A REVIEW AND AN UPDATE ON

USING CHILDREN'S LITERATURE TO TEACH MATHEMATICS

June Lundy Gastón

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Abstract

Children must develop reading, writing, speaking, and listening skills because those skills are required for success in any discipline. Consequently, in their mathematical development students need to be able to read, write, speak and listen in mathematical terms.

Research indicates that children's literature provides a means to promote such communication about mathematical ideas. Investigations examine why and how children's literature can be used to teach mathematics, the variety of children's literature that can be considered, and how lessons can also integrate technology that enhances both language literacy and mathematics literacy. Such information is important, not only for educators, but for parents and caregivers who want to appropriately utilize interdisciplinary connections to facilitate or improve both teaching and learning.

Educational research has shown that students taught mathematics via connections to children's literature become better critical thinkers and problem solvers, and become more able to connect mathematical ideas to personal and real-life experiences.

Parents, caregivers and educators can also benefit from the mathematics and literature connection. The research recommendations that parents and caregivers become more active in the education of their children include reading mathematics-based children's literature during story time. Parents and caregivers may also more easily participate in an effective homework program involving mathematical activities linked to such literature.

Teachers who are not comfortable with mathematics typically prefer teaching reading and language arts. Such teachers are attracted to beautifully illustrated children's books and good literature that generates children's interest and inspires their imaginations. By integrating literature in their mathematics lessons, such teachers can find more comfort and pleasure in teaching the material, and convey that positive attitude along with the content of the lessons.

Teachers can find many effective ways of unleashing the potential of literature in the mathematics classroom. The search begins with knowledge of the mathematics curriculum and their personal literary preferences. The search is modified by the needs of the students. The search is continuous because the ways of linking literature and mathematics are endless.

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Children must develop reading, writing, speaking, and listening skills because those skills are required for success in any discipline (Jacobs, 2006). Consequently, in their mathematical development students need to be able to read, write, speak and listen in mathematical terms. Communication is an essential part of mathematics education (NCTM, 2000).

Research indicates that children's literature provides a means to promote such communication about mathematical ideas. Investigations examine why and how children's literature can be used to teach mathematics, the variety of children's literature that can be considered, and how lessons can also integrate technology that enhances both language literacy and mathematics literacy. Such information is important, not only for educators, but for parents and caregivers who want to appropriately utilize interdisciplinary connections to facilitate or improve both teaching and learning.

Educational research has shown that students taught mathematics via connections to children's literature become more interested (Welchman-Tischler, 1992) and motivated (Usnick & McCarthy, 1998); become better critical thinkers (Murphy, 2000) and problem solvers (Jacobs & Rak, 1997; Melser & Leitze, 1999); become more able to connect mathematical ideas to personal experiences (Murphy, 2000); and can appreciate mathematics as a tool that can be used in real life (Hebert & Furner, 1997).

Parents, caregivers and educators can also benefit from the mathematics and literature connection. The recommendations that parents and caregivers become more active in the education of their children include reading mathematics-based children's

literature during story time. Parents and caregivers may also more easily participate in an effective homework program involving mathematical activities linked to such literature (Hartog & Brosnan, 2003).

Marilyn Burns, well-known author and mathematics educator, noted that teachers who are not comfortable with mathematics typically prefer teaching reading and language arts. Such teachers are attracted to beautifully illustrated children's books and good literature that generates children's interest and inspires their imaginations. By integrating literature in their mathematics lessons, such teachers can find more comfort and pleasure in teaching the material, and convey that positive attitude along with the content of the lessons (Bafile, 2001).

Although the curriculum may be preset, Welchman-Tischler (1992) has explored seven ways that teachers can incorporate children's literature in different types of mathematics lessons:

1. To provide a context or model for an activity with mathematical content.
2. To introduce manipulatives that will be used in varied ways (not necessarily as in the story).
3. To inspire a creative mathematical experience for children.
4. To pose an interesting problem.
5. To prepare for a mathematics concept or skill.
6. To develop or explain a mathematics concept or skill.
7. To review a mathematics concept or skill.

Later publications expand upon these ways, providing helpful details that link grade levels, mathematics strands, and lesson objectives with appropriate children's

literature (Braddon et al, 1993; Evans et al, 2001; Thiessen et al, 2004). Dr. E. Young of the Department of Mathematics and Statistics, Texas A&M University-Corpus Christi, currently provides a very concise version of the information on her website, http://sci.tamucc.edu/~eyoung/literature.html. Whitin's work (Whitin & Wilde, 1992 and 1995; Whitin & Whitin, 2004) includes discussions about the classroom experiences of both teachers and their students.

To further assist and encourage teachers seeking ways to utilize literature, the National Council of Teachers of Mathematics provides five model lessons on its Illuminations website (http://illuminations.nctm.org/ LessonDetail.aspx?ID=U83). Each lesson integrates appropriate children's literature and mathematics, including directions and downloadable worksheets that can readily be duplicated for assignments. A similarly helpful site, S.M.A.R.T.Books (http://www.k-state.edu/smartbooks), has a broad selection of over 200 lesson plans contributed by teachers.

Upon closer examination of children's literature used in such lessons, Lachance (2002) discussed the difference between "math concept books" and "math-related books." "Math concept books," such as those in the MathStart series, are written specifically for teaching certain mathematical ideas. Stuart Murphy has authored more than sixty MathStart books for grades PreK-4. The books are organized into three groups with overlapping grade levels PreK-1, 1-3 and 2-4. Popular titles from each of three levels include *Just Enough Carrots* (1997) for comparing quantities, *Give Me Half!* (1996) for understanding the concept of halves, and *The Penny Pot* (1998) for counting money.

"Math related books" may be used to introduce mathematical concepts or launch explorations. Pat Hutchins has written several popular math-related books, including *The*

Doorbell Rang (1986) for division, *Clocks and More Clocks* (1994) for time and *Shrinking Mouse* (1997) for perspective. Useful bibliographies like *The Wonderful World of Mathematics: A Critically Annotated List of Children's Books in Mathematics* (Thiessen, Matthias, & Smith, 1998), contain many "math related books." Some of these books, such as *The King's Chessboard* (Birch, 1988), *One Grain of Rice* (Demi, 1997), and *Grandfather Tang's Story* (Tompert, 1997) have multicultural themes that invite further integration with other curricular areas.

Even non-mathematical literature can be used to teach or review mathematical concepts and skills. For example, Vlaming (2000) devised story cards to help fifth graders practice their mental mathematics skills. The cards were developed by embellishing the story of *Three Little Pigs* (Golden Books, 2004) with mathematical details that were organized into a string of word problems. For example, the first card in the deck indicates the age of each of the pigs and requires finding the average age. Subsequent cards include details and related problems concerning the time, cost and materials for building the pigs' houses.

Clearly familiarity with the story facilitates the activity. A simple preliminary assignment might involve researching several versions of this classic fable, most of which are available at no cost on the Internet. After a Story Cards activity, children can make up additional problems for the given deck. Additional research may sometimes be necessary to provide useful details for such an assignment. For the *Three Little Pigs*, such research may involve examining the wolf's version of the story or its symbolism and psychological aspects. Students can also be assigned to write math problems based on more contemporary, popular stories or books such as *Harry Potter and the Half-Blood*

Prince. Working alone or in groups, students can create math story cards for one or more decks and exchange them for extra practice and review.

It is apparent that once a teacher's preference, interests and instructional needs are identified, a variety of children's literature can be used to teach and explore specific mathematical ideas. Whether the books are math-based or not, it is important to pinpoint good children's literature to incorporate in selected class work and homework activities. Austin (1998) suggests that in trying to find such literature, the story should be closely examined. It should have "layers of meaning," facilitate mathematical connections, promote mathematical inquiry, and really enthuse and engage the reader. *The Math Curse* (Scieszka, 1995) is an example. The story begins with a teacher, Mrs. Fibonacci, telling a class that they can think of everything as a mathematics problem. One of her students, the main character of the book, is thus "cursed" with an awareness that suddenly fills her days with mathematical challenges. Those challenges can be resources for a variety of lessons and projects, from simply finding more examples of different types of mathematics problems (and solving them) to more closely examining math difficulties or math anxiety and documenting personal experiences. Thus good literature used in teaching mathematics can promote language literacy and mathematics literacy, both of which facilitate the completion of assignments involving mathematics-related research and writing.

To further assist students in completing such assignments and projects, many teachers integrate literature and mathematics lessons with a technology component. For example, the Multigenre Mapper, the ReadWriteThink Printing Press and the Stapleless Book can facilitate mathematics-related writing and story-telling skills. The three are

among the user-friendly student tools available on a website (http://www.readwritethink.org/student_mat/index.asp) jointly sponsored by the International Reading Association, the National Council of Teachers of English and the MarcoPolo Professional Development Program. There are also examples of lessons and student projects that utilize these tools. For example, Renee Goularte's K-2 lesson "Draw a Math Story: From the Concrete to the Symbolic" begins with a teacher's choice of children's literature involving addition and subtraction. Toward the end of four sessions that include a focus on story-telling, addition and subtraction concepts, mathematics vocabulary and notation, children are introduced to writing tools (Shapebooks, Stapleless Book Planning Sheet and Stapleless Book) to help them document their own mathematics-related stories.

Other technological tools such as those in the MacIntosh iLife suite (iPhoto, iMovie, iTunes, and iDVD) are used in many digital classrooms. The online Apple Learning Interchange (http://ali.apple.com/ali_sites/ali/li.php) highlights learning in these classrooms. Lessons and projects are arranged by levels: Primary, Intermediate, Middle School and High School. Thus the diverse mathematics-related listing features technologically-enhanced lessons and products from primary-level counting books to high-school-level speed and projectile explorations integrating mathematics and science.

Teachers can find many effective ways of unleashing the potential of literature in the mathematics classroom. The search begins with knowledge of the mathematics curriculum and their personal literary preferences. The search is modified by the needs of the students. The search is continuous because the ways of linking literature and mathematics are endless.

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