The Effects of Genre on Student Learning From Informational Text

Donald Reece Wilson
University of Pittsburgh-Bradford
147 Swarts Hall, 300 Campus Drive, Bradford, PA 16701
United States of America

Abstract

The purpose of this study was to compare the effects of text genre on student learning from science text, using science-related traditional informational and poetic informational texts, with fifth-graders. Four texts were used: a traditional informational text about caves, a poetic informational text about caves, a traditional informational text about mountains, and a poetic informational text about mountains. One group of students worked with the traditional informational cave text and the poetic information mountain text, while a second group worked with the traditional informational mountains text and the poetic informational caves text. After reading each text, students completed comprehension questions and a sorting task involving the main concepts of each text. Results indicated that genre was not a factor in student comprehension of science text. Study results might be interpreted as an indication that in a classroom, some students might learn better from poetic texts, and that a variety of text types may be useful.

Keywords: literacy, comprehension, genre

Introduction

Current science standards emphasize inquiry, the manipulation and documentation of observable phenomenon, as the optimal learning context for students (NSTA, 2004). This emphasis on hands-on inquiry learning, however, does not mean that students are not engaged in learning from text. In fact, recent surveys reveal that science textbooks are an integral part of teaching science in many classrooms and that most elementary school teachers use science textbooks (Weiss, Banilower, McMahon, & Smith, 2001). According to Woodward and Elliot (1990), textbooks account for 75 to 90 percent of instruction in American classrooms. Weiss (1987) found that almost two-thirds of elementary students use science textbooks. St. John (2001) reported that textbooks are used as the main source of information during science lessons.

If textbooks are such an integral part of instruction in American schools, students must be able to learn from them. These textbooks must not only present correct information, but they must also be written in a manner that supports student comprehension. However, it appears that many of the textbooks being used by students are not meeting these criteria. Reviews of science textbooks have shown that the majority of these texts are ineffective in helping students succeed in science (AAAS, 2002).

Some of the ways in which science textbooks have been criticized for being ineffective include errors in information presented in these texts (Galley, 2001), text that is not written in a coherent and comprehensible manner (Beck, McKeown, Sinatra, & Loxterman, 1991), and the use of difficult vocabulary (Vacca &Vacca, 2002). Fang (2006) describes linguistic text features that can be troublesome for readers. She refers to these features as the *language of school science*, or LSS. Some LSS features include: technical vocabulary, ordinary words used in ways not commonly used, and the use of complex sentences with restrictive and non-restrictive clauses. These linguistic challenges in science textbooks can impede student learning.

Are there ways in which student learning of science content from text can be improved? Some scholars suggest that science trade books be used for science instruction rather than traditional science textbooks. The use of trade books for instruction in content areas in the elementary classroom has grown (Rice, 2002).

In some classrooms, science textbooks have been replaced by science trade books (Ross, 1994). Part of the appeal of tradebooks may simply be the way in which they are written. They are, for the most part, more interesting and less confusing for young readers than textbooks (Ross, 1994). Many trade books are written in narrative form with recognizable story grammars; that is, with a beginning, middle, and end. Because they present science concepts through a narrative, students can remember and understand concepts better than the writing in textbooks, which often presents lists of facts (Butzow & Butzow, 2000).

Other reasons for the growing popularity of trade book use in the science classroom are more practical. Trade books are widely available from bookstores and catalogs (Kralina, 1993). In addition, trade books are often more current than science texts (Tyson & Woodward, 1989). Textbooks traditionally include a large number of topics (Tyson & Woodward), while trade books provide a more in-depth focus on fewer topics. (Ross, 1994). Labbo (1999) offered some other reasons to explain why trade books might be an attractive alternative to textbooks. Specifically, she provided insights related to vocabulary used in the content areas. While vocabulary is very often defined formally in textbooks, trade books often present vocabulary in a contextualized manner. That is, "descriptions, rich examples, and illustrations" (p. 1) of vocabulary can often be found in trade books. The use of tradebooks and their rich language could aid in teaching science in a manner that interests and engages students.

Research suggests that interest elicits and supports engagement (Krapp, Hidi, & Renninger, 1992). Research by Krapp et al. (1992) looked at the interestingness of text. They reported that there are two distinct types of interest: situational interest and individual interest. Situational interest is defined as interest created by particular conditions and/or objects (e.g., text), while individual interest is what a certain individual finds personally interesting. Both of these types of interest can influence learning. Krapp et al. (1992) reported that when students were interested in the text being read, they were motivated to read, which resulted in higher levels of learning. Interested readers are engaged readers. Engaged readers read more often, which leads to better comprehension of text and ultimately, higher reading achievement (Renninger, 2000; Guthrie, Wigfield, Metsala, & Cox, 1999; Cipielewske & Stanovich, 1992). Many students find trade books enjoyable to read (Kralina, 1993) and less intimidating than textbooks (Casteel & Isom, 1994). Many teachers also find trade books more interesting than textbooks. As a result, informational trade books are being used more often to teach science (Maria & Junge, 1993).

This study was motivated by the idea that student comprehension of science text might be better supported when students use informational science trade books instead of traditional information texts. Why is it important to consider informational science trade books as key resources in science education? As mentioned earlier, trade books are often more interesting for students to read than textbooks. In addition, many trade books are written in a more comprehensible, coherent manner than textbooks and often do not contain the linguistic features that can be troublesome for young readers. There appears to be both potential and promise for the use of informational trade books in the science classroom.

While some studies have selected genre as the variable of interest (Cervetti, Bravo, Hiebert, Pearson, and Jaynes, 2009; Best, Ozuru, Floyd, and McNamara, 2006), studies in which the poetic informational genre was investigated do not exist. Thus, this genre was the focus of this study which addressed the following research question: How is genre related to student learning from science text? In addition, how can teacher educators use implications from this study when working with teacher candidates?

Participants

The students who took part in the study attended a rural school in Pennsylvania. This elementary school enrolled children in grades three through six. The school population was primarily Caucasian from mainly middle- and lower-income families. Two intact fifth grade classrooms participated in this study. Classroom A included 13 students and Classroom B had 15 students.

Texts

Four texts were selected for use in the present study: (a) traditional informational text about caves, (b) poetic informational text about caves, (c) traditional informational text about mountains, and (d) poetic informational text about mountains.

The texts were excerpts from tradebooks edited for length and content in order to create comparable selections. Table 1 provides a summary of the various analyses of the texts. Appendices A, B, C, and D present the four text excerpts.

Table 1: *Analysis of Text*

	Cave Trad. Text	Cave Poetic Text	Mountain Trad. Text	Mountain Poetic Text
Flesch-Kincaid Readability Formula	6.72	4.95	4.7	3.18
Word Count	424	464	310	279
Number of Sentences	32	34	22	26
Average Number of Words Per Sentence	13.09	11.73	14.08	10.73
Number of Propositions	57	64	37	37
Percentage Overlap of Propositions in Texts	58		54	
Percentage of Unique Propositions in Texts	42		46	
Number of Propositions Requiring Inferencing by The Reader	1	19	10	13

The texts were analyzed in further detail in order to identify features that might support learning as well as features that might challenge learning. Using an approach employed by Beck, McKeown, Sinatra, and Loxterman (1991), each text was segmented into content units. These content units corresponded to a complete thought expressed in a phrase or sentence. For example, in the sentence "As plates push against each other, they buckle at the edges and push mountains up. (p. 8)" (Morris, 1996), there are several content units. The content units in this sentence include: plates push against each other, plates buckle, and plates push mountains up.

After analyzing the texts into content units, the content units were compared to see which included information that was common to both texts in a set (caves or mountains) as well as how many content units required inferencing on the part of the reader in order to comprehend the text. The results of this analysis are presented in Table 1. As the table shows, more than half of the content units in each text set referred to the same information, and the poetic informational texts require more inferencing on the part of the reader. These content units relate to three main ideas in each text set as presented in Table 2.

Table 2: Main Ideas in Text Sets

Main Ideas in Cave Texts	Main Ideas in Mountain Texts
1. How is a cave formed?	1. How are mountains formed?
2. How are stalactites and stalagmites made?	2. How are mountains changed?
3. How do cave animals adapt to their environment?	3. How do animals survive in a mountain environment?

In addition to the above analyses, the important characteristics of the traditional informational and poetic informational texts are summarized in Table 3.

Table 3: Important Characteristics of Texts

Poetic Informational Texts	Traditional Informational Texts
No Headings	Headings
First-person narrative point of view	Third-person narrative point of view
High inference demands	Low inference demands
Unfamiliar genre: "I" poem	Traditional genre
Rhyme	No Rhyme

Table 3 shows the main differences between the poetic informational text and the traditional informational text. The most important difference relates to the inference demands of the texts. The content unit analyses of the texts revealed that the poetic informational texts required readers to make more inferences than the traditional informational texts; that is, it is expected that readers of the poetic informational texts will be engaged in making connections among content units because such connections are not explicit.

Table 4 contains examples of high-inference and low-inference content units from the study texts.

Table 4: High- and Low-Inference Content Units From Study Texts

High Inference Text	Low Inference Text	Content Unit In Common
1. And through the eons I evolved to 50 million years old. form. (From Poetic Cave Text)	Some Caves may be up (From Traditional Cave Text)	Caves take many years to
2. Of how this planet's faulted crust was shifted, lifted, tilted thrust. Toward the sky in waves of change, to form a newborn mountain range. platespushagainst each other, they buckle at the edges and push mountains up. (From Poetic Mountain Text)	The earth's outer rocky layer is called its crust. It is made up of huge pieces called plates which fit together like a giant jigsaw puzzle. As (From Traditional Mount. Text)	Discussion of Earth's Crust and how mountains are formed

In the first example, the concept that caves take many years to form is presented. The traditional informational caves text explicitly tells the reader that caves are very old (50 million years). In contrast, the poetic informational caves text tells the reader that the cave "evolved" "through the eons." The idea of cave formation taking a long time is not presented in an explicit manner for the reader but rather must be inferred.

In the second example, the concept of Earth's crust is discussed and how this relates to the formation of mountains. The traditional informational mountain text defines the term *crust* explicitly. The poetic informational mountain text does not define the term *crust*. The reader must have knowledge of this term or be able to infer from the proceeding words "…shifted, lifted, tilted, thrust" that *crust* refers to the Earth's changing surface.

The traditional informational text then tells the reader that Earth's crust is made up of plates, and that these plates fit together like a puzzle. The imagery of a giant jigsaw puzzle is helpful for the reader. The reader is then explicitly told that as the aforementioned plates push together, they push mountain up. In contrast, the poetic informational text tells the reader that the crust was "shifted, lifted, tilted, thrust" up toward the sky "in waves of change." The reader must then infer that these changes "form[ed] a newborn mountain range."

Measures and Scoring

Two measures were used in the study: a sorting task and a question task.

Sorting Task

The sorting task centered on the three main ideas of each text. The participants were given pieces of paper. Each piece contained one idea from the text. The students were asked to sort the pieces of paper into three groups. They were asked to put each group into an envelope and write a title on the envelope that describes the group. The sorting tasks for each text set can be found in Appendices E and F. One point was awarded for each item that was placed in an appropriate group. Two points were awarded for each title that described the group correctly.

Questions

Like the sorting task, the question measure involved students responding in writing to three questions related to the main ideas in each text set. Appendices G and H include the questions and ideal responses. Each student response was compared to the ideal response and awarded points for each content unit that matches the ideal response.

Results

Sorting Results

Tables 5 and 6 present results of the sorting and questions tasks for the posttests. As the tables show, student scores on the sorting task were similar. Students in both classrooms earned about two-thirds of the points (67%) out of the maximum of 15 possible points for both texts (Group A: 10.92, 10.38; Group B: 10.73, 10.2).

Student responses to the sorting task included common category names for each group. For example, students generated titles for the items about cave animal names such as "About How Animals Live in Caves," "Animals," or "Animals in Caves." Some common group names given to the items about cave formation included "Limestone and Water," "Underground Tunnels Carved by Water,"and "Limestone and Caves." Students gave the following names for the group of items related to mountain formation: "It Tells How Mountains are Made" and "How Mountains are Formed." The items related to erosion of mountains evoked responses such as "The Weather on Mountains" and "How the Mountain Changes." In general, students in both classrooms did well on the sorting task for both texts. *T*-test results revealed no significant differences in student performance on the sorting task.

Questions Results

Tables 5 and 6 present the mean scores for student responses to the questions about each text. As the tables show, students were able to provide an average of 3 points out of the possible 6 for caves text and 4 points out of a possible 6 for the mountains text. *T*-test results revealed no significant differences between responses from students in the two classrooms.

Table 5: Mean Scores for Sorting and Questions Tasks for Cave Texts

Caves Poetic Informational	Caves Trad. Informational	Caves Poetic Informational	Caves Trad. Informational
Sorting Task M (SD)	Sorting Task MMM (SD)	Questions Task (SD)	Questions Task (SD)
10.73 (1.43)	10.92 (1.55)	3.13 (1.35)	2.84 (1.46)

Table 6: Mean Scores for Sorting and Questions Tasks for Mountain Texts

Mount. Poetic Informational	Mount.Trad. Informational	Mount. Poetic Informational	Mount.Trad. Informational
Sorting Task M (SD)	Sorting Task MMM (SD)	Questions Task (SD)	Questions Task (SD)
10.38 (2.39)	10.20 (1.89)	4.23 (1.78)	4.46 (1.30)

Conclusion

The present study was an attempt to address the lack of research available regarding differences in student interactions with traditional informational text and poetic informational text. The fifth-grade students participating in this study were asked to read each type of text and complete both comprehension questions and a sorting task that attempted to measure student understanding of the texts read.

A major limitation in this study was the number of participants: Classroom A contained 13 students, while Classroom B had 15 students. If a larger number of students had participated, there may have been greater differences between groups. Originally, there were about 24 student participants in each classroom. However, because of absences, music lessons, and pull-out instruction, that number was decreased.

The type of interactions with students that this study provided could be an additional limitation for this study. The investigator was a visitor who came to each classroom four times. It is possible that students were not convinced of the importance of the study since the activities associated with the study were separate from the everyday activities of these students.

Another possible limitation for the present study involves the study measures themselves. In particular, the questions measure could have been more robust. A greater number of questions, as well as questions at different levels, may have influenced findings. For example, in their study, McNamara et al. (1996) incorporated comprehension questions as part of their measures which required different amounts of thinking and processing on the part of study participants. Using different types of questions may have generated different types of data.

Study results provide inconclusive evidence related to the potential impact of genre on student learning from science text. That is, genre did not influence student scores on study measures. These results might be interpreted as an indication that in a classroom, some students might learn from poetic texts and/or traditional texts, and that a variety of text types might be useful.

Research by Pappas (2006) and Ebbers (2002) has shown the importance of including tradebooks in the elementary school science curriculum. In addition, McClure and Zitlow (1991) urge teachers to use poetry in science instruction. Thus, educators may increase student learning by incorporating genres such as poetic informational text by authors such as Siebert (2000) into their instruction.

Recent research by Cervetti et al. (2009) as well as research by Maria and Junge (1993) and Lamartino (1995), suggests that students may comprehend science material presented in the form of traditional informational text more completely than material presented in the form of fictional narrative text. Cervetti et al. (2009) also found no differences in accuracy and fluency by students when reading informational and fictional narrative texts. With this in mind, it seems that educators may want to include traditional informational text when teaching science.

Appendix A

Traditional Informational Science Text
Caves
What Is a Cave?

A cave is a hollow in the ground. This hollow, which we sometimes call a cavern, is really a hole in the earth's crust. Some caves are just below the surface, while others extend deep down into the crust.

Caves can have very long underground passages, with lakes, rivers, and waterfalls. Some caves may be up to 50 million years old. Most developed as water trickled through them, finding paths between layers of rock, filling tunnels, and carving out new passages.

Limestone and Water

The world's biggest caves are found in limestone areas. Limestone is a soft rock that dissolves in weak acid. Rainwater contains the acid that eats away at limestone. Over thousands of years, the weak acid nibbles away until thin cracks in the rock grow into bigger holes and then become wide tunnels.

Cave Formations

Constantly dripping water creates fantastic shapes and patterns inside caves, where it is damp, dark, and cold. Amazing sights usually await explorers when they first enter a cave.

When water seeps through limestone, it carries a dissolved mineral called calcite. Over time, this mineral is deposited and creates formations called speleothems.

The best-known speleothems are stalactites, which hang downwards, and stalagmites, which grow upwards. To remember which is which, think "c" for ceiling in stalactite, and "g" for ground in stalagmite.

A gradual buildup of calcite makes strange shapes. Water drips down from stalactites to make stalagmites. Stalactites and stalagmites can grow together to form a column.

Animals

Inside caves it is dark, damp, and usually very cold, yet some creatures spend their whole lives deep inside caves. Because there is little sunlight, many of these animals have white, pale, pink or transparent skins. Although some are blind, they can rely on sharp senses of hearing, touch, and smell.

Cave-dwelling salamanders can see at birth, but since they never leave their dark cave home, their eyelids grow together and their bodies turn pale.

Other animals leave their caves to feed. Many sea caves, for example, are teeming with life. Crayfish, sponges, sea worms, and even sharks live in underwater caverns.

Many animals use caves simply for shelter. When autumn comes, black bears and grizzlies look for a cave in which to sleep through the long winter. Some snakes spend the winter in caves, too.

Colonies of bats often live inside caves. They hang from the roof during the day and leave at night to catch food. They find their way in the dark by sending out high-pitched sounds, which echo back from objects in their path.

Appendix B

Poetic Informational Text
I Am the Cave
I am the cave,
So cool and dark,
Where time, unending, leaves its mark
As natural forces build and hone
A crystal world from weeping stone.
And through the eons I evolved,
My limestone, bit by bit, dissolved
By Nature's forces intertwined
In endless tears that left behind
The hollows that grew long and wide—
A cave within the mountainside.
My ceilings cry their endless tears
That fall throughout the endless years,
Each droplet leaving just a trace
Of sparkling crystal in its place.
And as these tiny crystals build,
My surfaces are frocked and frilled
With finite, fragile works of art
That set this lovely world apart—
An unlit world, a world concealed,
Where cracked and dripping ceilings yield
Stalactites growing layer by layer
With spearlike tips that pierce the air;
Stalagmites form, round-topped and tall,
Arising from my floors to stand
Like castles in a wonderland;
These decorations slowly grow
Til those above meet those below,
And as these counterparts unite
Great columns form to span my height
And bridge the gaps of time and space
That fill the darkness I embrace.
I am the cave,
Dark, damp, and chill,
Where forms of life evolved to fill
This niche, whose mazes reaching back,
Progress from bright to blackest black.
Inside, where light fades into gloom,
A twilight place--an anteroom--
Greets trogloxenes who feed outside
But venture in to rest, to hide:
The snakes, the porcupines, the rats,
The skunks, the mice, and ah! The bats…
But unlike guests who come and go,
Some creatures choose to stay below,
For darkness, cool and damp, beguiles
These cavern-loving troglophiles:
The crickets without wings and voice,
And salamanders who, by choice,
Remain within where they can shun

All hint of day, all trace of sun.
And in those depths untouched by light,
In places darker than the night,
All hues are lost, eyes cannot see,
And troglobites have come to be:
These creatures, pale and blind, have found
No need for sight beneath the ground,
And sightless, they can never leave,
But with their other gifts perceive
The unseen world in which they dwell—
A world of hearing, touch, and smell.
I know these little troglobites:
White beetles, millipedes, and mites;
White crayfish whose antennae guide
Them through my stream, where blindfish glide;
White spiders that so lightly crawl
From rock to rock, from wall to wall.

Appendix C

Traditional Informational Science Text
Mountains
How Do Mountains Form?

There are various kinds of mountains. They are created in different ways. All, however, are formed by the movement of rocks in the earth's surface.

The earth's rocky outer layer is called its crust. It is made up of huge pieces called plates, which fit together like a giant jigsaw puzzle. As plates push against each other, they buckle at the edges and push mountains up. If the crust cracks, it has the same effect.

Folds and Faults

The earth's plates are made up of layers of rock, called strata. As the plates move, the strata are pushed and bent into folds. Themovement is very slight, but it exerts great force over millions of years.
When the strata are pushed and folded so much that they cannot bend any more, they break and form a crack called a fault. The world's mountains are made of folds and faults.

Wearing Away

Very old mountain ranges, such as the Appalachians, inthe eastern United States, and the Urals, in Russia, were pushed up more than 250 million years ago. Their peaks are now much lower than they once were because they have been worn down by erosion.

As soon as a mountain forms, it is attacked by wind, rain, and ice,as well as changes in temperature. Most erosion is caused by streams and rivers, which scrape away at the rock.

Animals

Mountain animals have adapted to life in a harsh, ruggedenvironment. Some, such as the yak, have thick coats to keep them warm. Other animals like to sleep through the winter months. Bearsthat live in forests on the lower slopes use a cave for their winter sleep.

Mountain lions, also called pumas or cougars, live in a variety of habitats-even high mountain areas. They will eat almost any prey, from hares to deer.

Appendix D

Poetic Informational Text
I Am the Mountain
I am the mountain.
Come and know
Of how, ten million years ago,
Great forces, moving plates of earth,
Brought, to an ancient land, rebirth:
Of how this planet's faulted crust
Was shifted, lifted, tilted, thrust
Toward the sky in waves of change
To form a newborn mountain range.
I am the mountain,
Young, yet old.
I've stood, and watching time unfold,
Have known the age of ice and snow
And felt the glaciers come and go.
They moved with every melt and freeze;
I am the mountain.
From the sea
Come constant winds to conquer me-
Pacific winds that touch my face
And bring the storms whose clouds embrace
My rugged shoulders, strong and wide;
And in their path, I cannot hide.
And though I have the strength of youth,
I sense each change and know the truth:
By wind and weather, day by day,
I will, in time, be worn away;
For mountains live, and mountains die.
As ages pass, so, too, will I.
I am the mountain.
In each breath
I feel the pull of life and death
As untamed birds and beasts obey
The laws of predator and prey.
On me, the hunted ones reside,
Sustained by foods my plants provide:
I shelter rodents. In my trees
Live pinecone-loving chickarees,
While tunnels, crevices, and holes
Hold marmots, ground squirrels,
chipmunks, voles.
I cradle herds of graceful deer
That drink from waters cold and clear;
I know each buck with antlers spread
Above his proud, uplifted head.
I know these creatures, every one.
They, to survive, must hide or run;
As food for those that stalk and chase,Within life's chain, they have a place.

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