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OF WOLVES, MATTER, AND MAGNETISM:
FOURTH GRADERS' WRITING IN SCIENCE

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CATHY TOWER

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OF WOLVES, MATTER, AND MAGNETISM:
FOURTH GRADERS' WRITING IN SCIENCE

By

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ABSTRACT

OF WOLVES, MATTER, AND MAGNETISM: FOURTH GRADERS' WRITING IN SCIENCE

By

Cathy Tower

This dissertation includes two manuscripts resulting from a year-long descriptive study of fourth graders' writing in science. The study explored the informational writing development of fourth graders within the context of science instruction over the course of one school year. The study was supported by genre theory, and it considered both structural/organizational and social/contextual aspects of genre. Forty-four students and their teachers in two classrooms participated in the study. Classroom visits were conducted once a week in each classroom. Data collected included all informational writing produced within science instruction (308 written texts), field notes of observations, relevant artifacts, and interviews with teachers and students.

For the first manuscript, structural (discourse) and context analyses were performed in order to gain a complex picture of the instructional context in which the written texts were produced. Results suggest that the written texts that students produced over the course of the school year varied in ways related to two powerful context factors: 1) the task structure (which has several dimensions, including the level of scaffolding, the focus of instruction, and the purpose and audience of the task) and 2) the topic of each writing assignment. As the task structure varied, so did the organization and text feature use within the written texts that students produced. The topic of any given writing assignment seemed related to the resulting organizational structures that students employed. Analysis suggests that some topics constrain writers more than others, and

thus it may make sense to consider topic when analyzing writing. This study reinforces the importance of considering writing growth in the contexts in which students learn to compose and communicate through written language.

In the second manuscript, an analysis of the science writing of 23 students, along with context data, from one of the fourth grade classrooms resulted in a list of nine elements of nonfiction writers' craft that students used: attention to audience, voice, humor, leads, questions, literary devices, connecting the new to the known, reference to authority, and visuals. Each of the nine craft elements is discussed and examples from students' writing are provided. Examples focus primarily on the work of one fourth grader, Robert, who tried out all of these craft elements in his science writing. Three conclusions based on the results are offered: (1) young writers are able to attend to generic and rhetorical issues as evidenced through their use of the elements of nonfiction writer's craft, (2) the craft elements identified here are closely inter-related and often overlapping, and (3) the teacher may play an important role in students' developing understanding and use of nonfiction writer's craft elements through attention to, or neglect of, these elements. The manuscript concludes with a brief discussion of future directions for research.

For David

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Finally, my unending love and gratitude go to my husband, David Oehmke. His patience, good humor, support and love sustained me through the process of writing and formatting this document. I am the luckiest.

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INTRODUCTION

The widely held opinion of wolves is that they are extremely dangerous. For centuries, children have been told fairy tales with wolves as the villains. Thanks in part to movies and books, the mere sound of a wolf howling in the distance is often enough to inspire terror. The wolf, in many cultures, is a symbol of evil.
--Jim Brandenburg, <u>To the Top of the World</u>, 1993, p. 41

Here comes the meanest, evilest, and most disgusting thing on the face of the earth. It's a wolf! Actually wolves are loving and caring for their young and nothing like the ones in movies or books, like the big bad wolf....
Wolves were never mean creatures, but loving and caring; never blood thirsty, but neading meat to survive. Beautiful in the color of its fur, and as clever as me, wolves are communicating every day and adapting to their envirment to be successful. Wolves are amazing creatures. There is still much to learn about them.
--David, Wolf Report, 2002, (opening and closing paragraphs)

My fascination with wolves and with science writing can be traced back to my days as a fourth grade teacher. During a master's level course on inquiry, I was assigned to embark on an inquiry project on a topic unrelated to pedagogical concerns; in other words, something personally interesting and unrelated to my job. No "How can I improve my spelling instruction" or similar questions. In the course of this project, I turned what had been a vague curiosity (should wolves be reintroduced into Maine, my home state, as some were arguing?) into a lasting passion and an impetus for major change in my science curriculum. Spurred on by the intellectual excitement I experienced in my wolf inquiry project, I took the leap into inquiry curriculum with my fourth grade students (Tower, 2000). The shift resulted in an avalanche of questions about how best to support my students in this new endeavor. Included in that avalanche of questions were some related to the writing that I was asking my students to do: What does it mean to be a "good" science writer? What kinds of knowledge, of genres and text features and science content, are necessary for good writers to possess?

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These questions and interests have led me to the work that is reported in this dissertation. This project is but a small step in what I expect to be a long journey of exploration of the ways in which students engage in inquiry. The fact that one of the classes of fourth graders involved in my dissertation study wrote wolf reports strikes me as wonderfully serendipitous. It serves to highlight the common thread that has brought me from my own classroom full of fourth graders as a teacher into the classrooms of others as a researcher who strives to understand children's writing in science.

Overview of the Dissertation

This dissertation was written in an alternative format (Duke & Beck, 1999). It consists of an introduction, two stand-alone manuscripts ready to be submitted for publication, and a concluding reflections section. In the Introduction, I will provide a brief description of the overall dissertation study that will serve to contextualize the two manuscripts that follow. The first manuscript, titled Informational Writing in the Context of Science Instruction: The Importance of Task Structure and Topic, presents results of the structural and context analyses conducted on data gathered over one school year in two fourth grade science classes. The second manuscript, titled "Nine Elements of Nonfiction Writers' Craft", reports the results of an analysis of the craft elements used in the science writing of one class of fourth graders. It takes a close look at one student's writing in science, with a particular focus on his craft as a writer of nonfiction text. The final section consists of my reflections on the process of conducting this study and writing it up.

Overview of the Study

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This study was designed to build upon our existing knowledge and address some gaps that I identified through the process of completing a literature review in the area of children's informational writing development (Tower, 2003). After conducting the review, I concluded that there was a dearth of research that focused on the informational writing of intermediate students (grades 4-6). I argued that there are two perspectives evident in the work on children's informational writing. A developmental perspective has generally been adopted in studies of primary students' informational writing. Those who take this perspective tend to view students' writing from the "inside-out", starting with the attempts that children make and working out to provide descriptions of their "intermediate forms" (Newkirk, 1987). An achievement perspective has more often been adopted in work that considers the writing of older children. This perspective moves from the "outside in", beginning with pre-determined rubrics or adult models, and moving in to compare children's writing to them (e.g. Applebee, Langer, Mullis, Latham, & Gentile, 1994). Additionally, work at the intermediate level tends to consider children's researching (Dreher, Davis, Waynant, & Clewell, 1998) and source-finding behaviors (Symons, MacLatchy-Gaudet, Stone, & Reynolds, 2001) more than it considers their informational writing per se. In this study I aimed to bring a developmental perspective to bear on the exploration of fourth graders' informational writing. I hoped to extend the descriptions of students' writing development that had been started by researchers at the primary level (e.g. Donovan, 2001; Kamberelis, 1999; Newkirk, 1987).

There was another important step that I wished to take with this study. Previous work often did not take instructional or writing context into account in considering children's written texts. In earlier studies, researchers went into a school at only one time

point, sometimes at the beginning of the year to administer writing prompts (Donovan, 2001) and sometimes at the end of the year to collect writing from students' writing folders (Newkirk, 1987). I was convinced by arguments put forth by Chapman (1994, 1995) that it is important to take into consideration the context in which students worked to produce written texts. Thus, I designed this study with the intention of collecting not only the written texts produced by students, but also of collecting data that would allow me to understand the context in which those texts were produced. To this end, I conducted weekly classroom visits, took field notes, collected instructional artifacts and rough drafts, and interviewed both teachers and students. This wealth of context data allowed me to better understand and explain the patterns that emerged in the children's written science texts.

The following research questions guided this study:

1a. What characterizes these fourth grade students' informational writing in science?

1b. What developmental written language issues do these students seem to attempt to work through or struggle with?

2. What patterns of development of structural organization and use of text features are found over the course of the year in these fourth grade students' informational writing in science?

3. In what ways do these patterns of development relate to aspects of the instructional context?

The two manuscripts that make up the body of this dissertation address these research questions. Manuscript #1 addresses questions 2 and 3, and to a lesser extent, question 1a. Manuscript #2 addresses questions 1a and 1b by describing elements of

writer's craft in nonfiction genres, including informational text. My data will allow further exploration of the first research question, and future manuscripts will address other issues that characterize these students' informational writing.

As discussed in Manuscript #1, the results of the study failed to show strong developmental patterns in students' informational writing over the course of the year. I hypothesize that this may be due to the fact that context factors, especially those related to task structure and writing topic, may have been so important that they obscured any nuances of development that might otherwise have been seen. It is also possible that one school year was not a long enough period of time in which to detect patterns of development in the writing of these students.

Taken together, the manuscripts presented here provide analysis and discussion of the science writing of 44 fourth grade students as well as the contexts in which that writing was produced. These analyses result in a broader understanding of the organizational structures and text features employed by these students in their writing. They also provide insights into some of the features in the instructional context that were important to young writers as they wrote science text. Further, the analyses allow us to begin to understand some important considerations of writer's craft that these students took up in their work. Finally, the work presented here is built on the premise that more attention is needed to the informational writing of students in the intermediate grades. This study paid such attention, and this attention resulted in a rich collection of data such as the excerpt presented above that reveals the possibilities and potential of what young writers can do. Further examination of these issues will result in a more complete and

complex understanding of how young writers learn to become proficient communicators

of science content, concepts, and findings.

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MANUSCRIPT 1

INFORMATIONAL WRITING IN THE CONTEXT OF SCIENCE INSTRUCTION:

THE IMPORTANCE OF TASK STRUCTURE AND TOPIC

Introduction

There has been a recent surge of theoretical and research interest in non-narrative genres, including informational text (Bamford & Kristo, 1998; Donovan, 2001; Duke, 2000; Harvey, 1998; Hynes, 2000; Kamberelis, 1999; Kamberelis & Bovino, 1999; Kays & Duke, 1998; Kress, 1999; Maduram, 2000; Nystrand & Graff, 2001; Pappas & Pettegrew, 1998; Shine & Roser, 1999; Tower, 2000; Wollman-Bonilla, 2001). Researchers and practitioners have argued that exposure to a variety of genres, including informational text, is crucial for even the youngest students (Duke, 2000; Kamberelis & Bovino, 1999; Tower, 2000). Indeed, many of these genres represent the "discourses of power" that are highly valued by schools and to which all students must have access if they are to be academically successful (Cope & Kalantzis, 1993). And although school literacy programs often provide overwhelmingly narrative-based experiences for students (Duke, 2000), much of what adults read and write each day are informational texts (Smith, 2000). In addition to more accurately reflecting the world of literacy outside of school, curricula that include informational texts can provide powerful connections to inquiry that may help to foster students' problem-posing and problem-solving behaviors (Harvey, 1998; Short et al., 1996; Tower, 2000). Informational text can also serve as a "way in" to literacy for certain students who have failed to make connections to fiction, or who prefer reading for facts (Caswell & Duke, 1998; Hynes, 2000; Jobe & Dayton-

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Sakari, 2002). In addition, the visual and graphic elements of many information books provide different ways for students to connect with books and different possibilities for comprehension and learning of new material (Moline, 1995).

Given the importance of informational text in the world both inside and outside of schools, it is imperative that students learn to write informational texts that are effective in communicating information to an audience. Scholars have begun a description of the ways in which children develop the ability to compose informational text (Donovan, 2001; Kamberelis, 1999; Newkirk, 1987). Much of this research has focused on primary age students (Tower, 2003). Less attention has been paid to students in the intermediate grades, and much of the work related to informational genres that has been done with older children has focused not on writing development, but instead on information seeking and research skills (Dreher, Davis, Waynant, & Clewell, 1998; Symons, MacLatchy-Gaudet, Stone, & Reynolds, 2001) or assessment outcomes (Applebee, Langer, Mullis, Latham, & Gentile, 1994). In discussing reading and writing, Langer (1992) states that "much current research and practice runs counter to these [developmental] notions and attempts to identify adult strategies and teach them to young children" (p. 33). She goes on to argue that "instruction can be more productive if we understand where students are coming from and going to within their own rule systems for particular literacy activities" (p. 34). Given that and other arguments that teachers should be provided with developmental information to use in guiding their writing instruction (Donovan, 2001; Dyson & Freedman, 1990), this study aims to build our knowledge base by describing the development of intermediate-grade children's informational writing.

In addition to the need for close attention to development at the intermediate grades, there is also a need for a reexamination of our methodological tools for investigating writing and writing development (Chapman, 1995). Chapman points out that there has been a focus in the writing research on structure in isolation from function and instructional context. She argues that we must address "the interactions of substance, form, context, and intention rather than focus on structure alone" (p. 190). This study will take up that challenge by employing a variety of methodological tools to consider both the written texts that some fourth graders created as well as the context in which they worked as writers.

Theoretical Framework

Three theoretical perspectives guided this study: genre theory, a sociocognitive perspective, and a developmental perspective.

Genre Theory

Genre theory provides the main framework that supports and informs this study. Current genre theory reflects a shift from a strictly structuralist view of genre (genres are stable categories or classes of texts) to a more social, situated view of genre (Kamberelis, 1999). Freedman and Medway (1994) state, "Genre theory makes us aware of the irreducibly social dimension of school and university writing" (p. 18). Indeed, current definitions of genre emphasize this social nature of discourse. For example, genre is said to represent typified rhetorical action (Miller, 1984). This new notion still recognizes that genres can be characterized by regularities in textual form and features, but it also expands to include the typical ways of engaging rhetorically with recurring situations;

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thus, genres can be understood both as structures and as social processes (Coe, 1994; Freedman & Medway, 1994; Pare & Smart, 1994).

Previous writing on genre development has emphasized the importance of providing students with the appropriate support and instruction so that they may gain mastery over the various types of discourse valued by schools and society (Coe, 1994; Freedman & Medway, 1994; Kamberelis, 1999; Kamberelis & Bovino, 1999; Pare & Smart, 1994). Informational text is one such highly valued genre. In this study, informational texts are defined as texts that convey information about the natural and social world (Duke, 2000). While such texts may contain elements of other genres (such as persuasive or procedural sections (Pappas, 2002)), their primary purpose is to inform. This study aims to consider both the textual regularities of the informational writing produced by students and the social situations in which that writing was produced. That is, discourse analysis of students' texts will be supported and informed by a careful analysis of the classroom and instructional contexts in which the students worked to produce the writing. Thus, this study will consider both of the important elements noted by genre theorists: genres as structures with particular linguistic and textual features, and genres as social processes that serve particular communicative functions.

A Sociocognitive Perspective on Children's Writing

A sociocognitive perspective on literacy development acknowledges the intertwined and inseparable nature of the individual and the social. Flower (1994) argues that neither social nor cognitive theory makes genuine sense without the other. She states, "The social cognitive view of literacy that is emerging in current discussions is a

stimulating, expansive vision, trying to embrace complexity and accept the serendipitous work of dialectic" (p. 32). She goes on:

> This vision [of literacy as a social and cognitive act] must be anchored in observation-based, grounded theories of literate action that help explain how social structures and cognitive processes do indeed interact at critical moments in reading, writing, or learning. (Flower, 1994, p. 33)

Other scholars have argued that we view writing development as both an individual and a social phenomenon (Chapman, 1995; Schultz & Fecho, 2000). Chapman (1995) argues that we should "consider sociocultural and cognitive processes as transactive" and "children's written genres as sociocognitive constructions" (p. 186). In adopting data collection and analysis methods that consider both the structure of children's written texts as well as the instructional context in which those texts were produced, this study rests on the assumption that writing is a sociocognitive phenomenon which can be more fully understood through the dual lenses of individual/cognitive and social/contextual perspectives.

A Developmental Perspective Applied to the Intermediate Grades

Much of the research conducted on children's informational writing development has occurred at the primary level (Tower, 2003). Given arguments that writing is a developmental process that is nonlinear, variable across contexts, and reflective of classroom practices (Schultz & Fecho, 2000), it is crucial that we bring a developmental perspective to bear on the exploration of writing at the intermediate grades. The adoption of such a developmental perspective at the intermediate grades will enable us to gather

the kind of developmental information that will aid teachers and others in fostering children's informational writing growth.

The Need for a Developmental Perspective and Attention to Context

A brief discussion of some key studies conducted on informational writing development will allow for a better understanding of the knowledge base that we have begun to build, the methodological and theoretical tools employed so far in this work, and the ways in which this study will build upon and extend our existing understandings.

In a cross-sectional study, Newkirk (1987) provided the first comprehensive description of the intermediate forms that students produce on their way to non-narrative writing competence. The study examined the structure of 100 pieces of non-narrative (which Newkirk defined as predominantly non-chronological) writing composed by students in first, second, and third grades. Through his analysis of the written pieces, Newkirk identified eight basic discourse structures that composed the categories into which the writing pieces were sorted. These categories were Label, List (basic, attribute series, and reason), Couplet, Hierarchical Attribute Series, and Paragraph (unordered and ordered). The youngest writers wrote labels and lists with little coherent connection between items, but by third grade, 49 percent of the pieces were classified as paragraphs.

In a related study, Donovan (2001) took up Newkirk's challenge that researchers begin examining the intermediate forms of writing development more closely in order to provide labels for what children are doing. Her goal was to learn about the patterns of development in the macro-level organization of children's informational and story writing. Her participants were 222 students from one school in kindergarten through fifth grade. At the beginning of the school year, students were asked to compose two texts in

response to prompts delivered by the researcher. Features of students' informational texts were analyzed at the macro-level, because Donovan argued that research has shown macro-level features to be more salient to children (e.g. Kamberelis, 1999). Donovan reported intermediate forms generated by the students. Patterns in the global structures of the children's informational texts indicated eight categories of complexity (or intermediate forms) in children's developing control of the genre. The categories identified (which were modified from Newkirk's work) were Label, Statements, Simple Couplet, Attribute List, Complex Couplet, Hierarchical Attribute List, Unordered Paragraphs, and Ordered Paragraphs. By third grade, none of the children in Donovan's study wrote labels, and 35% of third graders wrote paragraphs (27.5% unordered, 7.5% ordered). However, by extending her work into fifth grade, Donovan was able to determine that the oldest children in her study still relied on the lower levels of organization in their informational writing (e.g. attribute lists and complex couplets). She noted that "while the complexity of writing increased across the grades [K-5] in my study, this increase was not considerable and the oldest children still relied on the lower levels of organization in their informational writing" (p. 436).

No other studies have examined students' intermediate forms. However, there is additional research (Applebee et al., 1994) to suggest that intermediate grade students struggle with the production of information text. Therefore, it is imperative that we investigate more carefully the developmental paths of informational writing so that we can provide information to teachers and others who wish to support that development (Langer, 1992). Such developmental information will take many forms, one of which will be the continuation of the descriptions (started by Newkirk and Donovan) of the steps

that children take as they learn to compose informational text. The present study will employ a variety of analytic tools in order to continue to consider informational writing development beyond the primary grades.

Embedded within a developmental perspective is the assumption that development occurs in contexts, and that these contexts influence children's writing and genre growth. For example, research conducted at the primary level has suggested that exposure to and experience with informational texts (Duke & Kays, 1998), and scaffolding (Kamberelis & Bovino, 1999) are important to the developing ability to produce such texts. In her study of children's genre development in first grade, Chapman (1995) discussed the teacher's role in exposing children to texts through read aloud and in structuring writing tasks. She argued that the instructional actions taken by the teacher influenced the genres that the children produced. Dyson's (1984) analysis of three children learning to write led her to assert that "different school tasks focused the children's attention on different aspects of the writing process" (p. 258). The piece called attention to the importance of task structure and children's own understandings of the uses of written language (Dyson, 1984). Thus, previous research has acknowledged, to varying degrees, the importance of the context in which writing occurs. It has been argued that research attention should be focused on seeing the individual writer and text in multiple contexts that complicate our understanding of writing process (Schultz & Fecho, 2000). In addition to the adoption of a developmental perspective at the intermediate level, this study also considered such instructional context features as the levels of scaffolding (both instructional and material) provided by teachers during writing activities, the topics and task types that students are asked to write, and the ways in which

instruction attends to theoretically important concerns such as purpose and audience. Thus, this study builds upon previous work by extending models of informational writing development, considering multiple time points in the development of the fourth graders, employing multiple methodological tools, and examining links between the written texts and the context in which they were produced.

Research Questions

This study examined informational writing produced by two classes of fourth graders over the course of one school year during science instruction. The following research questions guided the study: 1) What patterns of development of structural (macro-level) organization and text features are found over the course of the year in these fourth grade students' informational writing in science? 2) In what ways do these patterns of development relate to aspects of the instructional context?

Methods

Research Context

The research questions were addressed through a descriptive study of informational writing of fourth graders in two classrooms.

Sample. Fourth grade students in two classrooms were invited to participate in this study. By the time they reach fourth grade, students have instructional histories that likely affect their ability to write all types of text, including informational text. Those instructional histories often involve little exposure to informational texts (Duke, Bennett-Armistead, & Roberts, 2002). However, these classrooms were selected because some students in each classroom in this study had been involved in a recently completed study of genre development referred to as the TEXT Study (Duke, Purcell-Gates, Tower, &

Hall, 2001). The students who participated in that study experienced a particular

teaching model in their second and third grade science classes that incorporated authentic

reading and writing of informational texts and explicit teaching of the features of those

texts. Thus, these students constitute a population of students who have had at least two

years of regular exposure to and instruction about the special features of informational

text (data collected during the TEXT study confirm this). To the degree that non-TEXT

students do not have that instructional history (and again previous research suggests they

may not have had a great deal of exposure to informational text), the students introduced

potential variation into the sample of this study (Miles & Huberman, 1994) that helped

me to address the second research question.

For the purposes of this study, the two schools shall be called Rose Elementary

and Laurel Elementary. The principals at each of the schools were contacted for

permission to conduct the study. Teachers who participated were those who were willing

to communicate with me about their instruction and to be observed delivering that

instruction, who agreed to be interviewed up to three times, and who agreed to set aside

any writing that was done during science class so that I might copy it during my visits. In

addition, teachers who participated had at least some TEXT students in their class during

the year of my data collection. Consent forms were sent to parents of all students in each

of the classrooms. Two students from Laurel Elementary were dropped from the study

when it became apparent that they received a substantial amount of support for their

science writing outside of the regular classroom (in a resource room). The ability to

carefully describe the instructional context in which the writing was produced was crucial

to the design of this study; thus, those two students for whom I could not describe that

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instruction were dropped from the analyses. The final sample consisted of 44 students: 23 students at Rose Elementary (85%) and 21 students at Laurel Elementary (84%). Five of the students from Rose Elementary and 8 of the students from Laurel Elementary had participated in the TEXT project. (For analyses in this paper there was little difference between children who had and had not participated in the TEXT study, so that distinction is not a focus in later discussions.)

Rose Elementary School. Rose Elementary School is a rural school, which, in 2002, enrolled 473 students in grades 2-5. The students are predominantly white, and 26% qualify for the free or reduced lunch program (Retrieved from http://nces.ed.gov/ccd/schoolsearch/ on December 8, 2003). The teacher, Mrs. Burke, is a white female with 11 years of teaching experience. She usually taught science every day, and her science curriculum was a combination of hands-on experiences, scientific models, reading, writing, and note-taking about science topics. In addition to a strong focus on science content, Mrs. Burke provided instruction on writing and writers' craft. She provided a lot of writing instruction to students during science class time. She reported in an interview in February that she focused much of her writing instruction on informational text:

> I don't write a lot of stories. I tend to write more factual, informational type, because I think that in reality that's what they're going to do more of, in life. If they want to write, and they want to write creatively, that's fine, they can do that at different times. But for the most part we focus on informational writing with a structure to it because, they're so weak in that.

This writing instruction was provided during science class time, and it was very much tied to the science content that students were learning. Mrs. Burke described her writing instruction as follows:

> In the beginning I was making sure they have good sentence structure, that they have good paragraph structure, that they know what makes a good paragraph a good paragraph. Are they on topic? Do they have a topic sentence. Of course topic sentences are something we focus on the entire year, but especially I'm more geared to that in the beginning. I'm assuming as we go along, they're doing; no I shouldn't say assuming because I'm constantly checking also, but I can kind of leave that part of the focus behind for myself, and then I work over to, okay, now we're never going start with, "I'm going to tell you a story about" or "I'm going to write a report about" or "This report is going to be". We work the next thing on changing our sentence structure around, starting with the end instead of the beginning, so you don't have to use "I" in the front all the time, or getting rid of all the "then"s, that type of thing. From there, once they've, semi-got that idea, I can add. Because if you wait until they get one idea, you may wait all year. So you eventually, each report you have to add one more thing while you're still working on the rest of them. Next I'll focus on adjectives and adverbs, and then figures of speech, and then gradually work on more independent. So then we continue to practice all of those things, with the things that they're constantly learning anyway: the punctuation, the mechanics aspects of it, you know, spelling; those things that you're always doing with reports, but you're increasing and making them more independent as they include all these other things into it.

Thus, the students at Rose Elementary School received writing instruction that was focused primarily on informational types of writing, that was tied closely to the content instruction within science, and that included careful consideration of issues of writers' craft. The writing that occurred in this classroom was usually referred to as "reports". These texts varied in length from several paragraphs to several pages. They were usually written on lined paper, though on one occasion students wrote their final drafts into pre-bound books with hard covers.

Laurel Elementary School. Laurel Elementary School is a suburban school, which, in 2002, enrolled 591 students in grades K-5. The students are predominantly white, and 14% qualify for the free or reduced lunch program. The teacher, Mrs. Moore, is a white female with 29 years of teaching experience. Mrs. Moore reported that her language arts instruction focused mostly on fictional genres, and such things as personal narrative, response to literature, and mechanics of writing. The science curriculum that is mandated by her district is based on hands-on experiences for students. Mrs. Moore taught science 4-5 days a week, and her science instruction was focused most strongly on science content and concepts. In an interview in October, Mrs. Moore talked about how writing is used in conjunction with experiments:

> Well, the first day, the first year we had the science program I had them writing as they were doing experiments and of course that was ridiculous. Because they weren't getting hardly anything down and it was terrible what they got down. Um, for most kids. So I made a point of most of the writing is done after they complete the experiment. Not during it. Unless they've got to take a table, you know fill out a table or graph or something as they go. But other than that, they

have to have time to reflect on it. And usually the next day is fine. And then even, like a week later then going back and saying, Okay, look at this page again. We just did this, go back now and look at it again. See comment above re shortening

One main purpose for writing in this classroom was to aid memory.

They'll do reports, um, I'll probably try to do a book like that every unit we do. Hopefully they will get better at remembering information. I think maybe we're gonna have to, um, take notes in their own, I think that might be a way to do it is to make summaries. And I do need to work on summarizing. I know that. I've got kids writing, some of the best kids are writing like two page summaries of something. So I've gotta learn, teach them how to condense that. So, we'll be doing more of that. And hopefully they can do that with their notes in science too, they'd be able to say, well let's go through the important things and make a list that's real generic, you know kind of thing. Then they could write from that. That would help them remember the topics.

Thus, the writing that occurred in science in this classroom tended to be in the service of the hands-on experiences or of helping students to learn and remember science content, and to display their knowledge. The writing that occurred in this classroom took various forms, including textbook summaries, answers to questions, class books, individual books and reports. The different types of writing varied in length (from a few paragraph to several pages) and in materials used (including lined paper, workbook pages with extended spaces for writing, and booklets stapled together in the center).

Role of the Researcher. My role within the classrooms was that of interested observer. Students were told that I was there to learn about how children write in science, and that I would watch their science class and take notes, copy their science writing, and occasionally ask them questions in order to learn about their writing. The teachers were asked not to change their instruction or their schedule in any way. My visits were arranged during their regularly scheduled science classes. My interactions with students and teachers were generally informal, though I did conduct formal interviews with each teacher and with a subset of students from each class.

Data Collection

Data sources for the study include written data (copies of all written informational texts produced during science instruction) and context data (observations and written field notes, artifacts related to writing and instruction, and interviews with teachers and students). The "context" to which I refer is the fourth grade classroom during the times when science instruction was provided to students. This context included the children and teacher, the interactions that occurred, the instruction that occurred, and the materials within (including books and other science text, overhead transparencies, and materials used in science experiments and experiences). I visited each of the two classrooms once a week during science instruction for the duration of the school year. Each visit lasted the length of the science period, usually 30-60 minutes. I visited during science instruction for three reasons: 1) I wanted to study informational writing in the context of an academic content area, 2) the TEXT study (Duke, Purcell-Gates, Tower, & Hall, 2001) was focused in the area of science instruction, and thus I would have continuity with that project, and 3) other researchers (e.g. Chapman, 1994, 1995) have argued that work is

needed that considers the development of genres in varied contexts, including within science instruction.

Written Informational Texts. I collected any writing assignments that required texts that were at the level of sentences or higher (no answers to questions that weren't phrased in complete sentences or fill-in-the-blank worksheet assignments, for example) and that conveyed information about the natural and social world (Duke, 2000). I collected writings that were done for a variety of purposes that included genre theoretical purposes as well as more "school-only" (Duke, Purcell-Gates, Tower, & Hall, 2001) purposes. Thus, my sample of collected writing includes such types as answers to questions written to display knowledge to the teacher, reports written for a grade, information books intended to be read to first graders, and so on. However, I excluded from my sample pieces of writing that clearly and primarily constituted a genre other than informational. For example, I did not collect procedural writing (writing that tells someone how to do something, and generally includes ordered steps) or recount (writing that describes something that the writer has done, such as science experiments completed, or something that has happened that is described in a narrative or chronological way). The final sample consisted of 308 written texts; see Table 1 for a summary of the writing data collected.

Context Data. In order to gather data about the instructional context in which the writing was produced, I observed the science instruction, took field notes on that instruction, and collected copies of all relevant artifacts (e.g. assignment guidelines; prewriting tools such as webs, outlines, and notes). On some visits, I conducted informal interviews with students about their writing, and/or recorded notes about informal

conversations with the teacher about her instruction or other contextual information. Teachers were interviewed more formally in order to provide further background information about writing instruction, curriculum, school and district guidelines, etc. Data from interviews with teachers and students provided information about not only curriculum and instructional expectations, but also about the understandings and assumptions that they held about writing within science.

Data Analysis

This study was designed to take into account both structural and social/contextual dimensions of genre. I conducted two different structural analyses on the written texts: a macro-level organizational analysis and a text features analysis. Each of these was supported by a context analysis.

Macro-level Analysis

The analysis scheme that I employed to investigate the macro-level organization of children's written texts was modified from the work of Donovan (2001) and Newkirk (1987). Macro-level organizational structure and features are an important aspect of genre. Donovan (2001) argues that there are three reasons to focus on macro-level features when analyzing children's informational writing: 1.) Macro-level features may be more salient to children, 2.) Macro-level features may provide children with indirect access to the micro-level features of the genre, and 3.) The visual tree diagrams [that are used in the analysis] offer concrete pictures of how texts are structured that may provide insight about genres and about how content is structured within them (p. 402). Another reason to employ this analysis scheme to the present study is that it allowed me to extend the work begun by Newkirk (1987) at the primary level (grades 1-3), by providing a

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continued description of informational writing development into the intermediate grades. Donovan's (2001) analysis included children at the fourth and fifth grade level, but her writing data were collected at one point in time, and in a research situation involving a researcher-created prompt. The present study thus complements Donovan's findings by reporting about fourth grade children's writing development over time and in the context of classroom instruction and teacher assignments.

Procedures. Each written text was transcribed into T-Units. A T-Unit is defined as a single subject/verb clause plus whatever other subordinate clauses or phrases are attached to, or embedded within, that independent clause (Hunt, 1977). Each piece was then organized into a hierarchical tree diagram (Donovan, 2001; Langer, 1992; Newkirk, 1987) that illustrated the connections (or lack of connections) between the T-Units, thus providing an overall visual representation of the structure of each text. Next, each text was classified according to its organizational structure. For this classification, I employed categories that were modified from the work of Donovan (2001) and Newkirk (1987). Modifications came in the form of expanded or added categories in order to better describe the data collected. See Appendix A for a list of the categories and their descriptions. The categories used to classify the texts in this study were simple couplet, attribute list, complex couplet, basic sequence, hierarchical attribute list—inferred topic sentences, hierarchical attribute list—explicit topic sentences, single paragraph, unordered paragraph, and ordered paragraph. Texts that could not be confidently classified into only one category were placed in a category called "mixed". These mixed texts contained elements of at least two of the other categories such that classifying them into only one category would be misleading.

In order to establish inter-rater reliability of the macro-level organization analysis, 10% of written texts were coded by a second coder trained in the tree diagramming and categorizing procedures. Samples were randomly selected from within each set of writing. The second coder produced her own tree diagram of each text, and then classified it according to the category system. The reliability reached for classifications was 85%.

Text Features Analysis

In addition to considering macro-level organization, it is also important to account for the development of text features of students' informational writing. Donovan (2001) suggested that macro-level features may provide children with indirect access to the micro-level features of the genre. An analysis that considers both levels of genre knowledge is therefore necessary to explore this possible connection. The second analysis scheme that I employed considered text features (linguistic and visual), and thus, when combined with the tree structure diagram analysis, allowed for a more thorough and inter-connected picture of the genre development of fourth graders. This scheme was adapted from the linguistic and visual features employed to assess students' genre knowledge in the TEXT study (Duke et al., 2001). These features of typical information texts were identified through a discourse analysis of a corpus of informational texts written for children (Purcell-Gates & Duke, 2001). See Appendix B for a description of the text features. All of these elements from the TEXT study can be considered specific linguistic or visual features, and thus can be distinguished from the organizational focus of the macro-level analysis. This second analysis, by allowing a consideration of specific text

features, afforded the opportunity to consider different aspects of genre knowledge, thereby complementing the macro-structure analysis.

Procedures. Each information text in this study was analyzed following the method set out in the TEXT study (Purcell-Gates, Duke, Hall, & Tower, 2003.) I scored each text analytically, based on the individual features of science informational text previously identified (see Appendix B). In keeping with a focus on purpose, scores were based on how effective the use of that feature was in providing information for the reader and not the number of times a student used a particular feature. For example, a student who drew only three realistic illustrations but who connected them to their text would have received a higher score than someone who drew five illustrations that did not relate to the text or that were merely decorative. Score points had the following definitions:

- Zero was assigned if a feature wasn't used because it wouldn't have made sense to use it. For example, if a student didn't include illustrations or other visual features in a text, then that text would receive a score of "0" for the "labels/captions" category, since there would have been no need to use labels or captions if there were no pictures or diagrams.

- One was assigned if a feature, such as illustrations, was not used and could have been to provide information the reader may want.

- Two was assigned when a feature was used at least once but may have been more confusing than effective in terms of providing information.

- Three was assigned when a feature was used fairly effectively but could have been used better to provide information for the reader.

- Four was assigned when a feature was used effectively, but had a small instance of instability in terms of effectiveness in providing information for the reader.

- Five was assigned when a feature was used as effectively and as clearly as possible (Purcell-Gates et al., 2003).

Once all the texts had been scored, average scores were computed for each feature, both within a particular writing set and overall for each classroom. Interrater reliability among the raters for this study was established during the TEXT project for this scoring system. Generalizability theory analyses conducted as a part of the TEXT project showed that individual raters (of which there were three, with interrater reliability assessed on approximately 10% of randomly selected texts) had little or no effect on scores, with $G = .85 - .92$.

Context Analysis

The context analysis considered the data that supported and extended an understanding of the written texts: field notes of observations, instructional artifacts, and interviews with teachers and students. This contextual information served to support the discourse analysis by providing a detailed picture of the rhetorical and communicative situations in which the students were working. Since genre theory reminds us of the importance of both the structural and the social/contextual aspects of genre, it is important that these structural discourse analyses be supported by a careful consideration of the instructional context in which the writing occurred.

This analysis started with the written field notes. Field notes were hand-written on field note forms that contained three columns, labeled "Time", "Activities (including purpose and audience for writing, if applicable)", and "Books, other text used or

stimulating, expansive vision, trying to embrace complexity and accept the serendipitous work of dialectic" (p. 32). She goes on:

> This vision [of literacy as a social and cognitive act] must be anchored in observation-based, grounded theories of literate action that help explain how social structures and cognitive processes do indeed interact at critical moments in reading, writing, or learning. (Flower, 1994, p. 33)

> Other scholars have argued that we view writing development as both an

individual and a social phenomenon (Chapman, 1995; Schultz & Fecho, 2000). Chapman (1995) argues that we should "consider sociocultural and cognitive processes as transactive" and "children's written genres as sociocognitive constructions" (p. 186). In adopting data collection and analysis methods that consider both the structure of children's written texts as well as the instructional context in which those texts were produced, this study rests on the assumption that writing is a sociocognitive phenomenon which can be more fully understood through the dual lenses of individual/cognitive and social/contextual perspectives.

A Developmental Perspective Applied to the Intermediate Grades

Much of the research conducted on children's informational writing development has occurred at the primary level (Tower, 2003). Given arguments that writing is a developmental process that is nonlinear, variable across contexts, and reflective of classroom practices (Schultz & Fecho, 2000), it is crucial that we bring a developmental perspective to bear on the exploration of writing at the intermediate grades. The adoption of such a developmental perspective at the intermediate grades will enable us to gather

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displayed". Those notes were typed, and questions, comments and patterns were noted. The field notes were then read and reread as I made notes about the amount and type of writing instruction that teachers provided, as well as notes on information related to the writing situations in each classroom. The unit of analysis that emerged was the writing assignment/task. This unit was defined as one particular written assignment or task that the class was instructed to complete, as well as all accompanying artifacts (e.g. rough drafts, rubrics, prewriting tools) and instruction that surrounded and supported that task. Analysis proceeded by listing all of the writing tasks that were at least partially informational in genre that occurred during science in each classroom (Rose Elementary: 6 tasks; Laurel Elementary: 11 tasks). Next, I focused on each task in turn and made up an information sheet for each one that included detailed notes on the amount and type of writing instruction that surrounded the task, the artifacts that supported the task, and any interview information related to the task. These information sheets were considered in conjunction with the discourse analysis results from the two structural analyses.

Results

Results of the context analysis, in conjunction with a consideration of the structural analyses, revealed two overarching factors that seem to be related to the organization and text feature usage of the written texts: task structure and topic. The task structure factor has several dimensions, including the level of scaffolding typically provided by the teacher for each structure, the purpose associated with tasks of each structure, and the audience for those tasks. Topic refers to the assigned topic of the writing task. Students wrote in various categories of topic, including earth science, biology (animals), and physical science.

No clear developmental trends emerged from the analysis. Students' written texts varied in ways that seemed to be significantly influenced by the task; by interpretations of the task demands, the purpose of the task, and the topic of the writing task.

Task Structure: Macro-level Organization

The results of the macro-level organization varied within the context of different factors related to the writing task that the students were assigned. These factors were the level of scaffolding provided by the teacher, the expectations and focus of the teacher's instruction, and the type of task and the purpose and audience for writing that accompanied the task.

Scaffolding. Researchers have considered, and argued for the importance of, scaffolding as a factor in writing instruction and development (Donovan & Smolkin, 2002; Kamberelis & Bovino, 1999). In this study, scaffolding was defined broadly as support provided by the teacher to students as they completed writing tasks in science. The types of scaffolding that students received fell into six broad categories (see Appendix C). Scaffolding came in the form of 1) specific writing instruction during science, 2) the provision of pre-writing tools, 3) the use of rough drafts and opportunities for revision, 4) feedback from the teacher and peers that was provided prior to the final draft, 5) the provision of specific guidelines of content to include in the written texts and grading criteria, and 6) the availability of text resources. As a part of the context analysis, each writing task was coded according to the level of scaffolding that was provided by the teacher during the time in which the students completed it. A task was coded "High" if students received five or six of the types of scaffolding, "Moderate" if they received three or four types, and "Low" if they received one or two types. There were no instances

of students receiving no scaffolding; all writing task situations included at least one form of scaffolding.

    Scaffolding and macro-level organization. The results of this analysis show the level of scaffolding to be associated with the organizational structures that students employed (see Tables 2 and 3). That is, when students did writing in contexts of high levels of scaffolding, they tended to write texts with more sophisticated organizations. At Rose Elementary, Mrs. Burke provided students with consistently high levels of scaffolding on all but one writing task (see Table 2). Usually, the students in this class were highly scaffolded. They spent a great amount of time on each task, they completed multiple drafts, they received ongoing instruction and feedback, and they were provided with several types of written artifacts (pre-writing tools, organizational guidelines, grading criteria). Mrs. Burke described the need for supporting her students as writers:

    Prior to three-four years ago, I didn't write down what they needed per paragraph, and I was not getting very good writing. And it sounds like it's very formatted, it sounds like it's boring, it's not creative, but the bottom line is if you don't tell them specifically "you need a paragraph with this many sentences, you better have three adjectives, and I want a figure of speech" [laughing] they're not going to do it. They're fourth graders. They're gonna do what they can get away with doing. But if it's an expectation you set from the start, they meet it. So in the beginning I'll start with something like this [shows some pre-writing forms] and I'll actually have the web there, and I'll tell them exactly what they need: three different aspects, gather the facts...and we'll web together, and that's how we start the webbing. So that they get an idea because you don't know where they've

come in at... And I will start with writing a rough draft, and organizing, and I'll

tell them exactly what they need in each paragraph. In the beginning it's real

basic. By the time we get to [later writing assignments], they've got a checklist

for things that they need in each paragraph.... And we lean now towards

continuity and smoothness: does it flow, does your writing flow, did you include

everything, it goes without saying that you've got to have your figures of speech

and adjectives and adverbs, now does it make sense? That type of thing. So we'll

do a lot more practicing, and I'll be expecting from this point on basically to

polish. (Interview, February 2003)

In the context of such guidelines and instructional support, the students at Rose

Elementary tended to write extended texts (average length: 44 T-Units) that employed the

more sophisticated organizations. The last task, a paragraph on a constellation, was an

exception. However, it was completed under very different instructional circumstances. It

occurred during the same time that students were working on a much larger writing task

(that was not analyzed for this study because it did not meet the study's definition of

informational text). The teacher, Mrs. Burke, reported that

"the constellations was an 'in the meantime' project, meaning that we did those as

we could squeeze them in. Some [students] finished, some did not because they

were working on other writing pieces. They didn't devote the time to those, nor

were they given the time to develop them as they normally had been given. The

focus was more on being able to find specific information and put it into a quick

draft, than full development. I think I checked those for content rather than

writing (i.e., a science grade as opposed to a writing grade)." (Email communication, Spring 2003)

Thus, the one task for which they received a low level of scaffolding was the one task for which they employed the least sophisticated organizations. The high level of use of attribute list (50%) and of mixed organizations (25%) may be associated with the lack of time and support that was provided to students during the completion of this task.

At Laurel Elementary, the students received more varying levels of scaffolding (see Table 3). In contrast to the writing situations at Rose Elementary, the students at Laurel Elementary spent less time on each writing task, and the resulting texts were shorter (average length: 12 T-Units). In contexts with high levels of scaffolding, the students tended to use paragraph organizations more frequently. In contexts of low and moderate levels of scaffolding, there was a lot of variation in the organizations used. The tasks for which students received a high level of scaffolding were those for which the teacher provided specific writing instruction, usually in the form of an outline to follow. These outlines provided organizational support for the students' writing by indicating what information to include and presenting an order in which to present that information. For the most part, students followed these guidelines, and their resulting organizational structures often mirrored the guidelines. In the Magnetism and Electricity books (see Table 3), for example, all students included the required information in their individual books. The two students who didn't elaborate very much at all on each subtopic wrote complex couplets (9.5%). Four students wrote hierarchical attribute lists that included subtopics that contained the required information, and all used explicit topic sentences based on the provided table of contents. The majority of students (67%) wrote unordered

paragraphs, the highest level of organization used at this school. The paragraphs tended to include topic sentences that were again based on information provided by the teacher in the table of contents. In contrast, in the context of low levels of scaffolding such as the free write ("earth", Table 3), students' text organizations were more varied and less often employed paragraph organizations.

Teacher's expectations and focus of instruction. Factors in the instructional contexts in these two classrooms, including the level of scaffolding that students received during writing and the instructional focus of each teacher, seem to be associated with the texts that were produced in those contexts.

The talk that students shared in their interviews with me reflected the two different instructional foci of the classrooms (which were, in turn, related to the amount of scaffolding that each teacher provided). At Rose Elementary, Mrs. Burke focused both on science content and on issues of quality writing and writer's craft. She provided extensive instruction on writing during science class, and she required that students employ such writing techniques as figurative language and careful attention to audience in their written science texts. In my interviews with students there, it was evident that the children understood these expectations.

Cathy: Why do you think she wants you to do this assignment?

David: Mmm, to build our writing skills and stuff like that

Cathy: You've done owls, and matter, and... why do you think she has you write all those reports?

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Charlie: So we can, so we can know about matter and all that. And to learn how

to actually make a report.

Student writers at Rose Elementary paid attention to their craft, and also to the

expectations that Mrs. Burke set forth:

Cathy: Why did you choose to put those [similes] in?

Robert: I just thought they were kind of funny and they had a small humor to

them, but they also still worked with what I had written.

Cathy: How did you make decisions about starting out your sections?

John: Well, she [Mrs. Burke] said to not just do "Wolves, blah blah, blah blah"

and all that stuff, really boring, but to do something interesting.

Cathy: And why do you think it's important to Mrs. Burke, or that it's important

that it be interesting?

John: Because then the reader doesn't just read a couple sentences and then they

go "Well, that's pretty boring, I'm not reading that." (laughs)

Thus, students at Rose Elementary were aware of the expectation that they not only learn

science content, but that they also learn to become better writers of science text.

At Laurel Elementary, Mrs. Moore focused more exclusively on science content

and the scientific method, with less explicit attention to writing and writing instruction

during science. In my interviews with the students there, I started by asking them to tell

me about the different types of writing that they did in science. In answer to that question,

nearly all of the students described some aspect of *content*, or else described a recent

experiment (investigation) that they had done. I found it difficult to get the students to

discuss the type, style, or format of their writing rather than its content.

Cathy: Can you tell me a little bit about the different kinds of writing that you do

in science?

Sarah: Well, we do writing about the experiments that we do, like paper airplanes,

we threw it, and um, we threw it to see how long, how far it could go, and, I

forget whose when the furthest, but it had a small wingspan. That's probably why

it went the farthest. And then, just a few weeks ago, we did the experiments

about electric circuits.

Cathy: Can you tell me a little bit about the kinds of writing that you do in

science?

Chris: Well, we do about like, um, energy, changes, like, energy changes, and um,

we do atoms, how many electric charges are in atoms, and um, what is it called? I

forget this one thing, it's called this something thingy, and um, we write about

like, we do the experiment, like um, we wrote about, um, how like we put baking

soda and water up in this canister and then we put, um, vinegar in it and it pops

open and the same thing with a volcano.

Cathy: Can you tell me a little bit about the different kinds of writing that you do

in science this year?

Laura: Um, well, we've been writing about static electricity and different forms of

electricity. How it works and, charges. We've learned about different types of

electricity and what happens with electricity, and what the charges are, like

positive charges and negative charges.

Cathy: Can you tell me a little bit about the different kinds of writing that you do

in science?

Matthew: We do writing on motion, force, energy. We study electricity, how it

works, where it works, what kind of charges there are, what, how they gain and

lose charges and, what makes, um, what charges atoms can get.

Mrs. Moore's students seemed particularly focused on issues of content, which reflected

her focus in science instruction. Thus, the instructional focus of each classroom was an

important context factor that can help us to understand the written texts that the students

produced. At Rose Elementary, where the instructional focus was on both science and

writing, and where students spent extended amounts of time on nearly every writing task,

students produced texts that were long and that often (44% of the time) employed

paragraph organizations. At Laurel Elementary, the instructional focus was on science

content and hands-on experiences, and the writing that occurred was more varied in

length and purpose. The written texts at Laurel also varied in length and organizational

structure. The interview data indicates that students were well aware of the focus of

instruction within their science classrooms.

Task type, purposes, and audiences for writing. Another dimension of task

structure was the type of task that students were asked to complete. Each task type tended

to have a particular writing purpose and a particular audience associated with it. These

task types, in turn, provided different writing contexts in which students produced texts with different organizational structures and varying usage of text features.

At Rose Elementary, the type of task didn't vary, and thus this factor didn't prove illuminating with regard to that school's data. All of the writing tasks were called "reports"; students wrote an "owl report", a "matter report", and so on. The constellations writing was one exception, as noted above, in that it was considerably shorter and much less scaffolded than the others, but it was still a form of a report.

At Laurel Elementary, however, there were five different task types, and these types were associated with the use of various organizational structures (see Table 4). The types of task employed were free writing, textbook summaries, a compare/contrast piece, class books, and individual books or reports. Each type of task was consistently associated with a particular level of scaffolding. The free writing task had a low level of scaffolding, the textbook summaries had a low to moderate level of scaffolding, the compare/contrast and class books had a moderate level of scaffolding, and the individual books and reports had a high level of scaffolding.

The types of task were also associated with different writing purposes. The free writing and textbook summaries served the purpose of displaying science knowledge to the teacher; they were used as assessments and checks of students' knowledge and understanding of science content and concepts. They were written to an already knowledgeable audience. The books and reports, while still serving something of an assessment purpose, were also intended for a larger, presumably less knowledgeable audience and meant to teach this audience about a topic. This purpose seemed to be associated with more attention to language, and thus more sophisticated organizations

and more varied use of text features. For example, the Rocks and Minerals (R&M) class book was written for second graders. Thus, Mrs. Moore focused on language in a way that she typically didn't with other tasks. She used the second grade audience as a way to push her students to be clear in their explanations ("Will a little kid know what that is?") and to define all specialized vocabulary words ("Remember to explain these hard words to little kids. They don't know 'classify', they don't know 'sedimentary'").

A consideration of the instructional context that surrounded the writing tasks allows for a more complete understanding of the organizational structures that the students ultimately employed in their writing. For example, consider the free writing task of October 2. The unusual nature of the task (this was the first, and only, free writing task that students did in science), the vague directions, and the lack of a particular purpose (besides showing the teacher some knowledge of earth materials) resulted in a set of writing that was varied in terms of genre, style, and level of sophistication. Mrs. Moore set up the free writing task with the following instructions on the chalkboard: "Write about earth materials: clay, sand, silt, soil, rocks, minerals". The teacher stated orally, "Free write on anything you want on earth materials; anything that you want that's in your head, anything you remember about earth materials and want to say about it." She went on to instruct them to write a text of about one page, or two to three paragraphs, in length. Because a parent volunteer had failed to show up on this day, Mrs. Moore was forced to supervise the small group that was working in the hallway on an investigation. Thus, she wasn't readily available to students as they were writing. She did pop into the classroom periodically, sometimes giving them reminders such as "you're not supposed to be talking." For this writing task, students were left mostly to their own devices, and

the resulting texts demonstrated a range of genres, styles, and levels of sophistication. All but four texts had at least some elements of informational genre in them, and many students wrote hybrid texts that included elements of recount and/or persuasive/opinion. (The four texts that didn't include any elements of informational genre were recounts or procedural texts, and they were not included in the analysis). Shana's text sounded very informational:

> Different minerals have different uses. For instance, sulfur is use to make matches and graphite is use make pencil lead....
>
> Minerals make up rocks. Like quartz is a mineral in granite. A mineral in Basalt is olivine.
>
> Lighter minerals are usually in lighter rocks. Darker minerals are usually in darker rocks. But sometimes darker minerals are in lighter rocks and lighter minerals are in darker rocks.

Jason's text discussed his personal preference as a way to lead into the information he presented:

> I like rocks because they can be all diffrent shapes and sizes.... My favorite kinds of rocks are Graphite, Satin Spar, Amazonite, Muscovite, Obsidian. I like those kinds of rocks because they have lots of different color minerals in them. Some of them have luster. Graphite is my very favorite because it makes pencil led.

Laura's text was primarily informational, but she did something that became a common technique in this classroom: she used the first person pronoun in reporting her knowledge. This use of "I learned" seemed a logical rhetorical move in a classroom

where the teacher expected students to display their science knowledge through writing. Here is an excerpt of Laura's free writing text:

> What I learned about earth materials is that some rocks can have little tiny particles that can't be seen. I also learned that there is a white powdery earth material called clay.... Plus I learned that rocks can be created into a useful item....

These free writes were the most mixed in genre of any of the texts collected for this study.

The textbook summaries served a similar purpose of allowing the teacher to check students' understanding of recently studied science concepts. Again, the task structure was related to the ways in which the students organized their writing. For the electricity textbook summary (elec, April 4) for example, Mrs. Moore assigned the students to read four pages in the science textbook and then use a pre-writing tool to help them in locating the main idea and supporting details. Students were to use the highlighted vocabulary in the textbook as the details, and they were further expected to use those vocabulary words in their summary. Some students were able to make explicit connections among the ideas in the summary, but others were not. If the students weren't able to make those explicit connections and supply cohesive devices, then their texts were less sophisticated. Chris, for example, wrote a text that was simply a list of the vocabulary words and their definitions, which was thus categorized as an attribute list:

> electric circuit is a path that moves continuously. electric current is the continuous movement of electrons. conductor is a material through which electrons move easily. filament is a thin wire inside the bulb. This filament is

made of the metal tungsten. insulator is a material though which electrons do not move easily. a swich is what thurns lights on.

In contrast, Laura wrote a more cohesive text that was classified as a single paragraph:

Electric current moving electrons in a circle. The conductor (copper wire) moves the electrons easily. The insalator covers the wire so the electric charge doesn't charge you. The circuits path helps the electrons move continuously. In a light bulb the cunductor is the filament. That's the thin wire in the bulb made of tungsten. the tungsten lights the bulb.

The single paragraph organization was only used by students at Laurel Elementary, and it was used most often in one particular task structure: the class book. The class book task structure required each student to contribute one page on a particular subtopic of the larger topic. Thus, these texts tended to be short, and the most sophisticated organization that was logical to employ was usually the single paragraph. The students knew that their text was only a part of a larger text. In contrast, the individual books and report were single-author pieces, so students were required to write longer texts that were organized across several subtopics. These task requirements, along with the additional writing purpose of teaching others about a topic and higher levels of scaffolding, often resulted in the use of unordered paragraphs.

Once again, the interview data provide some insight into the ways that the students were making sense of another aspect of the instructional context. In this case, the students at Laurel Elementary reported on purposes for writing that reflected the purposes embedded within the instructional expectations and demands of their teacher and of the science curriculum: to record data, to aid memory, to support learning, to show

accountability by demonstrating knowledge and attention, and occasionally to teach others.

Cathy: Okay, and why do you do that kind of writing?

Terri: Because, well, it helps me remember things, because when I write down notes first it's a lot easier to remember my notes, when I have to, like, if I write like a whole paragraph, and I gotta pick out what things I had in the investigation.

Cathy: Why do you think she wants you to do writing when you're doing science?

Chris: So that we learn

Cathy: So that you learn?

Chris: a lot more.

Cathy: Okay. How do you think it helps you learn more?

Chris: Um, it helps us because, if she just told us you could easily forget, but if you have a paper you can easily look back and remember it all.

Laura: Well, what she does is we read in our textbook, a paragraph, and then at the end she doesn't let us look in the book and we have to write down what we learned from the paragraph.

Cathy: Why do you think she asks you to do that?

Laura: Well, um, to see if we were paying attention.

Cathy: Why do you think Mrs. Moore wants you to write about your science experiments?

Marie: So we, so she knows that we were really doing the science experiment, and that we didn't make our parents do it or something.

Cathy: Oh, okay. So to check up on you, kind of.

Marie: Yeah and so that we learned something from it.

Cathy: And what about when she asks you to read the textbook and write about that, or write what you learned. Do you think that's the same? Or are there other reasons that she asks you to do that?

Marie: So that we were paying attention and not like fooling around.

Cathy: Okay. And then, um, same question for the books. Is that the same thing, or are there other reasons for writing books?

Marie: Same thing.

Unlike Marie, who seems to see an accountability purpose for all of the types of writing they do, Matthew has a more varied view of the purposes for the different writing tasks:

Cathy: Okay, and how do you think the writing about experiments helps you?

Matthew: Well, it helps us remember how we do it and um, where we did it and how long it took and how far or what happened. So usually it helps us remember.

Cathy: It helps you remember stuff? Okay, I understand. Um, another thing that I've noticed is that [you write textbook summaries].

Matthew: Yes

Cathy: Okay, and how does that kind of writing help you?

Matthew: Well it helps us learn more about electricity and, um, protons, um, electricity (pause) and electricity.

Cathy: Okay. So when you're writing about your experiments, that's to help you remember?

Matthew: Yeah.

Cathy: But then when you're writing about things from the textbook, that's to help you learn about things?

Matthew: Yes.

Cathy: One other thing I've noticed is that sometimes you write books, right?

Matthew: Yes.

Cathy: How is that different from the other kinds of writing?

Matthew: Well, 'cause when you're writing a book it's telling about a whole thing, it's not a small part of a really big thing.

Cathy: I see. Okay. And how does this help you? If one of 'em helps you remember, and this one [summary] helps you learn, how does this help you, do you think?

Matthew: Well it helps us teach other people to like, learn about different things.

Since I did not interview each student after each piece of writing, I cannot connect individual comments on writing purpose to each individual written text. However, in general the data seem to support the hypothesis that purpose matters a great deal in writing. Even within the same instructional context, different students can have varied understandings of the purposes for the writing tasks that they complete. In this classroom, these views reflected the purposes that were embedded within the assignments and the curriculum.

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Task Structure: Use of Text Features

There are clear relationships between use of text features and task structure and task expectations as set by the teacher. (Tables 5 and 6 show text features results for both schools.) At Rose Elementary, all of the pieces were viewed as "reports", so there is similarity in purpose and structure across sets of writing. Given this, there was variation in the usage of particular features depending upon the structure and instruction provided by the teacher for any given report assignment. This was true, for example, of the categories of *Denotative Language, Compare/Contrast,* and *Realistic Illustrations.* For *Denotative Language,* the range of student scores was 3-5 across all of the writing sets, indicating that students used language intended to describe or provide specific information about a topic on every piece. In fact, Mrs. Burke required students to carefully describe aspects of the topic in each assignment. She indicated this requirement through both oral and written directions. However, her emphasis on the use of figurative language did result in lower scores on this category at times. Whereas the scoring guide I used scored high for denotative language, but lower when connotative language was used instead, the teacher required and modeled the use of connotative language. Thus, students who followed her instructions would score lower on this category.

Use of the *Compare/Contrast* category overall was relatively low (average score: 2.68), with the most tasks showing a range of scores from 1-3 or 1-4. On the wolf report, however, the teacher required a section in which the students were to compare and contrast wolves and dogs. The average score on this category for the wolf reports was 4.35, and the range increased to 3-5. The third example of a category associated with teacher expectations is *Realistic Illustrations.* If Mrs. Burke didn't explicitly require

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illustrations, then students didn't use them at all (this was the case for 4 of the 6 sets, average score: 1.0). In the two sets for which she did require illustrations, students used them (with an average score of 3.72).

Thus, it seems that the use of certain text features didn't happen "naturally" or spontaneously, despite the fact that students had used books and other print materials that contained those features. Some text features were only used when the teacher explicitly required them. At Rose Elementary, at least, the students were required to attend to many cognitive tasks as they were writing. It is possible that they were only able to handle so many of these tasks at a time, and as a result they focused on the ones required by the teacher for each task assignment. With regard to illustrations, there may have been a sense that "drawing pictures" was not the same as writing, and that the writing was the higher priority task. Illustrations came only if time permitted, and often it didn't. This was likely the case at Laurel Elementary, which I will discuss later. At Rose Elementary, student interviews did indicate that students understood writing (that is, composing text) to be the most important task, with drawing pictures a secondary concern:

> Cathy: Could you talk to me about your pictures? How did you choose what
>
> things to draw and, did you do the pictures first or the writing first?
>
> Rick: You did the writing first, I did the writing first.
>
> Cathy: Okay.
>
> Rick: You're supposed to or you get in big trouble with Mrs. Burke.
>
> Cathy: You get in big trouble if you don't do the writing first?
>
> Rick: Yeah. 'Cause she wants you to do the report and stuff first.

Rick's comments indicate that he sees illustrations as being separate from the report itself ("she wants you to do the report and stuff first"). Such a view of drawing and visual elements of text as being separate from the rest of the text, or as being only add-ons or decorations, would certainly have implications for children's understanding of genres and genre features. I will return to this idea in the discussion section.

Unlike at Rose Elementary, where all of the tasks were of the same type (reports), at Laurel Elementary there were five main types of writing tasks, each with different purposes, structures, teacher requirements, and levels of scaffolding. Again, the task structure and requirements as set by the teacher were associated with the students' use of text features. Here, I will present examples from the categories of *Headings, Compare/Contrast,* and *Realistic Illustrations.*

One category that was related to task structure was *Headings.* Students used no (or almost no) headings in the free write, textbook summary, and compare/contrast tasks (average: 1.11). In contrast, headings were used moderately to highly effectively in the book structures (average: 3.8). Use was highest and most effective in the individual books (2 sets, average 4.88), in which students were responsible for the entire structure of the book (as opposed to only being responsible for one page of the class books). Interestingly, use of headings was lower in the animal reports (average: 2.9). Perhaps the students saw some difference in purpose or structure between the tasks called "books" and the task called "report". Indeed, perhaps students associated the feature of headings with books exclusively, and thus used headings only in tasks that were labeled "book".

Like at Rose Elementary, the *Compare/Contrast* category results at Laurel Elementary varied along with task requirements. There was one assignment in which

students were explicitly required to compare and contrast the two animals that they had in their classroom (frogs and crabs). The average score for this category on the compare/contrast assignment was 4.94 (see table 6). Students rarely used compare/contrast on the other assignments. The average score for that category on all ten other assignments was 1.4.

The use of *Realistic Illustrations* also varied according to the type of task. Students didn't use them at all in the free writes, and they rarely used them in the text summaries. In fact, on his energy textbook summary, Darren drew a diagram at the bottom of his page (under his written text). Next to the drawing, Mrs. Moore wrote, "Don't spend time on a complicated drawing when writing a summary!" The task structure didn't allow the use of illustrations on the compare/contrast piece. That task was completed in a workbook. The workbook page had plenty of lines for writing text, but little white space in which a picture could be added. On those three types, the average score for this category was 1.03. On the books, however, students did use illustrations (average score across book sets: 3.87). In this classroom, it seems that illustrations were "extra" (not necessarily decorative, but not as important as writing). Students used illustrations in books that were meant for a wider audience (as opposed to the text summaries, which were written for the teacher exclusively). Students reported in their interviews that they were supposed to do the writing first, and then go back and add illustrations. Indeed, some of the slower writers didn't include illustrations at all, which may indicate the priority on composing written text—writing comes first, and illustrations are to be done only if time permits.

Thus, the overarching factor of task structure, with its dimensions of level of scaffolding, focus of instruction, purpose and audience, created varying contexts in which students produced texts with varying macro-level organizations and text feature use.

Topic: Macro-level Organization

The other overarching factor to emerge from the analyses was topic. Topic emerged as an important factor when students received consistently high levels of scaffolding, as they did at Rose Elementary. As discussed in the previous sections, the variation in the use of written organizations at Laurel Elementary seems most related to the level of scaffolding and the type of task (See Tables 3 and 4). At Rose Elementary, where students did only one type of task and where they received consistently high levels of scaffolding, topic was the factor most associated with variations in their written organizations (see Table 7).

Some writing topics, such as animals, seem to place fewer constraints on writers than other topics, such as matter. When writing about owls, it doesn't seem to matter so much whether students first write about their feeding habits and then their physical characteristics, or vice versa. Thus, unordered paragraphs may be a perfectly acceptable and sufficiently sophisticated organization for this topic. Ascribing a hierarchy to the organizational category system becomes problematic here in that it may lead us to judge a text "less sophisticated" when in fact that text is organized in the most reasonable way for the topic. However, when writing about atoms, it makes sense to first define an atom, then explain that it has three types of particles, then list the particles, and so forth. In this case, unordered paragraphs likely indicate some failure on the part of the writer to present the information in an accessible, understandable way. The topic of the writing, then,

seems to have a relationship to the type of organizational structure that is most effective or logical to employ.

Some examples may help to illustrate this point. Ella is a student at Rose Elementary who used paragraph organizations (either unordered or ordered) for five of the six written texts that she produced over the course of the year. Figures 1 and 2 display her Matter and Owl reports and the corresponding tree diagrams. It could be argued that both of these texts are quite sophisticated for a fourth grader. Within the owl report, there is evidence of the use of an introductory paragraph that previews the content to follow. The rest of the report does, indeed, follow the order of this preview that Ella presented. However, because she could have chosen to order those introductory sentences differently without changing the overall meaning of the text, her organization is labeled "unordered paragraphs". This use of a "less sophisticated" organization doesn't result from Ella's inability to carefully plan and organize her text. Instead, it seems to be a result of the topic about which she is writing. It seems that animal topics, one popular set of topics at the fourth grade level, are quite "free-wheeling" in their possible organizational structures. They do not seem to constrain writers very much. Topics such as this may allow writers to make more creative decisions while still adhering to the purpose of the informational genre, which is to convey information about the natural or social world in a way that is comprehensible to a reader who wants or needs the information.

The topic of matter, on the other hand, seems to place more constraints on a writer. In order to adhere to the purpose of the informational genre while conveying information about matter in a comprehensible way, a writer has fewer choices in terms of

the organizational structure she uses. The information pertaining to the topic of matter is more hierarchical, and thus an effective written text must be more hierarchically arranged

See Ella's Matter Report in Figure 2. She begins, some might argue less skillfully than in her owl report, by giving some general information about matter and atoms. The following information builds on and expands this opening information. She describes atoms in detail (units 10-15). Next she describes elements, which are made up of one kind of atom (units 16-19). Next she describes mixtures, again relating the new concept back to the information about atoms by telling us that "mixtures are made of atoms in different amounts" (units 20-25). Next she presents special kinds of mixtures: solutions and suspensions (units 26-30). As she moves on to explain compounds (units 31-37), she continues to refer to previously discussed concepts such as mixtures and atoms. Her tree diagram indicates the sophistication of her text (see Figure 2). She organizes her report by helping the reader to understand that "everything is made of atoms" (unit 9). Unlike the owl report, any changes in the order of the paragraphs in the matter report would result in a change in the overall meaning of the text. The hierarchical nature of the information on matter dictated the use of ordered paragraphs in order to convey that information effectively to a reader.

Topic: Use of Text Features

There are also some connections between use of text features and topic, particularly in the data from Rose Elementary. Scores for *Attributes/Components* and *Characteristic Events* were highest at both schools on animal-related topics. At Rose Elementary, use of *Definitions* received a relatively low average score overall (2.00), but on the matter report, the score for that category was 4.6 (see table 5). This report

contained a large number of words that were entirely new to the students. Perhaps they thus chose to include definitions because they assumed that their audience might be new to these words as well. Alternatively, perhaps they defined the new words as a way to show their teacher all that they had learned. This large number of new words is likely related to the perfect score that the matter reports received on *Specialized Vocabulary* as well. Also, both of the earth science topic pieces (Matter and Earth) got higher than average scores on *Denotative Language* (4.95 and 4.88, compared to the overall average of 4.13). One possible explanation for this finding is that the earth science topics are simply harder to use figurative or connotative language to describe. Whereas students called wolves "beautiful creatures" or "fierce hunters", it could be harder to be so "connotative" when discussing compounds and solutions. It is possible that these topic findings support the hypothesis discussed earlier in reference to the macro-level organization results that some topics (such as animals) may be more "free-wheeling" than others, such as matter, which require a stricter adherence to a particular organizational structure and, perhaps, to particular stylistic and text feature constraints.

Thus, the results of this study indicate the importance of two context features: task structure and topic. The written texts that the students wrote varied along with variations in the instructional context related to such factors as the level of scaffolding, the purpose and audience for writing, the focus of instruction in science, and the assigned topic.

Discussion

This study, which applied a developmental focus and multiple methodological tools to the examination of intermediate grade students' informational writing, extended and built upon previous work by presenting a picture of student writing that was

necessarily complex and multi-faceted. By attending to both the structural and social dimensions of writing as advocated by genre theory, we can begin to understand the paths that students take as they learn to write informational text within particular instructional contexts. As others have argued (Donovan, 2001; Dyson & Freedman, 1990; Langer, 1992), such an understanding of development is necessary for anyone who wishes to support young writers as they move on their journey towards competency in academic written tasks and participation in discourse communities.

The results of this study should be considered within the following limitations: first, the study included only two classrooms. While the small sample provided the opportunity for a close-up look at the writing that occurred, readers should take care in generalizing the findings to other contexts. Second, the descriptive nature of the study precludes the drawing of any causal inferences. Instead, the data provides a picture of fourth graders' informational writing in two different instructional contexts.

This study has led to new insights into genre and children's informational writing, as well as to further consideration of the questions and challenges related to methodology and theory and concerns that can guide future research.

New Insights

The discourse analysis of the written texts provided further data that will allow us to understand the "intermediate steps" (Newkirk, 1987) that children take on their way to competence in informational writing. But the added context analysis provided a rich picture of the instructional situations in which the texts were composed, thus allowing a complicated picture of informational writing in these two classrooms to emerge. This multi-layered analysis led to the important finding that writing performance varies, and it

may be significantly related to complex factors in the instructional environment. The context analysis, in conjunction with careful discourse analyses of the written texts, revealed two overarching factors that were particularly related to the writing in these classrooms: task structure and topic. The task structure factor has several dimensions, including the level of scaffolding provided by the teacher, the instructional focus of the teacher, and the purpose and audience associated with a particular task. The topic factor refers to the particular topic (such as "Owls" or "Static Electricity") of any given writing task.

Other researchers have argued the importance of paying attention to scaffolding with regard to children's writing and genre development (Donovan & Smolkin, 2002; Kamberelis & Bovino, 1999). In this study, the context analysis revealed that the levels of scaffolding that students received varied in type and amount across the various writing situations. This variation in the level of scaffolding was associated with both the macro-level organizations that students employed in their written texts as well as the text features that they used. This finding was similar to that reported by Kamberelis and Bovino (1999) in their study of cultural artifacts as scaffolds for writing that "most children produced more well-formed texts in the scaffolded condition than in the nonscaffolded condition" (p. 162). At Rose Elementary, students were highly scaffolded on all but one writing task, and they tended to use the most sophisticated macrostructural organizations on all but that one task. At Laurel Elementary, the level of scaffolding varied across the writing tasks, ranging from low to high. The written texts also varied in their level of sophistication in a way that was related to the level of scaffolding. There was a general trend that indicated that the more sophisticated written texts were produced

within contexts of high levels of scaffolding, and the less sophisticated written texts were produced within contexts of low levels of scaffolding.

More work is needed on the effect of different types and levels of scaffolding on children's developing abilities to compose informational text. In this study, Mrs. Burke (Rose Elementary) provided writing instruction during science class that focused on issues of writers' craft, such as use of leads, attention to audience, and figurative language. This focus seemed to result in writing that was strong and full of voice, but that also diverged at times from specific informational text genre conventions, such as when her instruction in leads that grab the reader's attention prompted opening statements that are different from those that were identified in the TEXT analysis as typical of the genre.

The level and type of scaffolding provided were related to the purpose that the teacher set for writing as well as the type of task that she assigned. Other research has suggested that task structure can affect such things as the linguistic complexity of written messages (Li, 2000) and motivation to complete a task (Nolen, 2001). The present study suggests that the macro-level organization and the text features employed by students in written texts vary across contexts depending upon the ways in which a teacher structures a task, including the purposes she sets for it and the directions and expectations that she gives for its completion. At Rose Elementary, the written tasks analyzed for this study were all of one type: Report. The purposes for writing were similar across all six reports that the students completed, and the expectations, though they increased in number as the year progressed, were similar as well. Thus, type of task wasn't a factor that proved illuminating of this school's data. At Laurel Elementary, however, there were five task types, and each was associated with varying levels of sophistication in both

macrostructure and use of text features. Genre theory reminds us of the importance of purposes for writing. The purposes that were associated with these task types related to the writing that resulted. The textbook summaries, for example, had the main purpose of displaying knowledge and understanding of science concepts to the teacher, an already knowledgeable audience. The students thus focused on such tasks as defining terms and listing facts related to a topic, and seemed to pay less attention to the craft of writing. The task type of book, while still serving something of an assessment purpose was also intended to teach others about a topic. Thus, the books tended to include more sophisticated macro-level organizations as well as more illustrations to support a reader's understanding.

The other overarching factor, topic, represents an interesting new finding that deserves further research attention. There is research evidence to suggest that a writer's interest in a topic is related to the resulting written text produced (e.g. Donovan & Smolkin, 2002). However, as of yet there is no research that examines the ways in which different topics enable and constrain writers in their composing process. The results of this study suggest that some topics are more "free-wheeling" in that they don't constrain writers as much as other topics. Topics such as animals seem to allow greater freedom to the writer to structure the text in various ways while still adhering to generic conventions. For informational text, the generic conventions require an author to present information in a way that is accessible and understandable to a less knowledgeable audience. That constraint must first be met before a writer can take more liberties with language and presentation. A topic like animals seems to allow a writer more freedom because the subtopics to be presented can be arranged in many different orders. The subtopics aren't

typically very hierarchical, and thus the writer has to spend less cognitive energy attending to issues of the order in which to present information. That leaves more cognitive resources with which the author can be creative while still adhering to the generic conventions. Other topics, such as matter, seem to constrain writers more. The subtopics are much more hierarchical in nature, and thus the overall organization matters more to such a topic. In order to support a naive reader's understanding of a topic like matter, the writer must take care to present the information in a particular order, and thus a young writer may have few cognitive resources left with which to add creative touches such as figurative language. It is also possible that topics such as matter are simply harder to write about creatively.

Questions and Challenges

Chapman (1995) argued that researchers need to adopt multiple methodological tools in order to address "the interactions of substance, form, context, and intention rather than focus on structure alone" (p. 190) in children's writing. The results of this study provide some illustration of the importance, and the complications, of such an attempt. The context analysis guided the discourse analysis by pointing out some important factors from the classroom situations that seemed associated with the students' written texts. This, in turn, helped to make clearer the patterns of results that emerged within the discourse analysis. At the same time, the context analysis made the weaknesses of the discourse analysis more apparent. For example, a reliance on the discourse analysis alone, with its systematic category scheme, could result in an inaccurate judgment of the sophistication of texts that are about certain topics. A careful examination of the context factor suggests that certain topics allow a writer more freedom in composing a text that is

faithful to genre conventions. Thus, a text on the topic of animals may well be highly sophisticated in its organization even if it doesn't fall in the "highest" category (ordered paragraphs). Such an occurrence is but one small reminder of the limitations of tools that suggest that development can or should unfold along a particular linear path. Dyson (2001) suggests a different perspective:

> [R]esearchers interested in writing development have tended to equate "it" [that which develops] with children's ways of encoding messages. The forces shaping literacy growth may be variously named...but, typically, the developmental pathway is imagined as a linear road.... That is, more sophisticated writing (or encoding) evolves from less sophisticated writing.
>
> In this chapter, I envision "it" differently. I am not focusing on written language as a kind of code but as a kind of symbolic tool that mediates human experience and interaction.... Thus studied, writing no longer seems to emerge unilaterally from previous writing, nor is its development reducible to encoding (cf. Vygotsky, 1978). (p. 126)

At the same time, I would argue that there is tremendous value in such category schemes as the ones employed in this study. They are tools that allow us to look for patterns across large numbers of written texts. These tools must be used cautiously, and the results gained from them interpreted carefully and with an understanding of their limitations. Future work should continue this attempt at employing multiple methodological tools, questioning and improving those tools in the process.

Another challenge for researchers is designing tools that are informed by theory but that also acknowledge and reflect the realities of classroom practice. If researchers are

to consider and value the influence of the instructional context on writing development, then we will need to allow our methodological tools, and our theory, to be shaped by what happens in classrooms at the same time that we attempt to use theory and research to shape classroom practice. As this study suggests, teachers' and students' uses of genres often differ from and/or challenge theoretical notions of genre. For genre theorists, one challenge will be to decide how to acknowledge those "school-only" purposes for writing that teachers set for students. Should our goal as researchers be to convince teachers to move toward more authentic, real-world writing purposes and tasks? What can we learn from the school tasks that students are required to do? How do the communicative purposes that they set up overlap with, or contradict, the purposes for writing outside of school? Prior work on curriculum genres (Christie, 1985; Pappas & Zecker, 2001) offers one potential perspective on this issue. The notion that such routine activities as writer's workshop and author's chair, and the texts that result from those activities, constitute important genres that are worthy of study is a compelling one. But these curriculum genres will, of necessity, contain purposes that are unique to school settings. Another issue for genre theorists to consider further is related to the fact that school writing, even when "authentic" (such as reports written to teach second graders about a topic) is also usually accompanied by evaluation purposes. This may be more salient in the intermediate grades and up because there is more emphasis on grading and more sensitivity among students to purposes for writing set by their teachers.

This sensitivity to classroom practice and realities will open up new avenues of research and new ideas for future work. The writing instruction that Mrs. Burke (Rose Elementary) provided to her students in science class was a marriage of more typically

"language arts", writers' workshop views toward writing, which have tended involve expressive writing in narrative genres, and scientific writing, with its attention to accuracy, clarity, and conveying information. This marriage resulted in writing that, on the one hand, differed from generic conventions in its use of more figurative language and "attention-grabbing" leads. On the other hand, this writing was often quite sophisticated by the standards used to judge in this study, with many of the texts written at the level of paragraphs. Portraits of classrooms with teachers who strive to help their students to become better writers can help us to understand the various ways in which students are supported in their writing development.

Future Research

This study leaves questions that deserve exploration in future research. First, in studying children's writing, we need to take into account individual students' understandings of purpose of particular pieces of writing and how those understandings might affect the written texts that are produced. The results of this study indicate that the purpose of a given writing task (especially as it related to the task structure) was associated with the macrostructure and with the text features that students used in that task. In addition, the interview data indicated that not all students saw the same purpose for a particular task. Given the importance that genre theory places on the purpose for writing, it seems necessary that research investigate the purposes that students see for writing and how those purposes affect the writing process and the resulting text.

Second, more research needs to be done on students' use and understanding of visual elements in informational text. Visual elements such as graphs, charts, tables, illustrations and diagrams serve important functions in informational text. They carry

meaning that is not necessarily conveyed in the text, and they offer different ways of presenting information that can support and extend comprehension (Moline, 1995). Yet the results of this study suggest that many students saw illustrations as "extra" material that was to be included only if the teacher specifically required it, or only if there was time after the written text was finished. Indeed, in some cases where it may have helped the student writer or her audience, the teachers didn't allow the use of illustrations or other visual features at all. Interview data reveal that students at both schools routinely completed their writing first, and then went back to add illustrations (if they were added at all). There was very limited use of other visual or graphical elements in this corpus of writing. This view of visual features as "extra" is problematic in that it doesn't allow students to learn a range of ways to present information beyond written text.

Third, the work I've done on this study has left me curious as to the impact that a student's science knowledge and understanding of science concepts has on her ability to produce effective written texts. It has been my intuitive sense that students write more effective texts on topics of which they have a better scientific understanding. However, I do not have the data to investigate this hypothesis. Future work is needed that bridges the science and literacy fields to consider the effect of science knowledge on informational writing.

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Table 1: Written Data Collected

	# Writing Sets Collected	# Written Texts Analyzed	Average Length of Texts	Range of Length of Texts
Rose Elementary	6	103	44 T-Units	4-128 T-Units
Laurel Elementary	11	205	12 T-Units	1-49 T-Units

Table 2
Rose Elementary, Macrostructure Results By Level of Scaffolding

Low

	S coup	Att list	comp coup	basic seq	HAL-I	HAL-E	Single para	unord para	ord para	Mixed
conste (12)	0	50% (6)	8% (1)	0	0	17% (2)	0	0	0	25% (3)

High

	S coup	Att list	comp coup	basic seq	HAL-I	HAL-E	Single para	unord para	ord para	Mixed
finger (22)	0	5% (1)	0	0	0	50% (11)	0	41% (9)	5% (1)	0
matter (21)	0	0	0	0	0	43% (9)	0	0	57% (12)	0
owls (20)	0	20% (4)	15% (3)	0	10% (2)	40% (8)	0	15% (3)	0	0
wolf (20)	0	0	0	0	25% (5)	10% (2)	0	65% (13)	0	0
earth (8)	0	0	0	0	0	0	0	12.5% (1)	87.5% (7)	0

Table 3
Laurel Elementary, Macrostructure Results By Level of Scaffolding

<u>Low</u>

	S coup	Att list	comp coup	basic seq	HAL-I	HAL-E	Single para	unord para	ord para	Mixed
earth (17)	0	18% (3)	12% (2)	0	23.5% (4)	23.5% (4)	12% (2)	6% (1)	0	6% (1)
energy (18)	0	33% (6)	5.5% (1)	0	5.5% (1)	5.5 (1)	11% (2)	11% (2)	0	28% (5)

<u>Moderate</u>

	S coup	Att list	comp coup	basic seq	HAL-I	HAL-E	Single para	unord para	ord para	Mixed
minerals (18)	0	16.5% (3)	0	0	67% (12)	16.5% (3)	0	0	0	0
Rocks & Minerals (21)	5% (1)	19% (4)	9.5% (2)	0	14% (3)	9.5% (2)	33% (7)	5% (1)	0	5% (1)
energy book (19)	10.5% (2)	16% (3)	0	16% (3)	10.5% (2)	0	47% (9)	0	0	0
Static Elec (15)	0	20% (3)	7% (1)	0	13% (2)	20% (3)	27% (4)	0	0	13% (2)
Elec (18)	5.5% (1)	50% (9)	11% (2)	0	0	5.5% (1)	22% (4)	0	0	5.5% (1)
Compare frogs & crabs (18)	0	0	17% (3)	0	22% (4)	17% (3)	0	39% (7)	0	5.5% (1)

<u>High</u>

	S coup	Att list	comp coup	basic seq	HAL-I	HAL-E	Single para	unord para	ord para	Mixed
Motion, force & energy (20)	0	0	10% (2)	0	0	30% (6)	0	55% (11)	0	5% (1)
Magnetism & Elec (21)	0	0	9.5% (2)	0	0	19% (4)	0	67% (14)	0	4.5% (1)
Animals (20)	0	0	0	0	20% (4)	45% (9)	0	30% (6)	0	5% (1)

Table 4
Laurel Elementary Macrostructure Results By Type of Task (and level of scaffolding)

Free Write (low)

	S coup	Att list	comp coup	basic seq	HAL-I	HAL-E	Single para	unord para	ord para	Mixed
earth (17)	0	18% (3)	12% (2)	0	23.5% (4)	23.5% (4)	12% (2)	6% (1)	0	6% (1)

Textbook Summary (low-moderate)

	S coup	Att list	comp coup	basic seq	HAL-I	HAL-E	Single para	unord para	ord para	Mixed
minerals (18)	0	16.5% (3)	0	0	67% (12)	16.5% (3)	0	0	0	0
energy (18)	0	33% (6)	5.5% (1)	0	5.5% (1)	5.5 (1)	11% (2)	11% (2)	0	28% (5)
static el (15)	0	20% (3)	7% (1)	0	13% (2)	20% (3)	27% (4)	0	0	13% (2)
elec (18)	5.5% (1)	50% (9)	11% (2)	0	0	5.5% (1)	22% (4)	0	0	5.5% (1)

Compare/Contrast (moderate)

	S coup	Att list	comp coup	basic seq	HAL-I	HAL-E	Single para	unord para	ord para	Mixed
compare frogs & crabs (18)	0	0	17% (3)	0	22% (4)	17% (3)	0	39% (7)	0	5.5% (1)

Class Book (moderate)

	S coup	Att list	comp coup	basic seq	HAL-I	HAL-E	Single para	unord para	ord para	Mixed
rocks & minerals (21)	5% (1)	19% (4)	9.5% (2)	0	14% (3)	9.5% (2)	33% (7)	5% (1)	0	5% (1)
energy book (19)	10.5% (2)	16% (3)	0	16% (3)	10.5% (2)	0	47% (9)	0	0	

Individual Book/Report (high)

	S coup	Att list	comp coup	basic seq	HAL-I	HAL-E	Single para	unord para	ord para	Mixed
motion, force & energy (20)	0	0	10% (2)	0	0	30% (6)	0	55% (11)	0	5% (1)
magnetism & elec (21)	0	0	9.5% (2)	0	0	19% (4)	0	67% (14)	0	4.5% (1)
animals (20)	0	0	0	0	20% (4)	45% (9)	0	30% (6)	0	5% (1)

Table 5
Rose Elementary Text Features Analysis Results
Average Score, (Range)

	Att/ Comp	Char Ev	Def	C/C	Den Lang	Timel Verb	Gen Noun	Spec Vocab	Real Illus
Finger (22)	3.5 (1-5)	3.1 (1-4)	1.04 (1-2)	3.1 (1-4)	3.4 (3-5)	3.05 (1-4)	3.05 (1-4)	3.8 (3-4)	1 (1)
Matter (21)	5 (5)	4.9 (4-5)	4.6 (4-5)	2.6 (1-5)	4.95 (4-5)	4.95 (4-5)	4.95 (4-5)	5 (5)	3.33 (1-5)
Owls (20)	4.55 (3-5)	4.45 (3-5)	1.3 (1-4)	2.45 (1-3)	3.75 (3-5)	3.7 (3-4)	3.7 (3-4)	4.25 (3-5)	1 (1)
Wolf (20)	5 (5)	5 (5)	2.65 (1-5)	4.35 (3-5)	3.9 (3-5)	4.6 (4-5)	4.6 (4-5)	5 (5)	4.1 (1-5)
Earth (8)	5 (5)	0 (0)	1.25 (1-3)	1.88 (1-4)	4.88 (4-5)	4.6 (4-5)	4.6 (4-5)	5 (5)	1 (1)
Const (12)	4.5 (3-5)	0 (0)	1.17 (1-3)	1.67 (1-3)	3.92 (3-5)	4.33 (3-5)	4.33 (3-5)	4.42 (3-5)	1 (1)
Totals (103)	4.59	4.36	2.00	2.68	4.13	4.21	4.21	4.58	1.91

	Open State	Close State	Headings	Index	Classif	Label/ capt	Graph device	TofC	Entire Text
Finger (22)	2.7 (1-4)	2 (1-5)	1 (1)	0 (0)	4 (2-5)	.32 (0-3)	1.36 (1-4)	0 (0)	3.14 (1-4)
Matter (21)	3.3 (1-5)	1 (1)	1.67 (1-5)	1 (1)	4.3 (3-5)	2.9 (0-5)	1.4 (1-4)	1 (1)	4.76 (4-5)
Owls (20)	3.1 (1-4)	1.55 (1-4)	1.1 (1-3)	1 (1)	2.05 (1-4)	0	1 (1)	1 (1)	3.85 (3-4)
Wolf (20)	3.2 (3-4)	3 (1-4)	1 (1)	1 (1)	4.36 (3-5)	2.85 (1-5)	1.75 (1-5)	1 (1)	4.6 (4-5)
Earth (8)	1.13 (1-2)	1.25 (1-3)	2.25 (1-5)	0 (0)	5 (5)	0 (0)	1 (1)	0 (0)	4.38 (4-5)
Const (12)	2.17 (1-4)	1 (1)	0 (0)	0 (0)	1.92 (1-3)	0 (0)	1 (1)	0 (0)	3.75 (3-4)
Totals (103)	2.6	1.63	1.40	1.0	3.61	2.02	1.25	1.0	4.08

Table 6
Laurel Elementary Text Features Analysis Results

	Att/ Comp	Char Ev	Def	C/C	Den Lang	Timel Verb	Gen Noun	Spec Vocab	Real Illus
minerals (18)	3.56 (1-5)	3.11 (1-5)	3.22 (2-5)	1.11 (1-3)	3.78 (3-5)	4.0 (2-5)	4.0 (2-5)	4.11 (3-5)	1 (1)
rocks & minerals (21)	3.29 (1-5)	3.29 (1-5)	1.86 (1-4)	1.48 (1-5)	3.76 (1-5)	3.52 (1-5)	3.52 (1-5)	4.10 (1-5)	3.48 (1-5)
earth (17)	3.35 (1-5)	2.0 (1-4)	1.3 (1-3)	1.8 (1-5)	3.45 (1-5)	2.85 (1-5)	2.85 (1-5)	3.9 (3-5)	1 (1)
energy (18)	3.0 (1-5)	2.89 (1-5)	3.06 (1-5)	2.22 (1-5)	3.78 (1-5)	3.78 (2-5)	3.78 (2-5)	4.11 (3-5)	1 (1)
energy book (19)	3.3 (1-5)	3.7 (1-5)	1.25 (1-4)	1.45 (1-4)	3.35 (1-5)	3.2 (2-5)	3.2 (2-5)	3.35 (2-5)	4.05 (1-5)
motion force & energy (20)	2.85 (1-4)	4.6 (3-5)	4.25 (1-5)	1.3 (1-4)	4.3 (3-5)	4.25 (3-5)	4.25 (3-5)	4.5 (4-5)	4.3 (1-5)
static elec (15)	3.87 (2-5)	3.87 (2-5)	3.2 (1-5)	1.0 (1)	3.6 (2-5)	3.47 (2-5)	3.47 (2-5)	3.87 (2-5)	1.0 (1)
elec (18)	3.68 (1-5)	4.21 (1-5)	3.32 (1-5)	1.11 (1-3)	3.84 (1-5)	4.37 (1-5)	4.37 (1-5)	4.32 (2-5)	1.16 (1-4)
magnet & elec (21)	3.9 (2-5)	3.38 (2-5)	1.76 (1-5)	1.0 (1)	1.95 (1-4)	2.90 (2-4)	2.90 (2-4)	3.38 (2-5)	4.19 (1-5)
compare frogs & crabs (18)	4.0 (1-5)	4.83 (4-5)	1.11 (1-3)	4.94 (4-5)	3.67 (2-5)	3.83 (3-4)	3.83 (3-4)	3.94 (3-5)	0
animals (20)	4.8 (4-5)	4.65 (4-5)	2 (1-4)	1.5 (1-5)	3.55 (2-5)	3.85 (1-5)	3.85 (1-5)	4.5 (3-5)	3.35 (1-5)
Totals (205)	3.6	3.68	2.39	1.72	3.55	3.64	3.64	4.01	2.45

Table 6 (con't)

	Open State	Close State	Headings	Index	Classif	Label/capt	Graph device	TofC	Entire Text
minerals (18)	3.72 (3-4)	1.33 (1-4)	1 (1)	0 (0)	3.17 (3-4)	0 (0)	1 (1)	0 (0)	3.72 (2-5)
rocks & minerals (21)	3.10 (1-5)	1.71 (1-4)	3.57 (1-5)	*	3.33 (1-5)	2.52 (1-5)	1.90 (1-5)	**	3.57 (1-5)
earth (17)	2.9 (1-5)	1.3 (1-3)	1.45 (1-5)	0	2.9 (1-5)	0	1 (1)	0	2.6 (1-5)
energy (18)	2.78 (1-5)	1.17 (1-3)	1 (1)	0	2.78 (1-5)	.22 (0-4)	1.33 (1-5)	0	3.6 (3-5)
energy book (19)	2.3 (1-5)	2.05 (1-5)	2.8 (1-5)	*	1.65 (1-5)	1.95 (1-5)	1.6 (1-5)	**	3.4 (2-5)
motion, force & energy (20)	1.4 (1-5)	1.2 (1-3)	4.9 (3-5)	1.0 (1)	2.1 (1-4)	2.7 (0-5)	1.7 (1-4)	4.4 (1-5)	4.5 (4-5)
static elec (15)	2.13 (1-3)	1.47 (1-4)	1.0 (1)	0	1.4 (1-3)	0	1.13 (1-3)	0	3.67 (2-5)
elec (18)	1.53 (1-4)	1.0 (1)	0	0	1.0 (1)	.32 (0-5)	1.21 (1-5)	0	4.26 (1-5)
magnet & elec (21)	1.0 (1)	1.0 (1)	4.86 (4-5)	1.0 (1)	3.14 (1-4)	2.19 (0-5)	1.24 (1-4)	4.14 (3-5)	3.05 (1-5)
compare frogs & crabs (18)	3.11 (1-5)	1.22 (1-4)	0	0	2.89 (2-5)	0	0	0	3.94 (3-4)
animals (20)	2.1 (1-4)	1.1 (1-3)	2.9 (1-5)	1 (1)	3.85 (1-5)	1.7 (0-5)	1.2 (1-3)	1.7 (1-5)	3.9 (2-5)
Totals (205)	2.37	1.32	2.61	1.0	2.56	1.66	1.33	3.41	3.66

*The book did not include an index.
**One Table of Contents was used for the whole book.

Table 7
Rose Elementary, Macrostructure Results Organized By Topic

Animals

	S coup	Att list	comp coup	basic seq	HAL-I	HAL-E	Single para	unord para	ord para	Mixed
owls (20)	0	20% (4)	15% (3)	0	10% (2)	40% (8)	0	15% (3)	0	0
wolf (20)	0	0	0	0	25% (5)	10% (2)	0	65% (13)	0	0

Fingerprints

	S coup	Att list	comp coup	basic seq	HAL-I	HAL-E	Single para	unord para	ord para	Mixed
finger (22)	0	5% (1)	0	0	0	50% (11)	0	41% (9)	5% (1)	0

Earth Science

	S coup	Att list	comp coup	basic seq	HAL-I	HAL-E	Single para	unord para	ord para	Mixed
matter (21)	0	0	0	0	0	43% (9)	0	0	57% (12)	0
earth (8)	0	0	0	0	0	0	0	12.5% (1)	87.5% (7)	0

Constellations

	S coup	Att list	comp coup	basic seq	HAL-I	HAL-E	Single para	unord para	ord para	Mixed
conste (12)	0	50% (6)	8% (1)	0	0	17% (2)	0	0	0	25% (3)

Title: Owls

Hoo...hoo-oo hoo-oo. Do you know what that is? (1) It's the sound of the great horned owl. (2) They live in North America, are very execptional looking, (3) and they are large. (4) The unique creature has a good habitat, strang ways of raising young and weird habits. (5) There are also some facts. (6)

The facts about the owl are amazing! (7) They are very powerful. (8) The unique owl can get very aggressive (9) and they can take prey two to three times heavier than them. (10) The great horned owl has amazing habits, too. (11) They sometimes go into chicken coops. (12) They swoop down to get prey (13) and for small prey, the owl walks on the ground. (14)

The neat bird has three to six eggs. (15) The eggs hatch after thrity-three to thrity-five days. (16) The babies don't leave until they are nine to ten weeks old. (17) The parents that have the babies find nests in forests. (18) The owls like to live by streams in parks. (19) The forests they live in are found in North America, Central South America, and by the northern tree line. (20)

Other than their neat ways of living, they look neat, too. (21) They are reddish or grey or black and white. (22) the strang owls have large yellow eyes and ear tufts like "horns." (23) The neat look goes on a big bird. (24) The birds are as large [as] eagles. (25) They can weigh 32 to 63 ½ oz. (26) They are 18 to 25 in., and have a wingspand of 36-60 in. (27) The great horned owls have long calls. (28) The female has a longer call. (29) Her call is, "Hoo.. hoo-hoo-hoo, hoo-oo hoo-oo." (30) The males call is "Hoo...hoo-oo hoo-oo." (31)

We found alot of interesting bones when we dissected an owl pellet. (32) Our owl ate rodents, shews, and birds. (33) We found a rodent skull and four rodent hip bones. (34) We found eighteen shew vertebrae. (35) We didn't find very many bird bones, (36) but we found a feather. (37)

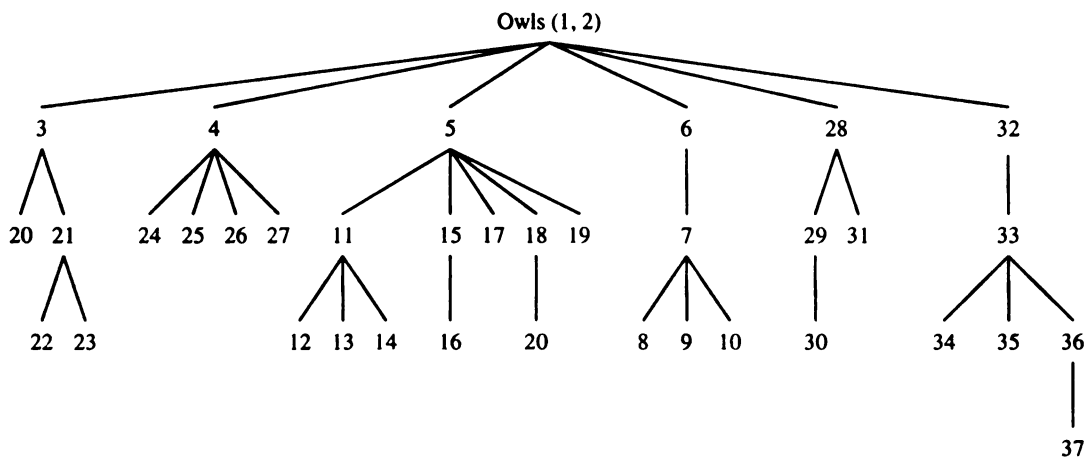**Figure 1: Ella's Owl Report and Tree Diagram**

Figure 1 (Con't)

Title: Matter

Did you know that only a few things are not matter? (1) The only things that are not matter are electricity and other things too. (2) Solids, liquids and gases are made of atoms. (3) Atoms make up molecules, elements, solutions, mixtures and compounds. (4)

Solids, liquids and gases are all matter. (5) They take up space and have mass or weight. (6) Some can be living, like you, (7) others are not, like your t.v. (8) Everything is made of atoms. (9)

Atoms are the smalles particles. (10) Every atom is made of protons, neutrons and electrons. (11) Neutrons have a neutral (0) charge and are in the nucleus. (12) Protons have a positive (+) charge and are in the nuclues. (13) Electrons have a negitive (-) charge and are in the energy layers around the nucleus. (14) There are different numbers of protons in each atom. (15)

There is 109 elements each kind of only one different kind of atom. (16) They are the simplest chemicals. (17) Some examples are gold, silver, and copper. (18) They can all be found on the Periodic Table of Elements. (19)

There are also mixtures. (20) Mixtures are made of different atoms in different amounts. (21) They are always made of two or more elements. (22) They don't react together (23) so they can be seperated. (24) The things that were put in don't lose their own properties. (25)

A solution is a special kind of mixture. (26) An exaple of a solution is a liquid with something dissolved in it. (27)

A suspension is another special mixture. (28) The particles don't dissolve in it. (29) They are temperarily supended.(30)

Do you know what a compound is? (31) It's a chemical combination of two or more atoms. (32) Unlike mixtures, compounds have a certain number of each atom. (33) Each atom dose lose it's charactoristics. (34) The atoms can't be seporated. (35) The two or more atoms make something new. (36) An example is H2O, also known as water. (37) Different atoms form in different numbers to make all the matter the matter in the world. (38)

Did you know that your a solid? (39) So is your house, the doors in it, and you furniture. (40) When you look at those things you can tell what they have in common. (41) They all have weight and take up space. (42) They are visible, (43) but they don't flow, (44) nor do they let other things pass through easily. (45) They have a definite size, shape, and volume. (46) They can be living or non-living. (47) You know that because you're a living solid. (48) The doors in your house are non-living. (49) Solids are made of atoms. (50) The atoms make up molecules. (51) The molecules are heild together by strong bonds. (52) These molecules move back and forth but don't move away from each other. (53) Some solids melt into liquids at the right time. (54)

Liquids are different than solids. (55) Liquids do flow. (56) They have no definate shape. (57) The molecules are held by weak bonds and can move more freely. (58) Liquids take the shape of the container their in. (59) It gose to the bottom of the container. (60) Other things like solids, can pass through liquids easily. (61) The molecules are farther apart than in solids. (62) There are some things that are the same. (63) Liquids and solids both have a definite size and volume. (64) Liquids are visible most of the time. (65) They have weight and take up space. (66) When heated, a liquid turns to a gas, (67) and when cooled it turns to a solid. (68)

Gases are different from solids and liquids. (69) Gases have no definate size, shape or volume. (70) You usually can't see it. (71) Gases can change shape easily. (72) It allows other things to pass through it (73) and it spreads out to fill something. (74) The molecules move freely and far away from each other. (75) They have no bonds holding them together. (76) When it's cooled, gas changes to a liquid. (77) When it's heated, it stays a gas. (78) There are some things the same about liquids and gases. (79) Gases flow and take the shape of the container the gas is in. (80) Gases also have weight and take up space. (81)

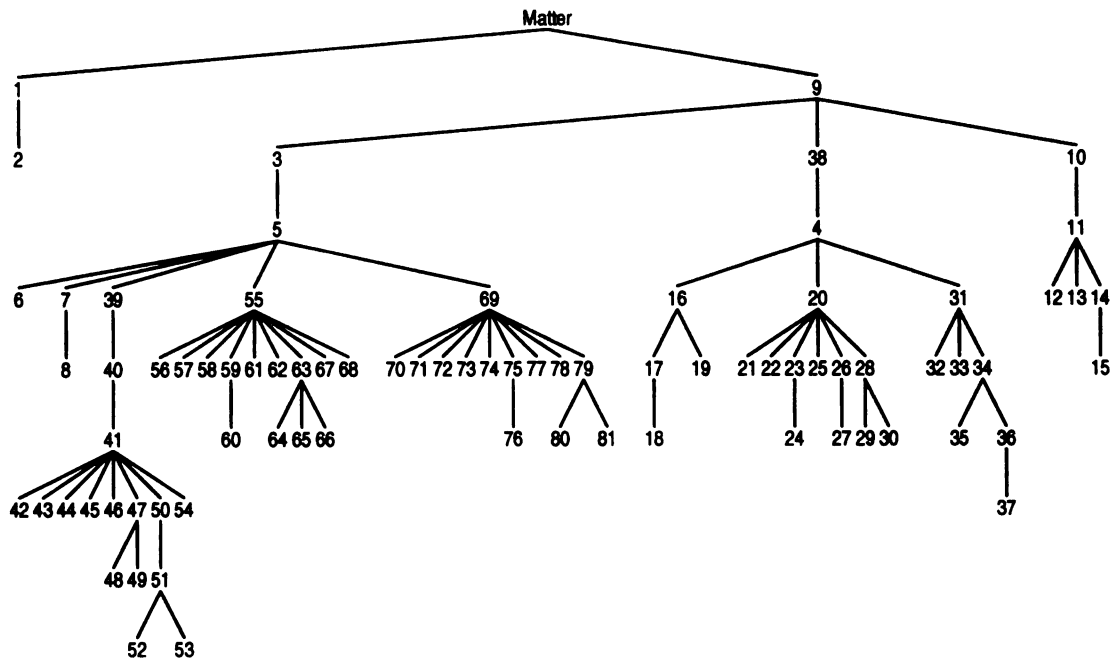**Figure 2: Ella's Matter Report and Tree Diagram**

Figure 2 (Con't)

MANUSCRIPT 2

NINE ELEMENTS OF NONFICTION WRITERS' CRAFT

Once these great creatures were plentiful, more plentiful than the plants on the largest

plantation on earth. Now there's only a few. They are great hunters. Mankind needs these

carnivores. They would be the first modern day mammal to be extinct if we didn't care.

Wolves are truly great mammals.

--Robert, Fourth Grader

Children develop in a variety of ways as writers. From their earliest experiences

with literacy, they are learning that print carries meaning, and that they can represent

their own meaning on paper (and on the computer screen). As they grow, they learn to

spell conventionally, they learn the mechanics of writing, and they become more

sophisticated in their organization and their use of text features. Literacy researchers have

considered the development of such issues in writing as spelling, mechanics, self-

regulation, transcription skills, organization, genre knowledge, and text features (e.g.

(Bissex, 1980; Donovan, 2001; Graham & Harris, 2000; Kamberelis, 1999; Newkirk,

1987; Purcell-Gates, Duke, Hall, & Tower, 2003; Read, 1971). The development of

writer's craft, particularly within nonfiction writing, is a new area of exploration. In this

article, I will consider issues of writer's craft as they relate to nonfiction writing in

science. Robert represents an interesting case of a young writer developing his craft in

science writing. I will focus on his writing in particular as I discuss the issues of writer's

craft that emerged in his science classroom. This data is part of a corpus collected during

a larger study of children's informational writing development (Tower, in preparation).

What is 'Craft'?

Although little research has taken up development of writer's craft, a number of people writing for practitioners have discussed craft. Portulapi (1999) states, "Craft is like a map that helps you as you move through writing and reading. It helps you understand the lay of the land and steer with more authority" (p. 7). Murray (1996) argues that "The craft of writing is, first of all, a collection of all those attitudes and techniques that summon and nourish spontaneity. Craft frees writing so that we may write what we do not intend, and then craft always shapes it so others will understand what we have to say" (p. vii). Definitions of craft will naturally vary from writer to writer, for writing is an individual, personal act. However, writing is also a social act, and writers work within particular genres, contexts, and discourse communities. Murray's quote speaks to the tension between choice and constraint that writers, especially young writers, face in attempting to convey a message in writing. Devitt (1997) argues that we should see both constraint and choice as necessary components of genre. Writers need the freedom, the space, to be spontaneous in their writing, to invent; craft allows them this space. But they also need the discipline, the conventions and structure that will allow them to make their message comprehensible to an audience. Craft provides this structure as well. Supportive teachers can aid students in developing their craft by teaching, modeling, and requiring the use of particular techniques or ways with language.

What, then are the components of craft? What elements make it up? Books about writing, books that aim to provide guidance to writers (and to teachers of writers) in improving their craft, include advice on qualities of good writing, specific techniques, types of language use, habits of mind and of routine, grammatical and mechanical rules, and so on (see for example (Atwell, 1987; Fletcher, 1993; Murray, 1996). Atwell (1987)

states, "I categorize as *craft* mini-lesson presentations that touch on matters of technique, style, and genre" (p. 130). In the section of his book called "The Craft", Fletcher (1993) includes such elements as voice, beginnings (leads), endings, and unforgettable language. As we shall see, Robert and his classmates were learning to use the varied components that constitute a writer's craft toolkit.

Different genres involve different ways of using language, different purposes, and often, different audiences. Writers of nonfiction, like all writers, face challenges that are specific to their genres. Writers of nonfiction genres such as informational text work with the purpose of informing a less knowledgeable audience on some topic of interest. They are constrained by the purpose of the genre, which dictates that they have a responsibility to convey information in a way that will be comprehensible to the reader. In order to meet this purpose, they will rely on, among other things, craft devices that are particular to the genre. For example, writers of nonfiction need to have a certain kind of audience awareness that allows them to "check in" with their readers, or to provide enough signposts to guide readers through the content. They often will compare a new and unfamiliar concept or idea to something that they assume is familiar to their audience. They also have unique opportunities and responsibilities in their use of visuals that can support and extend their written texts. As we shall see, the students in this fourth grade class, including Robert, experimented with various ways of conveying information and helping to ensure comprehension for their audience as they worked to improve their craft as writers of nonfiction text.

Influences on Writer's Craft

Genre theorists argue that genres represent both stable, structural forms and flexible, social functions (Freedman & Medway, 1994; Miller, 1994). The recurring patterns within genres grow out of the communicative needs of particular discourse communities. These patterns serve a standardizing function, helping speakers and writers to understand each other and to meet expectations for communication within a community. The patterns are also subject to the changing and evolving needs of that discourse community; thus, generic patterns are both stable and flexible; they represent both form and function.

As noted earlier, to writers, genres represent both choice and constraint (Devitt, 1997). As Devitt (1997) argues,

> Instead of seeing a dichotomy between constraint and choice, my argument in this chapter is that we must see both constraint and choice as necessary components of genre—both/and instead of either/or. This complementary relationship between constraint and choice within genre can be clarified by comparing it to standardization and variation within language.... I will argue that genres, like language standards, interlink standards/constraints and variation/choice, an interlink essential to the construction of meaning. (p. 45)

Writers ultimately attempt to make meaning with language, and usually to convey that meaning to some audience. The process of making meaning within a genre requires both choice and constraint; both the possibility to invent, and appropriate, language for one's own purposes and the standards and conventions that shape language in ways that make it comprehensible to both writer and reader. As we shall see, there was evidence that Robert was working to negotiate this boundary between constraint and choice.

In conducting this study, I adopted a sociocognitive perspective (Chapman, 1995; Flower, 1994). Working within this perspective, I assumed that it does not make sense to consider separately either the written texts produced by individual students, or the social context in which they produced those texts. Only by examining the interaction of both the individual/cognitive and the social/contextual can we hope to gain a rich understanding of the ways in which students learn to become writers of nonfiction text. This fits well with genre theory, as it allows a consideration of both the formal and functional aspects of genre at work in the instructional context that influenced the students' writing

Writing is a social act that always takes place within a particular context. Young writers are never alone as they work to refine their craft. They are embedded within, supported by, and sometimes challenged by particular historical, cultural, institutional and instructional contexts. In the case of Robert and his classmates, the science writing they produced occurred within the instructional context of their fourth grade classroom. This context will be described in more detail below. The writing context, including the instruction provided by the teacher and the assignment guidelines she required, helped to shape the work that they did as a science writers.

<div align="center">Methods</div>

The data analyzed here are a part of the corpus collected for a study on fourth graders' informational writing development in science. Forty-four students and their teachers in two classrooms participated in the larger study. I visited each classroom once a week in order to observe science instruction, take field notes on that instruction, and collect all writing that students produced within science that was at least partly informational. For the purposes of this study, informational text was defined as text

intended to convey information about the natural and social world (Duke, 2000). I also

conducted informal interviews with both teachers, and with 13 students from each

classroom (including Robert).

The present analysis was conducted only on data from one of the two classrooms.

Robert's classroom was located in Rose Elementary School, a rural school which served

473 students in grades 2-5. From the 23 participating students in Robert's class, I

collected six sets of writing, for a total of 103 written texts. I also collected rough drafts

of four of the six sets of writing (the other two sets were short; in one, the students didn't

write rough drafts and in the other the teacher didn't save them for me). I conducted the

analysis on data from this school because it was the one in which the teacher paid explicit

attention to the craft of writing during her science instruction time. She provided

instruction in writing that included a focus on some elements of writer's craft (especially

leads, figurative language, and attention to audience). Because of this, I hypothesized that

an analysis of her students' writing would result in a list of elements of nonfiction

writer's craft.

Each final draft written text was transcribed. Transcriptions (and the quotes from

them presented in this report) remain faithful to the spelling and punctuation used by the

student writer. Field notes were typed and then read and re-read as I asked questions and

noted patterns. The unit of analysis that I employed was the writing assignment. This unit

included the set of written texts produced on an assigned topic as well as the instruction

and instructional artifacts (e.g. pre-writing tools such as webs, written guidelines

provided by the teacher) that surrounded those texts. This unit allowed for a consideration

of each set of written texts within the instructional context in which it was produced, thus taking into account both the structural and social dimensions of genre.

The interviews were informal. The interview data was collected on audio tapes, in one-to-one situations with each student. Each interview was transcribed as faithfully as possible. Interview data was intended to support and extend the other analyses, so the transcripts were read and reread and coded for places in which the teacher and students discussed issues relevant to the other analyses. Excerpts of transcripts are reported in the results sections where relevant.

In analyzing the data, I employed the constant-comparative method (Lincoln & Guba, 1985). The first step was to read and reread the field notes in order to make a preliminary list of craft elements to code. This preliminary list came from elements of craft that the teacher included in her instruction. Analysis proceeded by taking the elements of craft that the teacher focused on in her writing instruction during science class and looking for examples of use of those elements in students' writing. Working through each of the six sets of writing, I read all of the texts and noted each example of the craft elements from the preliminary list. I also noted other craft devices and elements that students used, and then I did additional read-throughs of the written texts in order to record uses of those additional factors by each student. This process resulted in a list of nine elements of craft that these students employed in their nonfiction writing (see Table 8). The nine categories of craft elements were not mutually exclusive; that is, a single example from a student text could (and often did) fit more than one category. Each element of craft was further explored in order to understand the various ways in which

students employed it, to look at patterns of its use within and across writing sets, and to provide examples of its use.

Once the craft element categories were established, I created a database in which I entered a page for each set of writing in order to record whether or not each student used the nine craft elements in that piece of writing. The results of this analysis are presented in Table 9.

In discussing the nine elements of writer's craft, I have chosen to focus in particular on one student, Robert. Though I occasionally broaden my focus to include patterns noted across all the students, my examples will primarily involve Robert's writing. (See appendix D for Robert's written texts.) A focus on one student will allow me to provide continuity across the examples that I present, and to give a rather complete description of one student writer's use of craft. It will also allow me to reference comments that Robert made in his interview where relevant. I chose to focus on Robert because he employed each of the craft elements identified in the analysis, and because his writing and his interview talk reveal a student who tried out each of the nine elements of craft.

The Writing Context

Robert and his classmates worked in a classroom with a teacher who provided lots of writing instruction related to the science writing that she assigned. His teacher, Mrs. Burke, set high expectations for her students and provided a high level of scaffolding to support them as they worked to meet her expectations (see Manuscript 1 for a more detailed description of Mrs. Burke's instruction and scaffolding). Most relevant to craft, she created an environment in which young writers could experiment with language and

search for their own voices as writers of science text; thus, students had opportunities for choice in their writing.

To illustrate how she provided structured choices for her students, I will describe one of the science class periods I observed during the time the students were working on their wolf reports. In this lesson, Mrs. Burke focused on helping her students to brainstorm different possible leads and topic sentences. She started by reporting that some types of topic sentences (e.g. "Did you know...") were becoming overused. She asked her students to give examples of interesting topic sentences for the section on physical characteristics of wolves. One student volunteered, "Oh no, I got bit by a two inch long tooth by a wolf." Mrs. Burke replied, "Good starter, but now you need to lead into the rest...Remember, your topic needs to lead into that paragraph. If you only mention color, how will you lead into [other physical characteristics]?" She went on to reinforce the difference between topic sentences and detail sentences. Next, she urged her students not to start every sentence with the word wolves—"Wolves are", "Wolves have". She suggested instead that they use such constructions as "These special creatures" or "These unique mammals". She asked students to suggest other describing words, and she reminded them that they could refer to the thesaurus for help in choosing words. This type of instruction emphasized the range of choices that students had in composing leads and paragraph topic sentences. It also reinforced boundaries and conventions, such as what counts as an acceptable topic sentence.

In addition to the choices that Mrs. Burke provided, Robert was also expected to adhere to specific, structured guidelines for each writing task. Sometimes those guidelines were as specific as "your report will have six paragraphs", "be sure to include

five adjectives" or "add a figure of speech to this paragraph". Thus, students also were provided with constraints on their writing choices. While serving to constrain him, these requirements also freed him of the burden of making too many choices. The requirements created boundaries that provided a circumscribed space in which her young students could play with language. This tension between choice and constraint can help young writers to negotiate various ways to be effective with their writing. For young writers, the development of craft is a special challenge, given the many possibilities presented in our language. The tension that is always present between choice and constraint can be highly productive, given a supportive writing context that includes instruction that both focuses on structure and expects creativity.

In the following sections, I will discuss the elements of writer's craft that students used in their science writing. Specific examples will come primarily from four of Robert's written texts (composed during the period of September to January) and from the interview I conducted with him in late February. Data from my field notes of observations of the science class will also be presented as they support an understanding of Robert's writing and of the use of writer's craft in this classroom. The four written texts were on the topics of fingerprints, matter, owls, and wolves (see Appendix D).

Early in the year, Robert's class learned about fingerprints: the different types and how police use them to solve crimes. His class participated in the solution of a pretend crime that required them to match fingerprints taken from a safe to fingerprints of suspects. They then wrote a report that the teacher expected would serve two purposes: to inform a reader about fingerprints, and to recount their experience of solving a crime using fingerprints.

The next major writing assignment that Robert and his class completed in science was a report about matter. Mrs. Burke set high standards for the content and organization of this piece. Her guidelines for the matter report stated: "In this report you will have six main sections. You may split your major sections into paragraphs as needed and where appropriate." The guidelines went on to outline the sections and the required content for each. Her guidelines also indicated that students would be evaluated on the following criteria (in her words): paragraphs indented, spelling, punctuation, capitals, makes sense, organized well by paragraph, sentences within each paragraph in good order, enough descriptive details, titled, word choice varied, explanations clear, and sentences well developed and descriptive.

Next, Robert and his classmates wrote owl reports. By this point, Mrs. Burke was emphasizing the use of figurative language and other issues of writer's craft. She discussed and modeled the use of such literary devices as similes, personification, and onomatopoeia. In her instruction, she discussed leads, and on occasion she would invite her students to brainstorm different examples of possible leads. Her guidelines for the owl assignment indicated that she expected five or six paragraphs: an introductory paragraph, three to four descriptive paragraphs, and a concluding paragraph "that wraps up your paper and gives a closing". Her "guidelines for each paragraph" listed 10 requirements (stated here as they appeared on the guidelines sheet): topic sentence, 3-5 detail (supporting) sentences, topic/supporting sentences related, sentences well developed/descriptive, word choice varied, explanations clear/make sense, organized well, 2 adjectives, 2 adverbs, and 1 figure of speech.

The fourth science writing assignment was a wolf report. Once again, Mrs. Burke provided her students with a detailed (three-page) document that outlined her guidelines for the assignment. This time, her guidelines included three major sections: "Rules for Good Writing", "General Guidelines", and "Checklist for a Good Report". The "Rules for Good Writing" section contained these organizational and craft requirements: topic paragraph; interesting opening; 3-5 supporting (detail) sentences per paragraph; descriptive, colorful language; 3 adjectives, 3 adverbs, and a figure of speech per paragraph; indent all paragraphs; use your own words!!!; and use the writing process. The "General Guidelines" described the required cover page, bibliography, and illustrations. The "Checklist" listed the content expected in each of the 11 required paragraphs.

Mrs. Burke provided writing instruction for each of these four projects that often included mini-lessons focused on such elements as leads, use of questions, and attention to audience. She brainstormed with the class in order to come up with examples of these elements. Once students were involved in composing, she employed peer editing and ongoing teacher-student conferences. Students were usually expected to take notes and work from them while composing. Students were also expected to write multiple drafts, and to take into account feedback in revising their drafts. For each report, students completed a final draft. According to the interview data, the audiences for which the students wrote most often included the teacher, classmates, family members, and a hypothetical "reader". Analysis of the interview data suggests that some students had a rather complex idea of "the reader", and they used this idea to help them to consider audience issues as they wrote (see Tower, under review).

Results

The analysis of the field notes, instructional artifacts, and the 103 written texts resulted in a list of nine elements of craft that were employed by these young nonfiction writers. See table 8 for a list of the craft elements. Each element will be discussed separately, but it is important to bear in mind that the elements are interrelated and often overlapping. For example, the student writers often expressed their awareness of audience through the use of questions, they used humorous visuals to illustrate their similes, and they expressed voice through their use of humor (in words and visuals) and the technique of directly addressing the reader.

Attention to Audience

It is critical for young writers to develop the ability to consider an audience as they write. Considering the needs of a particular audience will help a writer to shape his or her text in ways that will result in effective communication of a message. The results of this analysis suggest that students demonstrated an awareness of audience through the use of most of the craft elements to follow, especially in their use of voice, humor, leads, and questions. Thus, Robert's awareness of his audience as revealed in his writing and his interview talk will be a strand that is woven throughout the rest of the paper.

Though I will focus primarily on examples from Robert's work, here I will share an example of some text and a related interview transcript from John, one of Robert's classmates. In his wolf text, John chose to set apart some of his rhetorical and craft elements (a definition, a connection of the new to the known, a simile) by putting them in parentheses. The four sentences from his wolf report that include parentheses are:

"Like the dog and the bear, wolves are warm-blooded (which means their blood tempature never changes)."

"Their snouts can hold up too one billion smelling cells (They can smell a cake over a mile away)."

"Also they have pads on their feet to protect them from sharp objects (They're as protected as 'superman')."

"Wolves (yes those fascinating creatures) are very complicated, but I managed to get the information."

Because this was an unusual rhetorical move in this classroom, I decided to ask John about it in our interview. John was explicit in his explanation that these uses of parentheses were intended to gain and hold his audience's attention by being conversational and/or adding interesting facts.

Cathy: "They can smell cake over a mile away". You used parentheses, and I was just curious about why, you used parentheses a couple places, you were one of the only people who did that, and I just wanted to ask you about it.

John: Well, I did that because it wouldn't really be something really needed, but I just added it on. So I put that in parentheses.

Cathy: Okay, so the information that's in the parentheses, you're saying is something that's not really needed?

John: Yeah, it's just extra.

Cathy: It's extra. Okay, so, why would you put it in if it's extra?

John: Mm, I thought that would be a pretty interesting fact to put in.

Cathy: Oh, okay.

John: And it would keep the reader, get the reader's attention.

Cathy: Oh, okay. Okay. But it's in parentheses because it's not exactly needed.

John: Yeah.

Cathy: I see. And so, let me see, there was another page where I think you had parentheses....Oh, like on the last page, "Wolves" and then in parentheses you said "Yes those fascinating creatures". Was that for the same reason you used the parentheses?

John: Yes.

Cathy: Okay.

John: And because, it's like a conversation too. And, you know. I don't know. I don't really know how to put it, but, it's hard to explain.

....

Cathy: Okay, and then there's one other parentheses here. You said "They're as protected as Superman." That looks like it's even different than the other two.

John: Like, their feet, the pads, it keeps 'em from cutting up their feet. It, so I put that because it's [in an exaggerated voice] SU per MAAAN!

From John's interview transcript, we get a sense of a young writer who thought carefully about various ways to gain and keep his readers' attention. He is still struggling to articulate why made particular word and sentence choices ("And, you know. I don't know. I don't really know how to put it, but, it's hard to explain"). Yet he had clearly reasoned through a way to present what he considered to be "extra", yet still interesting, information. And he believed that the inclusion of this "extra" information would serve to hold a reader's attention and by presenting interesting information and adding a conversational tone to his writing. The writers in this classroom showed attention to their

audience in many ways, and through many of the other elements of nonfiction writer's craft.

Voice

Writers who discuss elements of author's craft often include voice as an important consideration. Romano (2003) tells us that "Voice is the writer's presence on the page" (p. 50). Fletcher (1993) stated:

> When I talk about voice, I mean written words that carry with them the sense that someone has actually written them. Not a committee, not a computer: a single human being. Writing with voice has the same quirky cadence that makes human speech so impossible to resist listening to. (p. 68)

"Quirky" is a good word to describe Robert's voice in his writing. Over the course of the year, as he played with language, Robert wove more and more examples of his own voice into his written pieces. These are unexpected gifts to the reader that come in many forms, including a confiding tone, alliteration, or a funny picture.

As they did with audience awareness, students demonstrated their unique voices through their use of other craft elements such as leads, questions, and visuals. For example, in his matter report, Robert included this question: "What's an atom made of you say?" In his owl report, he directly addressed his readers: "If you want proof, here it is." Robert's voice could sometimes even be detected through his use of punctuation, as in the times he chose to end a sentence with an exclamation point ("Five things that make a wolf a mammal are, for exaple something every mammal has hair!") The exclamation point suggests that Robert found this fact interesting or noteworthy, and that perhaps he was conveying this excitement to his readers. Along with audience awareness, Robert's

use of voice will be another strand that gets woven throughout the rest of the paper in discussions of the other craft elements.

Robert's voice came through especially clearly in his wolf report. Robert's voice comes through from the very first paragraph:

> Wolves are great creatures. I mean, they keep the amount of game at a good rate, they have awesome abilities to help them do their jobs in nature. Though there aren't many they are well spread out around the world. They are as cool as rock stars. These things are number one types of dogs.

His use of "I mean" indicates a possible attempt to justify the opening sentence, which contains an opinion statement about wolves. The phrase "I mean" calls Robert's voice to a reader's mind, and immediately serves to remind the reader of the presence of the writer on the page. Additionally, his last sentence of the opening paragraph has a distinctive sound that I came to associate with Robert's voice: "These things are number one types of dogs."

In certain ways, Robert signaled that he was particularly interested in the topic of wolves. This may have resulted in a closeness that made the subject feel more personal to Robert, and thus more compelling to write about. Fletcher (1993) quotes the poet Suzanne Gardinier as saying that

> voice in writing has much to do with an *intimacy* between writer and subject: a close distance between the author and what is being written about. In voiceless writing, the author stands far back from the subject. Such distance can impart a cold, detached feel to the writing. When writing has real voice, you can sense the author pulling in close, cozying up to the subject.... (p. 72)

In his interview, Robert indicated just such closeness to the subject of his wolf report when he reported that the information he had learned helped him to train his dog.

> Robert: Ah, I liked them both [the wolf report and another piece he wrote] but I kinda like this one more [the wolf report] because it helped me train my dog.
>
> Cathy: The wolf report helped you train your dog?
>
> Robert: Yeah...there was a part in here where we had to write on sounds and movements dogs make when speaking to each other and I used those.

Thus, there is evidence both from his writing and from his talk about the writing that he felt close to the subject of wolves. This closeness is one possible explanation for the feeling of voice that is evident in Robert's writing.

An examination of Robert's revisions provides another possible insight into his attempts to develop his voice as a writer of nonfiction text. The rough drafts that I collected contained evidence of the revisions that he made (and the revisions that his teacher suggested he make). In a draft of his matter report, Robert had written the following sentences, which he subsequently crossed out:

> Last four paragraphs I've been talking about solids, liquids, and gases. This paragraph I will say a little diffrent. This time it's more like all types of matter. Solids, liquids, and gases haven't much to do with this paragraph. First and same as always I will say matter takes up space and has weight. But I didn't say this matter can be living or nonliving.

These deleted sentences have a more informal tone than he ultimately used in his final draft. They are also somewhat metacognitive; they sound like he has written down the thoughts from his head that were helping him to organize his report. Perhaps he chose to

delete those sentences as a result of a discussion with his teacher or a classmate, or perhaps he decided they didn't sound authoritative enough. It could be that Robert's revision indicated his growing understanding of the tone and language usually associated with informational genres. It could also be an indication of his consideration of voice and his decisions regarding how informal to be, and how much of himself to include in his report. Whatever the reason, these revisions suggest that Robert was working hard to craft a report that was effective and carefully written.

In Robert's work, there is evidence that he did some negotiating with Mrs. Burke over issues of choice and constraint. This took place was in the revision process, when Mrs. Burke provided feedback on students' rough drafts. An examination of Robert's rough draft of his owl report reveals a glimpse into the ways that he negotiated with his teacher and struggled with issues of choice and constraint. In his owl report, recall that Robert used the following narrative lead:

> Oh no, I'm late for the owl show. I can't wait to learn about owls, especially the barn owl. 'Doot doot doot doot doot doot dooooooo.' Just in time! They're presenting the barn owl! Barn owls have a unique size, call, and especially cool habitats for owls. It raises young like other owls, too.

A look at his rough draft of this piece again indicates that he was working with a tension between choice and constraint when drafting this opening paragraph. In the rough draft, his opening stated "Oh, no, I'm late for the owl show. Bye mom see you later. I can't wait to learn about owls...." Mrs. Burke crossed out the second sentence ("Bye mom see you later"). It seems that the narrative opening was acceptable to her, but the inclusion of dialogue was not. Robert seems to be learning where the boundaries are for his writing--

boundaries set both by his teacher and by the genre in which he is working. He seemed to be learning how to maintain his own voice while still adhering to the constraints imposed by the genre and by his writing situation.

His rough draft of the owl report also contained the following sentences in the introduction, which were subsequently crossed out (by Robert) and did not appear in the final draft:

> Oh, look at this she's got 4, 5, 6, 7 eggs! Wow, all this from an old owl that came from a poor old farm in the open country side. "Caw creek, caw creek" what a shrill sound. Look at this wing span must be 14 inches at least.

The information that Robert conveys in this longer narrative section in his rough draft (that owls live on farms in the countryside, that they have a shrill call, their wingspan) gets transformed into a more informational presentation in his final draft. Had he stayed with the rough draft wording, his report would have sounded less like a typical information text. Typical information text includes generic nouns and timeless verbs ("barn owls have", not "an old owl has"; Duke & Kays, 1998). Information texts do sometimes contain narrative beginnings (Pappas, 2002). But texts that continue to mix narrative and informational elements are more aptly described as hybrids. By attending to his choice of words, it seems that Robert (with the help of his teacher) is learning to write within the conventional constraints of information text, while still making choices that allow him to express his own voice and create his own meaning. This tension between choice and constraint, and his negotiations with his teacher, seem to help him to learn both the structures and features of informational genres along with ways in which he can be creative and expressive within those generic conventions.

Humor

The results of this analysis show humor to be the element least often used by the students in this class. As Table 9 illustrates, the use of each craft element varied across the sets of writing, but eight of the nine elements were employed by all or nearly all of the students in at least one written text. The exception to that is the element of humor. Only 38% of students employed humor in at least one written text. Humor was one of the craft elements that was not a focus of discussion or instruction by Mrs. Burke. However, humor is an important element of craft (Tower, 1998), and humor was used often and effectively by Robert. For these reasons, I include humor as a potentially important element of nonfiction writer's craft.

Humor is one powerful way that a writer can express her own unique voice in her writing. Humor can also be a tool through which a writer demonstrates audience awareness, since humor can work to retain a reader's attention or even to extend a reader's comprehension at the same time that it entertains (see Robert's use of humorous illustrations of his similes, and his discussion of this use, in the section titled "Use of Literary Devices"). As we shall see, Robert incorporated humor into his writing in various ways, including through his use of visuals, leads, and literary devices.

Use of Leads

Over the course of the year, Robert's teacher discussed and modeled the use of various types of leads. Her focus in this instruction was related to the development of audience awareness in her students. She encouraged them to consider interesting and varied leads that would "hook the reader" and make the reader want to keep reading. She

also indicated herself as an important reader, emphasizing that she didn't want to read 26 reports that all began "I'm going to tell you about wolves."

In his first text, the fingerprints report, Robert used a question as a lead: "Have you ever solved a mystery just with fingerprints? I have." This use of a question as a way to "hook" a reader was suggested and modeled by his teacher. His response, "I have", serves to connect his question of the reader to the upcoming content and to establish himself as something of an authority on the topic. The following two sentences in his introductory paragraph set up the two purposes of the piece: to recount his experience ("I did it in school it was an assignment in class.") and to provide information about fingerprints ("I also learned about them.").

As he did in his fingerprints piece, Robert began his matter report with a question: "Did you know that everything that has weight and takes up space is matter?" Again, Robert chose to use a question to begin his piece. The question also allowed him to include some important content (that matter takes up space and has weight).

In his owl report, Robert tried out a different type of lead. Instead of aiming to hook his readers with a statement or question directed right at them, he relied more on interesting language and humor to capture and hold their attention. He used a narrative opening. This was one of many suggestions that his teacher provided for ways to lead into the report. The opening paragraph of his final draft reads as follows:

> Oh no, I'm late for the owl show. I can't wait to learn about owls, especially the barn owl. 'Doot doot doot doot doot doot dooooooo.' Just in time! They're presenting the barn owl! Barn owls have a unique size, call, and especially cool habitats for owls. It raises young like other owls, too.

This opening presents a narrative beginning, which is presumably intended to draw the reader into the piece, but it quickly focuses on the main topic, owls, and introduces some of the characteristics that will be discussed in the report. Robert does not stay in a fictional narrative structure for very long before returning to an informational structure that he employs for the remainder of the report.

In the wolf report, he tried yet another type of lead:

Wolves are great creatures. I mean, they keep the amount of game at a good rate, they have awsome abilities to help them do their jobs in nature. Though there aren't many they are well spread out around the world. They are as cool as rock stars. These things are number one types of dogs.

This time, he presented something more closely resembling an argument in his lead. He began with a statement of opinion ("Wolves are great creatures") and went on to begin a justification of that statement (a justification that would continue throughout the report).

Thus, over the course of the year Robert tried out several different types of leads. Each one was aimed at gaining and holding a reader's attention. Each one revealed Robert's awareness of audience as well as his unique voice.

Use of Questions

In addition to his use of questions as leads, Robert employed questions in other places in his writing. As noted earlier, often this use of questions suggested an awareness of audience. Robert used three questions in his matter report. Recall that Robert began that report with a question: "Did you know that everything that has weight and takes up space is matter?" Robert's next question (and answer) comes in the second paragraph, and it gives a sense of his voice: "Whats an atom made of you say? Why protons,

neutrons, and electrons." This use of questions allows Robert to speak directly to his audience, while helping him to provide important content and to transition between ideas. His third question serves as a lead for his third section, and as a transition between the second ("describe matter") and third ("describe the properties that make a solid a solid") sections of his report: "Did you know you are a solid?" Again, Robert goes on to answer, or extend, his question: "If you didn't, now you do." Thus, Robert expressed his voice through his use of questions as he communicated directly with his audience. In his wolf report, it seems that Robert used a question to draw the reader closer to the content: "Can you belive their noses are big enough to hold two million smelling cells" (p. 4). His use of questions was becoming more varied, from his initial use to hook a reader, to later purposes of providing content, expressing his voice, and transitioning from one idea to the next.

In addition to these purposes, the students in Robert's class used questions for many other interesting reasons, and the use of questions became more varied and complex over time. For example, these student writers asked readers to imagine themselves in situations, or to imagine hypothetical situations:

Charlie: "If you were a wolf how would you raise your pups to be good hunters?"

John: "What would it be like if wolves were herbivores?"

Michelle:. "If you were a wolf what would you do for physical adaptations?"

Rick:. "If you're a wolf pup, ges what's for dinner?"

They quizzed the reader about content:

Charlie: "Are wolfs carnivors, herdivores, or ondivores?"

They assumed some knowledge on the part of the reader:

Charlie: "Have you ever wondered why wolfs build there dens on high grounds?"

They turned the question into a kind of game:

Carrie "Guess what the male would weigh? If you guessed 80-120, you won!"

They dispelled myths or set the record straight:

John "Did you know that wolves aren't dangerous and blood-thirsty like in the stories?"

Simon. "Do you remember the story about the Big Bad wolf? The information in this report could have saved poor old Grany."

They helped readers connect to their own experience:

Robert: "'Listen to me now!' Does that sound familiar?" I know it does everyone has heard it before. Did your parents tell you it was a lesson?"

Rick: "Do you have a family I do, and so do wolvs"

Rick. "Have you ever met a kid that just gets blamed? Wolfs have these kids to their called scapegoats"

Finally, students combined their questions with onomatopoeia, or pretending to hear the animal:

Carrie: "Hoooooool, Hooooooooool. What was that?"

Michelle: "Who was that? I think it is a bird. No, its a wolf."

Rick: "'Gerrrr,' thats a wolf's growl. Do you know why they do that?"

Each of these purposes for questioning revealed an awareness of audience, as students worked to engage their readers with the topic, to express and share excitement about the topic, and to help their readers to comprehend new information. The varied purposes for

which writers may choose to employ questions in their writing makes this element of

nonfiction craft a powerful and important one.

Use of Literary Devices

In their science writing, students employed various literary devices including

similes, onomatopoeia, personification, and alliteration. Robert started exploring literary

and figurative language in his first text, the fingerprints report. The third paragraph of

that report contains a simile: "When a crime is committed police find prints at the sight.

It's kind of like the person leaving their name, but they wrote very sloppily." Robert's

early use of a simile (he was one of the few students to do so in this assignment, see

Table 9) suggests that he was inclined to experiment with language. The simile he

employed also suggests that he was considering his audience by looking for ways to

compare new ideas to concepts that are generally familiar (a craft element that will be

discussed in more detail later).

As Table 9 indicates, student use of literary devices was low in the first two sets

of writing (fingerprints and matter), but then very high (100%) in the second two sets of

writing. In the owl and wolf reports, Robert's use of craft began to include more focus on

literary devices and figurative language. This focus reflected the increased attention that

Mrs. Burke was paying in her instruction to figurative language and literary devices. In

addition to the narrative opening he employed in his owl report, Robert used other types

of literary language. He resumed his experimentation with similes, which was started in

the fingerprints report:

> One of the barn owls habits is flying. It flies in the hills and the fields. It flies like
>
> a glider. It also hunts a lot. They love food. I mean they eat like horses!

Robert continued to play with similes in the wolf piece. In another example of the inter-relatedness of the various craft elements, one of the most prominent ways that Robert expressed his voice in this piece was through his use of similes and their accompanying pictures. The first example comes from his very first paragraph: "They are as cool as rock stars." The picture on this page showed an image of a wolf, an equal sign, and a picture of a rock star (see Figure 3). On page two, Robert inserted another unexpected simile: "Last but not least wolves are warm blooded. Sometimes they can become as hot as the Greek god Hades." It seems as if Robert's use of similes is becoming more creative and less conventional. As compared to the similes in his owl report ("flies like a glider", "eat like horses"), this comparison of wolves to a Greek god is more playful and unusual. Robert used another interesting and unexpected simile on page three: "Weighing seventy to one hundred pounds these aren't animals you want to mess with. Their as mean as sumo wrestlers." The friendly advice offered in the phrase "these aren't animals you want to mess with" again indicates some use of a more informal, confiding tone, suggesting further Robert's closeness to the subject, which seems to have resulted in the presence of his voice. The humorous simile is accompanied by a funny picture (see Figure 4) in which Robert depicts a cross between a wolf and a sumo wrestler, with the label "sumo wrestlers" and an arrow pointing at the bulging stomach. In our interview, I asked Robert specifically about his use of similes:

> Cathy: You used some interesting similes, and I was wondering how you thought of them: "Cool as a rock star", "As mean as sumo wrestlers"
>
> Robert: (laughs)
>
> Cathy: Why did you choose to put those in?

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Robert: I just thought they were kind of funny and they had a small humor to them, but they also still worked with what I had written.

Cathy: Okay. What do you mean they worked with what you had written?

Robert: Like, they're not saying something that doesn't have anything to do with all this reading and that thing

Cathy: Okay, so they're related, somehow, but they're also funny. Why is, why did you want it to be funny?

Robert: Ah, because usually when I read books that don't have anything funny in them, sometimes I like 'em, but usually they're just really boring.

Robert reports that his use of humor was intentional. He indicated that he was trying to accomplish two goals in his writing: keeping the content relevant ("they also still worked with what I had written") while at the same time including humor so as to keep the piece interesting for a reader. Again we have an example of the ways in which these writer's craft elements are related. Robert's use of similes indicates voice, shows his use of humor, and suggests attention to an audience whose attention he wishes to retain and whose comprehension he wants to support.

While similes represented the majority of Robert's experimentation with literary devices, he also tried out the technique of onomatopoeia in his owl report:

Barn owls are shrill sounding creatures to me, like a loud, 'Cow creek, cow creek'. It's sort of a rasping or creeking.

Onomatopoeia is a literary device more commonly associated with poetry, but Mrs. Burke modeled its use in science writing, and many of her students tried it out in their texts. For example:

Cherie:"This amazing bird makes a noise that sounds like 'hoo hoo'. When the snowy owl is excited it also makes a 'hooo uh hooo hu wah wah wah ' sound."

David: "Other calls of the snowy owl sound like, 'Kruff-gah-gunk' or 'Hooo-uh, hoo-uh, hooo-uh, wuh-wuh-wuh-wuh.'"

Ella: "'Ooooo, Ooo Ooo Ooooo.' Oh, the sound of the grey wolf. Isn't it lovely?"

Allie: "Howoooo...! That is a wolf trying to contact another wolf to try and join a pack. Grr..! That was a wolf asking another wolf if they want to play."

Amanda: "'Boom', the shooting of a gun made wolves almost became exinct." Mrs. Burke named this literary device and encouraged its use among her students.

Robert experimented with language in other ways as well. His sentence phrasings were sometimes varied and sophisticated, as evidenced in his use of a complex sentence in the line "Though there aren't many they are well spread out around the world." At one point in his wolf report (page four), he tried out some alliteration: "They can detect freind, foe, or food from a mile and a half away." Also, his use of phrases such as "Last but not least" is another example of his voice. While phrases such as "last but not least" have an informal tone, they serve to include a sense of voice without undermining the overall authority of the piece. A suggestion that Mrs. Burke made that was intended to help her students to vary their use of language was to rearrange the order of one or more sentences, putting the end part first and the first part at the end. Robert tried out this strategy: "Weighing twenty oz's is the barn owl." and "Weighing seventy to one hundred pounds these [wolves] aren't animals you want to mess with. In short, Robert seemed eager to experiment with many different uses of language in his science writing.

Connecting the New to the Known

The technique of helping readers connect to their prior knowledge is one that is used by skilled writers of nonfiction (Bamford & Kristo, 1998). Robert used similes and other comparisons in order to help readers link new information that he was presenting to other, more familiar knowledge. In these examples from his wolf report, Robert compares new information about wolves to presumably more general knowledge, or he compares new information about wolves to facts about or experiences of human beings:

p. 4: Wolves have great abilities. They're very speedy creatures. Wolves can run thirty five miles an hour. Thats exactly half as fast as the worlds fastest mammal, the cheetah!

p. 8: 'Listen to me now!' Does that sound familiar? I know it does everyone has heard it before. Did your parents tell you it was a lesson? It might be but for wolves I know it is. Wolves hear that a lot from babysitters.

p. 11: They talk as much in one day as a human in two.

p. 13: Wolves spend as much time hunting as humans sleep.

p. 15: Wolves have been around two million years. That's forty times as long as the human race.

p. 15: A full size coyote is only half the size of a wolf.

These comparison examples all relate new information about wolves to presumably more familiar information about humans and other animals. Robert's attempt to help his readers make connections of new material to existing knowledge suggests that he is aware of the potential needs of his audience, and that he is working to master various techniques of craft that will allow him to support (and entertain) his readers.

Reference to Authority

An important characteristic of nonfiction texts is their inclusion of information

that confirms the accuracy of the information contained within (Bamford & Kristo,

1998). Bamford and Kristo (1998) argue "It is important to guide students in becoming

critical and thoughtful readers by encouraging them to consider the author's credentials,

research process, involvement of other experts, etc" (p. 22). In turn, student writers of

nonfiction need to learn various ways in which they can verify for readers the accuracy of

their text. One way that students in Robert's classroom did this was by the inclusion of

bibliographies that could allow a reader to examine the sources that were used in the

research process. Another way that Robert addressed the issue of accuracy was by

making references to authorities, either outside authorities or to his own experiences that

rendered him an authority on a given topic. In his fingerprints report, he asserts his own

authority in an indirect way. His opening paragraph reads: "Have you ever solved a

mystery just with fingerprints? I have. I did it in school it was an assignment in class. I

also learned about them." This information about his own knowledge and experience

serves to establish himself as an authority on the topic who is qualified to talk about it in

an informative way. He was the expert because he had experience using fingerprints to

solve a crime, and because he learned about fingerprints in his class.

In his matter report, Robert called on outside authority to support the accuracy of

his assertions. In each of the three paragraphs about states of matter, Robert made

reference to authority by stating that "studies show" something. For example, he said,

"Studies show a solid does not change shape easily." and "Studies show all liquids have

weak bonds." Robert seems to have a sense that nonfiction texts need to rest on some

authority; some source of information that is accurate and verifiable. His references to

authority may be an indication of his attention to the specific characteristics of the informational genre. Such attention to genre is an important element of a writer's craft, since effective writing fulfills the purpose of the genre as well as the writer's purpose.

Use of Visuals

Only two sets of writing that the students did in this class (matter and wolves) included the use of visual elements (such as drawings, graphs, and charts) by a majority of the students (see Table 9). These two assignments were the ones for which Mrs. Burke required visuals. Three students chose to use visuals in their fingerprints report, despite the fact that this use was not required by their teacher.

Visuals play many important roles in nonfiction texts (Moline, 1995, Purcell-Gates & Duke, in press). Visual texts are often accessible to many readers, may be complex and multi-layered, and can communicate certain information more clearly than verbal texts. They can serve to support readers' comprehension by extending or clarifying written text. Visuals are used widely in informational texts, and also in electronic media. For young writers, visuals represent another avenue through which ideas can be expressed and meaning can be made. Often students who struggle with writing are better able to use visual representations to convey meaning.

Robert employed seven visuals in his matter report that explicitly served to extend or reflect the written text. On the first page, he drew an abstract representation of the periodic table, with the caption "Periodic table of elements **all** 109". This visual served to extend his text, which didn't explicitly refer to the Periodic Table (though it did state that there are "one-hundred and nine elements"). He also included a visual with the caption "Newest electron cloud modle", which also extended his text by giving more information

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about electrons. On the second page, he presented a visual with the caption "examples of mixtures". Again, this visual served to extend his text, which gave basic definitional information about mixtures. The visual showed drawings and their accompanying captions: "books", "melted crayon to a pencil", and "chemical". On the third page, he included a sidebar that contained only text, which read: "Solids: You, rocks, doors, Books, trees, plants, pencils, toys, plas [cut off]. Everything hard." (See figure 5). Though the sidebar did contain only text, it served to set this particular information apart from the running text of his report, and is visual in that sense. He also included a chart that showed pictures of molecules that were "heated", "plain", and "cooled" (see figure 5). Notice that his chart contained words that served as headings or labels, as well as a visual representation of the spacing of molecules in matter at different temperatures.

The other text in which Robert employs visuals is his wolf report. Recall that Robert used several unconventional similes in this report. The illustrations that accompany his similes, in which he compares wolves to rock stars (see Figure 3) and to sumo wrestlers (see Figure 4), are examples of visuals that reinforce information presented in the text (while adding an element of humor). In addition to illustrations such as those, he also used diagrams that worked to provide more support to readers in comprehending new information. The first of those appeared on page five of his report (see Figure 6). Notice Robert's use of labels, captions, and a "speech" bubble. The text on that page stated "They can hear a sound several miles away." The accompanying diagram included a caption ("hear several miles away") and depicted one wolf howling (the word "howl" in a speech bubble coming from its mouth) and another wolf hearing that howl from three miles away. The miles are marked by hatch marks and labeled ("1

mile", "2 miles", "3 miles"), and there are trees along the distance from one wolf to the other. The second diagram appears on page seven of his report, opposite the page on which he describes wolves' dens (see Figure 7). In this diagram, he labels the parts of the den that he described in the text, thus providing support to his readers in visualizing the dens. Both of these diagrams evidence a growing sophistication in Robert's use of visuals. Previous work with visuals in children's information books (Purcell-Gates et al., 2003) has indicated that illustrations and diagrams are not merely decorative but instead serve to extend or clarify the text and usually include captions and/or labels to help the reader gain meaning. Robert's visuals reflect these characteristics. In our interview, Robert discussed his use of diagrams (or graphs, as he also refers to one of them):

> Cathy: I was really interested when I looked at this [wolf report] in some of your pictures. Can you tell me a little bit about them? Like this one, where you sort of have this one mile, two miles, three miles//
>
> Robert: This is mainly, this is mainly just, um, it's partly a picture bit it shows the different, the difference in how far away they are.
>
> Cathy: Okay, so it's partly a picture, but it's partly something else?
>
> Robert: Yeah.
>
> Cathy: Like what, do you know?
>
> Robert: It's like a graph, kind of.
>
> Cathy: It's like a graph? Okay. And what about this one, where you have the dens, and you have the pathway and the puppy chamber.
>
> Robert: Um, it's just um, labeled, all the different, um, places in the diagram. I get that out of a lot of my sister's, um, my sister has these books, they're the Get-

Along Gang, and sometimes like at the middle of the book they have this big map and they have listings where everything is.

Cathy: Oh, so that's where you got the idea to do it like this?

Robert: Yeah.

Robert's talk suggests that he is still a bit uncertain about how to discuss these visuals. At the same time, he seems to see a difference between the two, calling the first one a graph (see Figure 7) and the second one a diagram (see Figure 8). He revealed that his diagram was inspired by some fiction books that he had read, suggesting that inspiration for nonfiction writing can come from various places. This intertextual awareness may have influenced Robert's writing in other unknown ways as well.

A third illustration provides further evidence of Robert's growing sophistication in his use of visuals. On page 15 of his report, he includes a scale model. The text on page 15 states "A full size coyote is only half the size of a wolf." His corresponding illustration has a caption that reads "bigger than a full size coyote". It shows labeled pictures of a wolf and a coyote, with the wolf appearing to be about twice the size of the coyote. Thus, in his wolf report Robert experimented with several different types of visuals. The importance of visual elements of texts will be discussed further in the conclusion section.

Conclusion

The analyses conducted on both the writing and context data from a fourth grade classroom resulted in a list of nine elements of writer's craft related to nonfiction writing in science (see Table 8). The context data included field notes taken during observations of science class, interviews with the teacher and students, and artifacts related to

instruction. The written data consisted of 103 science texts (and additional rough drafts) composed by the students in this class. This analysis of nonfiction writer's craft supports four conclusions, which are discussed below. The paper concludes with a brief discussion of suggested future directions for research.

First, a number of elements of writer's craft are evident in these fourth graders' writing. The analyses suggest that children are able to attend to larger generic and rhetorical issues such as audience, purpose, style, tone, and voice as they develop their writing craft. An examination of Robert's science writing revealed rich examples of these elements in one young writer's work. Robert's use of voice, visuals, leads, humor, similes and other literary devices; his attention to audience, and his negotiation of the ever-shifting boundary between choice and constraint provide a beginning map for teachers and researchers who wish to study and support the development of craft among young writers. The list of craft elements described here can provide a starting place for researchers who wish to explore the ways in which students learn to select and use elements of craft in their nonfiction writing. The list can help teachers to become aware of the various elements of craft that are available to writers of nonfiction so that they can carefully consider how to support their students in the development of their writing craft. In addition, the list may encourage discussion and careful thought about particular elements of craft that may not be valued or understood by teachers and others who wish to support students' nonfiction writing.

The second conclusion is that craft elements are closely inter-related and often overlapping. For example, the analysis presented here suggests that as an element of craft, voice gets expressed through many of the other elements. The same is true of

elements such as attention to audience and humor. Robert's use of the craft elements illustrates their inter-connected nature. His use of similes incorporated a literary device, humor, attention to audience, voice, and visuals. He also expressed voice and attention to his audience through his use of interesting leads, which were sometimes in the form of questions. His references to authority, his use of visuals, and his connections of the new to the known suggested further attention to the needs of his audience. In short, it is impossible to separate out the elements of nonfiction writer's craft. They work together in complex ways to help a writer express a message.

The third conclusion is that the teacher may play an important role in students' developing understanding and use of nonfiction writer's craft elements. Nonfiction writer's craft is not a matter of "anything goes", but rather a dance between choice and constraint. Teachers can play an important role in supporting their students as they learn this dance. Or, teachers may neglect some or all elements of writer's craft, and this too can send a powerful message to student writers. The importance of the teacher's role is suggested by the results that are presented in Table 9, especially related to literary devices and visuals. The percentages of students employing these two elements seem to be associated not with a developmental trend or with the point in the school year, but instead with the assignment guidelines and the focus of instruction.

In this analysis, it seemed that Robert and his classmates were working to express their own voices and to engage their audiences, while at the same time working to meet the expectations and requirements of their teacher and to negotiate the tension between choice and constraint that confronts all writers. Mrs. Burke provided structured organizational, content, and grammar requirements that were designed to help her

students to learn conventions of the informational genre, but she also provided instruction and modeling of the use of various elements of writers craft which presented her students with choices in their writing. Thus, Robert and his classmates were confronted with both the opportunity to make choices in their writing and the responsibility to adhere to generic and instructional requirements for their texts. Robert seemed to actively negotiate this tension, as we saw in the examination of his rough drafts and what he cut from them on the way to a final product. His written texts suggest that he did, in fact, experiment with language and convey his own voice in his writing at the same time that he produced texts that were effective in meeting the purpose of the informational genre. By attending to specific elements of nonfiction writer's craft, Mrs. Burke provided for her students a context in which they were supported as they practiced with different writing tools and techniques. Her requirements that they use particular elements (such as literary devices, questions, and interesting leads) as well as her instructional attention to those elements served to support her students in their use of these writers' tools.

Teachers can also neglect writer's craft. My work to date suggests that visuals represent one such element that isn't valued by teachers, and thus isn't given much, if any, instructional attention. Scholars have emphasized the importance of visuals in supporting comprehension, providing multiple ways to express meaning, and influencing the response to books of even very young readers (Moline, 1995, Purcell-Gates & Duke, in press; Tower, 2002). Robert and his classmates used visuals to serve many purposes in their science writing. Indeed, visuals served an important role in Robert's craft. They allowed him to extend and clarify his written text, to express meaning in multiple ways, and to express his voice, especially through the use of humor. Yet despite the many

compelling reasons to include visuals in written nonfiction text, I have evidence to suggest that the teachers in my study (and thus their students) did not value visuals as important aspects of texts, or they considered them to be of only minor importance as compared to written words (Tower, in preparation). Moline (1995) asserts, "Drawing can sometimes be neglected or treated as an add-on reward or afterthought in the classroom. Even in classrooms where there are many opportunities to draw there is sometimes the assumption that in the end drawing is not really as important (as useful, as serious) as writing" (p. 15). As Robert's work has shown us, visuals can play many important roles in helping a young writer to express his ideas about science. Teachers and researchers would do well to pay more attention to this important aspect of writing craft.

Voice is another element of nonfiction writer's craft that deserves more attention. Humorous visuals were but one way in which Robert expressed his voice as a writer. Robert expressed his voice and his personality through the use of many of the craft devices discussed here. His voice often came through most strongly when he was attending to the perceived needs of his audience; that is, when he was attempting to draw and keep their attention through the use of interesting leads and humor, and when he was attempting to support their comprehension through the use of similes and comparisons, visuals, and a confiding tone. Though Mrs. Burke didn't use the term "voice" in her writing instruction, this instruction still seemed to support a sense of voice on the part of her students. Her efforts to encourage her students to pay attention to the needs of their audience by using compelling leads and interesting language seemed to foster a sense of voice in their written texts.

Though it is often easy to get a "sense" of voice in a written text, it is much more difficult to define voice, or to say exactly what it is that makes us judge a text as possessing voice. Romano (2003) described the difficulty he had with in trying to convince teachers to include voice as one category in a holistic scoring rubric of students' writing. Teachers complained that voice is "too hard to explain, to slippery, too messy, too elusive" (Romano, 2003, p. 50). Despite this, Romano argued that voice should be included when we consider the important elements of good writing:

> To my mind, what is unnamed is unrecognized, what is unrecognized is unvalued.
>
> Voice is made up of many aspects of writing, but there is a gestalt at work, too.
>
> Voice emerges as greater than the sum of its parts. (Romano, 2003, p. 50)

Much more research attention is needed to the issue of voice, as well as to other elements of nonfiction writer's craft.

Finally, much more work is needed to help us understand elements of nonfiction writer's craft; the ways students use them and the ways teachers may support their students' use. There has been little research attention to the ways in which students learn (or fail to learn) to negotiate boundaries related to generic choices and constraints. With regard to children's learning of convention, in a book aimed at teachers of writing, Fletcher (1993) expressed a concern:

> ...when children learn the proper conventions, it seems that their language cools to safe correctness. With older children it's rarer to see the same degree of freedom, the bold images and striking metaphors, that we see with younger children. (p. 141)

Research is needed to bear out this claim that older children's writing contains fewer bold images and striking metaphors than the writing of younger children. Robert's work presents one example of a somewhat older student who did choose to risk the use of unconventional similes and humorous visuals in his writing. It seems that the environment in his fourth grade class provided the space in which Robert could play with language and explore the possibilities of science writing. Certainly, teachers must help students to come to terms with the conventions of written language. But it seems equally important that teachers encourage risk-taking among their students with regard to writing, foster a sense of voice, and help their students to develop their craft as writers.

The task of meeting these multiple purposes may be more easily said than done. In order to be effective at helping students to negotiate boundaries of choice and constraint, teachers need to be knowledgeable about language, and about the styles of language, discourses and genres that are used in various content area or discourse communities. Within any content area, people use multiple genres and styles to fulfill multiple communicative purposes. Those who work within the scientific discourse community labor within specific conventional rules and expectations to which they must adhere if their work is to be valued by others within the community. As the eminent scientist Edward O. Wilson (2001) argues, "Science writers are in the difficult position of locating themselves somewhere between the two stylistic poles of literature and science" (p. xix). He explains:

> A[n]... obstacle to converting science into literature is the standard format
> of research reportage in the technical journals. Scientific results are by necessity
> couched in specialized language, trimmed for brevity, and delivered raw.

Metaphor is unwelcome except in small homeopathic doses. Hyperbole, no matter how brilliant, spells death to a scientific reputation. Understatement and modesty, even false modesty, are preferred, because in science discovery counts for everything and personal style next to nothing.

In pure literature, metaphor and personal style are, in polar contrast, everything. The creative writer, unlike the scientist, seeks channels of cognitional and emotional expression already deeply carved by instinct and culture. The most successful innovator in literature is an honest illusionist. His product, as Picasso said of visual art, is the lie that helps us to see the truth. Imagery, phrasing, and analogy in pure literature are not crafted to report empirical facts. They are instead vehicles by which the writer transfers his own feelings directly into the minds of his readers in order to evoke the same emotional response. (p. xviii)

This task of situating oneself as a writer of science text requires complex understandings of audience, types of writing and different venues for it, and the general discourse rules and conventions of the scientific community. The task of situating oneself is a monumental one for any science writer, let alone a fourth grader who may also still be struggling with basic issues of encoding related to grammar and spelling. And yet, as Robert's work suggests, children can attend to larger generic and rhetorical issues as they develop their writing craft. Students like Robert could benefit from working with teachers who will provide them with opportunities to read, discuss, and write various types of science text. They could benefit from teachers with an understanding of the evolving nature of genres and generic conventions and the ability to help students to understand the purposes that such conventions serve as well as the constraints that they impose. And

teachers who strive to support their students in these ways need researchers who will continue to investigate the cognitive, social, and cultural factors that support and influence children's development as writers who work with a sophisticated sense of writer's craft.

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Table 8
Nine Elements of Nonfiction Craft Evident in One Fourth Grade Class's Writing

Craft Elements	Description	Examples
Attention to Audience	An important and (in good writing) pervasive element of craft; is revealed in nearly all of the other elements and is related to an understanding of the purpose of a piece of writing	"How many types of matter are there? If you guessed three, you are right. Do you know what they are? They are liquids, solids and gases."
Voice	The ability of a writer to provide a sense of herself on the page; the reader's sense of a person behind the text; expressed through many of the other craft elements including humor, leads, and visuals	"I can't believe how they do it. It's super hard to idenify smudged prints." "Did you know that wolves aren't dangerous and blood-thirsty like in the stories? Wolves are very affectionate loving creatures! Sure, they might kill other animals, but they do it to survive."
Humor	Expressed through words and visuals; related to voice, and often evidences attention to audience; serves to render a text more interesting and/or accessible to a reader	"I wish I was a wolf, because they can smell a mile and a half away. Then I would know how close I am to Mickey D's! Ha ha."
Use of Leads	Various types of leads can be used to gain and hold a reader's attention, including asking a question, presenting a narrative vignette, and making an assertion	"The wolf is a very neat social animal." "'Oooo, Ooo, Ooo'. Oh the sound of the grey wolf. Isn't it lovely?"
Use of Questions	Questions can be used for various purposes in a text, including to serve as openings (leads), to directly address a reader and/or to engage a reader, to present information, and to transition between ideas or sections	"Have you heard an owl? If you did, it was roosting. They are as silent as the wind when they are flying." "Did you know that wolves aren't dangerous and blood-thirsty like in the stories?"
Use of Literary Devices	Includes the use of similes, onomatopoeia, personification, alliteration, hyperbole. Attention to language, exploration of various figurative language techniques	"Hoo-hoo. That's the call of a great master of survival, the snowy owl!" "Always soaring like the wind and hunting like a shark, they catch their prey."
Connecting the New to the Known	An important consideration for writers of nonfiction; helps to support readers' comprehension by drawing comparisons or pointing out connections of new information presented in the text with more general knowledge, or with presumed existing knowledge	"Do you know what a gas is? For an example when your mom is cooking on the stove, steam comes up. That is a gas."
Reference to Authority	An important consideration for writers of nonfiction; acknowledgement of the writer's responsibility to present information that is accurate and verifiable	"Studies show..." "You can even ask our teacher!" "Many researchers have decided..." "Results of the 1998-99 Winter Wolf surveys confirmed the presence of..."
Use of Visuals	The use of various forms of visual representation of information, including illustrations/drawings, graphs, tables, charts, diagrams, and scale models	See figures 3-8

Table 9: Percentage of Students Using Each Element of Nonfiction Craft

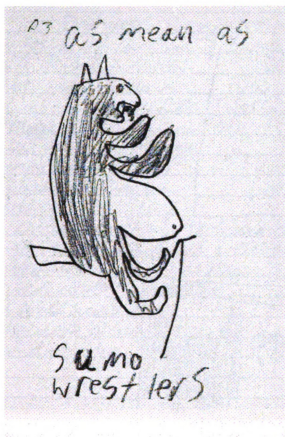|	Fingerprints	Matter	Owls	Wolves	% Students using element in at least one piece
Audience Awareness	100	100	95	100	100
Voice	95	76	100	100	100
Humor	0	5	5	38	38
Leads	100	100	100	100	100
Questions	41	90	45	62	100
Literary Devices	9	10	100	100	100
Connecting New to Known	86	95	65	100	100
Reference to Authority	100	19	45	95	100
Visuals	14	86	0	95	96
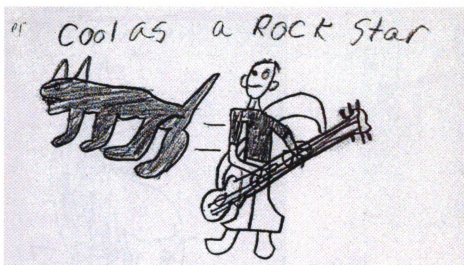
Figure 3: Robert's Rock Star Drawing

Figure 4: Robert's Sumo Wrestler Drawing

Did you know you are a solid? If you didn't now you do. A solid takes up space and has weight. It's molecules all move and but don't move away from each other. Their molecules are packed very close together. When a solid is heated it's ends weaken and the molecules move faster and faster. A solid has a definite shape and volume.

Solids
you, racks, doors, Books, trees, plants, pencils, toys, plas...

Everything hard

heated	plain	cooled

Figure 5: Robert's Sidebar and Chart

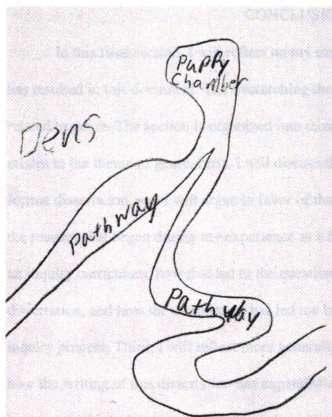Figure 6: Robert's Wolf Distance Diagram

Figure 7: Robert's Wolf Den Diagram

CONCLUSION

In this final section, I will reflect on my experiences and discuss the journey that has resulted in this document. The overarching theme of this section is considerations related to genre. The section is organized into three large subsections, each of which relates to the theme of genre. First, I will discuss the experience of writing an alternative format dissertation, and I will argue in favor of the experience. Second, I will reflect on the journey that began during my experience as a fourth grade teacher who implemented an inquiry curriculum, how that led to the questions I ultimately pursued in my dissertation, and how the dissertation has led me back to the larger questions surrounding inquiry process. Third, I will reflect more generally on issues of writing. I will consider how the writing of this dissertation has expanded and challenged my ideas about genre, how my thinking about genre has changed, and how my consideration of children's writing led me to reflect in new ways on my own writing.

Writing a Dissertation in an Alternative Format

From a genre theory perspective, the decision to write an alternative format dissertation seemed an obvious one. As Duke and Beck (1999) argue, the traditional dissertation in education meets both classical and modern definitions of genre, but it is a strange genre that has a limited audience and dissemination and lacks generalizability for the writer. A traditional dissertation is typically read by very few people (the student's committee members, perhaps some family and friends, and the few folks who order it through inter-library loan or who are assigned to read it as a model by their own advisor). And writing a traditional dissertation is an unusual experience; people typically write only one dissertation in their lives (Duke & Beck, 1999). Indeed, they write that

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dissertation at a time when they are in the best position to receive mentoring and guidance on more generalizable genres, such as the journal article.

In contrast to the traditional dissertation, an alternative format dissertation such as the one presented in this document has a potentially large audience (with the attending potential to make an impact on the field) and provides a generalizable experience for the writer. Each of the manuscripts included in this dissertation will be sent out for review to major journals in the field of literacy. The experience that I gained in writing articles for publication will serve me well as I move into a career as a literacy researcher. And perhaps most importantly, my experiences of conducting the research presented here and writing it up for publication were supported and guided by knowledgeable others in the field. This kind of support and scaffolding is just what we argue for in good teaching and learning situations.

I would describe my experience of writing an alternative format dissertation as a positive one. While the experience of writing any dissertation is at times overwhelming and frustrating, the knowledge that my work would be immediately sent out for publication made the experience feel authentic and worthwhile for me. Of course, given that people usually only write one dissertation in their lives, I have no other experience to which to compare this one. I'm sure there must be advantages to writing a traditional dissertation, given how long that form has endured. But for me, the alternative format made sense. I agree with Duke and Beck (1999) that education should seriously consider alternative formats to the traditional dissertation.

My Dissertation Journey

As I noted in the introduction section, my interest in science writing and inquiry can be traced back to my experiences as a fourth grade teacher. The journey that took me from a teacher with a thousand questions about children and inquiry to a researcher with four carefully constructed questions about fourth graders' science writing taught me a lot about the differences between teaching and research and about the process of research. The metaphor of an hourglass is helpful to me in making sense of the ways in which my research interests have changed over time. The image of an hourglass also brings to mind the importance of time in research, and the long amounts of time that it takes to design, carry out, and write up a research project. Thus, the sand in the hourglass represents both the time I've spent as a novice researcher, completing this dissertation, and the shape of the hourglass represents the path of my ideas, questions, and focus as along the way.

At the top of the hourglass I was full of questions and overwhelmed by the unlimited possibilities. As I learned more about research and about what was possible for one person with no funding to do, my possibilities were quickly narrowed, but many choices remained. My notes from a meeting with my advisor, Nell Duke, on February 7, 2002 include a list of possibilities for my dissertation. These possibilities included the following categories: assessment, information-finding behaviors and abilities, consideration of a new genre, how children understand diagrams and other visuals, teacher development, and individual differences (e.g., range of levels of genre understanding). Possibilities that we discussed for the larger focus/design included assessment, intervention, development, issues of epistemology, accuracy, audience, and authorship. Possible questions included "How might fourth graders come to understand genre as social action?" and "Related to source finding and synthesis in student research,

how do students learn to write 'in their own words'"? Nell recommended that I address a hole in the literature and consider what's pragmatic, but also that I make sure I chose a topic that *really* interested me.

At a meeting on March 26, 2002, Victoria Purcell-Gates (another mentor and committee member) suggested that I look at writing in a naturalistic way. She suggested that I systematically collect writing samples (rough and final drafts) and do a discourse analysis that both looked for particular things but was also open to seeing "what jumps out". She also urged me to capture the instruction that the students received. My next meeting occurred on April 4, 2002, and included both Nell Duke and Vicki Purcell-Gates. My notes from this meeting indicate that the process of narrowing down the choices was moving along quickly. We discussed two possibilities for my dissertation: one that closely resembles the work I actually did, and another that would have been built largely on data already collected for the TEXT project. When I asked for my mentors' advice about which of these experiences might be more valuable for me, Vicki argued that the first might be more valuable because it would force me to take my hazy idea and follow it through to a well-developed proposal, and project. Looking back, I can see exactly what she meant. My idea *was* still hazy at that point, and the decisions I made in the process of designing a well-developed project taught me much about the research process.

In this way, my journey through the hourglass progressed. I began the practice of writing "research memos" and sending them to Nell and/or Vicki (the rest of my committee was not yet established) for feedback and guidance. By reading those memos, I can trace the path of my work. I was quickly moving from the top of the hourglass to the more narrow middle section. In a memo dated May 8, 2002, I made my first attempt

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at drafting research questions. These questions would face many, many revisions over the course of the project. The next steps of submitting a human subjects committee application, selecting a sample and gaining entry into schools, and designing data collection instruments and schedules followed. Eventually, I formed the rest of my committee (adding Joseph Featherstone and Jenny Denyer as the other members) and successfully defended my dissertation proposal.

As my data collection progressed, I moved closer to the middle part of the hourglass. I was learning a lot about research at every step; about how to continually question what I was doing and why (continually developing and refining my rationale), about how to interact respectfully and productively with teachers and students who constituted my sample, as well as with principals and others who questioned my presence in the schools. I also learned that analysis is ongoing, and doesn't wait until the data collection is completed. For example, as Jenny Denyer reminded me, transcription is a form of analysis, and I was transcribing both written texts and oral interviews all along. I continued to gain an understanding of the recursive, iterative nature of research.

Once the data collection was complete and I turned my attention fully to analysis, I learned just how much the data had to teach me. I found it fascinating to dive into the tiny details of the students' writing. What did their use of the first person pronoun suggest? What did that exclamation point add to the meaning? I see this time during which I was immersed in the details of analysis as being the very center of the hourglass. It was the time when I was most focused on a very small subset of my original concerns about children's inquiry. This was also the time during which I found it hardest to talk about my work. Since I was so close to the details, and thinking so carefully about issues

of analysis, I had trouble moving back to a more distant stance that would allow me to describe my project to someone outside of literacy (or even outside of genre theory and children's writing).

But of course, the ability to describe my project to a variety of audiences would be critical. As I began to write up my results and to share those results with others (including my committee members, members of my writing group, and the teachers I had worked with in collecting data), I learned to shift my stance appropriately in order to communicate effectively with different audiences. The writing also required me to begin to think about the broader implications of my work, both for research and for practice. This movement into writing and talking signaled the movement out of the narrow section of the hourglass. This movement outward is where I am now, at this writing. I am working hard to consider the broader implications for my work. I am trying to articulate why anyone would, or should, care about my results. And I am being propelled back to the original questions and ideas that started me on this journey in the first place.

Reflections on Genre and Writing

My ongoing reflections on genre and writing center on the connections that this work has highlighted for me between my own writing, the writing of the students in my study, and issues of genre, hybridity, audience, and purpose.

My thinking about genre continues to evolve and change. As I progress in my work, I become more and more interested in the differences between theoretical notions of genre, and genres as they get enacted and used in classroom settings. The following excerpt is from a research memo dated September 24, 2002. This was early in the process of data collection.

As I'm observing in classrooms and reading the writing samples I'm collecting, I can see that the notion of "genre" is going to be really problematic. Oh no! I started this study with the aim of looking at "informational" writing, but how will I define that? Must I define it in some way that someone else has (e.g. the TEXT study)? Can I use a broader genre category? The problem arises when the teachers don't use my neat categories in giving writing assignments, and instead prompt a variety of genres (sometimes, they prompt more than one genre within the same assignment). For example, the first piece of writing I collected at [Rose Elementary] was completed within pretty strict parameters set by the teacher. They worked from a web, to a rough draft (which the teacher corrected, principally for spelling and other mechanical errors), to a final draft. She prescribed the number of paragraphs, etc. And her directions prompted both recount (tell about the fingerprint investigation we did in class) and information (tell about fingerprints) genres.

I've seen a similar thing happen at [Laurel Elementary]. The teacher gave a worksheet with two questions that prompted information writing, but she set up the activity by having students look at particular rocks and describe the features of them (thus prompting descriptive writing).

I have to say, I'm fascinated by the children's written responses to these conflicting genre prompts. I would like to investigate this more, but I need to think carefully about what kinds of evidence I need. Shall I talk to the students? How do I probe their understandings?

This all seems tied to purpose, and of course the genre folks are big on that. The problem here is that I can't see much of a purpose for the writing that the students are doing (except to display some knowledge for the teacher as sole audience). What implications does this have for their genre development?

At this point, I was pushing on my understandings and ideas about genre theory and its application to the classroom and to research in classrooms. I came up with a practical solution to some of these issues for the purposes of my analysis (using a theoretical definition of information text and then collecting all writing that was at least *partly* informational), but the questions still remain.

Upon reflection, it occurred to me to wonder how often science texts are "all one genre". Often, science writers include both informational (e.g. information about simple machines) and procedural (e.g. how to build a pulley) genres in the same text. Or they include informational and descriptive text (perhaps by starting with a description of a particular wetland area, then moving to general information about wetlands). Or they include descriptive, recount, and information (as when scientists tell us of a journey of discovery that they undertook). This reflection helped me to better understand the emphasis that Nell Duke and Vicki Purcell-Gates put on purpose in defining genre in the TEXT study. In my experience both as a writer and as a researcher of writing, it seems to me that a writer who has a clear purpose is more likely to produce a coherent text than one who does not. And a writer with a clear purpose may need to draw upon more than one genre in a text in order to convey the message they wish to communicate.

Indeed, this dissertation reflects a mix of genres. Because each piece of it serves a different purpose and is intended for a potentially different audience, the language varies

across the pieces. The two manuscripts are intended for education research (or more specifically, literacy education research) audiences, and they are written in the style of the academic research article. The introduction section is aimed at whatever audience reads my dissertation as its own document (and not as articles in journals). It aims to provide a preview, of sorts, of the content to follow. It also aims to provide some explanation of where the dissertation came from and how it relates to my previous interests and experiences. This conclusion section is more reflective. It is written for my committee, some members of which requested it. Perhaps it will have a larger audience as well, but it certainly won't reach the number of people that I expect will see my manuscripts, once they've been published. Because of the reflective purpose, it is more personal and more like recount. But it includes elements of persuasion as well, in the first section (Writing a Dissertation in an Alternative Format).

What are the implications of these varied writing purposes? My reflection has revealed some of the consequences that accompany the decisions that writers make. These consequences are related to genre, as I discussed in my second manuscript. Further, there are interesting similarities in my experience of writing this dissertation, and the experience of the students in my study (as I've understood it) in writing the various texts that they wrote in science class. Both the students and I were working in contexts that shaped the writing that we produced (as do all writers). We had teachers whose approval we needed in order to achieve some goal (passing a science class, successfully defending a dissertation). We also worked within particular genres that provided us with both choices and constraints. For example, the genre of the research article, while making it easier for me to shape my message by providing structured expectations, also

constrained the choices I could make (while still communicating effectively with my target audience). At a couple of points early on in the drafting of the first manuscript, I tried to deviate from the usual "introduction, method, analysis, results, conclusion" format. I met with resistance to my deviation from members of my writing group and a member of my committee. It seems that my deviation (though it also didn't work well for other reasons) got in the way of their expectations, and thus their comprehension of my message. In my second manuscript, I reported a similar negotiation between Robert, one of the students at Rose Elementary, and his teacher.

This process of negotiation between a writer and his or her audience illustrates the two dimensions of genre that I have written about in the manuscripts: the structural, formal dimension and the social, functional dimension. These two dimensions interact in ways that serve both to move the genre forward in its usefulness to a discourse community and to hold the genre constant such that it allows for clear communication between writer and reader. Our readers (for me, my committees and writing group; for Robert, his teacher) held particular expectations for the form and content of our writing. Insofar as they expected us to communicate clearly with them in predictable ways, our audiences pushed us to adhere to generic conventions. At the same time, our audiences also held the expectation that we would write texts that were innovative and creative. My committee members expected me to present findings that are new and important, and that make a contribution to the field. Robert's teacher expected him to experiment with language and to write about a topic in a way that held the attention of his audience. Thus, our audiences also encouraged us to take risks, and to push at the limits of our genres.

These new insights are helping me to better understand the potential applications and the limitations of genre theory.

Finally, the process of studying and writing about children's writing has helped me to realize the ways in which I am also a developing writer with much to learn. Just as the students at Rose Elementary experimented with new literary techniques and uses of language, so did I chart unexplored territory for myself in my academic writing. Just as the students at Rose took risks by trying out different similes and metaphors in their writing, so did I. Did my hourglass metaphor of the previous section work? Was it effective and interesting, or did it sound contrived? I will find out the answers to these questions through interactions (negotiations) with my audiences, and over time my experiences of reading and writing will help me to be more confident in my choices. Like the fourth graders who are learning to write effective science text, I am working to become a proficient writer of educational research papers. Lucky for me (and the fourth graders), there are thoughtful and experienced teachers (both "adult" and "peer") out there who will support us along our developmental paths.

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dissertation. *Educational Researcher, 28*(3), 31-36.

Appendix A: Macrostructure Organization Categories (modified from Donovan, 2001)

Simple Couplet
- two related statements—a fact or observation, followed by a related statement of information serving to describe or extend the first

Attribute List
- the random listing of two or more facts related to a single topic
- If there are two *related* (ie not random) facts, then it is a simple couplet
- information can be rearranged without any loss of meaning

Complex Couplet
- combination of several related simple couplets of two statements with coherence created among content units
- the couplets must stay together, but they can be moved around as a unit without loss of overall meaning of the text

Basic Sequence
- contains only one node, and looks like an attribute list, but the units within that node are related in a sequence; thus, the units aren't just a random listing of facts, but instead are related in a particular order
- generally shows up in pieces that are about certain topics, like the water cycle or an animal's life cycle

Hierarchical Attribute List—Inferred Topic Sentences
- two or more basic attribute lists are subsumed under the larger topic
- the inclusion of subtopics increases the levels of hierarchy and thus creates a more complex organization
- within each subtopic, the information could be rearranged without changing the meaning of the text
- moves beyond the complex couplet because it has several statements of information for each subtopic instead of just one
- the lack of connections between and among the information keeps the subtopics from being complete paragraphs
- **Inferred topic sentences**—the topics of each individual node (or of a majority of nodes) had to be inferred and added to the diagram; there was no use of explicit topic sentences for each attribute list

Hierarchical Attribute List—Explicit Topic Sentences
- same as above, except for last bullet
- here, there are **explicit topic sentences** to introduce each node (or a majority of nodes) in the diagram

Single Paragraph
- short pieces that are only one paragraph
- all the t-units must be in a single node, and they must otherwise meet the paragraph criteria
- will usually have an explicit topic sentence

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Appendix A (Con't)

<u>Unordered Paragraphs</u>
- inclusion of coherent links among the three or more statements within each subtopic, creating paragraphs
- the paragraphs could be rearranged without losing any meaning
- usually includes explicit topic sentences, but not always

<u>Ordered Paragraphs</u>
- connections among the paragraphs of the text; they could not be rearranged without changing the meaning of the text
- usually includes explicit topic sentences, but not always

Appendix B: Features of Informational Texts

Almost Always

- Has description of attributes/components (e.g., "Ants have six legs.")

- Identifies characteristic events (e.g., "Ants eat sugar.")

- Includes at least one definition

- Has compare and contrast (talking about ways things are alike and not alike)

- Employs some denotative language (e.g., "Most worms are between 1 and 4 inches long."

- Uses timeless verb constructions (e.g., "Ants eat sugar." versus "The ant ate sugar" or "The ant is eating sugar.")

- Uses generic noun constructions (e.g., "Ants have legs" versus "That ant has legs" or "Joe the ant has legs.")

- Has some specialized vocabulary

- Has realistic illustrations or photographs

Often
- Has an opening statement/general classification (e.g., "Ants are a kind of insect.")

- Has a general statement/closing

- Has headings

- Has an index

- Includes classification (at either the sentence level –"Bees are a kind of insect" or larger units-"Some frogs live in ponds. Some frogs live in trees. . . .")

- Has labels and/or captions

- Has graphical devices (diagrams, tables, charts, boldface/italicized vocabulary)

Less Often
- Has a table of contents

From:
Purcell-Gates, V., Duke, N. K., Hall, L., & Tower, C. (2003, December 5, 2003). *Explicit explanation of genre within authentic literacy activities in science: Does it facilitate development and achievement?* Paper presented at the National Reading Conference, Scottsdale, Arizona.

Appendix C: Types of Scaffolding: Categories and examples

Use of Prewriting Tools
- webs
- note-taking (teacher supported or independent)
- concept maps
- main idea/detail sheet
- Venn diagram

Writing Instruction
- direct instruction (on literary elements, leads, use of adjectives, etc)
- discussion
- brainstorming (topics, leads, etc)
- modeling
- setting up particular audience

Use of Rough Drafts
- opportunities for revision

Use/Availability of Text Resources
- independent search for texts
- teacher provided texts
- combination of those two

Specific Guidelines provided
- organizational tools/suggestions (piece broken into sections, table of contents provided, etc)
- checklist
- benchmarks to measure progress
- questions/prompts to address

Feedback
- from teacher prior to final draft
- from peers

Appendix D: Robert's Written Texts

Note: Robert's written texts were transcribed faithfully; that is, the transcriptions note his page breaks and retain his indentions, spelling, punctuation, and titles.

Text #1: Fingerprints

Collected September 24

Have you ever solved a mystery just with finger prints? I have. I did it in school it was an assignment in class. I also learned about them.

One thing I learned was there are three different kinds of finger prints. The first and most common is the loop. Loops go in on one side and out the same. The second is not a[s] common as the first but it still exists. They are called arches. They look like hills. The go in on one side and out on the other. The third and least common is the whorl. It looks like circles that go and go until they reach the middle.

Finger prints help solve crimes. Everyone's prints are different. When a crime is commited police find prints at the sight. It's kind of like the person leaving their name, but they wrote very sloppily. The police compare prints to suspects to find the criminals.

The way the police solve crimes is the way I did. First I had to use the suspects prints and compare them by looking at the size and formulas to the ones at the site. Then I used the prints of the suspects one last time because the first observation just made the suspects list smaller and then I found the crimenal.

Text #2: All About Matter

Collected October 29

Page 1

Did you know that everything that has weight and takes up space is matter? There are one hundred and nine elements. There are three main kinds of matter, and seven things that make it up. The three kinds are solids, liquids, and gases. The seven things that make it ups are elements, atoms, mixtures, solutions, molecules, and compounds.

Matter can be living or non-living. Also all matter is made of atoms. Atoms are the smallest particles something can be broken into. What's an atom made of you say? Why protons, neutrons, and electrons. A proton is posotively charged and electron is the exact opposite it is negitively charged.

page 2

Neutrons are neutral they have no charge.

Elements are made of one kind of atom. Elements are the siplest [simplest?] chemicals. Exaples are copper or silver. There are 109 known elements.

Mixtures are different of atoms or anything mixed together. There are two or more elements in a mixture. A mixtures parts don't react together. Suspensions are a special kind of mixture. The particles are disbursed through liquids but not dissolve. The particles are temporarily suspended after that. After a while they settle out.

Appendix D (Con't)

Page 3

Compounds are a mixture of two or more elements or atoms. There are a certain number of each. The elements loose their individual charicteristics.

Did you know you are a solid? If you didn't, now you do. A solid takes up space and has weight. It's molecules [move] all around but don't move away from each other. Their molecules are packe very close together. When a solid is heated it's bonds weaken and the molecules move faster and faster. A solid has a definate shape and volume.

Page 4

Studies show a solid does not change shape easily. Solids are visable.

Liquids are the next type of matter. A liquid has not definate shape, but it does have a definate volume. All liquids have weight and take up space. It's molecules are fairly close. A liquid always goes to the bottom of its container. Studies show all liquids have weak bonds. When the weak bonds get hot they break. The liquid then turns to gas. All liquids flow.

A gas has weight and takes up space. There molecule move freely away. Studies show molecules in a gas are far apart and have no bonds. Also know is gases chang shape easily.

Page 5

It's green it's slimy it's it's Oobleck! Oobleck is a solid and a liquid. We found it was more a liquid though. We did eight tests to prove. Only five said it was a liquid. The tests were slowpoke, flow, shape conformity, and shatter tests. two said it was a solid. those were fast poke and bounce. One said it was both the cut test.

Text #3: Barn Owls

Collected November 26

Page 1

Oh no, I'm late for the owl show. I can't wait to learn about owls, especially the barn owl. "Doot doot doot doot doot doot dooooo" Just in time! They're presenting the barn owl! Barn owls have a unique size, call, and especially cool habitats for owls. It raises young like other owls, too.

The barn owl lives on farms, in barns and broken tractors. It also lives in trees in the woods. They live anywhere they can get /?????/ the open country side.

One of the barn owls habits is flying. It flies in the hills and the fields. It flies like a glider. It also hunts a lot. They love food. I mean they eat like horses!

Page 2

They like meadow vole a lot. Barn owls usally eat small rodents. They prefer diffrent if the can help it but if they have too they will eat birds.

Barn owls are shrill sounding creatures to me, like a loud, "cow creek, cow creek". It's sort of a rasping or /creeping/. They range from North and South America all

the way back to America. They live everywhere except the North and South Pole. They only live in parts of the places though.

Wheighing twenty oz's is the barn owl. Barn owls are 32-38 cm tall. Their *[p. 3]* width is about 4-12 inches depending on how much they eat. When barn owls raise young they usually get four to seven eggs. The eggs hatch after 33 days. During the incubation the male brings the food. The barn owl has brown upper-parts. The[y] have /pole/ under-parts with light specks.

Rodents mole and shrew were the two things my pellet had in it. If you want proof, here it is. We found two skulls five legs, and two loose jaws. We found more but they're mixed up. The shrew and mole have a lot too but they are way too mixed up to count. All together we found about eighty four bones.

Text #4: Wolves

Collected January 9

<u>Page 1</u>
Wolves are great creatures. I mean, they keep the amount of game at a good rate, they have awsome abilities to help them do their jobs in nature. Though there aren't many they are well spread out around the world. They are as cool as rock stars. These things are number one types of dogs.

Page 2
Five things that make a wolf a mammal are, for exaple something every mammal has hair! Wolves bodys are coverd in hair. They also give live birth and give the baby milk. These animals are vertabrates too. Last but not least wolves are warm blooded. Sometimes they can become as hot as the Greek god Hadies.

Page 3
These mammals come in many colors, heights, lengths, and weights. They come in hues of white, gray, black brown, silver and tan. Weighing seventy to one hundred pounds these aren't animals you want to mess with. Their as mean as sumo wrestlers. Wolves average height is twenty six to thirty two inches. Wolves are fifty five inches long.

Page 4
Wolves have great abilities. They're very speedy creatures. Wolves can run thirty five miles an hour. Thats exactly half as fast as the worlds fastest mammal, the cheetah! They run about forty miles a day. These creatures arent only speedy they have super senses! All wolves realy on three senses. These are hearing vision and smell. They can detect freind, foe, or food from a mile and a half away. Can you belive their noses are big enough to hold two-million smelling cells. Wolves eyes are excellent. They are right in front of their heads so they can judge long *[p. 5]* pounces. Wolves tune into sound by pricking up ears and twitching them around.They can hear a sound several miles away.

Page 6

Wolves of North America usualy live in Canada or Alaska, but sometimes they'll pop up in the lower forty eight states. The landscape for wolves is mountains and forests. Their homes in these places might be open areas, caves, /bushes/ and other places like those. Their den's are a series of tunnels. They are fifteen feet long and big enough for a wolf to stand in. They're is a big camber where the pups are born.

Page 7; diagram w/labels

Page 8

The wolf family is never far apart. Even if they break off, they're practicaly still together. They always recognize each other. Some wolves can be as stubborn as a mule. "Listen to me now!" Does that sound familiar? I know it does everyone has heard it before. Did your parents tell you it was a lesson? It might be but for wolves I know it is. Wolves hear that a lot from baby sitters The baby sitters teach the pups a lot. Pups also learn how to stalk, pounce, swat, and bit through games.

Page 9

The young are cared for by all members of the pack. They are kept safe from other predators, are kept warm at night and fed. The pack is led by the alpha's, or top dog's. All wolves in the pack have their own rank. Scapegoats are the lowest ranked wolves.

Page 10

Wolves comunicate in three different ways! Sound, body language, and scent are those three. Sound and body language are used together.

Page 11

Wolves have to talk far away so they just howl. But they growl bark and whine close together. They talk as much in one day as a human in two. They use their tail, head, legs, and face to comunicate. They acutally use every part of their body. Wolves, like other dogs need space. They use urine and foot scratching too mark that territory. Their feet let of fumes.

Page 12

M-m-m my favorite, venison! Wolves are carnivores. Their diet consists of deer, birds, rabbits, elk, caribou, and Buffalo. Wolves are predators. When wolves hunt they divide up the work. They must work very hard to get food. They usualy look for weak or sick animals. Wolves hunt in packs because they have more power in numbers. For long periods of time wolves will track their next meal. When they find it, the alpha male decides if they can kill it.

Page 13

Appendix D (Con't)

If they can they make a plan and attack. If they can't they go on. When they attack, they work as a team. There are many stratigies to catch prey. Wolves spend as much time hunting as humans sleep.

Page 14
       Two types of adaptations are physical and behavioral. All wolves have at least one of each.Two physical adaptations are their brain power used to plan attacks on food, and their speed to help work their plan. Two behavioral adaptations are listening to the leader and keeping each other in line. When they listen they can hear how to get the food and other things they need to know. Keeping each other in line means no one can mess things up.

Page 15
       Wolves have been around two million years. Thats forty times as long as the human race. their canines are about two inches long. Wolves walk on their tiptoes. Their tails hang straight down unlike other dogs who's tails stand up. A full size coyote is only half the size of a wolf. Facts about wolves are cool.

Page 16
       Once these great creatures were plentiful, more plentiful than the plants on the largest plantation on earth. Now theres only a few. They are great hunters. Mankind needs these carnivores. They would be the first modern day mammal to be extinct if we didn't care. Wolves are truly great mammals.

Page 17: bibliography