

A Study on Gendered Portrayals in Children's Picture Books with Mathematical Content

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ARTICLE INFO

Article history:

Received 15 August 2011

Revised 20 November 2011

Accepted 5 December 2011

Keywords:

Children's Picture Books,
Gender, Mathematics,
Public Libraries

ABSTRACT

This study analyzes sexism in children's picture books that incorporate mathematical problems and problem-solving into the plot to determine if children's earliest reading material is affecting the achievement gap between males and females in this subject area. The study focused not just on overall totals of male and female characters, but also analyzed which genders most often portrayed gender stereotyped behaviors and personality traits and which characters were most often shown with mathematical skills. The findings of the study show that there were twice as many male as female characters, and the math problem-solving was generally done by males in the majority of titles.

1. Introduction

As a society, we are making great strides in narrowing unfair gender gaps between men and women in the workplace and in education. Indeed, at many colleges there are more undergraduate females than males. There still remain, however, significant differences in the number of women and men who choose to pursue careers in math and science, and many researchers trace this trend, not to an inherent inability or dislike on the part of women, but to the pervasive stereotype that girls are "bad at math". Research articles, both in respected peer reviewed journals and in popular newspapers and magazines, abound trying to find the culprit. Is it unfair instruction? Parental prejudices being passed down to their children? Are female brains really just wired so differently that they find other subjects more engaging from the start? What can we do to help girls realize their mathematic potential? While this paper will by no means answer these questions, which have entire, inconclusive books written on them by experienced researchers, it will attempt to examine if picture books, read to most young children at formative points in their development, are adding to the problem.

2. Related Studies

When discussing gender differences in mathematics, most studies either concentrate on inherent

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International Journal of Knowledge Content Development & Technology, 1(2): 5-14, 2011.
[<http://dx.doi.org/10.5865/IJKCT.2011.1.2.005>]

brain development differences or social differences from the outset, although most admit that the two are linked. In Martha Carr's study of problem-solving differences in ninety-two children from different first-grade classrooms (1999), she observed solving methods and how they changed over the course of the school year. Boys, she found, increased their use of retrieval methods, or retrieving previously learned or memorized information from memory when solving basic computations, whereas girls increased their use of overt methods, such as counting on fingers. Boys were offered metacognitive instruction on solving techniques more by their teachers and seemed to benefit from it, whereas girls who did receive such instruction seemed to actually be hurt by it since their performance suffered.

Tiedmann's 2000 study on 312 third- and fourth-grade students, on the other hand, focused almost exclusively on the parents and teachers and their perceptions of student math achievement. Specifically, Tiedmann was seeking out the self-fulfilling prophecy effect, where "an erroneous belief leads to behavior that makes it true" and the sustaining effect, when "teachers do not realize their students' full capacity and so do not encourage them to reach their potential" (191). Tiedmann asked teachers to pick out girl and boy students considered high achievers, low achievers, and average achievers in math, and then to list their grades, competence in the subject, and predictions of future performance. Teachers rated math as more difficult for average-achieving girls than boys who were performing at the same level, and also often noted that they were less logical. Girls were also perceived to exert more effort than boys to reach the same level. When discussing the low-achieving students, teachers most often cited lack of ability to explain girls' poor performance and lack of effort for boys, leading Tiedmann to conclude that teacher attitude, but also student attitude - both of which affect each other and are acted upon by societal norms - were holding female students back.

Children can absorb these negative attitudes from plenty of places in society, including their parents. Children's literature, however, and picture books in particular have fallen under scrutiny for sexism over the years, primarily because they are encountered by children at such a young age. According to Weitzman et al. (1972), picture books are important in the process of "early sex-role socialization" (1126) because they are a vehicle for presenting societal and cultural norms and values. The Council on Interracial Books for Children (1976) includes "television, comics, advertisements, and, of course, adult behavior" (173) as other forces that influence a child's ideas about gender, although books are often the medium introduced earliest. Adell and Klein (1976) wrote of the dangers of reading sexist books as a young girl, saying that the picture books of the day made girls at a very early age "internalize a picture of life in which they are not central" (147).

And yet, it is not always girls who are the victims of sexism. Both genders can be harmfully stereotyped, and many more recent studies have found changes in the way women and girls are presented, but little change in the stereotyped behavior of men and boys in literature. For instance, in their 2000 study on gendered traits, Evans and Davies found, among other things, that male characters were significantly less likely to be described as "affectionate, emotionally expressive, passive, or tender" (263) whereas by this time many picture books featured female characters exhibiting traditionally male traits. Although these facts are just as troubling, the majority of the research has thus far concentrated on sexism against females, including this study.

There are many different ways to measure sexism in picture books, and most studies attempt to take into account both illustrations and text. Weitzman et al. (1972) examined the ratios of male and female characters in book titles, covers, and central roles, and found women underrepresented in all three. They also studied the actions of the male and female characters and concluded that girls tended to be more passive, while boys were more active. Examining character actions for passivity or action, dependence or independence has become a common method of examining sexism since. The terminology most used for this dichotomy is that of expressive versus instrumental characters. Expressive characters are portrayed as having “concern for the well-being of another, caring affection, warmth, and dependency” whereas instrumental characters are more task-oriented, “self-sufficient, compulsive, and appropriately aggressive” (Kolbe & LaVoie, 1981, 370). Kolbe and LaVoie redid Weitzman, Eifler, Hokada, & Ross' study using these criteria to see if there had been any improvement in the field in the intervening decade and discovered that there had been some improvement in the number of females portrayed and the overall male-to-female ratio, but that the roles and character traits portrayed were still very much the same, with females being expressive and males being instrumental only.

More recently, Kortenhaus and Demarest (1993) and Kok (2006) have performed similar studies on award-winning books in the U.S. and Australia respectively. Both added more emphasis on the independent and dependent traits expressed as part of the expressive/instrumental continuum. Kortenhaus and Demarest (1993) found that males were depicted in titles fifty-percent more often than females, and if one included gendered animals the percentage jumped to one hundred percent more often. Kok (2006) found that the overrepresentation of males in award-winning Australian picture books had fallen dramatically since the 1970s, but found no statistically significant difference between females and males performing either passive-dependent or instrumental-independent actions in either time period.

Other studies chose to examine character traits instead of actions. Many of these utilize the Bem Sex Role Inventory developed by psychology researcher Bem in 1974. Bem compiled lists of masculine or feminine traits, grouping traits depending on societal norms, meaning traits would be listed as “masculine” if American society found it more desirable in a man than in a woman. Bem would then allow individuals to rank themselves for the traits and thus determine to what degree they were sex-typed, or to what degree they had internalized society's standards for their gender. Although this test was first used on people in clinical psychology studies, future researchers found it equally useful for analyzing characters in children's picture books.

Evans and Davis (2000) found that male characters were much more likely to be portrayed as aggressive, argumentative, and competitive than females, and that the genders were equal in traditionally female traits like impetuosity, nurturing, panickiness, and understanding. Many studies have used a combination of the Weitzman et al. (1972) expressive-dependent/instrumental-independent method and the Bem Sex Role Inventory method, such as Harada (1994), who studied prize-winning picture books and random books available in London libraries. The study found a fairly typical 1.23 males for every female character, and, when considering gendered animals a higher ratio of 1.9 to 1. Harada also noted the prevalence of male/female pairs of main characters, postulating that female characters were “not considered strong enough to hold the reader's interest alone” (11).

3. Research Design and Methodology

Since the research in math education reveals that there is, in fact, a gap in gendered math skills starting at a surprisingly early age, this study will examine the role of children's picture books that deal with mathematics in aiding or exacerbating this problem. How is gender portrayed in these books? Does it follow the trends discovered in the research? Are picture books attempting to encourage girls by modeling female characters with good math skills as well as significant roles in the story? These are some of the questions this study hopes to answer.

For this project, picture books were selected that featured characters who performed math in the course of the plot. *Best Books for Children Preschool Through Grade 6* (2010) was consulted, as was the local public library's catalog. Finally thirteen books were selected. One was eliminated on the basis of it having no continuous plot or recurring characters. Two of the books were found to be part of the same MathStart series, and so one was chosen for use in the study at random, leaving a list of eleven:

1. *Eric the Math Bear* by Caroline Glicksman
2. *Superhero School* by Aaron Reynolds
3. *Pigs Will Be Pigs: Fun With Math and Money* by Amy Axelrod
4. *Math Attack* by Joan Horton
5. *How Many? How Much?* By Rosemary Wells
6. *The Blast Off Kid* by Laura Driscoll
7. *Math Curse* by Jon Scieszka
8. *Sir Cumference and All the King's Tens* by Cindy Neuschwander
9. *First Day in Grapes* by L. King Perez
10. *100 Days of Cool* by Stuart J. Murphy
11. *The Warlord's Beads* by Virginia Walton Pilegard

As the other studies about sexism in picture books had done before, gender of characters in title, on cover, and in illustrations were recorded as well as the sex of the author and illustrator. If gender was indeterminable from pictorial or language clues, it was recorded as "neuter". Illustrations were defined as pictures which represented a single moment in time, so occasionally books had multiple illustrations per page. The main character was determined to be the character or characters who appeared in the most illustrations or performed the main actions in the story. Secondary characters were defined as those who had dialog in the narration or appeared in many illustrations. The actions, or verbs applied to characters in the narration, were also recorded to better inform decisions of gendered roles, following the example of Kolbe and LaVoie (1981). Just as did these two researchers, characters were assigned roles of: 1) expressive or instrumental, 2) significant or insignificant, and 3) stereotyped or androgynous. Actions and characters were considered primarily expressive if they were portrayed as enjoying interpersonal relationships, sharing, affection, or dependency, and instrumental if they were more interested in tasks, competition, or aggression. Characters were significant if they played out a major role in the course of the story, something vital to the narrative, and insignificant if they did not. Actions and characters were considered stereotyped if they portrayed

traditional culturally-defined sex role expectations, such as those referenced in the Bem Sex Role Inventory or elsewhere.

Since this study is specifically about math picture books, a check for which gender math was most associated with was also added. This included which character solved all or most of the math problems, or which character was most associated with math-solving words in the narration such as “counting” or “computing”.

4. Results

Of the books studied, four contained male characters in the title (one contained two male characters in the title), and none mentioned females. Only one book cover contained a picture of a male alone, and only one book cover contained a picture of a female alone. However, when counting total characters pictured on book covers, the study found twenty male characters as opposed to fifteen female characters. This disparity is actually quite favorable when one considers that the study found twelve male main characters and six female main characters. However, only one book featured a female main character on her own; the other three books featuring female main characters either had a girl/boy pair (*Sir Cumference and All the King's Ten*) or an equal girl/boy group of four (*Pigs Will Be Pigs: Fun With Math and Money and 100 Days of Cool*). The ratio becomes slightly more distributed among the secondary characters, with thirty-one total males as compared to twenty-two total females. As for illustrations, there were about 1.5 illustrations of males for every 1 illustration of females, or 50% more illustrations of males than females. Only one book was exactly 1:1 in the male-to-female illustrations ratio (*100 Days of Cool*), and one went as high as 17:1 (*The Warlord's Beads*).

As far as actions and gender roles were concerned, characters stayed fairly close to traditional gender lines. Of the female characters, 36% were expressive as opposed to 16% of the male characters, and 74% of male characters were instrumental as compared to 43% of females. Forty-two percent of the male characters had significant roles in the stories as opposed to 29% of female characters. Male and female characters were almost equal in their stereotypical portrayal according to the Bem Sex Role Inventory, with 44% percent of the male characters portrayed and 43% of the females.

As far as the character who exhibited math skill or solved most of the math problems, one book featured about equal gendered problem solving words (*Sir Cumference and All the Kings Tens*) while in another it was impossible to discern the main character's gender (*Math Curse*). Two featured mostly female math skills (*Math Attack and Pigs Will be Pigs: Fun with Math and Money*), and the remaining seven featured male characters solving most math problems.

5. Discussion

The 2:1 ratio of male main characters to female main characters seems to be an improvement from what older studies such as Weitzman et al. (1972). Haradas, who performed a similar study

in 1994, found a 1.23:1 ratio, which jumped to 1.9:1 when including animal characters, as this current study has done. These statistics, then, would seem to be about on par with her findings. However, when one considers that all the books studied but one featured female main characters in partnership with male main characters, the number becomes even more troubling. Perhaps the books featuring girl and boy main characters are simply trying to appeal to a larger audience or are showcasing the joys of working together. It is also possible, of course, that this disparity is another example of what Haradas (1994) pointed out, that female main characters are not considered strong enough to hold the reader's interest alone. After all, five of the books feature male main characters carrying the plot on their own, but only one features a female character in a similar role, without co-main character assistance.

Other studies in the past, including Kortenhaus & Demarest (1993) and Haradas (1994), have remarked upon the increasing predominance of male characters in books where the characters are animals rather than people. This study included three books with animal characters and found that the ratio of male-to-female main characters among these books was 2:1, but secondary characters almost equal with 7:6. Since there were only three of the ten titles featuring animal characters, the sample size is hardly large enough to decide one way or the other.

The ratio of male to female characters in illustrations (1.5:1) was also fairly insignificant overall, although naturally it varied from book to book. Given the difference between male and female main characters, this statistic seems even more equal, taking into account that the main character of a book will naturally appear prominently in most if not all of the illustrations.

As Kolbe and LaVoie (1981) found, though the ratios of male to female main characters might be improving, possibly thanks to these very studies on sexism in children's picture books, the roles the gendered characters are assigned are not. Though Kok (2006) in a later study did not find statistical significance between gender roles in award-winning picture books, this study's findings of math-related picture books more closely agree with Kolbe and LaVoie (1981)'s results. Being that female characters were in the minority, one would expect to find male characters portraying more roles in general, but the female characters still took the lead in the expressive roles, and the males in instrumental.

Overall, there were far more androgynous or unsteretyped characters (23 male, 16 female; 39 overall) than stereotyped characters (19 male, 12 female; 31 overall), although the difference seems somewhat marginal, in both males and females. As Evans and Davies (2000) found, it was indeed slightly more likely for male characters to portray stereotyped male traits such as aggression than female characters were to portray female stereotyped traits such as caring for others or cooking, perhaps because of the limited attention male stereotyping receives when compared with its female counterpart. For instance, the titular character in *Eric the Math Bear* is portrayed and described as shy, caring, and helpful. However, within the same book, the antagonist, a male polar bear, is always portrayed as shouting and growling, even kidnapping a nearby female bear named Erica, whom, of course, Eric must then save. The relatively androgynous Eric is practically forced into the male stereotype of being a knight in shining armor and coming to the aid of the helpless female stereotype who is being menaced by the rough male stereotyped polar bear.

Math picture books, therefore, follow similar gender trends as books used in more broad studies

like those completed by Kolbe and LaVoie (1981) and Haradas (1994). They lag behind some of the studies on more modern, or better acclaimed picture books like those analyzed by Kok (2006). Gender, however, seems even more out of balance as far as math is concerned when one takes into account which gender is most often portrayed actually performing the math integral to the plots of these books. In *Math Attack*, the single book with a sole female main character, the girl in question successfully completes the multiplication problems on her own. In *Pigs Will Be Pigs: Fun with Math and Money*, the main characters are a family of four, two females and two males, in which the mother character is the one portrayed as actually counting up the money. Even the book where male and female characters seem to be equally involved in math problem solving, *Sir Cumference and All the King's Tens*, presents a troubling dichotomy between the genders. It is Sir Cumference and the other male knights who propose increasingly more complex math solutions to their problems, while Sir Cumference's wife is merely in charge of carrying them out and counting. It is the men, again, who are problem-solving, even if it is a female character who is going through the motions after it is explained to her. *Math Curse* cannot really be discussed adequately in this section, since the main character was recorded as neuter. The narration never uses a gendered pronoun, and the character's appearance is such that a child could take the character to be either gender.

6. Limitations

Naturally this is not a study of all children's picture books about mathematics, so the truth may be more or less dramatic than it seems in this relatively small sample size. However, since the number of available titles in this area is relatively small, the researcher feels confident that the results have at least some generalizability. The main contenders in the math picture book world are part of large series such as Neuschwander's *Sir Cumference* books or Murphy's leveled *MathStart* series among others. For this study, one book from each of these major series was chosen, under the assumption that a randomly chosen title would more or less reflect the average gender neutrality in the entire series. A limitation can also be found in the occasionally subjective field of deciding which actions and therefore characters are expressive or instrumental, significant or insignificant, stereotyped or androgynous. Though the researcher followed the guidelines laid down by prior research in the field such as Weitzman et al. (1972), Kolbe and LaVoie (1981), and Bem (1974) among others, having one or two more judges to determine inter-rater reliability would have been preferable.

7. Conclusion

If indeed picture books are an important vehicle of portraying the dominant society's values to young children (Weitzman et al., 1972) then the results of this study indicate that we are giving young girls in preschool, kindergarten, and the early elementary grades a very one-sided view of

what they can accomplish mathematically. If the characters in these picture books are to act as models, young girls might assume that it is mainly boys who can do math problems or come up with problem-solving solutions. Girls can expect to be partners or part of a team with boys, often with the boys doing the majority of the creative problem-solving, such as in *Sir Cumference* and *All the Kings Tens* or *Superhero School*.

Even more interesting is that eight of the eleven authors are women. Why would so many women choose to people their books with predominantly male characters? Is it because they perceive young boys as being more interested in math? Or is it, as the Council on Interracial Books for Children (1976) suggests, that the system of bias and stereotypes in our culture is so powerful that many authors can write totally unaware of its influence upon them? Such stereotypes are insidious and difficult to eradicate, although it is clear that the attention given to gendered math performance is having some effect, with more studies written each year about how to get girls more involved in math and definite gains in equal portrayal of genders in other areas of children's literature. Indeed, Clark and Fink noted in 2004 that such studies on sexism in children's books have changed the American Library Association's views on which books to select for awards which has then changed the kinds of books that are written and published (Clark & Fink, 2004). One can only hope that such advances will soon be made in more niche areas of children's fiction, such as math picture books since, as this study found, many of the "best" titles in the field are definitely wanting.

Acknowledgements

This article was rewritten from a paper completed in December 2010 at the School of Information and Library Science, University of North Carolina at Chapel Hill.

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[Appendix: Annotated list of Children's Books]

- Axelrod, A. (1997). *Pigs Will Be Pigs: Fun With Math and Money*. New York: Aladdin Paperbacks.
The Pig family is hungry for dinner, but must count up all of their spare change before they can go out to eat, leaving their house a total mess.
- Driscoll, L. (2003). *The Blast Off Kid*. New York: Kane Press.
Jim tries to save 10,000 Blast Off Bar wrappers to win a trip to space camp, and soon must come up with more complicated ways of easily storing and counting them using place value.
- Glicksman, C. (2003). *Eric the Math Bear*. New York: Alfred A. Knopf.
Shy about being the only bear at the bank who's bright red, Eric is able to use his math skills and quick thinking to save Erica Bear from being harmed by polar bear bank robbers.
- Horton, J. (2009). *Math Attack*. New York: Melanie Kroupa Books.
When she can't remember her times tables correctly, numbers begin to spew out of a girl's head, terrorizing the town until she can come up with the correct answer.
- Murphy, S. (2004). *100 Days of Cool*. New York: Harper Collins.
Four students are challenged by their teacher to do 100 cool things for the 100 first days of school, keeping track of their progress using subtraction and fractions.
- Neuschwander, C. (2009). *Sir Cumference and All the King's Tens*. Watertown, MA: Charlesbridge.
Using visual representations of place value, Sir Cumference and his wife are able to keep track of the many, many guests arriving for the King's birthday party.
- Perez, L. (2002). *First Day in Grapes*. New York: Lee & Low Books Inc.
A migrant worker's son is nervous about his first day at another new school, but ends up standing up to the bullies by gaining confidence from his math skills.
- Pilegard, V. (2001). *The Warlord's Beads*. New York: Pelican Publishing.
In ancient China, Chaun and his father are afraid they will not have time to count the
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vast treasures of the often cruel Warlord they serve before he arrives home with more.

Finally, Chaun uses place value represented by beads on sticks to keep track.

Reynolds, A. (2009). *Superhero School*. New York: Bloomsbury Children's Books.

When the superhero school teachers are kidnapped by ice zombies, the students must use math and their super powers to free them.

Scieszka, J. (1995). *Math Curse*. New York: Viking.

A student is cursed by a math teacher into seeing every small part of life as a math problem.

Wells, R. (2001). *How Many? How Much?* New York: Viking.

Timothy's class do many fun activities throughout the day, each one containing hidden math skills.
