Mathematical Stories for the Junior High Classroom: An Annotated Bibliography

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Stories have always existed. In earliest times, these stories were communicated verbally and pictorially. Over time, additional stories were written, and the study of human culture became centred on fine arts and literature. A fracture between arts and sciences emerged, and mathematics was placed firmly in the latter category.

For much of the 20th century, we settled into a pattern portraying mathematics as tenseless and timeless. We communicated mathematics through graphs, equations, proofs and algorithms. Our texts of mathematics were the products or artifacts of mathematical thinking. We seemed to have forgotten that mathematical texts throughout history included narrative letters, explanations, poetry and word problems—the texts of patterned, storied thought.

The separation of mathematics from the humanities is no longer feasible. Returning to and expanding the notion that mathematics is socially constructed and negotiated, mathematics educators and researchers are promoting new curricula that emphasize the mathematical processes of communication and connections. We are beginning to understand that the development of mathematical concepts occurs in a contextual and relational manner and that this context can provide meaning. When mathematics is placed in a social and cultural context, we can think of mathematics as humanity. Using stories in mathematics classrooms enables us to experience the human dimensions of mathematics.

Considering mathematics as story suggests that using literature in school mathematics humanizes mathematics. By challenging common misconceptions of mathematics as a disconnected set of rules and procedures to be memorized, and of mathematicians as isolated social loners, stories show mathematics as part of human culture. Perhaps this is the most compelling reason for teaching and learning through literature. Pragmatically, using literature integrates learning across curricular areas, thus addressing the issue of limited time resources. Students are interested in stories, and literature provides an alternative way for communicating about mathematics. This bibliography attempts to explore possible ways of using literary resources in middle school mathematics classrooms.

The bibliography is composed of picture books, puzzle books, novels and non-fiction writings organized into five sections: number; patterns and relations; shape and space; statistics and probability; and puzzles and recreational problems. Each book was read and analyzed on the basis of mathematical and literary standards. Particular elements noted in each entry include mathematical concepts, text features, possible teaching suggestions, and the place of the entry in the program of studies. A comprehensive bibliography of books for Grades 1–12 entitled *Once Upon a Mathematical Time* is available at www.ioncmaste.ca/homepage/resources.html.

When mathematics is presented vibrantly and creatively, students begin to appreciate and understand mathematical concepts. By linking mathematics and literature, the role mathematics plays in our society can be investigated. It is hoped that teachers will explore the potential of these books to promote mathematical thinking in their classrooms.

Number Strand

***The Curious Incident of the Dog in the Night-Time* by M. Haddon, 2002. Toronto, Ont.: Doubleday. ISBN 0385659792.**

Math Concepts: arithmetic operations can be used to solve problems in logical ways (explicit)

Text Features: novel; main character is a 15-year-old autistic boy; language warning

Teaching Suggestions: students can solve the problems presented in the text; students can discuss the experience of living in a world that is interpreted literally

Program of Studies: Grade 7—SO #14, 15, 16, 21; Grade 8—SO #9, 10; Grade 9—SO #7, 8

***Erin McEwan, Your Days Are Numbered* by A. Ritchie, 1990. New York: Alfred A. Knopf. ISBN 0679803211.**
Math Concepts: numbers can be used to solve problems (explicit)
Text Features: novel; imperial measurements used
Teaching Suggestions: students can construct mathematics questions that arise from situations involving consumer sales; students can use metric measurements to convert decimals into fractions
Program of Studies: Grade 7—SO #4, 6, 6, 7, 13, 14, 15, 17, 18, 21; Grade 8—SO #3, 6, 10, 12, 13; Grade 9—SO #7, 8

***The Essential Arithmetricks* by K. Poskitt, 1999. London: Scholastic. ISBN 0439011573.**
Math Concepts: algorithms can be used to demonstrate proficiency with calculations; understanding numerical patterns can encourage the development of a number sense for decimals (explicit)
Text Features: information text; includes table of contents; cartoon drawings
Teaching Suggestions: chapters can be read and discussed throughout the teaching unit
Program of Studies: Grade 7—SO #3, 4, 5, 6, 13, 14, 15, 17; Grade 8—SO #10; Grade 9—SO #1, 7, 8

***Fabulous Fractions* by L. Long, 2001. New York: John Wiley & Sons. ISBN 0471369810.**
Math Concepts: numbers can be represented as fractions; problems can be solved using arithmetic operations with fractions (explicit)
Text Features: games and activities book; includes contents and index
Teaching Suggestions: problems presented in the text
Program of Studies: Grade 7—SO #4, 5, 6, 7, 21; Grade 8—SO #3, 6, 9, 10; Grade 9—SO #1, 2, 7, 8

***Mathematickles* by B. Franco, 2003. New York: Simon & Schuster. ISBN 0689843577.**
Math Concepts: number operations can be used to express relationships (explicit)
Text Features: poetry; language and number operations are combined into playful equations; colourful illustrations (picture book)
Teaching Suggestions: students can write their own mathematical poetry (for example, crisp air + shadows tall + cat's thick coat = signs of fall)
Program of Studies: Grades 7–9—General Outcomes: develop and demonstrate a number sense; apply arithmetic operations while solving problems

***Much Bigger Than Martin* by S. Kellogg, 1992. New York: Penguin Books. ISBN 0140546669.**
Math Concepts: ratios can be used to solve problems (implicit)
Text Features: narrative picture book
Teaching Suggestions: students can calculate the height of the person throughout the book using ratios to compare the sizes of body parts
Program of Studies: Grade 7—SO #19, 20

***The Number Devil* by H. M. Enzensberger, 1997. New York: Henry Holt & Company. ISBN 0805062998.**
Math Concepts: numbers can be represented in multiple ways; numbers can be used to solve problems (explicit)
Text Features: novel; colourful artwork; humorous
Teaching Suggestions: students can generate and extend the number patterns presented in the text
Program of Studies: Grade 7—SO #1, 3, 4, 5, 6, 13, 14, 20, 21; Grade 8—SO #3, 7, 8, 9, 11; Grade 9—SO #1, 2, 3, 4, 7, 8, 9

***On Beyond a Million* by D. M. Schwartz, 2001. New York: Dragonfly Books.**
Math Concepts: numbers can be expressed as powers with exponents and bases (explicit)
Text Features: picture book; cartoon drawings; sidebars provide additional information
Teaching Suggestions: students can express large numbers in scientific form
Program of Studies: Grade 7—SO #1, 2

Patterns and Relations

***Anno's Mysterious Multiplying Jar* by M. Anno and M. Anno, 1999. New York: Philomel Books. ISBN 0698117530.**
Math Concepts: patterns can be expressed in terms of variables; variables and equations can be used to express and summarize relationships (explicit)
Text Features: picture book; includes afterword; recursive ending
Teaching Suggestions: as the book is read, students can develop their own system of notation; introduce students to factorial notation
Program of Studies: Grade 6—SO #1, 2, 3, 4; Grade 7—SO #1, 2, 3, 4; Grade 8—SO #1, 2, 3; Grade 9—SO #2, 3

***The Countingbury Tales* by M. de Guzmán, 2000. River Edge, N.J.: World Scientific. ISBN 9810240333.**
Math Concepts: games and beauty often compel mathematicians to develop concepts (explicit)
Text Features: information book; includes table of contents and bibliography; historical; each chapter differs in degree of difficulty
Teaching Suggestions: activities are presented in the text
Program of Studies: Grade 7—SO #1, 3, 4; Grade 8—SO #1; Grade 9—SO #1

***Fascinating Fibonaccis: Mystery and Magic in Numbers* by T. H. Garland, 1990. Palo Alto, Calif.: Dale Seymour. ISBN 0866513434.**
Math Concepts: patterns can be used to describe the world and to solve problems (explicit)
Text Features: information book; includes diagrams, a few proofs and historical notes
Teaching Suggestions: students can express patterns using variables
Program of Studies: Grade 7—SO #1, 2, 3, 4, 5, 6, 7, 8, 9; Grade 8—SO #1, 2, 3, 6; Grade 9—SO #1, 2

***A Gebra Named Al* by W. Isdell, 1993. Minneapolis, Minn.: Free Spirit. ISBN 091579358X.**
Math Concepts: patterns can be expressed using variables (explicit)
Text Features: novel; includes table of contents, a map of mathematics, and a list of characters
Teaching Suggestions: integrate with science unit on the periodic table
Program of Studies: Grade 7—SO #4, 5, 6, 7, 8, 9; Grade 8—SO #1, 2, 4, 6; Grade 9—SO #1, 4, 6

Shape and Space

***Around the World in Eighty Days* by J. Verne, 1873. United Kindgom: Oxford University Press, 2000.**
Math Concepts: periods of time can be measured (explicit)
Text Features: novel; includes full-page coloured illustrations
Teaching Suggestions: students can construct a time-line of the journey
Program of Studies: Grade 7—SO #3, 4

***Circles: Shapes in Math, Science and Nature* by C. S. Ross, 1998. Toronto, Ont.: Kids Can Press. ISBN 1550740644.**
Math Concepts: everyday phenomena can be described and compared using circles (explicit)
Text Features: includes historical notes; contains contents, circle formulas, answers, a glossary, and an index; metric measurements are given
Teaching Suggestions: Pi is presented incorrectly as 3.14; activities and games are presented in the text
Program of Studies: Grade 7—SO #1, 2

***Four Colours Suffice* by R. Wilson, 2003. Princeton, N.J.: Princeton University Press.**
Math Concepts: design problems can be explored using properties of networks (explicit)
Text Features: historical non-fiction; includes a table of contents, a preface, notes and references, a chronology of events, a glossary and an index; contains photographs and diagrams; the text is dense and is at a high reading level
Teaching Suggestions: students can investigate the four-colour problem and other problems using various maps and diagrams presented in the text
Program of Studies: Grade 8—SO #12

***Holes* by L. Sachar, 2000. New York: Yearling. ISBN 0440414806.**
Math Concepts: everyday phenomena can be described and compared using measurement; the effects of dimension changes in 3-D objects can be described using volume measurements (implicit)
Text Features: novel; national book award winner
Teaching Suggestions: students can calculate the volume of the dirt removed from the holes and the surface area needed for the resulting conical piles
Program of Studies: Grade 8—SO #3, 4, 5, 7, 9; Grade 9—SO #5, 11, 12

***The Librarian Who Measured the Earth* by K. Lasky, 1994. Boston, Mass.: Little, Brown. ISBN 0316515264.**
Math Concepts: similar triangles may be used to solve problems; angle measurements are linked to the properties of parallel lines (explicit)
Text Features: biography of Eratosthenes; picture book; includes the author's note, an afterword and a bibliography
Teaching Suggestions: students can replicate Eratosthenes' system of measurement using e-mail partners from another city
Program of Studies: Grade 7—SO #1, 2, 5, 6, 7, 9; Grade 8—SO #3; Grade 9—SO #1, 3, 4, 8

***The Library of Alexandria* by K. Trumble and R. M. Marshall, 2003. New York, Clarion Books.**
Math Concepts: mathematics develops within a cultural context (implicit)
Text Features: information book; includes a table of contents, maps, family trees, names and terms, a bibliography, suggested reading lists, and an index; full-page colourful and detailed illustrations; includes short biographical notes on Euclid and Archimedes
Teaching Suggestions: students can determine the volume of a sphere that fits exactly into a cylinder
Program of Studies: Grade 8—SO #4, 7; Grade 8—SO #9; Grade 9—SO #5

***Polyhedron Origami for Beginners* by M. Kawamura, 2001. Tokyo: Nihon Vogue. ISBN 4889960856.**
Math Concepts: 3-D objects can be described and analyzed according to their characteristics and their relationship to 2-D shapes (explicit)
Text Features: activity book; contains brightly-coloured photographs and diagrams; includes step-by-step instructions

Teaching Suggestions: students can construct, identify, and classify polyhedrons
Program of Studies: Grade 8—SO #8, 9

***Sir Cumference and the Dragon of Pi* by C. Neuschwander, 1999. Watertown, Mass.: Charlesbridge. ISBN 1570911649.**
Math Concepts: properties of circles can be used to solve problems; everyday phenomena can be described and compared using measurement (explicit)
Text Features: narrative adventure; the play on words for characters' names reinforces vocabulary
Teaching Suggestions: imperial measurements are used; the mathematically incorrect use of three and one-seventh to describe Pi is corrected on the last page of the book
Program of Studies: Grade 7—SO #1, 2

***This Book Is About Time* by M. Burns, 1978. Boston, Mass.: Little, Brown and Company. ISBN 0316117501.**
Math Concepts: periods of time can be measured (explicit)
Text Features: information book; includes a table of contents, an introduction, and a conclusion; line drawings
Teaching Suggestions: activities are presented in the text
Program of Studies: Grade 7—SO #3, 4

Statistics and Probability

***Why Do Buses Come in Threes?* by R. Eastaway and J. Wyndham, 2000.**
Math Concepts: everyday phenomena can be described using probability (explicit)
Text Features: information book; includes a table of contents, a foreword, an introduction, references, and an index; contains dense text
Teaching Suggestions: students can investigate the questions posed in each chapter
Program of Studies: Grade 7—SO #9, 10, 11; Grade 8—SO #8, 9, 10; Grade 9—SO #8, 9, 10

Puzzles and Problems

***50 Mathematical Puzzles and Problems* by G. Cohen, ed., 2001. Emeryville, Calif.: Key Curriculum Press. ISBN 1559534982.**
Math Concepts: logic, symmetry and numbers can be used to solve problems (explicit)
Text Features: collection of puzzles from the International Championship of Mathematics and Logic; includes a preface, a table of contents and solutions
Teaching Suggestions: puzzles are presented in the text
Program of Studies: focuses on number and shape and space strands

***How Math Works* by C. Vorderman, 1999. New York: Reader's Digest.**
Math Concepts: everyday phenomena can be described using mathematics (explicit)
Text Features: activity and information book; historical notes are included; colourful pictures and diagrams; includes a table of contents, a glossary, answers to puzzles and an index
Teaching Suggestions: activities are presented in the text
Program of Studies: all four strands are addressed

***The Man Who Counted* by M. Tahan, 1993. New York: W. W. Norton.**
Math Concepts: throughout history, people have engaged in solving mathematical problems; there are connections between philosophy, religion and mathematics (explicit)
Text Features: narrative; set in the 13th century on the road to Baghdad; answers are provided within the text; historical references to traditional and classic problems are made
Teaching Suggestions: students can investigate the problems as they are introduced and prior to reading the answer
Program of Studies: focuses on the number strand

***Marvels of Math* by K. Haven, 1998. Englewood, Colo.: Teacher Ideas Press. ISBN 1563085852.**
Math Concepts: mathematics develops in a social context and is a dynamic cultural activity (explicit)
Text Features: biographies; a collection of 16 historical stories; includes a table of contents, an introduction and an index; brief summaries, terms to know; follow-up questions and activities are included for each story
Teaching Suggestions: activities presented in the text tend not to support constructivist approaches and need to be adapted
Program of Studies: all four strands are addressed

***Math Trek: Adventures in the Mathzone* by I. Peterson and N. Henderson, 2000. New York: John Wiley & Sons. ISBN 0471315702.**
Math Concepts: numbers, arithmetic, geometry and algebra can be used to solve problems and investigate patterns (explicit)
Text Features: narrative; weak plot; includes a preface, answers, a glossary, further readings and an index; contains photographs, diagrams, drawings and tables

Teaching Suggestions: problems are presented in the text
Program of Studies: focuses on number, shapes and space, and patterns and relations strands

***Women and Numbers* by T. Perl, 1993. San Carlos, Calif.: Wide World Publishing/Tetra. ISBN 093317487X.**
Math Concepts: women are actively engaged in creating new mathematics; numbers can be used to solve problems (explicit)
Text Features: biographies; includes a table of contents, timelines and solutions to activities; the historical backgrounds of conceptual developments are provided
Teaching Suggestions: activities are presented in the text
Program of Studies: all four strands are addressed

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