be used by teachers as is, or teachers can further elaborate on these activities based on their students' capabilities. The lesson plans provided usually integrates different mathematical concepts in other subject areas, such as human geography and art. This resource is relevant to the issue because it is from the National Council of Teachers of Mathematics (NCTM), and this organization offers many resources for teachers to incorporate and teach mathematics in the classroom.

Silbey, R. (2016). Math journals: A window into students' whole-school thinking. *Teaching Children Mathematics*, 23(2), 63.

Silbey discusses the popular uses of Math Journals. The two primary uses shes cites are to aid in student's *reflection* and to *organize* student's thoughts, especially those that are too complex to simply remember. This article is a great source for educators to know the "why" behind math journals and the many purposes they serve.

Virginia Department of Education. (2016). *Mathematics Vocabulary Word Wall Cards*. Retrieved from http://www.doe.virginia.gov/instruction/mathematics/resources/vocab_cards/index.shtml.

This website provides comprehensive packages of mathematical vocabulary for all grades that teachers can use for their word walls. It includes diagrams, pictures, notations, and definitions that students of different learning styles and abilities can enjoy and learn from. This website is relevant to the issue because it is a great resource for teachers that wants to use a math word wall in their classroom.

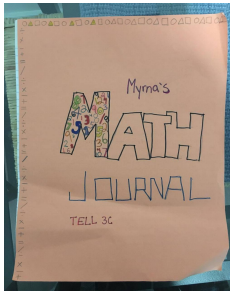
Annotated Bibliography

Yates, P. H., Cuthrell, K., & Rose, M. (2011). Out of the room and into the hall: Making content word walls work. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas, 84*(1), 31. doi:10.1080/00098655.2010.496810.

This article examines the effect of word walls on grade eight students. Word walls were used in the classroom and hallways to enhance and help students retain vocabulary and concepts. A word wall was arranged such that it aligned with the curriculum and learning objectives. Assessment found that these content word walls had a positive effect on students as it increased their reading, math, and science comprehension. This article is relevant to the issue because word walls is one of the ways that Mathematics can be integrated with Language Arts.

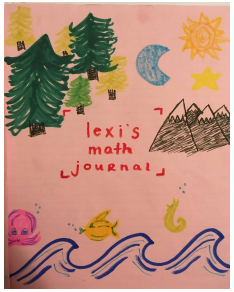
Research Package Work Bibliography

Research Package Bibliography



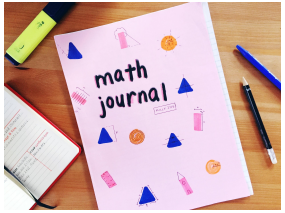
Myrna Ordona

The Implementation Process & Conclusion



Lexi Pufahl

Introduction, BC Curriculum & Marilyn Burns' Big Ideas



Milly Zhu

Affordances of Math Journals, Math Across All Subject Areas, Conclusion