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Beyond the Talking Groundhogs: Trends in Science Trade Books

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Abstract

Resources for selecting high-quality elementary science trade books include lists exclusively for science and those that contain a broad spectrum of content foci such as the IRA's Teachers' Choices *list. In this study, the genres and content areas of science-based* Teachers' Choices *books from the list's inception in 1988 through 2004 were analyzed for trends. Based on our analysis, the storybook genre has decreased while informational books, particularly those classified as non-narrative informational books (Donovan & Smolkin, 2002), showed marked increases. Life science was the most prevalent content area. The implications of this increase in informational books are discussed in terms of integrating science and literacy.*

In the era of No Child Left Behind legislation, content area instruction in science and social studies often seems to be relegated to the sidelines of elementary classrooms in order to provide more time and emphasis to reading and math (Douville, Pugalee, & Wallace, 2003; Smith & Trexler, 2006). The same legislation, however, required standardized testing in science beginning in 2007, therefore creating an increased awareness of the possibility of linking science and literacy instruction (Rice, 2002). As teachers struggle to find meaningful ways to integrate the two subject areas, the route of incorporating trade books in science instruction is increasing in popularity (Lundstrum, 2005; Rice, 2002). Research indicates many benefits associated with the practice, including increased knowledge of the world (Galda, Ash, & Cullinan, 2001) and exposure to the positive portrayals of women and minorities (Rice, 2002). Both Wellington and Osborne (2001) and Pappas (2006) emphasize the importance of learning the language of science. Ouzts, Taylor, and Taylor (2003) suggest that students adopt the language they hear and read; as such, the importance of carefully selecting materials to teach science is critical. In another study, Morrow, Pressley, Smith, and Smith (1997) found that children assigned to a classroom using a literature-based program integrated into literacy and science instruction scored significantly better on all literacy measures and on two of three science measures than either the literature only group or the control group. The students not only performed better, but expressed their enthusiasm for the program. Approximately 80% of those who took part in the integrated science and literacy program claimed that they liked science as opposed to only 40% in the other two conditions. Furthermore, using literature in conjunction with science can increase student motivation by allowing students more opportunity to connect science concepts to their own literary experiences (Casteel & Isom, 1994). Yet researchers caution that trade books—those books published primarily for the general public—are not necessarily written with educational standards in mind (Ford, 2006).

Mayer (1995) found that students who read stories containing factual information about science concepts were often influenced by the story or illustrations rather

than the facts, often resulting in the transmission of incorrect information. Rice's (2002) work documented similar phenomena. Pappas (2006) and Akerson, Flick, and Lederman (2000) suggest the use of nonfiction children's literature can help develop understanding of science content without the mediating factors associated with fictional stories laced with science-related information. Their voices are among many calling for increased use of informational text in elementary classrooms (e.g., Christie, 1987; Hiebert & Fisher, 1990; Lemke, 1994; Pappas, 1991). Unfortunately, Duke's (2000) research documented the dearth of such informational texts in elementary classrooms, finding that they comprise less than 10% of books in classroom libraries, and that students spend, on average, a minimal 3.6 minutes per day interacting with such texts. The available research seems to suggest that teachers either have too little time (Sudol & King, 1996) or lack an adequate understanding of how to choose trade books that are appropriate for enhancing science instruction (Donovan & Smolkin, 2002).

Fortunately, a simple search of the Internet demonstrates that industrious elementary teachers have a wealth of resources at their disposal for identifying science-based trade books to use in their classrooms. Those familiar with the National Science Teachers Association (NSTA) are likely to access the list of *Outstanding Science Trade Books* (*OSTB*), which first appeared over 30 years ago as a result of the organization's collaboration with the Children's Book Council (CBC). This list has provided librarians, teachers, and parents with a resource for choosing exemplary science trade books for K-8 students since it was first published in 1973, and it has expanded to serve students and teachers from K-12 since 2002 (National Science Teachers Association [NSTA], 2007). The selection team reviews hundreds of science-based trade books. Of the nearly 250 books submitted for review in 2004, only 40 were chosen for publication in the annual *OSTB* list (Crowther, Venable, & Barman, 2005).

In addition to NSTA's list for exemplary science trade books, other resources exist for teachers to choose high-quality books for their classrooms, including the Caldecott Honor and Award winner lists; the American Library Association's *Children's Notable Book* list; the CBC's lists; and the International Reading Association's (IRA's) *Choices* lists, which specifically include the *Children's Choices*, *Young Adult Choices*, and *Teachers' Choices* lists. The *Teachers' Choices* (*TC*) list, published annually in the November issue of IRA's premiere practitioner journal, *The Reading Teacher*, is unique in that the books are selected by teams of teachers, reading specialists, and librarians from across the country (International Reading Association [IRA], 2005). Introduced in 1989, the *TC* list includes books from a broad range of disciplines that "reflect high literary quality in style, content, structure, beauty of language, and presentation; might not be discovered or fully appreciated by children without introduction by a knowledgeable educator; and have the potential for use across the curriculum" (IRA, 2003, p. 271). While not specifically identified as such, there is a selection of books containing science content included in the annual list of approximately 30 books.

While the *OSTB* list published by NSTA's journals *Science Scope* and *Science & Children* is readily accessible to those elementary teachers with an interest in promoting science education, its circulation is not as widespread or diverse as *The Reading Teacher*. *Science & Children* has a circulation of 21,000 and a readership of approximately 54,000 people; *The Reading Teacher* is the premiere journal for practitioners focused on elementary reading with a circulation of approximately 57,000 and readership of approximately 171,000 people. It is therefore likely that more elementary teachers will have access to the *TC* list as a resource for choosing trade books for their classroom. For this reason, in addition to the fact that the list

is generated by teachers and other school-based personnel, this study focused on the quality of science trade books listed each year in the *TC* booklist. Guided by the research of both Duke (2000) and Donovan and Smolkin (2002), the following questions were addressed:

1. What genres of science books are included in the annual *TC* list, and have the percentages of those genres changed over time?
2. What science content areas are represented in the books, and is there a predominance of any content area?

Methods

Broemmel and Rearden (2006) identified 99 potentially science-based books from the annual *TC* booklist from 1998 to 2004. Attempts were made to locate each of these books from either the local metropolitan library's collection or from the personal collections of the authors. Of these 99 books, 12 were unavailable for review, and 13, when reviewed, did not contain any science content. The remaining 74 make up the data source for this study. The books were first analyzed for quality in terms of science content, visual features, and genre, the results of which can be found elsewhere (Broemmel & Rearden, 2006). For the purposes of this study, however, the authors chose to engage in a more in-depth analysis of genre, noting trends in both type and content over time. As such, the 74 books were simply divided into two eight-year time periods. The first group of 42 books was selected during the 1989 to 1996 time period (Period I), and the second group of 32 books was selected during the 1997 to 2004 time period (Period II). Since genre is a "social act" (Pappas, 2006, p. 229) and, as such, can have varying interpretations, the classification of genre relied heavily on the work of Donovan and Smolkin (2002). Classification of science content areas was guided by the content area descriptions in the National Research Council's (NRC's) (1996) *National Science Education Standards* (*NSES*).

Genre: An Introduction

Guidelines for selecting quality science trade books are readily available in the literature (Butzow & Butzow, 2000; Mayer, 1995; Pottle, 1996; Sudol & King, 1996). However, Donovan and Smolkin (2002) provide the specific framework for identifying genres associated with science-based trade books used in this study. They identify four genres: (1) storybooks, (2) non-narrative informational (NNI), (3) narrative informational (NI), and (4) dual purpose (DP). Broemmel and Rearden (2006) added a fifth genre for science-based trade books: poetry. For the purposes of this research, books that could be categorized in multiple genres or that were anthologies containing multiple genres were designated as variety (VAR).

Storybooks are easily identified by their plotlines, following characters' actions over time. Although they include science within the context of the story, the conveyance of scientific knowledge is not typically the primary purpose. These books are usually for enjoyment and entertainment (Kress, 1994). Lake (1993) suggests that these types of books are most effectively used to create a love of science, and McClure and Zitlow (1991) reinforce that idea, indicating that these types of books help to alleviate the meaningless dispensing of facts. Carle's (1987) *A House for Hermit Crab*, for example, tells the story of a hermit crab who wants to decorate his very plain shell. Embedded within the story are facts about hermit

crabs such as their need to periodically relocate to new shells rather than growing their own fitted shells. Interesting sea creatures are also introduced in the story. The primary focus of the book is entertainment, however, and the colorful visual images provide an engaging setting for the text. Since they have been shown to perpetuate common scientific misconceptions or even create new ones (Mayer, 1995; Rice, Dudley, & Williams, 2001), books from the storybook genre would be the least likely to positively impact science content knowledge.

NI books are distinguished from NNI books primarily by their presentation of information (Donovan & Smolkin, 2002). NI books present factual events over time, while the NNI books utilize a hierarchical format of topics and subtopics. NI books are read from beginning to end to make sense of the information; specific chapters of sections of NNI books can be read and understood without reliance on previously included material. *How Ben Franklin Stole the Lightning* (Schanzer, 2003) is an example of an NI book. Throughout the text, references to and questions about "stealing the lightning" abound, and the reader does not learn until after exposure to many of Ben Franklin's achievements that he invented the lightning rod. Those books that are most often recognized as "informational" typically fall into the NNI category. Wick's (1997) *A Drop of Water* is a perfect example. The presentation of the many properties of water is topical rather than sequential and includes information about phases, phase changes, and physical characteristics. Historically, NI and NNI books have been viewed as too hard or too complex for elementary students, leaving primary grade students with far fewer experiences with these books than storybooks (Donovan & Smolkin, 2002). However, children of this age not only enjoy information books (Pappas, 1991) but can also use the books to develop the language they need to further understand scientific vocabulary and concepts (Duke, Bennett-Armistead, & Roberts, 2003; Elley, 1989).

DP books, as described by Donovan and Smolkin (2002), present both a story and information. The sequential story is supplemented by additional information, typically in sidebars or other visual displays, that can be accessed at any point as well as used independently from the story. Familiar examples of DP books include Joanna Cole's *Magic School Bus* series. Some research indicates that this genre of book is more effective than storybooks or informational books for student retention of information (Leal, 1992), while other studies have found mixed results (Donovan & Smolkin, 2002).

In reviewing the *TC* books, the authors determined that a fifth genre was needed: poetry. Several of the poetry books included in the *TC* lists were anthologies of poems that were science-based and, therefore, we added this category. *The Beauty of the Beast* is an example of a book that contains poetry appropriate for science classes. Compiled by Jack Prelutsky (1997), this book contains works about arthropods, fish, birds, reptiles, and mammals. Watercolor illustrations complement the text and add to the enrichment offered by the poems.

Science Content: Supporting the Standards

The *NSES* (NRC, 1996) include science as inquiry, physical science, life science, earth and space science, history and nature of science, science in personal and social perspectives, and science and technology. We explored these content areas for Grades K-4 and Grades 5-8, although the majority of the books were targeted for Grades K-4. Some books contained more than one content area focus; for example, both life science and earth/space science elements were addressed. Additionally, for some books, we recorded the science content area despite a limited presentation of the

content in order to demonstrate that it was not necessarily the preponderance of the content but rather the theme or embodiment that was important (e.g., see Polacco's [1990] *Thunder Cake*). Although the book itself does not have an abundance of content about weather, it contains some information pertaining to the estimation of a storm's location. The book could also be used to address a science concept from an affective domain. Reading the book aloud to young students could provide a means of opening a dialogue. Similar to one of the main characters, some students may fear thunderstorms. This book could provide the forum for a teacher to resolve concerns they may have about severe weather.

Results

Genre: Changes Over Time

Overall, DP books were the least common type of book. Only three books, all from Period I, were classified as *dual purpose*. Poetry books, not prevalent in either time period, decreased from 12% in Period I to 3% in Period II. Interestingly, storybooks, which made up 31% of books in Period I, decreased to 3% in Period II. The two most prevalent genres across both time periods included both NI and NNI books. Furthermore, the number of books in each of these genres increased from Period I to Period II. NI books comprised 29% of the books from Period I, and increased to 44% of the books in Period II. Similarly, NNI books, comprising 21% of the total in Period I, increased to 50% of the books from Period II. See Table 1 for a full listing of the genres of books from each year.

Table 1. Book Genres Represented on the Annual *Teachers' Choices* List

	Year	DP	NI	NNI	P	S	VAR	Total
Period I	1989	0	1	2	1	3	0	7
	1990	1	1	0	1	1	0	4
	1991	1	4	1	1	3	0	10
	1992	0	4	1	1	2	0	8
	1993	1	1	2	1	1	0	6
	1994	0	0	3	0	1	1	5
	1995	0	0	0	0	1	0	1
	1996	0	1 (dual)	0	0	1 (dual)	0	1
Total		3	12	9	5	13	1	42
Period II	1997	0	1	1	0	0	0	2
	1998	0	3	1	1	0	0	5
	1999	0	0	3	0	0	0	3
	2000	0	1	4	0	0	0	5
	2001	0	1	5	0	0	0	6
	2002	0	3	0	0	0	0	3
	2003	0	4	0	0	0	0	4
	2004	0	1	2	0	1	0	4
Total		0	14	16	1	1	0	32
Total I and II		3	26	25	6	14	1	74

Note: DP = Dual Purpose, NI = Narrative Informational, NNI = Non-Narrative Informational, P = Poetry, S = Story, and VAR = Variety

Science Content: Unquestionable Dominance

The second focus of our research pertained to the science content in the 74 books. While all content areas were represented in the *TC* list, the most prevalent content area was life science. Seventy-five percent of the books contained information pertaining to life science either exclusively or combined with another content area. Life cycles, characteristics of organisms, and/or organisms in their environment were themes for books for Grades K-4. For Grades 5-8, the life science topics addressed populations and ecosystems, structure and function of living things, reproduction and heredity, and diversity and adaptations of organisms. Additionally, all five genres were represented in this category. Included in the life science categories were storybooks such as Cherry's (1990) *The Great Kapok Tree: A Tale of the Amazon Rain Forest*; NI books such as *Urban Roosts: Where Birds Nest in the City* (Bash, 1990); poetry books such as Prelutsky's (1997) *The Beauty of the Beast*; NNI books such as Jordan and Jordan's (1996) *Amazon Alphabet*; and DP books such as Cole's (1989) *Magic School Bus: Inside the Human Body*. These books, as well as others on the list, could be used to support instruction in elementary life science.

Books focusing on earth and space science content and personal and social science content each comprised roughly 15% of the books in the *TC* book list. Again, there were representations from multiple genres. In several of the earth and space science books, such as Simon's (1993) *Autumn Across America*, we found the visual images were appropriate for all students, but the content was appropriate for only upper elementary/middle school students. Dense text and advanced vocabulary, along with complex concepts, can limit the efficacy of using some of these books with younger students.

On the other end of the spectrum, physical science books were scarce. Schanzer's (2003) recent book, *How Ben Franklin Stole the Lightning*, addresses concepts related to electricity in an engaging and entertaining manner, and Wick (1997) visually and textually presents properties of water in a fascinating manner in *A Drop of Water*. Similar to the lack of physical science books, books pertaining to inquiry-based science, technology, and the history and nature of science were also limited on the *TC* lists. Books containing elements of inquiry included *Slime, Molds, and Fungi* (Pascoe, 1999), which proposed suggestions for investigations and encourages readers to find out more about the fungi kingdom through exploration. Cone's (1992) *Come Back, Salmon* documents the successful quest of elementary students to bring back salmon to a local creek and provides an excellent example of scientific research, and books, such as *A River Ran Wild* (Cherry, 1992), focus on technological advances and the environmental impact of those advances, but, overall, the technology-based content area was limited in the *TC* annual lists.

Discussion

Book Genres

The increase in the identification of informational books as *TC* books is an especially interesting and important trend. The low frequency of NI and NNI books during Period I could stem from the historical view that these genres have been viewed as too complex for elementary students to read, with the promotion, instead, of books from the storybook genre (Donovan & Smolkin, 2002). Viewed through the lens of children's literature in general, Kasten, Kristo, and McClure (2005) note

that "nonfiction for children has gained tremendous respect" (p. 222). Despite the fact that research such as that of Elley (1989) supports the use of introducing new vocabulary through books, Duke's (2000) documentation of the limited use of nonfiction texts implied that classroom teachers were not following the trend. It may be that this research coupled with additional work is spurring a rising awareness of the discrepancy between use of literature and informational texts in the elementary grades. For example, the meta-analysis of genre-related research by Duke et al. (2003) refutes the following "unsupported beliefs": young children cannot handle the informational texts; they do not like informational texts; and they should first learn to read and then read to learn. Some have even hailed Duke's (2000) work as a renewed call for increased use of nonfiction texts in classrooms (Bamford, Kristo, & Lyon, 2002). It is encouraging to see evidence that researchers are not the only ones who have heard this call. Our research implies that teachers, at least those selecting the *TC* books, are more readily recognizing the importance and utility of informational science books.

Science Content

While the prevalence of high-quality life science trade books provides teachers with many options for supporting their science instruction in that content area with literature, the downside to that prevalence is the lack of physical science and inquiry-based books. The dearth of physical science-based trade books in the *TC* list is not unexpected; Ford (2004), too, had similar results when reviewing science trade books. Given the lack of confidence in physical science content that many elementary education majors express (Volkmann, Abell, & Zgagacz, 2005), however, it is unfortunate that there are not more options to support the integration of trade books with physical science instruction. This does not imply that there are no options in this content area. Certainly, outstanding physical science-based books for the elementary science classroom exist. Their prevalence is just far less extensive, and they are not being selected as readily for the *TC* lists.

Implications for Elementary Science Teachers

In our nation's classrooms, science is seemingly often relegated to the background in favor of reading and math instruction. Reform rhetoric, however, has called on science educators to step forward and connect the curriculum to children's lives (Yerrick & Roth, 2005). Learning science and language can be a reciprocal process (Akerson, 2001), and learning the language of science is key to furthering children's understanding of it (Wellington & Osborne, 2001). There have been many calls for integrating science content and literacy (Saul, 2004; Yerrick & Roth, 2005; Yore, Bisanz, & Hand, 2003), and the connection between the two is well-documented (Casteel & Isom, 1994; Hand & Yore, 1999; Yore et al., 2003). It is no wonder that enterprising teachers may heed the suggestions of researchers and strive to integrate literacy and science instruction if for no other reason than maximizing instructional time. Their resources, particularly in terms of nonfiction trade books, have exploded in terms of both number and quality in the past decade.

Undoubtedly, teachers seeking to integrate literature and science have many resources from which to draw suggestions for excellent books. In an attempt to investigate the trends in the types of science-related books that teachers identify as outstanding, we chose to examine the *TC* lists. Not only are the books selected by teachers and other school-based personnel, but the wide circulation of *The Reading*

Teacher in which the annual list is published provides a reasonable assumption that this list is more widely accessible to elementary teachers than more specialized lists, like the *OSTB* list available through NSTA. Based on our analysis of the overall quality of the science-based books on the *TC* list, we believe that these books can strengthen the content presented in elementary teachers' science instruction and further encourage the integration of literature and science. Although the list is not specifically tied to science content, the *TC* list appears to be a reliable resource for seeking high-quality picture books to support science instruction.

The recent increase of NI and NNI books, coupled with the concurrent decrease in storybooks, provides even more support for using this list as it emulates the trends suggested by the body of research surrounding the use of science trade books. Duke (2004) suggests that the inclusion of such texts can significantly impact learning, stating, "Incorporating informational text in the curriculum in the early years of school has the potential to increase student motivation, build important comprehension skills, and lay the groundwork for students to grow into confident, purposeful readers" (p. 44). Unlike storybooks, which often contain fantasy elements, such as talking animals, these informational books can expose students to accurately portrayed characteristics and historical events.

It is important to note that storybooks can still have value in the elementary science classroom. Certainly, *How Groundhog's Garden Grew* (Cherry, 2003) is an engaging story featuring a talking groundhog and can be used to support life science instruction. Similarly, the inclusion of genres, such as poetry, in science instruction serves to broaden the sources of science knowledge well beyond traditional fact-based presentation. The beauty of poetry can be appreciated by students of all ages, and the science-based poetry books contained in the *TC* list are recommended for not only their content, but also for their method of conveying information. Teachers must pay close attention to the possible pitfalls of misunderstanding that can accompany the use of such books, however.

As indicated by the analysis of content, the prevalence of life science-based books in the *TC* lists is a double-edged sword. On one hand, teachers have a wealth of books from which to choose when addressing content such as life cycles, animal characteristics, and animal behavior. If teachers rely solely on this list, however, they will find their choices for topics, such as physical science, are sparse. Unfortunately, this is less a reflection of the *TC* list than it is of the realm of children's literature as a whole. Teachers who strive to support this curriculum in the same way will need to look to other more specialized resources such as the *OSTB* list and the American Institute of Physics (2002) trade book list.

In conclusion, the evidence supports the fact that books, especially informational books, can effectively support science instruction in elementary classrooms. Our research indicates that teachers have heard the call for the increased use of such texts as evidenced by the trends in science books selected for inclusion on the annual *TC* list. Whether the topic is the life cycle of sea turtles or the molecular structure of water, teachers can broaden students' exposure to science vocabulary and concepts through the inclusion of high-quality books in a manner that textbooks and worksheets often fail to do.

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