A Study on Gendered Portrayals in Children's Informational Books with Scientific Content

Patricia R. Ladd*

ARTICLE INFO

Article history:
Received 15 July 2012
Revised 30 October 2012
Accepted 5 November 2012

Keywords:
Children's Literature,
Non-fiction Books,
Science Books, Gender

ABSTRACT

This study analyzes gender bias in children's informational books about science and science careers to determine how these early resources are affecting the disparity between males and females in science and engineering fields. The study focused on the number of male and female scientists both in pictures and text, and how much space was devoted to discussion of scientists of each gender. Overall, the findings of the study show that only 18% of the pictured scientists were female as well as only 16% of the scientists discussed in the text. These numbers are below current industry data that puts the number of females working in science and engineering fields at 26%.

1. Introduction

In recent years, our society has seen many great successes in the struggle for gender equality. Indeed, women now earn more bachelor's degrees than men in the world of higher education, which was once all but closed to them (United States Census Bureau, 2011). These degrees are most likely to be in the humanities or social sciences, however, since men still outnumber women in physical science, computer science, math, and engineering, both in education and in the field (National Science Foundation [NSF], 2011). Though the cause of this disparity is undoubtedly a tangled combination of many factors, a dearth of examples of women in these fields undoubtedly contributes. Unable to see examples of people like themselves pursuing these careers, young girls may give up on their science dreams too soon. Though young girls may be unable to visit actual science laboratories or field sites to find role models (or, unfortunately, a lack thereof), the informational or non-fiction books at their public or school library may provide either important career ideas or a discouraging portrait of women's place in the sciences, depending upon how the scientists are portrayed.

This study hopes to discover how women are currently portrayed in science informational books for children. Because it is important for children to see that anyone can pursue a career in the

* MLS University of North Carolina at Chapel Hill (patriciarladd@gmail.com)
International Journal of Knowledge Content Development & Technology, 2(2): 47-56, 2012.
[http://dx.doi.org/10.5865/IJKCT.2012.2.2.047]

sciences, no matter their gender, it is equally important to portray many different scientists and people pursuing science interests in these early introductions to the subject. However, publishers and authors do not always keep these issues in mind when creating informational books for children, and libraries may not always consider these problems when building their collections. The reality of the current offering of informational science books for children may be very different from gender equality ideals.

2. Related Studies

The National Science Foundation monitors the participation of women, minorities, and persons with disabilities in science and engineering fields as mandated by the Science and Engineering Equal Opportunities Act. Their most recent report found that women earn degrees at medium to low levels compared to men in physical science and mathematics, and women's participation is lowest in engineering and computer sciences (NSF, 2011). Professionally, women participate half as often in science and engineering occupations than they do in the US workforce as a whole, making up 26% of the science and engineering fields, although these numbers vary widely by specific occupation (NSF, 2011). For instance, women make up 68.3% of psychologists, but only 10.7% of engineers and 24.8% of the mathematical/computer science field (NSF, 2011). Women are also less likely to be supported by federal grant money, and earn less than their male scientist and engineer peers. This discrepancy between the treatment of men and women in the sciences, therefore, still exists, both in academics and in the work place.

A 2010 article written by an anonymous "female science professor" detailed the subtly sexist treatment she faces daily, painting a grim picture for any girls interested in pursuing a similar course. "Even today," she writes, "being… a woman in a male-dominated profession has meant that my female colleagues and I are seen as less qualified than our male counterparts" (2010, A42). In an illuminating history of women in the engineering field, Amy Sue Bix reported on a 1993 Society of Women Engineers survey that found 55% of male engineers said that men and women were treated equally in their profession, while less than one third of the female engineers (26%) agreed (Bix, 2005). MIT also acknowledged in a self-examination that female faculty received less work space and fewer financial resources and rewards than male colleagues, a trend described by one engineering professor as "microdiscrimination" (Bix, 2005, p. 45).

Societal influences, rather than some innate lack in girls' math and science ability, are often cited as the cause for girls' lower interest and achievement in these areas. Research shows that girls' attitudes towards science begin to be warped by these societal biases from a young age. For instance, Christia Spears Brown and Campbell Leaper investigated 345 adolescent girls between the ages of 13 and 18, surveying them about their experiences with academic sexism, their perceived ability in the science and math subject areas and also the value they saw in these subject areas. They found that the younger girls had higher grades in math and science, and also a greater perceived competence in the subjects than the older girls (Brown & Leaper, 2010). They concluded that by the time girls enter later adolescence (16-18 years old), the importance they place on math and science may be negatively affected by the negative comments they have experienced about their own abilities, since the older girls were more likely to understand sexist comments or were experiencing its cumulative effects over a period of years (Brown & Leaper, 2010).

Another very illuminating study on the effects of gender discrimination on interest in science was undertaken by Erica S. Weisgram and Rebecca S. Bigler in 2007. Over 150 girls in the formative 11-14 age range were divided into two groups for a day of science intervention. Both groups were given talks and presentations from actual female scientists in the field, but one group was also given information about the gender discrimination that often affects women working in the sciences. Despite a day of stressing the value of science and encouraging its study, only girls in the group who had received the gender discrimination information showed an increase in science self-efficacy and a belief in the value of science (Weisgram & Bigler, 2007). The researchers theorized that their exposure to information about gender discrimination made the girls reinterpret past negative feedback that influenced their own beliefs about the performance of both themselves personally and their gender as a whole. Another interesting finding was that, though girls were aware of the underrepresentation of women in science fields, their estimates of the proportion of women were much higher than the reality. Girls in the group who did not see the presentation about gender discrimination actually increased their estimates of women in the field in the post-survey, probably from exposure to the female scientist presenters (Weisgram & Bigler, 2007). Providing girls with information about the gender discrimination faced by women in the sciences shifts their attitudes about their own science achievement, and providing female role models shows them a career in the field *is* possible, despite these setbacks.

Though much recent and needed research in psychology and education has focused on this issue, library science has remained largely silent, despite children's literature being one of the first exposures many children have to a world outside their daily experience, from which they may take many attitudes and biases, consciously or otherwise. A previous study on gendered portrayals in picture books with mathematical content found that girls in these stories appear half as often as boys, and most often in conjunction with a male partner (Ladd, 2011). Even more troubling, girl characters were actually shown completing math problems 33% of the time, and using analytical skills to come up with a process for solving only 22% of the time (Ladd, 2011).

An older study from 1987 of sexism in school science materials compared the extremely pro-science texts produced during the space race of the 1960s with then-new science books of the 1980s for portrayals of girls and boys, women and men. The author, Alleen Pace Nilsen, claims that both could still be found on library shelves at the time since “in education, the time lag between research findings and classroom practice is approximately 20 years” (Nilsen, 1987, p. 117). Budgetary concerns also present a problem even when a library is willing to update its collection. Nilsen found that the ratio of boys to girls was 5:1 on the covers of the older 1960s books, and 15:19 on the covers of the newer books, leading her to suspect that publishers were aware of the issue and attempting to correct it (Nilsen, 1987). Textbooks often would use the pronoun “him” for scientists or animals since English lacks a neuter pronoun, except if the animal was seen to be having a baby (Nilsen, 1987). Books about science careers from the 1960s excluded women almost entirely, while books from the 1970s were mixed, some becoming political and writing only about girls, which Nilsen cites as harmful, creating a genre of specifically “girl” science books (Nilsen, 1987).

These informational science books for children may also be influenced by the background of their authors. A study in 1991 found that author genders were almost evenly split between males and females, who fell into the 35-64 age range (Broadway & Howland, 1991). Most had some degree, though the largest percentage of these (43%) were in English, journalism, or another humanities field qualifying them as a writer but not a scientist (Broadway & Howland, 1991). The authors of the study concluded that publishers believe interest in a topic and writing ability qualify authors to write science books for children rather than credentials in a subject, a complacent attitude that would not be tolerated for informational books aimed at an adult audience (Broadway & Howland, 1991).

3. Research Design and Methodology

What effect do children's information books have on societal views of women in the sciences? Do they reflect the disproportionate status quo in their portrayal of scientists, or are they attempting to draw more girls in by showing more female science role models? Children's informational or non-fiction books were chosen as the basis of this study because they are readily available in both public and school libraries, and are often a prime resource for children exploring the possibilities the world has to offer outside of their immediate community. One of these possibilities is a career in a science field, and the library carries many books both about the subject matter and what a job working with that subject may be like.

For the purposes of this study a “children's information book” was defined as a book shelved at the library in the juvenile non-fiction section, and a “science book” was defined as a book with a Dewey Decimal Classification number in the 500 or 600 class. Within this category, books chosen must address, at least in part, the work of individual scientists. As Nilsen observed, presenting children with special, separate “girl science books” is detrimental to the attitudes of both girls and boys, so no books whose titles proclaimed they would concentrate only on one gender were considered (Nilsen, 1987, p. 121). Because this issue has improved dramatically over time, as evidenced by Nilsen's survey of three decades of literature, only books published within the past ten years were deemed recent enough to be considered.

Review sources such as *School Library Journal* and *Book List*, as well as local public library catalogs were consulted. Finally, twenty books that met all of the criteria were selected. For an annotated list of these selected books, please see Appendix A.

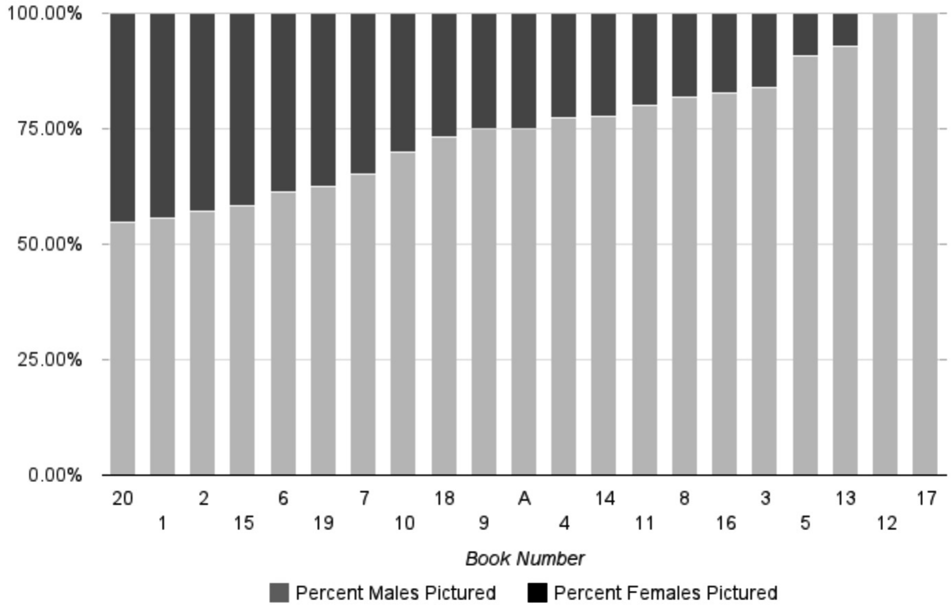
As in other studies about gender difference in books for children (Ladd, 2011), the genders of people portrayed in illustrations and on the cover of each book were recorded. If the gender of a person portrayed in an illustration or photograph was indeterminate (for instance, due to a full-body diving suit) and the caption provided no clarification, the gender was marked as “neuter”. Crowd scenes were not considered, as such an illustration does not emphasize any one participant personally. Because this study is specifically about women in the sciences, a further count of all pictures for male and female scientists was recorded. An illustration was considered to be of a scientist if he or she was portrayed performing clearly scientific work or was identified as such in the caption or text.

A record of the number of separate, specific male and female scientists mentioned in the text of each book was also recorded (including picture captions), as well as the number of times male or female scientists were mentioned. This last statistics was achieved by counting the number of times a name or gendered pronoun referring to a previously stated name occurred in the text. In this way, the study was able to record data on not only the number of individual scientist role models the book sets forward, but also the amount of discussion given over to them.

4. Results

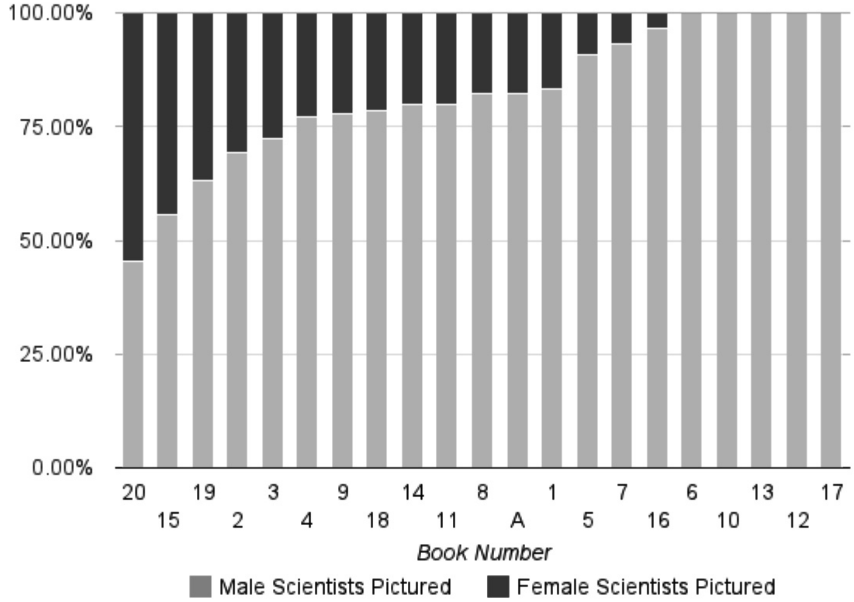
For the majority of books, cover illustrations featured animals or science equipment instead of people, but of the 25% that depicted people on the cover, males were represented more than females at a ratio of 11:4 or 73% more often. Within the books, illustrations and photographs of people depicted males 75% of the time and females the remaining 25% on average. The book with the most even overall representation in visual gender portrayal (*Turn It Loose*) was 55% male to 45% female, and two books (*Green Technology* and *Chasing Tornadoes*) contained no pictures of females at all.

Table 1. Percent of Males and Females Pictured by Book



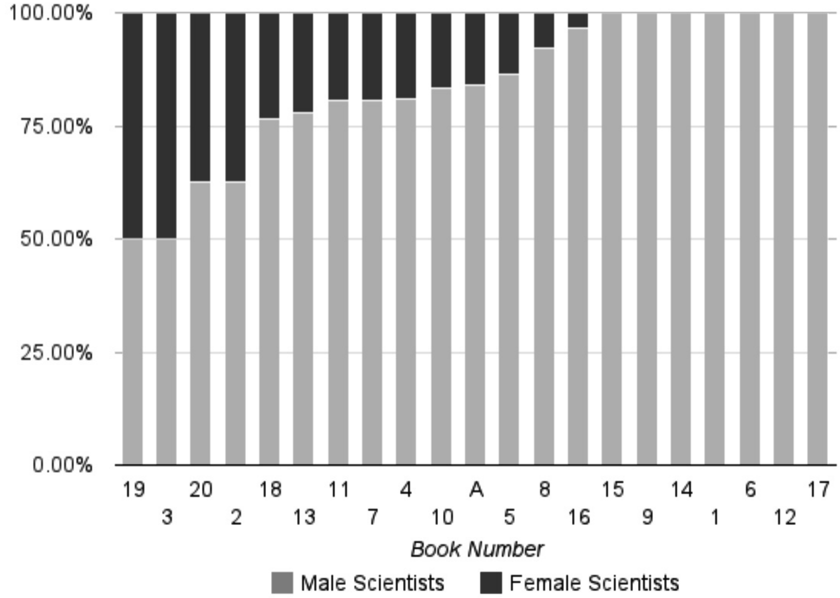
Overall, pictures of scientists were 82% male and 18% female on average, this time with five different books portraying no female scientists at all. On the other hand, *Turn It Loose* once again came out as the most female-friendly, actually portraying more female scientists than male at 55% to 45%.

Table 2. Percent of Pictured Male and Female Scientists by Book



Within the text, an average of 84% of the specific scientists introduced were male and 16% female. Two books (*Bat Scientists* and *Cave Detectives*) introduced an equal number of male and female scientists, while seven different books introduced only male scientists within the text.

Table 3. Percent of Male and Female Scientists in Text by Book



The male scientists introduced were mentioned an average of 36% more often than female scientists, although eight different books actually discussed female scientists that were included more often than their male counterparts. Though, as previous results show, there are fewer female scientists introduced in almost all of the books, in 40% of the texts, these female scientists were discussed in more detail than their male counterparts, in one case (*Lava Scientist*) by as much as 31%.

4.1. Discussion

This study found female scientists were portrayed *less* often in these informational science books than even their proportion of the scientific work force might dictate. A pictured scientist was female only 18% of the time, as compared to the 26% of the scientific workforce available to illustrators of children's books. A scientist introduced to the reader within the text had even less chance of being female (16%). One explanation for these numbers, given the background research, is an inherent bias on the part of authors, illustrators, publishers, and society at large who still perceive science and engineering as male fields, consciously or otherwise. Another, though possibly related, explanation is that many of the books surveyed contained historical sections about the history of science, which included famous breakthroughs made by such well-known scientific figures as Albert Einstein and Isaac Newton. Though women presently represent 26% of the scientific community, their social situation in past ages prevented them from attaining higher education or, in many cases, recognition for their achievements. The history of science is therefore largely male, leading Janice VanCleave in *Janice VanCleave's Science Through the Ages* to mention 101 separate scientists, not one of them female. And yet books like *The Biographical Dictionary of Women in Science: Pioneering Lives from Ancient Times to the mid-20th Century* or even, for children, *Extraordinary Women Scientists*, exist and are readily available on library shelves, so there certainly are at least some historical female scientists who might be included in more general lists of scientific accomplishments past.

Though 35% of the books surveyed mentioned no female scientists at all in the text, the remaining 65% showed an average of only 1.4% difference between the amount of detail men and women scientists were discussed. 20% of the total books surveyed had a margin of difference of 10% or less in this area, showing that at least some titles are available where individual female scientists are given about as much in-depth discussion as men, if the overall numbers are still discouragingly low.

4.2. Limitations and Future Research

Though every attempt was made to randomly select titles from those that would most likely be available to children at their local libraries, this study is by no means exhaustive. The relatively small sample size is certainly one limitation, which will hopefully be addressed in future studies. Another limitation is the at times subjective nature of the task of determining what actions might be seen as "science performance" or even identifying the gender of some uncaptioned illustrations. Though the researcher attempted to default towards how a child might interpret the image, having one or two more judges to determine inter-rater reliability would have been preferable.

5. Conclusion

When young girls first deciding what they want out of life read books about prospective careers or subjects they will learn about in school, they would ideally discover a font of inspiration, positivity, and encouragement to reach their dreams. At the very least, they should find an accurate portrayal of a field they may want to enter themselves one day. As this data shows, the portrayal of female scientists in science informational books for children is unacceptably low, not even able to meet the 26% of women who are actually in the field currently. To encourage girls to expand their scientific horizons and close that gender gap, they must be given literature that presents role models and gives them the chance to see people like them succeeding at something they want to do. Instead, through these books, they are shown that people like themselves have very few scientific opportunities, particularly in the physical sciences, math, or engineering. It's true that, for such inspiration, they may turn to entirely female-dominated books specifically written to address this gap, but setting them apart in this way sends a message to both boys and girls that women in some way do not “belong” with the male scientists in the general books. Ideally, there would be no need to set female scientists apart in this way, since their inclusion in general science books would be as natural as their participation in the field.

Unfortunately, that is not currently the world we live in, but, as evidenced in this study, for every book that completely ignores the existence of female scientists, there is at least one that is trying. 65% of the books surveyed contained at least one female scientist, and 20% contained scientists who were more than one-third female. This subgenre of information books has come far since the 1960s when the gendered pronoun used to refer to a generic scientist was always male, but, to reach equality, we still have far to go.

References

Bix, A. S. (2005). From ‘engineeresses’ to ‘girl engineers’ to ‘good engineers’: A history of women's U.S. engineering education. *NWSA Journal*, 16(1), 27-49.

Broadway, M. D. & Howland, M. (1991). Science books for young people: Who writes them?. *School Library Journal*, 37(5), 35-38.

Brown, C. S. & Leaper, C. (2010). Latina and European American girls' experiences with academic sexism and their self-concepts in mathematics and science during adolescence. *Sex Roles*, 63(11-12), 860-870.

Ladd, P. R. (2011). A study on gendered portrayals in children's picture books with mathematical content. *International Journal of Knowledge Content Development and Technology*, 1(2), 5-14.

National Science Foundation. (2011). Women, Minorities, and Persons with Disabilities in Science and Engineering: 2011. Retrieved from: http://www.nsf.gov/statistics/wmpd/pdf/nsf11309.pdf

Nilsen, A. P. (1987). Three decades of sexism in school science materials. *School Library Journal*, 34(1), 117-122.

Ogilvie, M. & Harvey, J. (2000). *The biographical dictionary of women in science: Pioneering lives* *from ancient times to the mid-20th century*. New York: Routledge.

Stille, D. R. (1995). *Extraordinary women scientists*. Chicago: Children's Press.

United States Census Bureau (2011). More Working Women Than Men Have College Degrees, Census Bureau Reports. Retrieved from: http://www.census.gov/newsroom/releases/archives/education/cb11-72.html

Weisgram, E. S. & Bigler, R. S. (2007). Effects of learning about gender discrimination on adolescent girls' attitudes toward and interest in science. *Psychology of Women Quarterly*, 31(3), 262-269.

Why ‘female’ science professor?. (2010). *Chronicle of Higher Education*, 56(38), A41-A43.

[Appendix: Annotated List of Children's Books]

Burns, L. (2007). *Tracking Trash*. Boston: Houghton Mifflin. (10)

Oceanographers track trash and other objects to learn more about the ocean and its currents.

Carson, M. (2010). *Bat scientists*. Boston: Houghton Mifflin. (19)

Scientists at Bat Conservation International attempt to save bat species despite disease and habitat loss.

Domaine, H. (2006). *Robotics*. Minneapolis: Lerner Publications Company. (13)

Robotic experts and scientists show how robots are increasingly becoming a part of our society in many ways.

Fortey, J. (2007). *Great scientists*. New York: DK Eyewitness Books. (8)

A detailed history of scientists making breakthroughs from ancient history to modern times.

Fridell, R. (2006). *Genetic engineering*. Minneapolis: Lerner Publications Company. (1)

An introduction to the basic principles and uses of genetic engineering, including details about current controversy and scientists in the field.

Gray, S. (2012). *Oceanography: The study of oceans*. New York: Scholastic Children's Press. (9)

An introduction to the study of oceans, including details about theory, technology, and what the career entails.

Hammond, R. (2006). *Can you feel the force? putting the fizz back in physics*. New York: DK. (16)

A colorful review of the basic theories of physics, including historical notes, real-life examples, and scientist profiles.

Harrison, D. (2007). *Cave detectives: Unraveling the mystery of an ice age cave*. San Francisco: Chronicle Books LLC. (3)

The true story of paleontologists and other experts exploring a cave to discover facts about the ice age.

Holmes, T. (2010). *Dinosaur scientist: Careers digging up the past*. Berkeley Heights: Enslow Publishers. (4)

Many real-life paleontologists discuss their work and the day-to-day reality of being in the field, including advice for prospective paleontologists.

Johnson, R. (2006). *Nanotechnology*. Minneapolis: Lerner Publications Company. (14)

Introduces basic concepts and uses of nanotechnology.

Latta, S. (2009a). *Ice scientist: Careers in the frozen Antarctic*. Berkeley Heights: Enslow Publishers. (5)

Many real-life scientists in Antarctica explain their work and their different fields as well

as what it's like to live at the bottom of the world.

Latta, S. (2009b). *Lava scientist: Careers on the edge of volcanoes*. Berkeley Heights: Enslow Publishers. (18)
Many real-life volcanologists discuss their work and the basic concepts of volcanology, including advice for those interested in studying in the field.

Lindop, L. (2003). *Chasing tornadoes*. Brookfield: Twenty-First Century Books. (17)
Meteorologists who specialize in tornadoes discuss the many challenges posed by studying these deadly storms, as well as methods and findings.

Lindop, L. (2006). *Venturing the deep*. Minneapolis: Twenty-First Century Books. (11)
Several scientists who study conditions and animals deep on the ocean floor discuss their work and the extraordinary methods they use for it.

Sobha, G. (2008). *Green technology: Earth-friendly innovations*. New York: Rosen Publishing Group. (12)
Engineers and scientists discuss the many different kinds of green technology available and different ways anyone can help save energy.

Somervil, B. (2010). *Marine biologist*. Ann Arbor: Cherry Lake Publishing. (2)
Marine biologists discuss their work with the ocean and its life.

Stewart, G. (2003). *Microscopes*. San Diego: Kidhaven Press. (15)
A detailed informational book about microscopes, detailing their history and use among many different kinds of scientists.

Swanson, D. (2004). *Turn it loose: The scientist in absolutely everybody*. New York: Annick Press. (20)
Through illustrative examples of scientists and non-scientists alike, discusses the many important qualities a scientist possesses and how anyone can use them.

VanCleave, J. (2002). *Janice VanCleave's science through the ages*. Hoboken: John Wiley and Sons. (6)
Profiles scientists and their discoveries from ancient times to the modern day.

YES Magazine Editors. (2006). *Science detectives: How scientists solved six real-life mysteries*. Toronto: Peter Piper Publishing. (7)
Explains the methods of scientific discovery using real-life examples.