Choosing Books to Support Elementary Girls' Science Learning: Instructor Guide

Title

Choosing Books to Support Elementary Girls' Science Learning

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Discipline

Education

Target Audience

Intermediate, majors

Keywords

Education, literacy, science education, teacher education, teaching

Length of Time/Staging

Three to five days

Abstract

In this problem designed for teacher education majors, students prepare a grant proposal to obtain trade books for elementary science curricula that will support girls' science learning.

Students will first determine what makes a good science trade book for children, examine books within a particular content area for their quality and appeal to girls, determine a list of text materials appropriate for instruction, and prepare a grant application to request those materials. The problem can be used as a supplement to the PBL problem "How will I know if my students learned what they're supposed to?" (Ford, 2005).

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Format of Delivery

The problem is designed for small groups or pairs, preferably already engaged in curriculum evaluation or in lesson planning around particular science topics. There are several stages to the problem that each take one to two days: determining criteria to evaluate science trade books, determining criteria for their suitability for girls, selecting text materials for a particular content area and grade level, and preparing a grant proposal to request funds for those materials.

Student Learning Objectives

1. Learn to identify quality science trade books, in particular those that appeal to elementary-age girls.
2. Understand the importance of written texts within science and science instruction.
3. Understand issues of gender and inquiry science.
4. Identify funding opportunities for K-6 science instruction, and learn how to write a persuasive grant application.

Student Resources

Two resources are included below.

Preferences—What Types of Books do Girls Like?

(Ford, Brickouse, Lottero-Perdue & Kittleson, 2005)

Girls' book genre preferences.

Genre	% reporting that they "like" this genre
Animals	88
Funny books	83
Fairy tales/magic	73
Joke books	71
Mysteries	69
Poetry	54
Magazines	50
Biographies	50
Science books	46
History	44
Internet	42
Sports	29
Comic books	25
Encyclopedias	21

Girls' Science sub-genre preferences.

Science genre	% who chose this book
Informational narrative	43
Experiment	30
Fiction	15
Informational expository	6

Genre Use Chart

How can I use a trade book in my science instruction?

To use this chart: If you have a single book you are considering for use in the classroom, start on the left and identify the science book subgenre. You can then look to the right for possible uses for that type of book. If you are trying to find a book to fit a particular need in your curriculum, start on the right side of the chart. Identify the use, then look to the left for the most suitable science book subgenre. Book format suggestions are found in the center.

SCIENCE GENRE ß----------à USE

FACTS	The primary purpose of this type of book is to provide factual information about a topic or series of topics. The books often contain expository text, often descriptive or taxonomic. They may also provide scientific explanations. Popular formats: Single topic of interest to children (e.g., Volcanoes, Saturn, Baby Animals). Question and Answer, Field Guide	·Resources/references during investigations ·Generate questions or ideas ·Confirm/disconfirm science claims ·Identify/classify unknowns
EXPERIMENTS	This book focus presents collections of projects or experiments that illustrate scientific concepts. Popular formats: Science Fair ideas, experiments, activities, projects.	·Ideas for classroom activities ·Methods, procedures for investigations ·Standards for collecting data
BIOGRAPHY/ HISTORY	These books explain the history of a scientific field, or tell the story of a scientist past or present. They tell students something about the way science is done, or the people who do science. Popular formats: biographies of scientists, profiles of science careers, historical science events (space program, enlightenment).	·Introduce students to scientific community, scientists ·History of controversial science topics
GEOGRAPHY/ TRAVEL	These books present nature, habitats, ecosystems from a variety of locations around the world. Often combine biology, anthropology, and nature. Popular formats: rainforest expeditions, habitat/biome books, conservation books.	·Integration with social studies

ARTISTIC EXPRESSION	These books use art, poetry, song to express the beauty of the natural world. Popular formats: picture books, art books, poetry.	·Engage learners in content area ·Integration with literacy, art
STORY	These books use fictional narratives to tell stories related to science or with science themes. Popular formats: science fiction, fiction, fables and legends with nature themes.	·Engage learners in content area ·Integration with literacy

*From Ford, D.J. (2004). Scaffolding preservice teachers' evaluation of children's science literature: Attention to Science-Focused Genres and Use. *Journal of Science Teacher Education, 15,* 133-153.

Instructor Resources

In addition to the Teaching Notes, please refer to the resource included below.

Background Information for Instructors

Globally, the gender gap in science achievement in high school persists in earth science, physics, and chemistry (Martin et al., 2001). Girls continue to express less confidence in their scientific abilities and less positive attitudes than boys (Martin at al., 2001). While in the U. S., much of the gender gap in achievement has closed as enrollment has equalized in many advanced courses (Campbell, Hombo, & Mazzeo, 2000). Unfortunately, the closing of the gender gap may have more to do with boys' decreasing achievement in science rather than girls' increasing achievement (Campbell et al., 2000). There is also concern that girls continue to be underrepresented in some areas, such as computer science, and that girls from poor and/or minority backgrounds continue to participate and achieve at lower levels than middle class, white girls (NSF, 1999).

In recent years, inquiry as a foundation of elementary science has been advocated by national and state science standards and supported by the production of commercial materials such as the kits developed by the Smithsonian Institute (STC) and Lawrence Hall of Science (FOSS). However, these kits include very little reading material. This may give the false impression that reading is not critical to both science and high quality science instruction. Indeed, when the focus in elementary school science is exclusively on empirical observation and experimentation, the use of text is oftentimes omitted. Pedagogies that teach young children how to engage in scientific investigations either bypass text use entirely, or relegate it to introductory or extracurricular positions in instruction (Palincsar & Magnusson, 1997). In many cases, the omission of text is justified by interpretations of the importance of hands-on science that are contrasted with the problematic use of textbook-based science instruction. This is an unfortunate oversimplification of both the nature of scientific practice and inquiry science instruction. Texts in scientific and classroom communities allow practitioners to engage in the critical ideas of science as communicated by other members of scientific and learning communities. In effect, text serves as one of many tools available to researchers in the construction of understandings during their investigations.

Reintroducing texts to science instruction in a more scientifically authentic manner can benefit learners and present a more complete understanding of the practices of scientific communities (Ford, 1999; Gaskins et al., 1994; Palincsar & Magnusson, 1999; Saul & Jagusch, 1991; Varelas, Pappas, O.Neill, Barry & Kogen, 2001). Furthermore, facility with a variety of science texts will serve learners well in their adult lives. The majority of Americans are far more likely to engage in science by reading about it than they are by engaging in scientific research. Many of these science texts produced for citizens are not textbook-like, and contain narrative and argumentative as well as expository text genres. As such, as citizens they will need to derive meaning from a variety of science texts (Norris & Phillips, 1994).

The omission of texts in science instruction may be particularly detrimental to girls. Throughout their school lives, girls are consistently strong readers. Girls outperform boys on measures of reading achievement at all levels of elementary and secondary education, and receive higher grades in reading and other literacy activities (AAUW/NEA, 1998; Hedges & Nowell, 1995; Young & Brozo, 2001). Without the presence of reading in activity-based science, classroom science instruction may be lacking an important entry point for girls' engagement with scientific ideas.

The re-introduction of text into inquiry-based science, however, is not straightforward. Although girls are avid readers, their preferences in reading are for fiction. When investigating reading preferences, researchers have found consistently that girls and women prefer fiction, while boys and men prefer nonfiction texts (Barrs & Pidgeon, 1994). These preferences are not unknown to book authors; there are strong delineations between "boy" books and "girl" books, and the themes used to appeal to girls rarely include overtly scientific themes (Dutro, 2001/2002).

Why do girls not choose to read informational texts? One reason for the lack of interest could simply be the lack of exposure to informational texts. Most literacy experiences throughout school, but especially in the early grades, are fiction experiences (Barrs & Pidgeon, 1994; Duke, 2000). Basal readers used in elementary classrooms are overwhelmingly narrative in format (Flood & Lapp, 1990). Supplemental reading experiences—read alouds, reading centers, and the like—also contain primarily narrative texts (Hedges & Nowell, 1995). Duke (2000), in observations of elementary classrooms, came to the striking conclusion that the average amount of time spent on reading informational texts was 3.6 minutes per day. Why is so little time spent on nonfiction? Surprisingly, this is not due to a lack of informational texts. In fact, roughly half of the children.s books published each year are nonfiction, according to the Library of Congress designations. In addition, 60-70% of public and elementary school library collections are informational texts (Hepler, 1998).

Another reason might be the lack of access to science books. Barrs and Pidgeon (1994) surmise that the gendered nature of elementary literacy instruction, dominated by women (teachers, mothers, children's book authors and editors), has an impact on the books chosen and emphasized in elementary instruction. Elementary teachers, predominantly middle class white women, choose the books they are familiar with and enjoy—fiction and narrative—and use these books in literacy instruction. At home, bedtime reading often falls on the mother, who may have a strong preference for fiction, and a strong desire to pass on this love of fiction to her daughter(s) (Cherland, 1994). Girls' preference for fiction may be part of a gendered identity construction modeled after the preferences of mothers and mostly female teachers (Cherland, 1994).

Girls' lack of interest in science texts could also be complicated by the unappealing writing style found in many informational texts. In scientific texts written for public consumption, the subtleties of science writing, which include powerful narrative components (Fox, 1990; Millar & Osborne, 1998; Strube, 1990), are often overlooked. The resulting reliance on expository textbook-like formats produces texts that present science as a collection of unrelated facts. In an attempt to appeal to an educational market, many informational trade books for children are overly concerned with modeling this textbook-style expository format. These texts contain the same features that have been criticized in textbooks (Roseman, Kesidou & Stern, 1997): too many facts without sufficiently deep explanations, jumping from topic to topic, and an avoidance of overarching conceptual frameworks. It is unlikely that these books would appeal to girls any more than their science textbooks do.

Are there any science books that appeal to girls? Research conducted by Ford, Brickhouse, Lottero-Perdue, and Kittleson (2005) shows that girls have strong interests in books about animals, and moderate interest in books about other areas of science. They also found that girls show interest in science books that use narrative elements, good stories, and appealing

illustrations. Using this information, it is possible to imagine science reading experiences within inquiry science instruction that can support girls' interest and learning.

Author's Teaching Notes

Stage 1: Introducing the Problem

This problem is designed to complement curriculum planning and evaluation projects within teacher education methods courses. If your course requires students to plan and enact science lessons in elementary or middle grade classrooms, then you should direct students to align their efforts with the specifics of their field placement context (e.g., focusing on the science instruction in that classroom, using those science topics, etc). If your course does not include a field placement in which students are planning instruction, then students should select their own content area to focus their efforts. It is important to constrain the content in this problem, so that evaluation by genre and gender are not confounded by content.

Introduce the Stage 1 Scenario:

> Your cooperating teacher* has noticed that the girls in her classroom are not participating in the hands-on science activities in the same ways that boys do. However, the girls do excel during other instruction, notably, during literacy activities. She wonders if there is a way to help girls engage with science by drawing on their literacy strengths and has some ideas about ways to use books to support girls' learning. She needs your help in finding books that are most appropriate for this task, and preparing a grant application to request funds for these books. In this problem, you will determine what makes a "good" science book, what qualities of science books make them most supportive of girls' science learning, select a and develop a grant proposal to obtain these text materials. Finally, you will present your request to a panel of evaluators.
>
> *for students not in a field placement, "An elementary teacher" can be substituted.

Students will engage in a scenario where they write a grant to obtain books for their field placement classroom in order to support girls and boys in their science learning.

Introduction.

Introduce the problem with a whole class discussion of science instruction in the students' field placements (if applicable) and their own experiences as learners. The following prompts can structure discussion to highlight the major issues that the problem will address:

- What types of science instruction have they observed in their field placement? Students will likely have answers along the lines of "inquiry" or "hands-on" if the classrooms follow these models, or "reading out of books" "sitting in rows" if they do not. Bring out the instructional strategies and participant structures that they have observed in their classrooms.
- What types of science instruction have they experienced themselves as children? As college students? Students will likely have answers along the lines of "inquiry" or

"hands-on" if the classrooms follow these models, or "reading out of books" and "sitting in rows" if they do not. Bring out the instructional strategies and participant structures that they have experienced, as well as how they felt about these experiences (positive and negative aspects).

- What are children doing during this instruction? Students will describe what children's activities are. During this discussion, prompt students to note any patterns in gender / participation (What do the boys do? What do the girls do? Are they grouped in same-gender or mixed-gender groups?)
- What tools are used during instruction? Pay particular note to the presence or absence of books and other text materials in the discussion.

Learning issues.

Using the handout prompts to guide group discussion, groups generate learning issues/focus questions. Reiterate the main idea of the problem and have groups generate learning issues or focus questions that will guide their research.

Possible focus questions (students should generate their own, but these can be suggested if groups get stuck):

- What books are out there in various science content areas?
- How do we find out if they are any good books?
- What text materials besides books can be used in science?
- What instructional strategies support girls in learning science?
- How does inquiry work in elementary classrooms?
- Which foundations or granting agencies support this kind of materials procurement?

Share learning issues with whole class; revisit and revise group lists as needed. Groups assign members to research various topics and bring materials back to next session. *If students need assistance finding research, the bibliography can be shared.

Session 2.

Students return with their research, and the class begins to organize and order the focus questions into a plan of action for developing their grant proposals. The amount of direction at this point is left to the discretion of the instructor.

Intermediate Stages: Developing Knowledge and Expertise

The students should be focusing on several key elements related to this topic: (1) evaluation and selection of trade books; (2) consideration of gender in selecting trade books; and (3) grant proposal preparation. Instructors should feel free to address these topics in any order that makes sense for the way the problem unfolds in their classroom. Each intermediate stage described below can be considered interchangeable, with slight modifications as needed to suit your class. It is also possible to jigsaw responsibility for these stages across groups.

Stage A. Evaluating science trade books & selecting books within content areas

You will need a collection of science trade books for this step. One way to gather a set of books is to assign students the task of gathering books from the library. If they are engaged in lesson planning or curriculum evaluation for their field placement, this can be books for the content area

of their lessons. If they do not have a field placement, then each group should select a science topic that will be the focus of their investigation.

The majority of students in teacher preparation programs have developed expertise in evaluating trade books from their literacy education courses taken prior to science methods. However, that method of evaluation is quite general and does not take into consideration the specific criteria that would apply to science instruction. In this stage, students will develop and justify a set of criteria that are specific to science book genres.

The first step is to become familiar with the different types of books. The "Genre Use Chart" is a tool that students can use to sort the books they have into research-based categories. This is a challenging task, as many books can be classified in different ways. When students have made their decisions, they should share and justify their choices.

Evaluating the quality of the books is the central task in this stage of the problem. Students should work together to determine a set of criteria that are appropriate to apply to science books. Using their own experiences from their literacy education courses, as well as the research they have found from Stage 1, they will develop and justify a set of evaluation criteria by genre. Each group can then share their criteria, and the class can together determine a final set that they will use to evaluate the books they have found for their topic area.

The intermediate product for this stage is a set of evaluation criteria for science books and a research-based justification for the criteria.

Stage B. Evaluating books for suitability for girls

Students refine their evaluation criteria to take into consideration gender and text suitability in science instruction. [If this stage is completed first, then the criteria are developed first with respect to gender, and then refined with respect to science (stage A). Either way is appropriate.]

Introduce this stage with a discussion of the students' own experiences with reading nonfiction (and science) as children. Did they read science books? Animal books? What kinds of books appealed to them? If they have access to children in classrooms, they may wish to discuss this topic with the children, or design a small survey to give to children. A starting point is Ford et al., (2006) for information on girls' reading practices in and out of school. Pertinent data from that paper is reproduced in the 'Preferences' handout (in Student Resources), and can serve as a discussion point or possible model to use in collecting classroom data.

Using a combination of this information and research on girls' reading in science, groups should revise their evaluation criteria. They'll then need to cross their two lists (quality and suitability for girls) and decide which are most appropriate to request in their grant application.

The intermediate product for this stage is a set of evaluation criteria for science books that is sensitive to girls' reading preferences, and a research-based justification of these criteria.

Stage C. The grant proposal writing process

The final product for this problem is the completion of an actual grant proposal, which will give future teachers practice with the art of requesting funds from foundations and agencies. Students will need to research sources of funds for K-12 instructional improvement, download application files, and complete the applications. Good starting points for this research are the National

Science Teachers Association website (http://www.nsta.org) which has a section dedicated to grants, and Toshiba America Foundation (http://www.toshiba.com/tafpub/jsp/home/default.jsp) a granting agency that targets K-6 science instruction improvement.

Students should decide which granting agency is the best match for their needs and should prepare their application following the guidelines presented by the agency. They will use the evaluation criteria they developed in the intermediate stages to select text materials most appropriate for the grade level, content area, and interests of the children in their field placement (or scenario classroom). They will research costs and sources as well.

The intermediate product for this stage is a grant proposal. I generally require a completed application and a separate paper justifying the choices in materials. However, this is dependent on the grant requirements (some require that justification within the applications, others just request the budget list).

Stage 3: Budget Reduction Scenario and Final Presentations

In this final stage, the students receive word that the granting agency is cutting their awards to $100. They must revise their proposal, making difficult decisions about what is most important in their request.

After making their final revisions, each group presents and justifies their request for written text materials to support girls' science learning. Instructors may wish to invite elementary teachers and/or administrators to provide feedback and evaluation of the requests.

Possible Extension for Courses with Field Placements: Planning text-integrated inquiry lessons

Students can design lessons or supplements to lessons that make use of the materials they've argued as important to girls' science learning. Use whatever lesson plan formatting and guidelines that are familiar to them.

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