

Using Children's Literature to Enrich Mathematics in the Elementary Classroom

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Abstract

Math and literacy integration supplement children's experiences and increase the chances of being successful in the elementary classroom. Elementary-age students spend many hours daily building reading skills across the curriculum. Literacy skills that are emphasized in reading programs, including comprehension, making predictions, listening, and higher order thinking, are a valid fit with elementary mathematics. Through subject integration teachers and students dismiss the illusion that mathematics is a separate subject unrelated to other disciplines. Using children's literature to connect literacy skills to mathematics, a subject that often produces misconceptions and anxiety in students, is an acceptable and constructive method. Educational arrangements such as state tests and instruction that exploit repetitive drill as evidence of standards mastery contribute to student anxiety. Integration of math and literature release students to use knowledge they already have in new concentrations. The use of children's literature in mathematics can motivate students to understand that success in mathematics is possible. Significant children's books also form connections between math and its application in the real world. This helps students to realize that math goes beyond what they see on a math worksheet or in a textbook.

Introduction

The importance of integrating children's literature into math

The Principles and Standards for School Mathematics suggest that through the use of other subjects (such as literature), students can comprehend the concept of mathematics in its entirety, outside of “isolated skills and arbitrary rules” (Mattone, 2007, p. 205). By using literature in order to discover the usefulness of math in the “real world”, students will be able to take the skills they learned in the classroom with them into the next stages of their lives. “Since the early 1900’s, linking math instruction to children’s literature has become increasingly popular” (Van den Heuvel-Panhuizen & Van den Boogaard, 2008, p. 342).

Using children's literature in math can reduce the monotony of math class that causes students to be bored and dread their math lessons. The incorporation of stories into math lessons makes lessons more interesting, facilitating students' comprehension. (Wilburne et al., 2007) Children's literature can enable students to develop a positive "mathematical attitude." (Van den Heuvel-Panhuizen & Van den Boogaard, 2008, p. 342).

"Mathematics can be an intimidating language to learn..." (Ward, 2005, p. 133). Using language skills to help teach the concept of the use of various math symbols helps to prevent the confusion that often comes as students are overwhelmed with an abundance of symbols and formulas. "Literature not only enables students to overcome the difficulty of communicating mathematically but also provides a means for math and language skills to develop simultaneously as students learn to listen, read, write and talk about math." (Ward, 2005, p. 133). Elements of math can be disguised and discovered through the use of literature which presents ideas in a more informal, familiar language. As students recognize the use of math in simple literature, they are able to gain an understanding of the importance of math in everyday life (Rathé, Torbeyns, Hannula-Sormunen, & Verschaffel, 2016). Texts can be used to connect subjects across the curriculum, alleviating the "subject area" focus that often occurs in the classroom (Kinniburgh & Byrd, 2008).

Picture books create the ambiance needed in order for students to operate mathematically. Through the use of such resources, students can compare magnitudes, explore spatial relations and recognize patterns within the context of an illustrated story (Elia, Van den Heuvel-Panhuizen, & Georgiou, 2010).

"Literature motivates students to learn, provides a meaningful context for math, celebrates math as a language, demonstrates that math develops out of human experience, fosters the development of number sense, and integrates math into other curriculum areas" (Shatzler, 2008, p. 649).

If students cannot understand the context of math, they will not see the importance of learning its concepts and will likely be devoid of complete mastery in mathematical areas. In order to fully grasp the concepts, students must view mathematics in light of their contextual importance. Through the use of literature, students are able to obtain a mental picture (and in some cases, actual illustrations) of the context in which math is being required and operated (Burns, 2015).

Tips for integrating children's literature into the math curriculum

There Was an Old Lady Who Swallowed a Fly

Mattone (2007) wanted to help her students go beyond the thinking that patterns are in colors and shapes. She introduced the book *There Was an Old Lady Who Swallowed a Fly* by Simms Taback to her class. The text consists of a visual pattern of growing animals. She gave the students pictures of the animals that were included in the story and as she read the students pictures of the animals as they were mentioned. They then created a pictograph of the animals. She asked the students what they noticed about the graph. The students noticed that it got taller. One student commented that it went up one step each time. As she questioned the students more about the pictograph, the students began to predict numerical increases in the pattern rather than just the idea of visual repetition.

Mattone continued reading similar stories to the students using pocket charts to create the growing patterns found in the texts. She used increasing patterns as well as decreasing patterns. The students learned to "describe the patterns numerically, verbally, and graphically – all skills necessary for the future development of mathematical thinking" (Mattone, 2007, p. 204).

The Thirteen Days of Halloween

The Thirteen Days of Halloween by Carol Greene is a spin-off of the song "The Twelve Days of Christmas". In this story, a charming ghoul tries to entice his green-skinned girlfriend with a series of unique gifts (Forbringer, 2004, p. 83).

Forbringer used this book with a class of second-grade students who needed practice in using multiple representations to solve problems and in expressing word problems symbolically (p. 84). The students had no problem representing math equations with objects but they were unable to write number sentences or describe in

words the process of working out the problems. The class included one special needs student and five advanced learners. She wanted to design a lesson that would provide all students with problem solving practice by using multiple representations of the problems. She designed a lesson that would continue for two days.

The first day of the lesson was a whole-class introduction to allow the students practice with problem solving skills. She began by asking the students if they had heard the song “The Twelve Days of Christmas”. They all raised their hands. She then discussed with the students how Greene had adapted the song for this story. She then read the story aloud to the students then asked if they had noticed math in the text. The students responded with “counting, number patterns, and sequence” (p. 85). She then flipped back through the book and the students made more suggestions about math. They practiced making lists by listing the gifts in order which helped students organize information without relying on illustrations. Then they added up the gifts which helped students who helped students still needing help in counting. They then wrote number sentences for the gifts horizontally and vertically for students needing help with writing number sentences.

On day two, activities were differentiated. The students worked with similar problems as the day before to continue to express word problems in multiple ways. Numbers were selected for each group based on their readiness levels. Each group was responsible for solving the problem given them. Counters were available for those needing help with calculation. Once they had arrived at an answer, the students had to illustrate their answers on large sheets of white construction paper, and they had to write a number sentence representing their solution to the problem. After the students finished, they shared with the class how they arrived at their answers. The students were surprised by the different ways that were used among their classmates to solve the problems. Through sharing the students learned new ways to work the problems.

Ten Black Dots and September 11, 2001: Attack on New York City

Ten Black Dots by Donald Crews and *September 11, 2001: Attack on New York City* by Wilborn Hampton was used by Kinniburgh and Byrd to show a fifth-grade teacher how to integrate subjects. They begin the lesson by asking the students about their prior knowledge of the events that took place on September 11, 2001. The students' comments were recorded on chart paper and hung on the wall. Then, only the introduction of the book *September 11, 2001: Attack on New York City* was read to the class because it provided a good summary of the events. The students were then told that their teacher would finish the book throughout the week. After reading the introduction, another discussion was held with the students about what was described and explained in the book. Their comments were recorded on another piece of chart paper and hung by the first.

The lesson then transitioned to math. The students were shown the book *Ten Black Dots* and were told it was a counting book that used ten black dots to illustrate things that surround us in our everyday lives. The students were told that counting was not the purpose of reading the book. The objective was to get them to notice how the author used the dots to show different objects and specific parts of objects. After reading the book, the students were asked to find things in the classroom in the shape of circles. Then they reviewed what had been discussed concerning September 11. The students were instructed to make a picture using black dots to signify something that had been discussed regarding events of September 11. Each student was given ten black Avery self-sticking dots, a piece of white construction paper, markers, glue sticks, and construction paper scraps. The students could use all ten or as few as one dot to represent any event or object in their pictures. Once their picture was created, they had to write an explanation at the bottom of the page of what their picture signified. They had to include the numeral and written word for the numeral of black dots used in their picture. They were very pleased with the pictures created by the students. One student wrote, “Eight (8) black dots stand for the eyes of four children who are crying because their parents died on September 11” (p. 36). The teacher confirmed Kinniburgh and Byrd's belief that activities such as this make the content areas meaningful to the students and show them that all subject areas have connections to their real lives (Kinniburgh & Byrd, 2008).

Are You Really Going to Read Us a Story?

Capraro & Capraro (2006) conducted a study to examine the effects of using children's literature as part of their math instruction. The participants were three groups of sixth-grade students. One group of 57 was called the story group – the ones to which children's literature were read to enhance the math lesson. The other two groups were called the non-story groups – they were not read children's literature. All three teachers had the same amount of teaching experience and used the same textbook to teach the curriculum. The teachers taught the same content on

the same day. The ninety-minute class periods were constructed to be the same except the last twenty minutes. This period of time was unstructured and used by the non-story groups for seatwork. The story group was read children's literature to enhance their math lesson during this time period.

The students were given a pre and post-test using a multiple-choice format. At the end of the study, the story group significantly outperformed both of the non-story groups and there were no significant differences among the two non-story groups. During follow-up interviews, students indicated that the stories were their favorite part of the lesson even when compared to the hands-on investigations.

Research studies

Wilburn et al.

Wilburne et al. (2007) designed a study to examine the effects of the use of storybooks to teach mathematical concepts. They formulated two main research questions: "What effect does teaching math through storybooks have on kindergarten math achievement?" and "What effect does teaching math through storybooks have on kindergarteners' attitudes toward math?" (p. 233) Participants were observed over a three-month period of time. Three modalities were focused upon including: involving students intellectually, involving students physically, and involving students emotionally. The teachers asked problem-solving questions while reading to the students that related mathematical concepts to the story. Then they asked students to write about the stories' math connections. Storybooks used in the study included: *Benny's Pennies*, *A Chair for my Mother*, and *Minnie's Diner: A Multiplying Menu*. Each of these stories was a guided practice on the use of money.

Three teachers participated in the study. One teacher found that the meaningful stories solicited more positive responses from students when math time came. Another teacher discovered that by using children's literature, more in-depth problem solving could be introduced. The third teacher realized that the same books could be used repeatedly to teach different mathematical concepts.

All classes participating in the study mastered the objectives associated with money, including: counting money, counting mixed coins, and sorting coins. In addition, students exhibited a deeper understanding of the concepts as they relate to the value of money.

Through the use of a pretest and a posttest, researchers found that students who had no prior knowledge showed great improvement after the storybook lessons. All students improved significantly, regardless of their pretest scores. A qualitative survey also revealed that students' attitudes toward math improved greatly following the use of literature in the classroom.

Researchers concluded that literature provides a more personal approach to learning mathematics (Wilburne et al., 2007).

Vygotsky

Another study was conducted by Vygotsky to investigate the impact of literature-based math instruction. For this study, four five-year-old girls in their second year of kindergarten were chosen to be exposed to a literature-math integration lesson. Two girls were from middle-class families, and two were from immigrant families. The teacher read the same books to all students individually. Results suggested that "picture books have the power to elicit mathematical thinking" (Heuvel-Panhuizen & Boogaard, 2008).

Conclusion

Collectively, the research reviewed for this paper concurs that the use of children's literature in the mathematics classroom is very advantageous for young students. Literature is beneficial in many ways because it encourages students to think critically, provides students with the capacity to see the real-world impact of mathematical skills, and introduces a visual model to abstract concepts being learned. In addition, such integration achieves the desired cross-curricula focus mandated by state standards.

These findings are somewhat limited, due to the fact that most of the studies referenced in this research pertained only to young students (kindergarten and early elementary). Additional studies would need to be conducted in order to generalize these findings to a larger population.

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