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Using Storybooks To Teach Science Themes

Sandra Moser

Be nice to spiders! You should be nice to spiders because they did not do anything to you, did they? You should be nice to spiders. That means no spiders should be killed or electrocuted by humans unless you did it on accident. -- Britany, age 7.

Sympathy, empathy, respect, admiration, affection: These are not words normally found in the science texts of primary level classrooms, and the emotions they name are not ordinarily associated with the teaching of science. Yet the young writer quoted above communicates an involvement with small creatures — even an urgency — that was learned through literature. And this emotional involvement was gained right along with a knowledge of spider anatomy, web building and feeding habits. Through literature — storybooks — this student learned science content intertwined with values.

Educators and researchers are recognizing the role of children's literature in classroom instruction (Armbruster, 1991). No longer limited to the inclusion of real stories in basal readers, children's literature has found its way into the teaching of science, social studies and other content areas in the form of nonfiction tradebooks and storybooks (Stewart and Cross, 1993). Several educators have recommended the

use of fiction as well as nonfiction children's literature for content area teaching, and have made extensive lists of suggested titles (Butzow and Butzow, 1989; Armbruster, 1991; Olson and Gee, 1991; Galda and MacGregor, 1993; Stewart and Cross, 1993).

An increasing recognition of the need to communicate values of caring and concern for nature have brought literature into the area of general classroom instruction. This attention to the importance of the student's emotional needs and the need for emotional involvement warrants a look at the techniques of bibliotherapy, which enable a student to use dilemmas and conflicts experienced by storybook characters to help put real-life conflicts into perspective (Afolayan, 1992). Children wrestling with concerns about the environment, the uses for technology, human/nonhuman interactions, and other science-related issues may find valuable insights in storybooks addressing these concerns. The use of children's literature dealing with science issues can contribute to a whole-person approach to science that gives attention to values as well as knowledge.

Storybooks provide a unique tool for engaging students in the active formation of the values of caring and concern. When used to teach science content, storybooks may have several advantages over nonfiction tradebooks and content area textbooks. When attempting to read expository texts, students may have difficulties stemming from limited prior knowledge, lack of motivation and involvement with the text, and mystifying text structures (Butzow and Butzow, 1989; Olson and Gee, 1991). Where an expository text may present an unfamiliar science concept, a storybook can couch that science concept in a fictional setting that is familiar to the reader. This familiarity born of prior knowledge enhances emotional involvement and the motivation to keep reading and

thinking about the problem presented in the story (Butzow and Butzow, 1989; Moser and Perez, 1992). Aiding the reader is a familiar textual structure with a character working through problems to meet a goal and find a resolution; such a story structure carries the reader along and allows the comfort of predictability that enhances rather than hampers the reading process.

Choosing storybooks for science themes

The classroom teacher at any grade level will keep some important factors in mind when choosing storybooks for science themes. An early consideration should be the suitability of the book's topic to the science theme: Does the book address an important concept of the theme? Next, the teacher needs to decide how accessible the material is to the students, whether the readability level will enable most of the students to read the book independently, with guidance, or if the book must be read to the students. Linked to the book's readability level are the reading skills that can be taught using the book. The key to determining the appropriateness of the storybook in these areas is to plan and list the important science concepts to be presented through the theme, and to identify the reading skills and strategies to be taught during the theme.

Of critical importance in the selection of a storybook for science instruction are the quality, accuracy and timeliness of the book's content. While the copyright date need not be current, the science concepts presented must be accurate. To encourage students to revise misconceptions about science and nature, those misconceptions must be directly addressed and refuted (Anderson and Smith, 1987; Butzow and Butzow, 1989). The teacher must decide if the storybook itself directly addresses students' misconceptions or if the information presented, while not direct, can be used by the teacher to confront and challenge students' inaccurate notions.

The teacher will need to look closely at writing style when choosing a science theme storybook, with particular attention to the use of anthropomorphism in the presentation of animal characters (Butzow and Butzow, 1989; Sutherland and Arbuthnot, 1991). While ascribing human speech, traits and motives to animals can enhance reader involvement and empathy, the teacher should determine if this way of portraying animals overwhelms the factual content of the book: Are realistic aspects of animal life obscured or ignored in favor of an anthropomorphic view? If so, the opportunity to engage in meaningful learning, especially the revision of misconceptions, may be lost.

However, a teacher can choose a storybook *because* of its anthropomorphic approach and directly address its inaccuracies, leading students toward conceptual change. Another challenge involved in the choice of a storybook with an anthropomorphic view of nature is to guard against the notion that animals and plants have value only to the degree that they resemble (or can be portrayed resembling) humans. Since one goal of science teaching can be to promote an attitude of caring, concern and responsibility, the use of anthropomorphism in storybooks must be directly confronted during instruction with such questions as "Should humans care more for slugs or pandas? For centipedes or gorillas? Do we value animals that are more similar to us?" An animal's ability to entertain, look like, or act like humans should not be a criterion in the decision to safeguard its existence. This message should be made clear in any science instruction that aims for the development of caring and concern in students.

Other criteria for storybook selection are length and genre; type, quality and realism of illustrations; and level of scientific terminology. Variations in all of these areas may be

appropriate depending on the teacher's purpose, the breadth and depth of information sought in the storybook, and the ages and ability levels of the students.

Finally, the selection of the storybook may be influenced by the availability of other materials and resources. For example, if field trips to an aquarium are planned, a book featuring the animals there may be an appropriate choice. Classroom exhibits of plant life and activities involving seeds and plants may prompt the use of a book describing the same kinds of plants. When these factors lead to the selection of a storybook, the teacher will want to be sure that the book meets the criteria involving readability, accuracy and style discussed above.

Using storybooks to teach science themes

Two science themes in which second graders have developed values of and decision making skills are the themes of spiders and of whales. The themes share a common format, featuring identification of important concepts, relevant concrete experiences, vocabulary and reading instruction, active listening and reading, and extension (post-reading) activities.

Spiders. Margaret Bloy Graham's *Be Nice To Spiders* (1967) is the first text read during a theme of "Spiders." In this book, a spider named Helen builds webs and catches flies in a zoo, contributing to the animals' comfort, but presenting a problem to the zoo keeper. The zoo keeper feels that all the spider webs around the zoo make the place "look a mess."

Identification of concepts. Using a concept mapping approach, the teacher first elicits and lists the students' ideas about spiders (Butzow and Butzow, 1989). Correct notions as well as misconceptions are listed in clusters of connected

ideas. One misconception commonly held by children is that spiders eat their prey. This misconception, along with any others presented by the students, will be addressed and challenged during this oral activity, and during the concrete activities to follow.

Concrete experiences. The concrete experiences designed for this theme serve many functions. They provide discrepant events meant to reveal, address, challenge and replace incorrect concepts students have about the topic. They provide and enhance background knowledge relevant to *Be Nice To Spiders*. In addition, they lend immediacy to the theme and invite motivation and emotional involvement.

One concrete experience in the theme is the location and observation of spiders in their webs around the school yard. During this activity, students have the opportunity to watch a spider trap and wrap its prey; they also can see that the bodies of flies and other insects caught in a spider's web are actually dry shells. These observations can be used to enable the students to confront their erroneous ideas about spiders eating insects. A follow-up activity involves bringing a spider into the classroom and allowing it to make its web in a corner or terrarium and observe the spider's trapping and feeding behavior over several days' time. Students can keep journals on the spider's actions, noting each new victim and its appearance after being drained of its bodily fluids. This ongoing record of observations may be used during discussions to reinforce the new, correct concept that spiders drain their prey of fluids.

Other concrete experiences relevant to *Be Nice To Spiders* may include a visit to an animal barn where spiders have spun webs. Children may be asked to consider how the webs benefit the animals that live in the barn.

Vocabulary and reading skills instruction. Before reading each episode of *Be Nice To Spiders*, vocabulary for the episode is taught. Science vocabulary such as insects, prey, predator, and fluids can be taught along with the reading vocabulary because although these words do not appear in the story, students can benefit by learning and applying their meanings to the story. Decoding strategies such as cloze and phonetic analysis may be used at this point.

To help students with comprehension and critical reading of the story, the teacher may encourage an ongoing critique of the author's anthropomorphic view of Helen, the spider who comes to live in the zoo. To balance this portrayal, the students are asked to evaluate elements and events in the story that are helpful or harmful to Helen, the zoo animals and the humans in the story. The goal of such a critique is to lead students to see that in real life, spiders' insect trapping behavior, while beneficial to humans, has value apart from its effect on humans, and that all animal life is valuable regardless of its usefulness to people.

Extension activities. Postreading activities reinforce the acquisition of correct science concepts and skills, and enable students to apply values of caring and concern. Students may form reading clubs, in which they get together to enjoy other books related to spiders. They may adopt a spider that has spun a web on the playground, making its safety and security their responsibility. Students may write and dramatize a play in which a spider's life or web has been threatened. Student-made posters can alert others in school to be careful of spiders, to avoid harming them, and to respect their webs.

Students involved in this theme have often taken their thoughts about spiders beyond schoolroom walls. From at-

home observations of spider behavior to journal writings, they have expressed interest and caring for these small creatures. One student wrote on his family word processor this concern about the human treatment of spiders:

We should be nice to spiders.

We should leave them alone.

Spiders should be left alone. -- Tyson, age 8

Reading Graham's story of Helen has caused many second graders to look down, think small, and be more careful.

Whales. A theme of whales can be highlighted by the reading of *Ibis* by John Himmelman (1990). This story, based on the life of a real humpback whale, shows students what can happen to whales tangled in fishing nets.

Identification of concepts. To orient students to the study of marine life and to find out how much background knowledge they have, the teacher may organize sea life stations around the classroom and invite the students to explore them. Working collaboratively, small groups answer specific questions at the stations, which contain tidal and ocean plants and animals as well as sea shore litter. Questions include *Where did it come from?*; *Was it made by nature or by humans?*; and *How is it dangerous to sea animals?* Discussions and sharing after the station activity can give the teacher and students an idea of conceptions and misconceptions held by the class. All ideas are recorded and will receive focus as the theme progresses.

Concrete experiences. One common second-grade level misconception about whales is that they are fish and get their oxygen from the water. This notion will conflict with the ideas presented in *Ibis* about the danger of the title character's

situation, so it is a misconception worth addressing. Providing discrepant events to challenge the mistaken idea should be followed by direct instruction during which the misconception is presented and refuted.

Appropriate discrepant events include films, or first-hand experiences in which students see whales out of water for extended periods. Whale-watch tours or visits to marinas are such first-hand experiences. The teacher or a visiting expert may show and explain pictures that demonstrate how the whale's lungs and blowhole work, contrasting the whale's anatomy with that of a fish.

Having confronted and corrected their initial ideas about the necessity for whales to be able to breathe air, the students will be invited to read about the real-life situation of Ibis the whale. Ibis' life depends upon being able to get to the surface for air, and the whale is threatened with starvation, suffocation and death when tangled in a drift net. The process of revising a misconception, begun during participation in discrepant events and direct instruction, will continue through the application of the correct science concept in a real-life, emotionally involving story.

Vocabulary and reading skills instruction. During the reading of *Ibis* the students learn far more than the meanings of vocabulary such as *pod*, *blowhole*, and *calf*. Through Himmelman's very subjective telling of Ibis' story, they come to identify with the whale's attachments to its mother and the other whales in the family group. The sense of danger the children feel as Ibis swims too near a fishing net gives meaning to new reading vocabulary words *panic* and *struggled*. The story's level of suspense leads the children to search the text and illustrations for clues about Ibis' dangerous situation and her responses to the humans who help her. In short, the

story and its characters give life to vocabulary and concepts that might otherwise be one-dimensional. The desire to know more about this whale's life lends an immediacy to the pursuit of facts about whales.

The skill of identifying story elements is a natural part of the study of *Ibis*. As students follow the story to learn more about how whales survive encounters with people, they also learn to name characters and settings, to understand the goals and problems of the characters, and to see how each episode advances the story. A chart of these story elements can be kept for students to fill in after the reading of each episode. This chart may be used to compare and contrast the structure of *Ibis* with books the class will read later in the theme.

Extension activities. Several unplanned, student-initiated activities have occurred after reading *Ibis*. Students have become interested in joining a whale adoption program and have decided to recycle aluminum cans as a way of earning money to adopt a whale. Friends have formed earth clubs outside of class; one student issued this invitation to a group of like-minded second grade environmentalists:

I'm making an Earth Club. Instead of bringing dues money we bring something to recycle. Like cans, newspaper. It's a club that saves whales, rainforests, stuff like that. --Teri, age 7.

Children have been observed searching out, reading and sharing books about whales during their free time. Throughout the school year the students made frequent, spontaneous references to *Ibis*' life. Her character had become real to the class, and her problem became for them a real concern. Activities such as whale adoptions, recycling, shoreline cleanup, reading clubs and earth clubs may be initiated by the

teacher or by students. They are meaningful ways of translating concern about a storybook character into real-life action.

RECOMMENDED BOOKS

Animals

- Aardema, V. (1978). *Why mosquitoes buzz in people's ears*. NY: Dial.
- Arkhurst, J.C. (1986). *The adventures of spider*. NY: Scholastic.
- Atwater, R. (1938). *Mr. Popper's penguins*. NY: Dell.
- Bonnors, S. (1978). *Panda*. NY: Dell.
- Carle, E. (1969; 1984; 1986; 1987). *The very hungry caterpillar; The very busy spider; The grouchy ladybug; House for a hermit crab*. NY: Putnam, Philomel Books, and Harper Junior Books respectively.
- Davis, B. (1975). *King snake*. NY: Scholastic.
- Graham, M.B. (1967). *Be nice to spiders*. NY: Harper & Row.
- Himmelman, J. (1990). *Ibis*. NY: Scholastic.
- Korchunow, I. (1982). *The foundling fox*. NY: Scholastic.
- Lexau, J. (1979). *The spider makes a web*. NY: Scholastic.
- Martin, B. (1974). The digger wasp. In B. Martin, & P. Brogan, (Eds.), *Sounds in the wind*. NY: Holt, Rinehart & Winston.
- McCloskey, R. (1976). *Make way for ducklings*. NY: Penguin.
- White, E.B. (1952). *Charlotte's web*. NY: Harper.
- Wilhelm, H. (1985). *I'll always love you*. NY: Scholastic.

The World Around Us

- Aardema, V. (1981). *Bringing the rain to Kapiti Plain*. NY: Dial Press.
- Cole, J. (1987; 1990). *The magic school bus inside the earth; The magic school bus lost in the solar system*. NY: Scholastic.
- Tresselt, A. (1947). *White snow bright snow*. NY: Lothrop, Lee & Shepard.
- Zolotow, C. (1952). *The storm book*. NY: Harper & Row.

Evaluating storybook use in science themes

If storybooks are used in science themes to make content learning more meaningful as well as to enable children to grow in the areas of caring and concern, then there must be ways to measure that growth or at least to see evidence of it. Teachers attempting to communicate the value of sympathetic involvement with nature through storybooks can be alert to student behaviors during and after reading that show evidence of emotional growth.

Children may begin to use trash bins instead of littering, and exhort their friends to do the same. Students who were used to stepping on insects may become very careful where they walk. Parents may report that their children are actively watching nature programs on television, becoming interested in recycling, or showing concern about pollution. A common element among these behaviors is spontaneity. Teachers and parents need to be watching to help children make the most of them.

Conclusion

As children grow in knowledge of science content, they need also to be equipped with decision making skills grounded in the qualities of caring and concern. Perhaps the development of emotional involvement will be the crucial, protective barrier between scientific knowledge and the destruction of nature. Storybooks have identifiable ways of developing children's involvement and empathy. Let's use them to direct children's attention toward a nature that needs protecting.

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- Stewart, R., & Cross, T. (1993). Content area literacy and reading comprehension. *The Reading Teacher*, 46, 708-710.
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